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IMPACT OF THE METAVERSE ON THE RETAIL INDUSTRY

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Abstract

This paper examines the impact of the metaverse on retail, how it can be used successfully, and the extent to which technical, legal, and social challenges may limit its application. The results of the literature analysis and expert interviews carried out in this thesis show that the metaverse can close the gap between the physical and virtual worlds. Currently, it is used in retail primarily as a marketing tool. Access to the metaverse is indeed possible with current technology. However, further development of software and hardware solutions is required for a more user-friendly application. Similarly, legal, and social challenges have not yet been fully resolved.

Keywords

Metaverse, Second Life, Technology, Augmented Reality, Virtual Reality, Mixed Reality, Extended Reality, Retail Industry, E-Commerce, M-Commerce, Marketing, Strategy, Implementation, Data Security, Privacy, Laws

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Introduction

Digital transformation and changing consumer behavior have significantly changed the retail industry in recent years. Consumers have started to use digital devices such as smartphones and laptops, which allow flexible shopping at any time and from any location. They can also obtain information on individual products and prices and compare them with each other. Consequently, brick-and-mortar retail has become heavily pressured by online retailing (Deloitte 2014).

E-commerce offers new and easier ways to reach customers. However, this opens up a wide range of products and services from a variety of providers to customers. In addition, the shopping experience combined with qualified advice and interactions with other consumers as in the physical world is missing. This makes it more difficult for retailers to generate strong customer loyalty in the digital world. The metaverse is seen as a promising approach to combine the benefits of brick-and-mortar retail shopping with those of e-commerce (Bourlakis et al. 2009). The metaverse is a three-dimensional virtual world that has emerged in recent years as a result of the development of new immersive technologies (Ball 2021). Until now, the impact of the metaverse on retail has been largely unexplored.

The purpose of the work project is to find out what impact the metaverse has on retail and how it can be used successfully. It also aims to identify to what extent technological, legal, and social challenges may limit retailers' use of the metaverse and what action measures are needed. The results of this work project are based on a literature analysis and expert interviews. Throughout the work project, the following research questions are answered:

1. How does the metaverse impact the retail industry?
2. How can the metaverse be used successfully in the retail industry?
3. To what extent can technical, legal, and social challenges limit the application of the metaverse in the retail industry, and what actions are necessary to overcome these challenges?

This work project is divided into three sections. Chapter 1 contains the analysis of the literature and the presentation of the theoretical assumptions. First, the definition and characteristics of the metaverse are described. This is followed by a discussion of the evolution of digital technologies and their impact on consumer behavior and the retail industry. Subsequently, the impact of the metaverse on the retail industry is narrowed down based on the use case of Walmart Inc.. Finally, technological, legal, and social challenges related to the application of the metaverse in the retail industry are addressed. In chapter 2, the research method used to validate the findings from the literature analysis is explained. In addition, the interview guidelines and interviewees are discussed. In chapter 3, the theoretical assumptions are analyzed with the help of the interviewed experts' opinions and findings. Based on this, a marketing strategy for a successful entry into the metaverse is presented and action proposals are given to mitigate technical, legal, and social challenges that arise by using the metaverse.

1 Literature analysis

The purpose of the literature analysis is to examine the impact of the metaverse on the retail industry, how it can be used successfully, and to what extent technical, legal, and social challenges may limit the application of the metaverse in retail. First, an overview of the definition and characteristics of the metaverse is provided. This is followed by a discussion of the evolution of digital technologies and their impact on consumer behavior and the retail industry. Subsequently, the importance of the metaverse for the retail sector is explained. This is substantiated by examining current and future use cases of Walmart Inc.. Finally, technological, legal, and social challenges associated with the application of the metaverse in retail are addressed.

1.1 Definition and characteristics of the metaverse

In recent years, new business environments have emerged due to technological developments such as the internet and mobile devices. These are currently further driven by the development of the metaverse. "*The Metaverse is a massively scaled and interoperable network of real-time rendered 3D virtual worlds which can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments.*" (Ball 2021, 1). According to Meta Platforms Inc., based in Menlo Park in the United States, formerly Facebook, *"[t]he metaverse is the next evolution in social connection and the successor to the mobile internet."* (Meta 2022, 1). Media in 2D, limited to what is happening on the screen, is changing to immersive simulated media in 3D. This means that people are no longer just looking at the internet, they are immersed in it. Digital and physical life become seamlessly connected. Virtual content or environments are perceived as real. Users can interact with each other in real-time. The metaverse can be used as a place to socialize, work, play games, and do

business together (PWC 2022). Users can create their own content, rules, and business models. They can own, buy, or sell digital and physical goods in the metaverse (BCG 2022). Interoperability, meaning the interaction of different systems, techniques, and organizations, will be possible (Büchel and Klös 2022). Companies are already building their own metaverse or partnering with metaverse software developers such as Decentraland or Roblox (Möller and Wenz 2022). This means that the metaverse will not be owned by one single provider. The metaverse has its own virtual system that can be created and customized by anyone (Gartner 2022). Taking together the described characteristics – three-dimensionality, real-time, interoperability, ownership, and creator economy – underline that the metaverse can be seen as the next stage of the internet (Büchel and Klös 2022). The following section describes which technologies make it possible to create and use the metaverse.

1.2 Evolution of digital technologies

The evolution of digital technologies already makes it possible to enter the metaverse. First, the development of backend engines enables simplified and fast creation of three-dimensional digital objects and environments in the metaverse (McKinsey 2022). There are already 3D modeling tools and frameworks, so-called game engines such as Unreal Engine or Unity. In recent years, sophisticated games and experiences have also been developed with the help of game engines. The development of backend engines has helped to make the shift from 2D to 3D possible (Hertz 2022). This has also been driven by leading software companies such as Meta and Decentraland (Möller and Wenz 2022). Second, edge computing plays an important role in the metaverse. It forms the basis for providing the computing power and processing speed that is required for the metaverse. Edge computing no longer captures, stores, and processes data in a decentralized manner in a cloud, but locally on smart devices and local networks. This helps to ensure that many users can access the metaverse at the same time, and

avoid overloading computational resources, which is essential for an immersive and unique experience (McKinsey 2022). Third, hardware devices have been developed in recent years to merge the virtual and physical worlds. This involves Extended Reality (XR), an immersive technology such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). In the case of VR, a person can be fully immersed in the virtual world by using special VR headsets. While using AR, the user is not fully immersed in the virtual world, but only partially. In this case, the physical world is augmented by digital objects or information (Büchel and Klös 2022). MR is a combination of VR and AR where users can interact with digital objects in the physical world (BCG 2022). Immersive technologies are expected to dominate in the coming years. Currently, they are still not widely used due to their cost and weight (McKinsey 2022).

1.3 Retail in the metaverse

In the previous section, it became apparent that with the currently available digital technology it is already possible to enter the metaverse. The following section explores how the metaverse may impact the retail industry. Therefore, it is first described how the development of digital technologies has changed previous consumer behavior and consequently is impacting the retail industry.

1.3.1 Evolution of consumer behavior

In recent years, interest in the metaverse has exploded. More than three billion users are active and driving the use of the metaverse. This behavioral change already started two decades ago, when gamers began creating digital identities, so-called avatars, in digital worlds and pursuing virtual goals such as designing virtual rooms in Second Life (Ball 2021). Second Life was the first online game platform that allowed users to be in a virtual world (McKinsey 2022). This behavioral change was further driven by the Covid 19 pandemic. The situation has forced

people to isolate themselves at home. To continue participating in social life, people have increasingly moved to the virtual world. Consequently, the adoption of XR has increased. (Kerdvibulvech 2022). According to a survey conducted by McKinsey (2022), 59% of all surveyed consumers are excited about moving their daily activities into the metaverse. These activities include, for example, playing games, attending virtual concerts, socializing, or buying physical or virtual goods. Nowadays, around 79% of respondents are willing to make virtual purchases in the metaverse to enhance their online experience. Already 47% of those participating in the survey have purchased digital products in the metaverse (McKinsey 2022).

1.3.2 Evolution of the retail industry

Digital transformation and changing consumer behavior significantly pressured brick-and-mortar retail in recent years. As a result, online retailing has strongly increased. Consumers have started to use technological devices to conduct research on products and prices, and to make purchases. Therefore, the omnichannel strategy has become increasingly popular in recent years. It offers customers a flexible shopping experience that allows them to find information about products at any time and from any location. For retailers, online commerce provides new and easier ways to reach their customers. Moreover, they can more easily identify and respond to customer preferences by collecting data on customer behavior in online stores (Deloitte 2014). However, e-commerce offers a wide range of products and services from a variety of providers. Moreover, it doesn't provide a shopping experience with qualified advice and interactions with other consumers as in brick-and-mortar retail. As a result, it is more difficult for retailers to build high customer loyalty in e-commerce (Bourlakis et al. 2009). The metaverse is seen as a promising approach to combine the advantages of shopping in brick-and-mortar retail with those of e-commerce (PWC 2022). In the metaverse, consumers are operating in the virtual world, with a digital identity. Thereby, they can receive customer support in real-

time, experience the products that are offered just as they would in brick-and-mortar retail, get in touch with other consumers, and exchange their experiences. Retailers can thus strengthen customer loyalty and engagement (Khatri 2022). The following sections describe how the metaverse can be used efficiently in retail.

1.3.4 Impact of the metaverse on retail

This section explains how the U.S. multinational retailer Walmart Inc. headquartered in Bentonville is already operating in the metaverse and what opportunities arise in the future.

Current metaverse use case

Walmart Inc. launched two immersive virtual experiences, Walmart Land and Walmart's Universe of Play, on the Roblox metaverse platform in September 2022 as part of an advertising campaign (Walmart 2022). Roblox is one of the fastest growing and largest online gaming platforms in the metaverse, with an average of nearly 55 million daily users in February 2022 (McKinsey 2022). According to William White, Walmart Inc.'s chief marketing officer, the primary target group is young people under the age of 25, who already spend a lot of time on the gaming platform. This audience represents a high priority for the company in the long term. Immersive, creative, and entertaining environments have been created in the two experience worlds to present merchandise that is sold in online stores (2D) and brick-and-mortar stores. The first experience world, Walmart Land, includes three 3D experiences, House of Style, Electric Island, and Electric Fest, promoting fashion, cosmetics, and entertainment items such as music and movies. House of Style, for example, has cosmetics sections. Electric Island features a quiz about the popular Netflix series "Stranger Things" as well as dance competitions inspired by the world's biggest music festivals. Electric Fest allows visitors to participate in virtual concerts by well-known artists. Walmart's Universe of Play experience integrates

popular toys sold online and in brick-and-mortar stores into various 3D games where virtual coins can be earned. This allows players to purchase digital goods for their avatars. The goal is to market the toys in the 3D games and encourage people to buy the physical products online or in brick-and-mortar stores (Walmart 2022). Access to the two worlds of experience is available for free. Initially, the focus is not to earn money in the metaverse. White hopes the ad campaign will bring young people in the metaverse together, which will enable users to socialize and share their interests and opinions. This should encourage community building and customer engagement. In future, Walmart Inc. aims to generate new revenue streams by selling digital goods in the metaverse. Therefore, Walmart has commissioned several brands to produce digital goods such as home decorations, toys, sporting goods, and personal care products and sell them in Walmart Inc.'s virtual experience. These digital goods can be purchased by consumers or traded with other users. Walmart Inc. also plans to charge fees in the future for including more brands in the metaverse. In this way, Walmart wants to encourage exchange in the community and generate additional sales (Thomas 2022). The example of Walmart Inc. has shown that the metaverse is currently being used as a marketing tool in the retail sector to strengthen brand image and increase customer loyalty.

Future metaverse use case

The development of digital twins can intensify and improve the shopping experience in the metaverse in future (McKinsey 2022). Digital twins are virtual products that mirror a physical product in detail. Before purchasing the physical product, their functionality can be tested, for example, by a 360-degree view. Subsequently, the sale of the physical product takes place in the real world (IBM 2022). Walmart Inc. for example, already allows consumers to view furniture using AR through the screen of a computer or the camera of their smartphone. However, this is still limited to 2D technology. In future, however, Walmart Inc. can envision

developing digital twins of furniture and its customers' homes in the metaverse (Melendez 2022). This will give customers a better idea of how the furniture available for sale will look in their real homes (Tan 2022). Digital twins will also allow retailers to test the attractiveness of new products before launching the actual product (Aberer 2018). This leads to lower returns and, consequently, to increasing sustainability and decreasing costs (PWC 2022).

1.4 Technical, legal, and social challenges

It has been demonstrated that the metaverse has an enormous impact on the retail industry. Some retailers, such as Walmart, are already operating in the metaverse. However, there are technological, legal, and social challenges that need to be dealt with. These are highlighted in the following section.

1.4.1 Technical challenges

In future, the metaverse will replicate reality in 3D. As described previously, 3D applications can be created with the help of backend engines and edge computing. However, the more complex the requirements of the virtual worlds become, the more data is needed to create a metaverse. Therefore, the question is whether the currently available software can fully handle the complexity and processing speed of the data in terms of graphical representation and real-time interaction and communication in future to create an experience that encourages users to dive deeper into the metaverse (Ning et al. 2022). Although the hardware has evolved in recent years, XR is still very expensive and heavy and, therefore, not yet widely used in society (Park and Kim 2022). In addition, many people do not have sufficient skills to use XR (Aberer 2018). More than 70% of respondents surveyed by IBM (2022) said they did not know how to use these technologies. However, it is required that both retailer employees and customers can use metaverse technologies to be able to use all applications in future. The question is how to

simplify the operation of the hardware so that as many consumers as possible will use the metaverse (Aberer 2018).

1.4.2 Legal and social challenges

In addition to technical challenges, retailers also face legal and social challenges in the metaverse, such as cybersecurity and consumer privacy. The metaverse extends screens and activities to the physical human environment. As a result, hackers are no longer just attacking servers or networks. The hackers' attack surface has expanded to include human behavior and social interactions that now take place online, providing insights into people's most intimate areas (McKinsey 2022). The user data collected in the metaverse is, therefore, more detailed than previously available data on internet users. Data protection laws exist, such as the Data Protection Regulation (GDPR) introduced by the European government. However, the question arises whether these laws provide sufficient security in the metaverse. In addition, laws that apply for example in the UE may not be valid on other continents. Since the metaverse is boundless, it is, therefore, ambiguous which laws of the physical world also apply in the metaverse and whether they can be introduced in a standardized way or vary from metaverse to metaverse (Dwivedi et al. 2022). In addition, there is a high risk of people hiding behind false identities and committing crimes. Therefore, it must also be clarified whether surveillance measures by the police or the state, as they exist in the real world, can be transferred to the metaverse. In addition to legal issues, social challenges must also be considered, since it is mainly the young generation that has been operating in the metaverse so far. They have different social views than the older generation (Park and Kim 2022). However, ethical, and moral norms, that are not yet established in the metaverse, are important to create a good and orderly social environment (Ning et al. 2022). The mentioned challenges will probably make it difficult for retail companies to ensure a safe environment for their users of the metaverse, especially

since there are not enough qualified employees yet to cope with the complexity of the architecture (Dwivedi et al. 2022).

1.5 Summary of the results

The metaverse represents the next stage of the internet as it is an interoperable network where users can socialize, experience, create, and own digital and physical goods and environments in real-time, in 3D, and synchronously. In recent years, digital transformation and the Covid 19 pandemic have led to consumers increasingly moving into virtual worlds. As a result, brick-and-mortar retail has come under significant pressure in recent years. Subsequently, online retailing has increased. The metaverse is seen as a promising approach to combine the benefits of shopping in brick-and-mortar retail with those of e-commerce. This was concretized by the Walmart Inc. use case. As part of an advertising campaign, the company launched two immersive virtual experiences, Walmart Land and Walmart Universe of Play, on the Roblox metaverse platform with the goal of bringing users together in the metaverse and promoting community building and customer loyalty. By using digital twins, the shopping experience in the metaverse can be intensified and improved in the future. The currently available software and hardware solutions already enable access to the metaverse. However, user-friendly solutions that are aligned with the required complexity and processing speed of the data are still required. There are also not yet solutions for legal and social issues such as cybersecurity and consumer protection, which are necessary for secure operation in the metaverse. The following chapter explains the research method used to validate the results from the literature analysis. In addition, the interview guidelines and interviewees are discussed.

2 Qualitative analysis & method

2.1 Explanation of the research methods

To validate the results extracted from the literature analysis two different research methods can be applied. The quantitative method obtains information by measuring, counting, and analyzing statistical data, surveys, tests, and structured observations. In this process, they are usually presented visually in diagrams or tables. Due to the standardized presentation, this method is particularly suitable for large samples. However, differentiated findings cannot be optimally presented using this method. In the qualitative method, detailed and individual insights, opinions, attitudes, motives, behaviors, or expectations are obtained. Deeper insights into a particular subject area are gained and different perspectives are explored. Data collection methods include interviews, observations, or document analyses (Flick 2002).

2.2 Choice of the research method

This work project uses a qualitative research method to analyze the opinions and insights of selected experts about the metaverse and its impact on the retail industry. It is explained which strategic measures are required from their perspective to successfully enable retailers to enter the metaverse, and what technological, legal, and social challenges thereby exist. It is also important to find out whether the approaches highlighted in the existing literature that has been published so far about this new trend can be confirmed or rejected by the experts. To clarify these questions, expert interviews are conducted. The semi-structured interview method is chosen, which involves open-ended questions. A relaxed, conversational atmosphere is created, which makes it possible to better understand the mindset and attitudes of the interviewees. Respondents can speak freely and provide a variety of detailed information. Additionally, relevant information can be found through follow-up questions (Bryman 2008).

2.3 Preparation of the interview guideline

To conduct the semi-structured interviews, it is important to prepare a suitable interview guideline. On the one hand, this is created based on existing literature. On the other hand, the questions are asked based on their suitability for answering the formulated research questions. The questions are only intended to provide a thematic framework. The order in which the questions are asked is adaptable and respondents are free to answer. Three interview guidelines are created for the following thematic blocks. In the first block, the impact of the metaverse on the retail industry and its use cases are considered. In the second block, the digital technologies required to use the metaverse in retail are addressed. Finally, the third block focuses on the legal and social factors that are relevant for operating securely in the metaverse. The experts are selected according to their respective expertise. The interviews are conducted in both German and English and have a duration of 30 to 60 minutes. All participants agree to take part in the qualitative interview. An overview of the experts interviewed can be found in Appendix 1. The interview guidelines and the summarized answers are listed in Appendix 2.

2.4 Choice of the interview partners

First, to find out how the metaverse impacts the retail industry and how it can be used successfully, two experts from the retail industry were interviewed. Both already have experience with the metaverse. These are, Marilyn Repp, a metaverse expert at Handelsverband Deutschland (HDE), and Sara Teixeria, a metaverse Marketing & Retail Manager at Exclusible in Portugal. In addition, two expert interviews were conducted with Fatih Tunc and Raimund Krämer, software developers and VR/AR experts working in the IT consulting company it-economics GmbH in Germany. They are both involved in the development of gaming, VR, and AR and consequently qualified as valuable interview partners. Finally, Stefan Schmid, a legal and contract management partner in IT & metaverse at it-economics GmbH in Germany was

interviewed to gain an understanding of the legal and social challenges that arise by using the metaverse in retail.

3 Empirical findings & analysis

This chapter presents the results of the semi-structured interviews. First, it is illustrated how the experts evaluate the influence of the metaverse on the retail sector. This is followed by an explanation of a marketing strategy that enables retailers to operate successfully in the metaverse. Finally, expert opinions are given on the technological, legal, and social challenges in the metaverse particularly the extent to which these may prevent retailers from entering the metaverse and what action measures are needed to limit the challenges.

3.1 Impact of the metaverse on retail

The experts confirm the assumption extracted from the literature analysis that the metaverse has an enormous impact on the retail industry. According to Respondent 1 (Sara Teixeira, in the following R1), a virtual customer experience has previously been established in 2D on e-commerce platforms. For example, a virtual environment has been created based on the theme of a particular product collection. However, according to Respondent 2 (Marilyn Repp, in the following R2), the social and collaborative aspect of the physical world has been missing. In the metaverse, this digital and physical gap can be closed since on the one hand virtual worlds of experience can be created (R1, R2). On the other hand, in the metaverse community and interaction between retailers and customers are interoperable possible. The constant presence of the retailer opens new opportunities to identify customer needs and provide customers with a holistic shopping experience. The current omnichannel strategy in e-commerce is evolving toward the omnipresence strategy (R1, R2). Connecting the physical and digital worlds creates one of the metaverse's greatest competitive advantages in retail (R1, R2). On the one hand, this

leads to the fact that retailers can reach every customer, both in the digital and the physical world. On the other hand, a connection between customers and retailers can be built, and consequently, high customer loyalty can be achieved (R1, R2). As a result, it was confirmed by the experts that the metaverse will have a very strong impact on retail. In the following, a marketing strategy is presented that enables retailers to successfully enter and exploit the metaverse.

3.2 Retail marketing strategy

R1 and R2 confirm that the metaverse can be used as a marketing tool to strengthen brand image and increase customer loyalty in retail. They also believe that immersive marketing in the metaverse is currently one of the most applied use cases in retail. Therefore, the following analysis focuses on the four most important elements of a marketing strategy (4Ps), product, price, place, and promotion. In the following, these are analyzed based on application examples from the literature analysis and expert opinions. The goal is to develop a marketing strategy that allows retailers to successfully enter and use the metaverse.

3.2.1 Product

R1 and R2 agree that before entering the metaverse retailers need to consider what product or service they want to offer in the metaverse. These must be designed to pursue the company's goals. If the goal is to reach and retain a specific group of customers, retailers can develop their own games in which they place their physical products within the game, for example, to present the latest product collections (R1). By creating their own virtual locations or environments, retailers can aim to expand their customer segments (R2). As described in the literature analysis, immersive, unique, realistic, and personalized 3D worlds, rooms, or events can be built. According to the experts, this represents more than just a creative opportunity to promote the

brand. Rather, the goal is to be a part of the experience, to connect with existing or new customers in real-time, and to collect customer feedback on immersive worlds or latest product collections. (R2). As described in the literature analysis, the metaverse is a creator economy in which every user can design or create something on their own. Consequently, according to R2, customers can also create virtual worlds, spaces, products, or services in the metaverse. This offers another opportunity to gain valuable customer feedback (R2). It also enables future product collections and services to become better planned and aligned to customer wishes (R2). If the goal is to showcase new products, they should be presented as real as possible in the metaverse. For this, according to R1 and R2, digital twins can be used in future to provide a 360-degree view of the physical product. This allows customers to first test the virtual products with VR or AR, then purchase the virtual products, and finally receive the physical product (R1, R2). It becomes apparent that there are currently and in future many opportunities for retailers to use and design the metaverse. However, R2 underlines that both the physical interaction and the virtual experience must always be provided to increase brand loyalty and retain customers in the long term.

3.2.2 Price

The literature analysis revealed that Walmart Inc. decided to currently offer access to the two Walmart virtual experience worlds for free. R1 and R2 also believe that retailers should consider in advance whether and what prices to charge in the metaverse and what goal they want to achieve (R1, R2). If the goal is to initially attract and engage with many customers in the metaverse, access to the games, virtual environments, or services in the metaverse should initially be free. According to R2, revenue increases are not initially the priority in the metaverse. R1 also confirms that creating virtual experiences and environments in the metaverse is not expensive. It is easier and cheaper to do marketing in the metaverse than in the

physical world. However, if the goal is to increase revenue in the long term, new revenue streams can also be created in the metaverse. Retailers, for example, can generate new revenues by selling virtual goods, such as clothing for avatars. According to R1, users already spend a lot of money on digital goods in the metaverse to be fully integrated into the virtual world. In addition, retailers may consider charging money from other brand owners to include and showcase their products in the metaverse (R2). However, if the stated goal is to increase sales the company should already have a high number of customers in the metaverse (R1). Finally, R1 and R2 emphasize that the focus is initially on providing free access to the 3D games or worlds to attract as many customers as possible to the metaverse.

3.2.3 Place

The use case of Walmart demonstrated that the company focused on targeting young people as a priority and long-term target group and has therefore positioned itself on the gaming platform Roblox. R1 and R2 confirm that the channel and the place, respectively, must be consistent with the company's goals, values, and norms. According to R1, if the goal is to reach many young people gaming platforms such as Roblox or Decentraland are currently the most powerful tools for marketing products. However, if the focus is on exchange and interaction between users then, according to R1, Spatial would be a suitable platform. It offers the possibility to create places and spaces where users can come together, interact, and exchange ideas. If retailers want to provide graphically high-quality and realistic experiences in the metaverse then, according to R1, Journee would be an appropriate platform. If entry into the metaverse is planned on one of these platforms it should be checked in advance that many users who belong to the respective target group are already active there (R1, R2). Furthermore, the target group must be present. According to R1, gaming platforms such as Roblox or Decentraland are the best choice to enter the metaverse to conduct marketing. This is where most active users are already located. It has

been shown that retailers need to address which platform they want to work with before entering the metaverse to achieve their business goals.

3.2.4 Promotion

As mentioned in the literature analysis, the goal after entering the metaverse is to attract as many users as possible in the virtual worlds. R1 and R2 confirm that in the metaverse the community should be expanded, and users should be retained for the long term. Retailers should therefore pursue the goal of making customers who have been less active in the metaverse aware of their product or service in the metaverse. R1 and R2, therefore, agree that information should be distributed on the new metaverse medium. This can be done through education, awareness campaigns, discussions, or public debates on social media such as Instagram, Facebook, Twitter, or LinkedIn (R1, R2). The enormous impact of the metaverse on retail and society, in general, should be addressed. Furthermore, the management of technical, legal, and social challenges must also be communicated to the public (R2). In addition, it is beneficial if retailers constantly follow current trends in technology and consumer behavior and publicize them via social media (R1, R2). According to R1, retailer employees also need to be trained. Therefore, it is crucial to implement metaverse departments in companies that focus exclusively on the appropriate training of employees (R1).

3.3 Technical, legal, and social challenges and action proposals

The literature analysis pointed out that technical, legal, and social challenges may currently limit the application of the metaverse in retail. The following section explains to what extent the experts confirm this assumption and what measures should be taken. First, the technical challenges are discussed in more detail. Subsequently, the legal and social problems are highlighted, and action proposals are given in each case.

3.3.1 Technical challenges and action proposals

According to the literature analysis, the existing software solutions are currently not able to offer a high qualitative resolution as well as low processing speeds which are, however, required in the metaverse. This is also confirmed by Respondent 3 (Fatih Tunc, in the following R3) and Respondent 4 (Raimund Krämer, in the following R4). They emphasize that the more the real world is replicated the more the complexity of the data increases. This will continue to be challenging for retailers to provide customers with a unique user experience in the metaverse. However, this should not prevent retailers from taking their first steps into the metaverse (R1, R2, R3, R4). Therefore, according to R4, it is recommended to employ software and game developers in the company who are already creating and experimenting with metaverse worlds. R4 suggests that this requires little to advanced programming skills. Using a game engine, which is already used in game development today, virtual realities can be recreated free of charge, easily and quickly. The distribution of immersive hardware (XR), as in the literature analysis, is also viewed critically by R3 and R4. According to R4, immersive technologies have been available for several years and have been further developed in recent years. In the meantime, they can even be used wirelessly such as the Meta Quest Pro VR headset developed by Meta. However, R4 criticizes the fact that users cannot see their surroundings while using VR headsets which can lead to motion sickness. Therefore, they can only use the VR headset for a short period of time which, in turn, reduces the fun factor and the user experience. Both R3 and R4, furthermore criticize the fact that the available headsets are still large, heavy, visually unappealing, and expensive. However, according to R3, the costs may become lower in future as the number of hardware vendors increases. According to R4, to increase usability and reduce costs retailers should produce their own headsets with the help of product designers in the company or collaborate with VR headset manufacturers. Consequently, R3 and R4 agree that the currently existing headsets are not very user-friendly due to the aspects mentioned

above and will therefore not be sufficiently widespread in the short term. This may prevent the success of a metaverse strategy in retail.

3.3.2 Legal and social challenges and action proposals

In the following, it will be stated which legal and social conditions are required so that the metaverse can be used in the retail sector. Respondent 5 (Stefan Schmid, in the following R5) confirms that, compared to the previous web2, the hackers' attack surface expands in the metaverse, and provides insights into people's most intimate areas. Therefore, in his opinion, all the laws that exist in the physical world must also apply in the metaverse. When trading digital goods and selling services in the metaverse, for example, intellectual property must be protected by copy protection, distribution protection, licensing conditions, and other property and user rights (R5). To ensure security against criminal acts, such as data or identity theft in the metaverse, the criminal law must be met (R5). In addition, civil law and the protection of minors must be observed to ensure that contracts are concluded, and ownership is transferred in a legally safe manner. One of the most important laws is competition law. As in the previous e-commerce in the web2, this is intended to prevent monopolistic market positions through illegal activities. However, the borderless virtual space in the metaverse leads to challenges. According to R5, it is impossible to introduce global authority. Therefore, as in web2, each company operating in the metaverse is responsible for creating its own secure environment. For example, vendors in the retail sector should introduce a policy department to deal with the legal framework. In this process, companies can follow the framework of current e-commerce and potentially expand it. Since there will probably be legal gaps despite great diligence, each user is ultimately responsible for what data he or she provides in the metaverse (R5).

Conclusion

The goal of the work project was to investigate the impact of the metaverse on the retail industry and how it can be successfully used. In addition, the aim was to determine the extent to which technological, legal, and social challenges can limit the retail industry's usage of the metaverse and what action measures might be necessary. The findings presented subsequently are based on a literature analysis and expert interviews.

The first chapter covered the analysis of existing literature and the presentation of the theoretical assumptions. The second chapter described the research method used to validate the findings from the literature analysis. In addition, the interview guidelines and the interviewees were presented. In the third chapter, the assumptions from the literature analysis were analyzed with the help of the opinions and insights gained from the interviewed experts. Based on this, a marketing strategy for the successful entry into the metaverse was developed and action proposals were given to limit technical, legal, and social challenges that may arise in context of the application of the metaverse.

First, the research question of how the metaverse impacts the retail industry was answered. It was shown that the metaverse has an enormous impact on the retail industry as this medium can close the gap between the physical and virtual worlds in retail. In the metaverse, consumers operate in the virtual world, but can still get advice in real-time, and experience the products offered as they would in brick-and-mortar retail. Retailers can thus build up a relationship with their customers and strengthen their loyalty to the company or brand.

The research question of how the metaverse can be used by retailers was subsequently answered. It was found that the metaverse is currently and primarily being used as a marketing

tool in the retail sector to strengthen brand image and increase customer loyalty. Based on the use case of Walmart Inc. and expert opinions, a marketing strategy was developed that enables retailers to successfully enter and leverage the metaverse. This strategy focuses on the four key elements of marketing (4Ps), Product, Price, Place, and Promotion. Accordingly, the products offered in the metaverse should generally be designed to achieve the retailer's goals. To establish contact with as many users as possible in the metaverse access to the games, virtual environments, or services in the metaverse should initially be free of charge. In addition, the platform on which a company wants to position itself should be consistent with the company's goals, values, and norms. To make customers who have only been active in the metaverse to a limited extent more aware of the new medium more information about it should be published. This can be done through education, awareness campaigns, discussions, or public debates via social media.

Finally, the research question was clarified to what extent technical, legal, and social challenges can limit the application of the metaverse by retailers and what actions are required. It has been shown that the software and hardware solutions currently available already provide access to the metaverse. However, user-friendly solutions that are tailored to the required complexity and processing speed of the data are still missing. Therefore, it is recommended that retailers acquire software and game developers who are already creating and experimenting with metaverse worlds. To increase the usability of the headsets and reduce costs it is suggested to produce them with the help of product designers in the company or to collaborate with VR headset manufacturers. Finally, it was identified that the legal and social challenges are comparable to those in existing e-commerce. In general, all the laws of the physical world should also apply in the metaverse. However, according to the expert opinion, it is impossible to introduce a global authority. Therefore, every company operating in the metaverse is responsible for

creating a secure environment itself. Since there will probably be legal gaps despite great diligence, each user is ultimately responsible for what data he or she provides in the metaverse.

After the research questions have been answered, the limitations of the work project and future research possibilities are indicated. Due to time and space constraints, only the retail industry and the use case of Walmart Inc. were addressed in detail. Since the literature analysis and expert interviews revealed that immersive marketing is currently one of the most common use cases in the retail industry, this work project focused on the discussion and analysis of this topic. For future research, it can be investigated what strategies other retail companies not mentioned in this work project that are already using or thinking about using the metaverse are pursuing. It can be assumed that additional areas of application will be possible in the metaverse in future in addition to marketing, such as the trade of digital goods briefly addressed in this work project. In the metaverse, transactions are processed via cryptocurrencies. This area also offers potential for deeper analysis. Finally, it can be expected that the metaverse will not only affect the retail sector in future. Therefore, the impact of the metaverse on other business sectors can also be investigated in further work.

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Appendix

Appendix 1

Participants of the Interview

Respondent	Surname	First Name	Function	Location
Respondent 1	Teixeira	Sara	NFTs & metaverse marketing & retail manager at Exclusible	Portugal
Respondent 2	Repp	Marilyn	Retail expert with expertise in AI, metaverse, web3, and blockchain at Handelsverband Deutschland	Germany
Respondent 3	Tunc	Fatih	Software developer with expertise in AR/VR at it-economics GmbH	Germany
Respondent 4	Krämer	Raimund	Software consultant – Expert in unity, android, AR/VR at it-economics GmbH	Germany
Respondent 5	Schmid	Stefan	Partner in law and contract management in IT & metaverse operations at it-economics GmbH	Germany

Appendix 2

Interview Guidelines

Guideline 1: Retail

Respondent 1: Sara Teixeira

1. What future impact will the metaverse have on the retail industry?

When the Covid19 pandemic began, retailers started to question the role of stores. The store of the future will no longer rely on the product but on the experience and the relationship with the brands of the companies. Retailers also need to adapt to digital technological changes, because they can't for example, use the same interface or mobile devices in the future. This means that retailers must look at both, the digital and physical aspects in the future. The digital aspects need to be considered when it comes to transactions, buying, and selling, in the metaverse. The physical world needs to consider the experience of the customers as it was so far. Due to digital features, these physical experiences can be created. This is where the metaverse comes in. The metaverse can be the enabler of creating those customer experiences. The reason for this is that the metaverse is a creator economy, where a user can create anything. Creating something in the physical world is way more difficult and creates more costs than in the metaverse because of flexibility reasons. The technology is already there and is being used.

The digital format in the metaverse enables retailers to build a community, in which users and retailers can interact and connect while creating a one-on-one experience in a more sustainable and simple technological way. The metaverse can fill the gap between the physical and the virtual aspect of retail. So far, a customer experience was created in 2D on E-Commerce platforms. For example, an environment was created based on the theme of the product collection. However, the social and community aspect of the physical world was missing. In the metaverse, this digital and physical gap can be closed, because first a virtual environment can be created. Second, the community and interaction between retailers and customers across

several channels will be possible in the metaverse. Being present all the time as a retailer enables new possibilities to find out customer needs and thus enables the customers a seamless and holistic shopping experience (omnipresence). So far, the omnichannel approach was applied in 2D. Now in 3D, retailers need to go one step further to be omnipresent to connect the physical and digital worlds. This connection creates one of the biggest competitive advantages of the metaverse in retail, which leads to the fact that retailers can reach every customer, in the digital but also in the physical world. Especially the young generation is looking for brands or retailers to partner with and not just provide products. This partnership can be provided by this physical and virtual connection. Therefore, retailers need to make a strategy and not just enter the metaverse space, that is integrated with the whole journey and parts of the company. They must go where the consumer is. They must provide them with a customer experience. The metaverse can be the enabler of creating those customer experiences.

2. How can the metaverse be used and applied by retailers already? What competitive advantages arise?

As mentioned, the creation of those customer experiences and environments will be possible in the metaverse and can thus create a big value and competitive advantage. The reason for this is, that the metaverse is a creator economy, where retailers can create anything, they want. Creating something in the physical world is way more difficult and creates more costs than in the metaverse. This makes it possible to create completely new products in terms of digital goods. For example, retailers are already creating and selling digital products such as clothes, or discounts, which users can use in the physical world while buying a physical product. Currently, the greatest value and benefit to the customer comes from creating virtual experience and environments, but also purchasing digital goods, as it provides customers with a new physical lifetime experience, they haven't had so far. This also merges the physical and digital

worlds, meaning that physical and digital are seamlessly connected. This creation of new digital worlds and products can create new markets in the retail industry. Retailers can thus reach new customer groups in the metaverse and expand their product collection. So, the most important aspect here is, to be as creative as possible, and discover new directions while following the trends and the customer needs. When it comes to marketing, for example, retail companies are already using gaming platforms, where retailers can customize their products, and customers can buy digital assets and can then choose if they want to receive the digital product in real life as a physical product. Marketing is one of the most common and used tools so far in retail in the metaverse, and thus offers a great opportunity to market and place their products in the virtual world or sell digital good. This will not just enable great marketing opportunities but will also positively impact the supply chain. If customers buy digital products first and then choose to receive them as physical products, the physical product can be customized. This will help a lot in terms of sustainability as well as controlling the number of productions and inventory. The metaverse will thus have a positive impact on the supply chain.

3. How can retailers and consumers use the metaverse in the future?

In the future, people say that the metaverse will represent the real world in the virtual world. In that sense, retailers can create digital twins of their physical collection which will be presented in the virtual world. Digital goods can be bought virtually, and consumers will get the physical product. Or consumers will buy the physical product and will get the digital product in form of wearables which users can use to dress their avatars for example. Furthermore, customers will have the possibility to try and test products in this virtual environment and get for example assistance from the retailer in the virtual store. The interaction between customers and retailers in the metaverse will differ from metaverse to metaverse. For example, chatbots can be used. But this mainly depends on the metaverse

provider.

4. How is the demand for retail products in the metaverse?

Especially the young generation is looking for brands or retailers as partners and not as just product providers. But not only the young generation is demanding retail products in the metaverse. For example, the company Exclusible made an experiment. They have created very expensive digital goods for 15 ETH which is more than 1.000 EUR. They wanted to find out, who was going to buy this. And surprisingly, it was a 53-year-old man who bought his second digital good so far at this point. Currently, many people already have a digital wallet, and more people will have a digital wallet in the future. It will be sneaking into our lives, such as all the other technological developments in the past years. The most powerful tool right now, that the retailer needs to take into consideration is gaming. Because many people are already using those gaming platforms and spending a lot of money on schemes to be fully integrated into this virtual world and go into several different metaverse platforms. They want to be connected, and they want to switch to different metaverse platforms. The metaverse platforms are open spaces, where everyone can be part of it, and nobody can be excluded.

5. What strategy of retailers is needed to reach their customers in the metaverse?

Retailers need to make sure, that they have a very clear strategy in terms of the goals and whom they want to reach in the metaverse while they are creating this experience as well as what to offer to this community. For example, they can produce their own game, where they can present and place their physical products as a marketing strategy. After that, retailers must make sure to choose the right partners (metaverse providers, etc.) also when it comes to security. Once, retailers have found the right metaverse platform, which matches their goals and strategy, they can start testing and experimenting in the metaverse. This is also why retailers need to make

sure, that they partner with the right metaverse provider/ developer, taking into consideration the goals and needs to provide a customer experience. So, it starts with choosing the right partner as a retailer to be successful in the metaverse. For example, if customers want to make marketing on gaming metaverse platforms then Decentraland or Roblox will be a good option. But if retailers want to focus on the interaction and the community aspect, then Spatial could be a great platform to partner with. If retailers want to create high-quality, realistic graphic design and a highly immersive experience, then Journee would be a great fit. Currently, it is very important to already start with the first steps, and once everyone is in the metaverse, then retailers can start to learn by best practices. Even if the technology is not that highly qualitative, it doesn't need to be an obstacle for a retailer when they go into the metaverse. It all depends on how the retailers want to use the metaverse and what goal they want to achieve and what audience they want to reach. Try to be as creative as possible as a retailer. Focus on the customers and the reason why they should choose you as a retailer. Ask yourself, how you can impact the world when entering the metaverse or changing the strategy. Make sure that your customers see you as a life partner, not just the provider of products. Choose the right partners when moving into the metaverse as a retailer.

6. How can retailers speed up the process so that consumers become more active?

To speed up the process, first, retailers need to start educating their audience. Second, retailers must implement web3 or metaverse departments into their company and train their employees. Especially luxury brands are currently creating those departments. However, it is still a long way to go. The reason is that retailers also need to take into consideration creating new customer segments and reaching new customer groups. Retailer companies need to find out how to be part of the market and part of the community, to reach the customers and get them further into the metaverse and thus speed up the process. Furthermore, to push the process,

retailers need to be as creative as possible, and shouldn't overcomplicate the user experience. Furthermore, retailers must also make clear what impact and utility the metaverse will have for its customers and the world regarding sustainability. Retailers must make this clear to their customers, that the consumers accept and understand the sense of the metaverse so that they automatically move to the metaverse.

7. How can retailers reduce the prejudices and reservations of consumers, e.g., regarding their security in the metaverse, so that they will enter the metaverse?

One word that answers that question is education. Retailers need to educate their customers when it comes to the metaverse and web3. They must provide them with the right information about that topic. They need to start educating their audience. Because in the end, customers need to go there. They need to have this know-how. So, it starts already in the early stages of education. But not only on the customer side. Also, retail companies need to get educated. Once consumers start moving further into the metaverse, retailers need to follow them. So, education on both sides is very important.

Respondent 2: Marilyn Repp

1. What future impact will the metaverse have on the retail industry?

Most people who deal with the metaverse think that there is no metaverse yet. It will arise only slowly evolutionary. It will take about 10-20 years until there is something like the metaverse and until all criteria are fulfilled to use the metaverse. The metaverse is currently a trending topic. The development phase is already done, and the technologies have been developed for a while. Currently, the topic is in the discussion and education phase with most companies trying to get an understanding of the topic and the terminology. The metaverse is a new stage of the internet where everyone will co-own compared to the web2 and everyone will and can manage their data. There will no longer be one platform, such as Facebook and Instagram where

everyone is located. The metaverse will be more diversified. It will be possible to move from application to application with a single identity and to take digital property with you because the spaces will be connected. It will be possible to communicate and exchange with each other in the metaverse. This did not exist in the previous e-commerce. This is one of the biggest competitive advantages for retailers.

2. How can the metaverse be used and applied by retailers already? What competitive advantages arise?

First, it is important to understand that the metaverse is currently used in retail, especially in marketing, because it can strengthen customer loyalty and customer engagement. The metaverse offers new approaches to do this. For example, Deiters, a medium-sized stationary retailer with 30 stores in North Rhine-Westphalia, started a customer loyalty project in the metaverse. The goal was to build a party community in the metaverse. The creation of the community is probably one of the most relevant success factors in the metaverse. The key point is to implement a strategy on a platform or build a community where most active people are. 40 million people are already active on Roblox or Fornite. The goal is to communicate and trade with the people in the community. To become a member of the community, Deiters produced digital goods that could be purchased to gain access to this community. These are costumes that avatars can wear in the metaverse worlds and virtual environments. In addition to the digital products, the community is also regularly sent physical items (promotional items) as well as discounts. The exchange takes place in the community. Deiters also receives a lot of feedback on its product range from the community. For a stationary retailer, it is very difficult to get feedback on the product range. Therefore, the creation of a community is an essential success factor to experience customer satisfaction. The reason why people have started to give more feedback is that people have paid money to become part of this community. This automatically makes people feel more connected to the company and see the company as a

partner, as if you paid nothing. In addition, it is possible that the value of digital goods increases, which is why it is important to the community that the company becomes more successful and that more people come to the community thus digital goods become more expensive, and you can sell them at a more expensive price. Therefore, people are interested in the company and the project is successful. Currently, Deiters has 800 people in the community. However, before starting the project, it is important to know who the target group is and to focus on one specific group. In this example, it was the young generation. When you start such projects, you must start thinking about what the goal of the metaverse project. You must think about how you can reach your target group and where they are located.

The success factors that they were able to conclude from this are that, on the one hand, valuable customer feedback was obtained through the creation of the community, and on the other hand, it was recognized that many digital goods were purchased. In addition, they were able to reach a new group of customers that they did not have before. So, implementing a metaverse strategy can also expand the customer group or create a new target group. Virtual environments, customer experiences, and customer loyalty programs can be created, thus expanding the retailers' ability to approach customers and reach new customer groups. Also, for example, the design of products can be co-created by users. This allows more interaction with customers and feedback to be gathered, and product collections to be better planned because customer wishes can be better addressed. This has already been strengthened by social media, but it can be strengthened even more in the metaverse, partly because people will co-own the Internet.

3. How can retailers and consumers use the metaverse in the future?

What currently does not exist in retail are physical products that are offered in the metaverse as a digital twin. In the future, retailers will be able to market, offer and sell physical products and collections in the metaverse and have them physically sent to them. People will then presumably be able to see on their bodies in a 360-degree view what the product looks like.

This is still a future territory, as it is also not yet clear how this can be implemented. This will promote the sustainable aspect enormously. Fewer goods are returned. In fashion, for example, the return rate is particularly high because the sizes don't fit, or the item doesn't look as expected. The digital twin can promote fewer returns and thus make the company more sustainable. Also, in the future, consumers will be able to take everything they own to every other world in the metaverse, which is a huge advantage. There is no need to create a new profile and avatar every time, and all digital goods that have been purchased can be accessed in any world.

4. How is the demand for retail products in the metaverse?

As already seen above, many users are already active on gaming platforms such as Roblox or Fortnite and are also willing to spend money on digital goods. The example of Deiters has shown that Deiters currently has 800 people in the community.

5. What strategy of retailers is needed to reach their customers in the metaverse?

Retailers must first think about what product they want to offer, what goal they are pursuing in the metaverse, and what target group and customers they want to reach. Then you must consider where the target group is located and how to reach them. The key point is to implement a strategy on a platform or build a community where most active people are such as on platforms Roblox or Fornite with more than 40 million active people. The goal in the metaverse is not to focus on the product, but on the community, and what get their opinion on the company and their products to build a connection whereby the customer should be so strongly tied to the retailer so that this becomes the partner for life and incidentally will buy many of the products. The most important thing is that the retailer is always omnipresent, present with the customers, and communicates with them continuously and all the channels they use fit together thematically. They must focus on experience and get away from being a provider. Customers

don't need to be supplied anymore because they can theoretically get that anywhere. You need to create an experience that is tailored to a specific target group, that encourages the customer to only shop at and rely on that one retailer such as events to share advice, etc.

It is also important to understand that the goal is not to directly achieve a return on investment but to first implement a new innovative strategy (innovation project) (trial-and-error) to have a major advantage in the future over others who have not dealt with it at all or too late. Thus, the goal is not to achieve cash flow and sales directly, but to first try out the project and venture into something new. In addition, it is not particularly expensive to set up a metaverse project. Therefore, access to the metaverse worlds should initially be free. But to gain exclusive access to certain communities, digital goods can be sold, but not particularly expensive, to attract many people. Retailers can also charge money on their platforms from brands that want to present their goods there.

6. How can retailers speed up the process so that consumers become more active?

It is particularly important for retailers to educate customers via social media, for example, and to provide application examples. But ultimately, it is a business decision what should and should not be done and what goal you are pursuing as a retailer. However, the companies have not yet reached the point where they are forced to develop a metaverse strategy so that they don't lose touch and suffer disadvantages as a result, because it will still take a while before they reach that point. However, what is important in the beginning is to digitize the company, to already deal with the topics, and to consider innovation topics the big companies are dealing with. Because it can go fast, as you can see from the technological change in recent years. It is also important to look at the customer, where they are going, and follow the trend. The problem is customers are not that forthcoming. Therefore, retailers must develop a strategy and possibility like in the mentioned example above from Deiters to get this information and feedback.

7. How can retailers reduce the prejudices and reservations of consumers, e.g., regarding their security in the metaverse, so that they will enter the metaverse?

Particularly important here are education, discussions, public engagement with the topic, and the dissemination of knowledge via social media (Instagram, Facebook, Twitter, and LinkedIn). The energy requirements of technologies such as blockchain are also often viewed skeptically. But with e-commerce, the online stores are not talked about how much energy this technology consumes. Servers and cloud services that currently already exist also consume a lot of energy. However, it is still talked about that, for example, blockchain again consumes far more energy than the already longer existing technologies that we already use constantly. Therefore, one should clarify this publicly. As a retailer, you also must explain and discuss what the relations are, and what impact you can achieve with the metaverse or blockchain technology, in turn, to compensate for the negative aspects such as energy consumption.

Guideline 2: Technology

Respondent 3: Fatih Tunc

1. How advanced is the software to use the metaverse? How can it still fail?

In terms of computing capacity and speed, the metaverse can already be used and does not pose any problems here. In the future, it should even be possible to generate the same computing power with less energy. However, the graphic representation in the development of the software is rather the problem. A graphical representation in the metaverse is already given and accessible to the public. For example, Meta already has about 300,000 users in America who are using the metaverse in the test phase. However, this raises the question of how far the metaverse can differ from our real world. Currently, the graphical representation is rather pixelated and looks like cartoons. If this should hardly differ from the real world, and the demands on the graphical representation increase, then the question arises of how to manage

this in terms of energy, especially in the current energy crisis, global warming, and climate change. Currently, about 20% of electricity is lost to Bitcoin mining, which is the decentralized Bitcoin data center, which is a significant amount. However, despite high energy consumption, the software is functional and accessible to the public. Thus, it should not fail because of that. One factor that can cause problems, however, is the number of metaverses available to people. There is not only one metaverse, but many ways to get into the metaverse. However, if there are too few providers of metaverses, then there can be a monopoly. This gives the providers power over the assets that users have in a metaverse. They also have all the users' data. This raises the question of whether data collection can be reconciled from a legal perspective and with the GDPR. For example, it should be the case that users create their content and that this also belongs to them. With meta, however, it already starts so that users create content, this content, however, Meta, and not the users belong. From a moral point of view, the metaverse should also be viewed critically. If you are on the road with a virtual avatar, the inhibition thresholds are lower to commit something immoral, such as bullying or harassment of any kind.

2. How long is the development time expected to be before the metaverse can be deployed globally from a technical perspective?

The software to get into the metaverse is functional and ready to use. The only question to ask is how demanding the graphical representation is, and how the metaverse should differ from the real world. As mentioned earlier, Meta already has about 300,000 users in America using the metaverse in the testing phase. However, until the metaverse can be fully used depends not only on the software but also on the hardware. In approx. 3-4 years it can be so far, that one can use the metaverse with the available hardware in the public. However, depending on the demands on both software and hardware, this may still be delayed.

3. What are the technical requirements in terms of processing speed, complexity, and power consumption (e.g., with the current energy crisis)?

The metaverse requires approx. 1,000 -fold increase in computing power and exhibit massive energy consumption for the use of VR/ AR and the storage of data in the cloud, among other things. As mentioned earlier, about 20% of electricity is also lost to Bitcoin mining, i.e., the decentralized Bitcoin data center, which is a significant proportion. Two mechanisms can be used to perform the transactions that can take place in the metaverse. However, the execution of such transactions requires a lot of power. The Proof-of-Stake process is intended to create a more environmentally friendly future for the metaverse and is intended to replace the current more polluting Proof-of-Work. Due to the validation of the transactions according to a random principle, the PoS procedure enables shorter transaction times, e.g., for the exchange or purchase of digital assets in the metaverse. The shortening of transaction times is thus more energy efficient.

4. Currently, the hardware is still very expensive and heavy (including VR and AR glasses). How long is it likely to take in development before there is comfortable, easy-to-use hardware on the market to buy?

The idea is that at some point there will be a world that is almost indistinguishable from the real world. Currently, the technology is already so far advanced that it can be used. But on the one hand, the hardware is still too heavy. This means that in the long run, it will be uncomfortable to carry the hardware, which will limit its use. And on the other hand, you also want to feel and touch objects like in the real world. For this, you need hardware that gives you this feeling and you can feel clothes on your skin, for example. Here, however, the hardware is even further away from this. Even if you want to try on clothes in a virtual store, it may be possible in the future to see your reflection in a virtual garment and view it from a 360-degree

angle. This is technically probably not that far away. In approx. 3-4 years it can be so far, that one can use the metaverse with the available hardware in a broad mass. Lightweight and convenient hardware could be developed in the future in the form of contact lenses and headphones that allow access to the metaverse. However, this will likely take much more than 3-4 years. The first step is to get VR and AR glasses on the market for the first time and make them accessible to everyone.

5. What are the requirements to make the necessary hardware and thus the metaverse easily accessible to average consumers?

Once the hardware exists, it will sooner or later be accessible to everyone, especially because hardware becomes cheaper over the years. After about 2-3 years after the introduction of the hardware, every consumer will be able to afford it. However, monopolies can be detrimental to the introduction of hardware. The more providers of hardware there are, the more the prices can be adjusted and reduced so that everyone can afford the hardware. Currently, Google, Microsoft, and Meta are the main hardware providers on the market. To lower the prices and distribute the hardware, even more, companies could, for example, produce their hardware.

6. What technical skills are needed? Which educational places or study courses are needed, that go in this direction? Do you learn those topics in the general IT program?

There are already electives in the normal IT degree program in which you can specialize in the direction of VR/AR or cryptography. In addition, you can teach yourself the subject matter as a developer very well, for example via videos on YouTube. This should be sufficient for the moment to participate in the design of the metaverse in a company and to help design and create it. However, to design a metaverse, you need several people to program and develop it. Because the metaverse represents a whole universe, a platform that other people can program software

or design content on it. Thus, it is rather unrealistic that one person designs and programs a metaverse. Developers need to get together/form a talent pool and work together on a project or in a company to create a metaverse or software to implement the complexity and the requirements.

Respondent 4: Raimund Krämer

1. How advanced is the software to use the metaverse? How can it still fail?

The metaverse is a kind of multiplayer VR game. On the one hand, you need VR hardware in the form of VR headsets. In VR glasses, you can look through two lenses, with two screens built in side by side behind the lenses. An alternative would be VR glasses into which you can slide a smartphone, looking at the smartphone through two lenses. The smartphone's display is placed twice side by side. However, the angle of the lens looking at the display is different in each case, so the effect is like VR headsets. The alternative works the same way, but only with weaker hardware since it is calculated with the smartphone and not with the PC. This alternative is more accessible for users because it is cheaper. On the software side, you need a game engine that calculates and displays the image of the game/metaverse. A game engine is a program that makes it easier to develop and program a game. In most games, this game engine is already given. It is comparable to web frameworks, which go one step further than the framework. A game engine does most of the computation to program a game. You can use a game engine to program any game on any software platform. The only thing that needs to be developed is the content, 3D models, textures, etc. as well as the programming for what should be in the game/world and what makes it tick in the end. Unity or Unreal are examples of game engines and are quite well known among software developers as well as free to use or a license must be purchased only after a certain size of the project.

With these frameworks/game engines like Unity or Unreal, it is nowadays already possible to program your metaverse even as a hobby developer and graphic artist. The software is far

enough developed. There are already some multiplayer games, which have very large worlds and, in that direction, goes also the metaverse, which should be a virtual universe. There are already some online role-playing games that also go a bit in that direction and allow a second virtual life, just not with VR headsets yet. However, if you want to represent real life as we know it in the metaverse, which is also what the metaverse is and should be, then it is still quite inadequate graphically. The reason is that the bigger the world you want to represent, the less realistic you can make the virtual world. For one thing, you need a lot more calculations for it, which the hardware at some point can no longer cope with in terms of computing capacity. You could partially circumvent too large calculations with tricks, however, even that goes to the limits if you want to recreate reality. The software is developed so far, and there are no big gaps where the metaverse could still fail.

2. How long is the development time expected to be before the metaverse can be deployed globally from a technical perspective?

The software is available and already in use, and anyone can use it. Some game engines are accessible for free and relatively easy to use, especially if you have a little programming knowledge. Networking, and multiplayer games, where you are in the same game with other users and can interact via a server, are a bit harder to program, but there are already given software solutions that make the whole thing relatively easy.

3. What are the technical requirements in terms of processing speed, complexity, and power consumption (e.g., with the current energy crisis)?

Users want maximum graphics performance. The higher and better this graphics performance is, the higher the power consumption is. There is also a limit here that you cannot exceed. Even if you dive into the metaverse with VR headsets and your cell phone in front, which can happen

in many cases because people want to be mobile, you still need such a high computing capacity that the cell phone's battery life won't last long. This is also the case with games in 2D nowadays.

4. Currently, the hardware is still very expensive and heavy (including VR and AR glasses). How long is it likely to take in development before there is comfortable, easy-to-use hardware on the market to buy?

The metaverse starts where you immersively enter the metaverse through VR, AR, or MR. Anything else in 2D can be understood with the multiplayers that have existed in gaming for some time and is not the metaverse. The difference between VR and AR is on a spectrum. There is a smooth transition in some ways. With VR, you immersively enter a second world and bring your real self into another, virtual environment. With AR, you're not creating an additional reality, you're augmenting real reality, with things that are virtual like Pokemon Go or information about things in real reality. With both, you have glasses on. With AR, however, these glasses are transparent, so you can still see the real world. Also, with AR, virtual things can be augmented by a tablet or smartphone camera. With MR, virtual and physical are combined, so it's a combination of AR and VR. VR and AR have not yet caught on as one might have thought a few years ago. Especially because until now VR had to be connected to a cable where power or HDMI or sound cables are. It, therefore, weighs a lot. Also, people get carsick quickly because they can't see their surroundings, which can quickly lead to motion sickness, e.g., compare it to reading in a car, and you make turns without seeing the turn though, you get sick quickly. One possibility against sickness would be to put a virtual point on the floor, where the user has an orientation/ reference point. However, it ruins the immersion a bit. A lot has already improved due to new technological developments, but it's still basically a clunky device that you must put on your head and walk around with. Meta Quest Pro, the new version of

Oculus and can be charged via USB-C cable. Additionally, you have two controllers that you can use to manually control things in the metaverse. It can still take about 4 years until the headsets have really arrived in society and everyone is walking around with them.

5. What are the requirements to make the necessary hardware and thus the metaverse easily accessible to average consumers?

The headsets must become lighter than they have been so far so that they reach the public and are used. We also must find a solution to avoid motion sickness so that users can use the headset for more than half an hour a day. It should also look reasonably good so that people will buy it. The Meta Quest Pro already looks quite appealing and not as boxy as it used to be. So, technical development is on a good path. In the future, VR headsets could also look smaller and in the form of goggles with a small screen inside. However, these will have to completely seal the eye so that you really can't see anything of the outside world and immerse yourself in the world immersively. VR glasses in the form of contact lenses are rather unlikely. A visual range of more than 180 degrees with VR glasses would be conceivable and relevant. So far, this is not possible, which could also be a reason why users might feel sick when using them.

6. What technical skills are needed? Which educational places or study courses are needed, that go in this direction? Do you learn those topics in the general IT program?

You must think about which people you need as if you were building a smartphone. So, you need experts from the hardware and software area. The software area includes computer scientists, media computer scientists, and business computer scientists. When it comes to building VR headsets, other specializations are required. These include electrical engineers, product designers, and designers who create the usability design and the user experience. You need a team of experts to do this, that you have like Meta, who provide both hardware and

software. You should acquire employees in retail companies. But if you only want to create the software yourself and use existing hardware, then this is also feasible with software or game developers. In both cases, costs can be saved, and the technology can be spread further. So, it's not very hard to find talent that can build the metaverse. Users who want to enter the metaverse and create and create content themselves can also program something of their own in the metaverse using NoCode, for example, even if they have no programming experience. It is not on the same technical level as if you would program something yourself. However, it also allows non-technical users to create and extend something themselves.

Guideline 3: Legal & Social

Respondent 5: Stefan Schmid

1. Which laws are generally or additionally necessary so that the metaverse can be legally applied in the future for companies/economy and consumers?

The metaverse will be the next evolutionary stage of the internet. First, all the laws that exist in the physical world will apply in the metaverse. It starts with who owns the data that is provided in the metaverse. There will be different levels of privacy in the metaverse, which will make a big difference compared to today's Web2. Therefore, many different laws besides the privacy law are needed, which also exist in the physical world, such as property law (who protects the property you own or develop), criminal law (who protects you from criminal acts in the metaverse), civil law (conclusion of contracts, transfer of property), public law (how can the state use the metaverse e.g., virtual registry office). In addition, the competition law about cartels will also apply in the same way as before. This means that the provider of a metaverse platform, such as Meta, must not achieve a monopolistic market position, especially if this monopolistic position has been achieved with the help of illegal activities such as data theft. If this occurs, heavy penalties will have to be paid. There will be no area of law that is not affected.

2. How is it possible that global laws apply to the metaverse, i.e., boundless laws?

As is already the case today in web2 or the dark web, the biggest problem in the metaverse will also be that the metaverse does not stop at the borders of national states but is transboundary/borderless. All the laws we know are specified in each country. There is no global law. However, it won't be worse or more difficult in the metaverse than it already is in the web2. Of course, the web2 is quite well protected so far and is not lawless. On the one hand, it is protected by the provider of the respective service. On the other hand, web2 has so far been protected by the state legal system in the respective country in which the provider of the service is located or works. As in web2, this will probably also be the case in the metaverse. However, where the boundaries are expected to merge in the metaverse is in the aspect of who the provider of the metaverse is, because interoperability will be possible in the metaverse, and users can jump immersively from one provider to another. The legal aspect is about where the metaverse provider and the users are located. German law, for example, can also control which offer or which domain may not be accessible on the web2 and thus most likely also on the web3. The government can thus prevent data streams from dubious providers from reaching users, for example.

3. How can data protection and security be ensured in the metaverse?

Ensuring data privacy and security will be a major challenge for the respective provider. Therefore, policy departments should be implemented in the company. Providers must create such a secure environment that the data is safe. Furthermore, users are responsible for what data they provide to whom in the metaverse. There will be platforms or offerings in the metaverse, as there are in web2 today, that can be trustworthy or criminal. Also, such as in web2, a user needs to trust the provider. Currently, there is a big race going on between the biggest Metaverse platform developers. The biggest providers are among others Google,

Microsoft, Meta, and Apple. Each of them wants to build the biggest metaverse platform. As a retailer, it is important to partner with a platform/ metaverse provider which they can trust in terms of norms and data protection.

4. How can identity theft or crime be prevented in the metaverse? What ethical and social norms must exist? What institutions must exist so that law and order can be established, such as the police in the physical world?

So far, there is no general law and authority on web2 and thus not on the metaverse either. This means that the provider is also responsible for creating an order on its platform/ in its virtual space and for ensuring that no crimes or criminal acts occur. For example, Meta/ FB also already filters, shared posts, according to whether the legal framework allows it or not. But there is a great danger that this will also mean that freedom of expression will not be respected. The more multifaceted the virtual world becomes, the more difficult it will be to manage without an unmediated police department to ensure law and order. However, the world is not yet ready to create a police department for the metaverse. Because ultimately, each provider is responsible for law and order itself. Even as the virtual world becomes more multi-faceted, it is assumed that any amount of time and energy will be put into a legal framework and law and order within the provider's organization. For example, providers and thus retailers will have to introduce a policy department that will deal with precisely these issues and thus ensure law and order. This can work, as it already does today in web2. Nevertheless, there are gaps here as well, because every country has different social and ethical, and legal values and norms.

5. How is the protection of minors handled when trading in the metaverse?

The business capability in the metaverse can be controlled, as in the web2, by age controls or rules or laws of age limitation. In the web2, however, it is still timidly implemented. This will

probably also be the case in the metaverse, although the government will take a much closer look at the metaverse. However, every provider and thus also retailer is responsible for carrying out age checks. In web2, for example, age verification is carried out via credit or EC card. There are KYC - Know Your Customer - rules in the world that apply both in the metaverse and in web2. Of course, it is also relevant here that users visit reputable providers' websites. For example, the European legal system has always provided for the possibility that the user who wants to accept or trade an offer in the metaverse must authenticate himself. Thus, the government can also force the provider to provide proof of age. If this is not the case, the providers will be blocked.

6. What will be still the biggest challenges in retail in the metaverse?

Retail is a harmless case compared to politics, for example. If the retail trade wants to deal with digital goods and services, then a new world opens that the individual world has no idea about yet. This involves the world of intellectual property such as copy protection, distribution protection, licensing conditions, and further user rights. If you want to do retail in the sense of commerce, you must be careful not to get hacked, as is already the case today. For most retailers, physical goods and merchandise are still of central importance and will be in the future. Therefore, retailers should rather ask themselves what can be done in the metaverse today, such as running e-commerce, running loyalty, marketing, sales, and creating digital twins. Another option is for retailers to rent merchandise to consumers, and the consumers can sublet the merchandise, with the retailer receiving an ongoing rent. This allows the challenge of a new market being created to be taken on by retailers directly, not allowing consumers to rent goods to each other, but allowing retailers to start renting goods directly themselves and having control over the reuse of the goods

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