



Risks in the metaverse

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1. Introduction

The metaverse is no longer a speculative concept explored by tech visionaries in science fiction novels. After decades of technological progress, the metaverse is gaining momentum as an opportunity with great disruptive potential. Compelling, yet hard to grasp, the rise of the metaverse is undeniable. A breakthrough moment can be pinpointed to October 2021, when Mark Zuckerberg, founder and CEO of Meta, announced the beginning of a new chapter for the company formerly known as Facebook. The leap was the adoption of the next immersive platform, an embodied internet: the metaverse (Zuckerberg, Founder's Letter). Google captured this moment in time, recording 2.62 million searches (Google Trends) for the term 'metaverse' in the span of one month. The metaverse did not only become an internet sensation, but it is now a tagline for companies around the world which are clearing the tracks to explore the advantages the metaverse could bring.

Society is currently at a crossroads between the rise of the metaverse's popularity and the convergence of emerging technologies boosting its applicability. Materialising the opportunities offered by the metaverse, a report by McKinsey¹ put forward an estimation of the value creation in the metaverse market. In 2022, investments into metaverse development more than doubled compared to 2021, reaching approximately 120 billion dollars. By 2030, the value of the metaverse is projected to reach 5 trillion dollars. Packed with opportunity, the metaverse adoption also comes with associated

risks. It brings together interactive platforms, immersive shopping experiences and absorbing working environments that dissolve the boundaries between online and offline interaction. As a result, the merger of our physical and digital world triggers new types of risks for users and this environment will require calculated action by legislators.

1.1. Purpose

As new challenges arise, risks linked to the use of the metaverse must be considered. The purpose of this whitepaper is to investigate risks particularly associated with the metaverse and the experiences it delivers. How will risks manifest in the future? What aspects of people's lives will be affected by the metaverse? What is the role of regulators in predicting and appealing risks in the metaverse?

The risk analysis will help address these questions and provide insights into how to identify the risks in the metaverse. This paper is focused on the user and what they (will) experience within the environment. Given the convergence of multiple disruptive technologies in one digital space, the metaverse amplifies current digital risks and brings forward new concerns for its users.

It is crucial for regulators and policymakers to acknowledge the risks and strike a balance between encouraging investments in the metaverse and protecting its users' rights. Responsible practices and

standard creation should not be overlooked when first tapping into the capabilities of new technologies.

Digital regulations have recently become more prominent and far-reaching. Oftentimes, regulations lag behind technological developments. That is why, this whitepaper aims to make current legislative gaps more apparent by elaborating on what impact the metaverse will have on its users.

1.2. Our perspective

We will look at the metaverse from a responsible business perspective. New technological advances have oftentimes disruptive effects and the metaverse is no exception. Organisations that consider playing a part in building and implementing the metaverse landscape must assume responsibility when providing users with such digital experiences. For this reason, we will investigate responsible business practices that create value for the organisation through harbouring an active concern for the environment, ethics and its users. The goal of taking these elements into account is to make a positive contribution while leveraging the benefits the metaverse brings.

To achieve this goal, our whitepaper will be grounded in identifying risks that affect most aspects of a person's life. The metaverse has unique features which make it stand out in comparison with other innovative technologies. This also entails that the emerging risks are intensified and their effects or extent is

¹ McKinsey. (2022). Value creation in the metaverse.

not yet known. For example, cyberbullying is widely recognized as harassing someone online through sending threats, sharing private information without consent, and spreading rumours to damage reputation. In the metaverse, aside from being exposed to such cyberbullying methods, you are also at risk of someone stealing your digital property or violating your avatar's autonomy.

Concerns related to digital environments are not new and most users have experienced online risks to a degree. That is why, users might recognise risks they have been previously exposed to, such as malicious cyber-attacks, invasion of privacy or identity theft. Nevertheless, the metaverse amplifies risks for users and the extent of their impact is yet to be explored.

Deloitte recognises the confusion and divisiveness over the metaverse and aims to contribute to a deeper understanding of the concept. Based on our know-how related to emerging risks, technical skills, and years of practical

experience in various industries, we are ready to bring a new perspective to the table. Our main focus will be exploring the future effects of the metaverse and the potential risks it might have on users. By using the latest industry insights and varied expertise, we aim to analyse a less explored outlook on the metaverse but one which is crucial for its responsible development and adoption: the risk landscape. The combination of legal, operational and technological knowledge covers the multitude of facets of the metaverse and can render insightful patterns for users, organisations and regulators.



2. Metaverse: puzzling the pieces

Imagine the metaverse as a mystery puzzle with no reference picture provided on the box. Instead, the full picture gradually appears as pieces are placed together. When solving the puzzle, actors such as scholars, business leaders and policymakers are working towards finding the best matches. Since the future potential of the metaverse is still unknown, agreeing on how to fit the pieces together has proven difficult. Despite the divisiveness over how to best define the metaverse, some characteristics are recurrent and crucial for understanding the concept.

This chapter will capture current perceptions of the metaverse and define the main characteristics which makes it stand apart from other emerging technologies instead of providing a fixed definition. Moreover, an alternative way of framing the metaverse will be included. By sectioning the concept in three comprehensive, practical layers, it becomes easier to examine essential components and ultimately create a working definition for the metaverse.

2.1. What is the metaverse?

Attempts at defining the metaverse have been consistent throughout the years, yet general consensus remains out of reach.² It is expected that different actors seek to define the metaverse in relation to their previous experience, industry affiliation or ambitions. That is why definitions diverge but still preserve important common characteristics particular to the metaverse. The EU Parliament's Policy Department for Citizens' Rights and Constitutional Affairs proposes the following definition in their study: *"the metaverse is a digital simulation of a multidimensional space. The metaverse can be provided by public or private actors for single users or as a networking platform. It can mirror reality, create a simulation of an entirely new space and actors (bots), or mix both."*³

One ambitious way to define the metaverse can be attributed to Mark Zuckerberg who sees the metaverse as the next iteration of the internet. In his words, the metaverse is *"a virtual environment where you can be present with people in a digital space."* He believes that *"the metaverse is going to be the successor to the mobile internet, and it's going to enable entirely new kinds of experiences"*.⁴

To compare, Matthew Ball, CEO of Epyllion and prominent author, acknowledges the metaverse as a virtual extension of the physical world but illustrates the concept as a *"network of virtual worlds"* rather than one comprehensive environment. He adds that the metaverse is characterised by features such as persistency, interoperability, large-scale reach,

immersive features, 3D capabilities, and real-time execution.

What Zuckerberg and Ball both have in common is the notion of a singular metaverse and, while this might be the case in the future, a fully interoperable, far-reaching metaverse does not yet exist. That is why scholars such as Alanah Davis take a more tangible approach and refer to metaverses as *"immersive, three-dimensional virtual worlds"*.⁵ Whether or not separate virtual worlds will be consolidated in an all-encompassing metaverse remains to be seen.

Despite efforts to grasp the concept, there is no agreed-upon definition; however, the general consensus is that an integrated metaverse does not yet exist.⁶ This begs the question what is holding back the emergence of the metaverse? Matthew Ball explains that, although remarkable technological improvements encouraged actors to explore the potential of the metaverse, there are still significant obstacles regarding capabilities from a software and hardware perspective.⁷ The metaverse requires a significant graphics processing unit (GPU) and central processing unit power (CPU) to render digital objects in real-time. It needs agreed-upon protocols to ensure that avatars are interoperable across different virtual worlds. Low latency and high bandwidth are also a must for engaging in simultaneous experiences that require large data transfers.

Given current limitations, user experiences in the metaverse often translate to a limited environment,

² Park, S.-M., & Kim, Y.-G. (2022). A Metaverse: Taxonomy, Components, Applications, and Open Challenges. IEEE Access.

³ EU Policy Department for Citizens' Rights and Constitutional Affairs Directorate-General for Internal Policies. (2023). Metaverse

⁴ <https://www.theverge.com/22588011/mark-zuckerberg-interview-facebook-metaverse-vr-ar>

⁵ University of Nebraska at Omaha, Davis, A., Murphy, J., University of Nebraska at Omaha, Owens, D., University of Nebraska at Omaha, Khazanchi, D., University of Nebraska at Omaha, Zigurs, I., & University of Nebraska at Omaha. (2009). *Avatars, People, and Virtual Worlds: Foundations for Research in Metaverses*. Journal of the Association for Information Systems.

⁶ World Economic Forum. (2023). *Demystifying the Consumer metaverse*.

⁷ Ball, M. (2022). *The metaverse: And how it will revolutionize everything*. Liveright Publishing Corporation, a division of W.W. Norton & Company.

restricted actions and confined interactive boundaries. Only fragmented elements of the metaverse are showcased, leading users to interact with enhanced virtual worlds rather than an encompassing, interoperable, single metaverse. That is the case in the gaming industry. Metaverse elements, such as 3D features, have a significant application in the gaming industry, however, characteristics such as synchronicity, persistence or capacity for unlimited users are not fully available yet. As a result, using the metaverse term interchangeably with other technological capabilities such as 3D or CGI (computer-generated imagery) creates confusion and limits the metaverse to a few restricted industries.

Similarly, the metaverse is often misunderstood as extended reality technology (XR) which includes augmented reality (AR), virtual reality (VR), and mixed reality (MR) features. While these elements greatly boost the quality of user interaction with virtual worlds, they are not prerequisites for the metaverse.

Decentralised vs. centralised metaverse

While the individual pieces of the metaverse are built, it is important to consider the governance and ownership in the end state. Who is responsible for its governance, how is ownership distributed and what are the subsequent effects? A key question that needs to be answered is whether the metaverse will be centralised or decentralised.

In a centralised metaverse, operations are controlled by one central entity. Users are invited to the environment to share experiences or create content; however, they must respect and are limited by rules, policies, and decisions made by this entity. This type of

metaverse can be associated with traditional virtual games such as Farmville or Roblox. Moreover, spending hours on your virtual estate or designing the perfect outfit for your avatar, the central entity has ownership of your digital land and appearance.

Leading technology companies are the actors which outpaced the rest in the race toward building a metaverse.⁸ Given their early start, in combination with considerable investments, tech giants can attract users with high-quality graphics, worthwhile experiences and exclusive content. Examples of companies testing the waters of the metaverse are notably: Meta presenting their “Horizon Worlds” environments, Microsoft’s shared platforms “Mesh” or NVIDIA’s “Omniverse” for creating metaverse applications. An evident downside of a centralised metaverse is the potential for monopoly and exclusion of smaller actors who will have difficulties to compete. In addition, a central entity can further limit access through payment-based privileges or censor users according to their set of policies.⁹

In a decentralised metaverse, users have the freedom to control their own experiences in an open-source platform. Decentralised metaverses are usually built on Web3 (distributed ledger) technology that aims to enable a secure and transparent environment to create, trade, and interact with virtual assets. Some early examples of decentralised metaverses are Decentraland and The Sandbox, both built on the Ethereum blockchain.

These worlds are often governed by decentralised autonomous organisations (DAOs) which offer the possibility for users to make decisions without the

need for a central entity. Participating in a DAO usually requires a user to hold digital assets such as cryptocurrency. The advantage is that all users have a say in the decision-making process and all decisions are recorded on the blockchain, making them auditable. Security, transparency and traceability can come naturally in decentralised metaverses given their heterogeneous structure and distributed storage.

Web3 and the metaverse are sometimes used interchangeably to describe the “next generation of the internet”. However, Web3 can best be viewed as an overarching definition of the decentralised web of which the metaverse is a part. The internet has experienced significant disruptions throughout time. The evolution started with the Web1 stage, marked by static web pages needed to be manually updated and was followed by the Web2 stage, an interactive web where online services and user-generated content thrived. Web3 is the next development stage which implies a paradigm shift from the centralised digital authorities to decentralised platforms enabled by technologies such as blockchain, smart contracts, and digital assets. The aim is providing greater control over data, more equally distributed power, transparency and openness.¹⁰

It is important to note that decentralisation is a spectrum where users can benefit from various degrees of control over governance, economic systems and content creation. Hybrid models can also emerge where a metaverse has a centralised decision-making process but utilises blockchain technology so that users can have ownership of their digital assets.

⁸ <https://www.reuters.com/technology/whos-building-metaverse-2021-11-01/>

⁹ World Economic Forum. (2023). *Demystifying the Consumer metaverse*.

¹⁰ World Economic Forum. (2023). *Demystifying the Consumer metaverse*.

3. Differentiators

The main takeaway from analysing metaverse definitions is that the end-state metaverse does not yet exist. However, the technical and financial efforts to make the metaverse a reality do not go unnoticed. What drives the investments and what makes the metaverse different from virtual worlds that we can currently experience through gaming or the use of extended reality technologies?

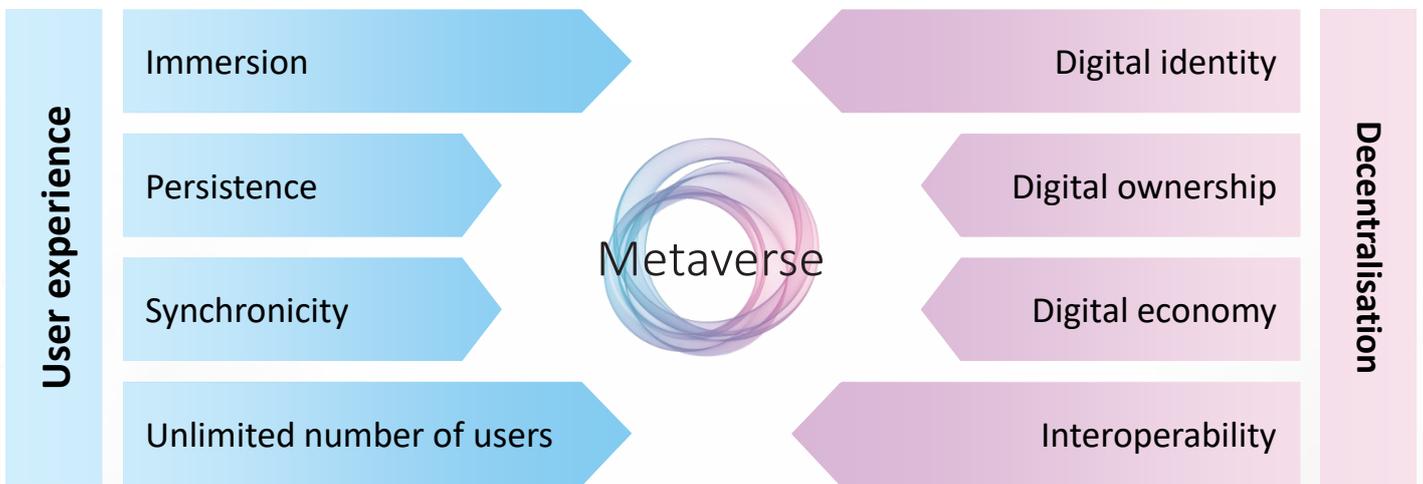
The metaverse is characterised by unique features with a high potential for

disruption in the technological field. These differentiators set the metaverse apart from current virtual experiences and require the convergence of technical capabilities, governance systems and payment schemes. Placing all these pieces together in one digital environment is unprecedented but also comes with risks.

Enhanced computing power, the prevalence of digital assets and intricate user-generated content are attractive promises for the metaverse experience.

However, rushing into development and implementation can prompt concerns for users of the metaverse. This chapter will introduce the features particular to the metaverse, also referred to as differentiators. These are split into two categories: differentiators pertaining to the novelty of user experience in the metaverse and differentiators enabled by decentralisation.

Differentiators



3.1. (User) Experience

A metaverse containing engaging experiences for users is crucial for its successful adoption. Activities, places and objects are expected to be of high quality and experiences must be realistic or augment reality in creative ways. The top drivers of excitement for consumers active in virtual worlds are 'connecting with people' and 'exploring new environments'.¹¹ For these objectives to be met, the metaverse experience needs some key differentiators explained below.

Immersion

Immersive digital experiences are not a new concept. The gaming industry masters captivating users through XR technologies, advanced 3D graphics or animation techniques. It creates engaging storylines and a sense of presence and community for players online. The metaverse adopted all these essential features and greatly extended the scope of activities users can experience. Aside of playing goal-orientated games in which an outcome is expected, the metaverse facilitates environments for learning, work collaboration, shopping and many more. The diversity of social interactions, places to explore and the possibility to customise every experience brought the sense of immersion to an unprecedented level in the digital world. Although technological developments enabled immersive sensations for users, technical limitations still exist in terms of processing power to render such complex environments.

Persistence

Persistence refers to the ability of digital elements to remain unchanged over time even when the user is not present. In virtual gaming worlds this is illustrated by, for example, users being able to build houses, logging off and finding them in

the same condition upon logging back in. Storing items and building lasting structures contributes to continuity, creating a shared history and a sense of place. In the metaverse, persistence is taken to the next level as users have more control over their environment and can create longer-lasting structures with which other users can interact at any time. In addition, given that the metaverse is designed to interconnect multiple environments, objects and places persist in different worlds and do not need to be recreated.

It is important to note that full persistence does not exist. The amount of data that needs to be rendered to sustain long-lasting experiences to the fullest extent is (currently) not manageable. That is why, in virtual worlds, enemies respawn and footprints in the snow disappear behind players. Achieving a high level of persistence with efficient use of computational power is an ambition for businesses and a long-awaited promise for users.

Synchronicity

Synchronicity is a crucial aspect of online user experiences. Receiving messages in real-time, using collaborative tools at work or playing video games with friends are all actions that depend on synchrony. Experiencing the same events at the same time is fundamental for the success of the metaverse. By synchronising users' actions, data and environment, you can enable valuable shared experiences mimicking or enhancing real-life events such as concerts, meetings or games. Unlike any other digital space, the metaverse uses synchrony to enhance the feeling of immersion and take collaboration online to an elevated level.

Similar to persistency, synchrony requires high bandwidth and low latency

to transmit the large volumes of data required. Currently, this is an unsolved constraint that still highly affects online experiences leading to lagging, delivery errors or loss of connection. In the metaverse, any such hiccup will be disruptive to an otherwise immersive experience.

Unlimited number of users

Technological advancements made it possible to increase the number of users simultaneously active in digital spaces. Video conferences, multiplayer games, and streaming services are being developed to support increasing numbers of users; however, limitations still exist. As Mathew Ball notes, even the most successful video games of all times struggle to accommodate more than 150 users in a shared simulation¹². The metaverse will only be functional if it can make room for a large number of users without compromising on other presented functionalities. If this will be possible, the metaverse will be a one-of-a-kind digital environment enabling large-scale social interactions and opportunities for entertainment, education and commerce.

The amount of data to be processed in order to welcome an unlimited number of users is mindboggling. The physical infrastructure and computational power are currently not advanced enough for this next step.

¹¹ McKinsey. (2022). Value creation in the metaverse.

¹² Ball, M. (2022). The metaverse: And how it will revolutionize everything. Liveright Publishing Corporation, a division of W.W. Norton & Company.

3.2. Enabled by decentralisation

As described in the previous section, Web3 technology enables decentralisation and leads to a secure and transparent environment in which users can create, trade, and interact with virtual assets. Decentralisation, in turn, enables unique features which enable users to autonomously form a digital identity, have ownership of digital assets and interact with a trustless digital economy. Below, these differentiators will be explained in depth.

Digital identity

Digital identity enables the identification, authentication and verification of users on the internet. In virtual worlds, the most popular form of illustrating a user's digital identity is by creating an avatar. The possibility of customising features and clothing enhances the way users identify themselves with their online persona. This concept is naturally transposed in the metaverse. What is special about digital identities in the metaverse is the extent to which they can be used to represent a person and access goods and services. For example, in a metaverse that uses XR, a user's identity goes far beyond a username and picture, creating a life-like depiction of a person with a sense of presence and movement. In addition, authentication in the metaverse by using your identity, leads to ownership of digital assets and access to specific areas or communities.

Multiple methods exist to integrate real-world identities into the metaverse. One method that aligns well with the web3 philosophy is "self-sovereign identity" – an emerging concept that empowers individuals in taking back control of their identity by using technologies like blockchain and zero-knowledge proofs.

Blockchain allows for a decentralised identity infrastructure to be built that is not owned by any business or government. Zero-knowledge proofs allow for data minimisation in decentralised environments which improves user privacy.

A risk of any digital identity technology is that there is no fool-proof way to ensure every digital identity is matched one-to-one with the correct physical identity. Users may have the possibility of hiding or altering their true identity online. While this type of subterfuge may be seen as a legitimate attempt at protecting personal data, it can also raise concerns regarding the creation of false identities with the aim of misleading people online.

Digital ownership

Similar to how Web3 technology enables digital identities, it can also be used to prove ownership without the need for verification from a centralised authority. Advancements in technology enabled more complex assets such as the Non-Fungible Tokens (NFTs), which are tokens that represent digital assets and have proof of ownership embedded. The characteristic of each token being unique and distinctive from another has strengthened the security of assets and reinforced unique ownership.¹³ Digital items and assets programmed as NFTs could help ensure there are no ownership disputes within the metaverse, however they also bring great responsibility to users. Self-custody of these digital assets for example brings responsibilities in terms of key management. Losing access to one's private keys would mean that one loses access to these digital assets. This could be mitigated by educating users on the basics and best practices on secure storage of digital assets.

Custody of digital assets can also be entrusted to third-party service providers that are specialised in safeguarding such assets. However, it is important to highlight that this approach comes with its own set of risks. Relying on third parties to hold your digital assets, may expose you to potential security breaches, regulatory uncertainties and the potential loss of assets by the third party. The saying in the crypto world, "not your keys, not your crypto," underscores the idea that relinquishing control over your assets to a third party can entail risks that users should carefully consider and evaluate before opting for this custody method.

Digital economy

The rise of e-commerce platforms, mobile app purchases and digital payment systems are proof that the global digital economy is becoming more robust. In the metaverse, one particularity in terms of digital economy is the emergence of the creator economy. Users desire more engagement with their digital environment and express this need through user-generated content and co-creation of virtual environments which in turn are monetised. Users will be able to buy and sell (customised) items, assets and content to other users. Since the advent of drag-and-drop builders and AI-generated imaging, users can create apps and content without having elaborate programming experience. It is thus expected that metaverse economies will continue to evolve.

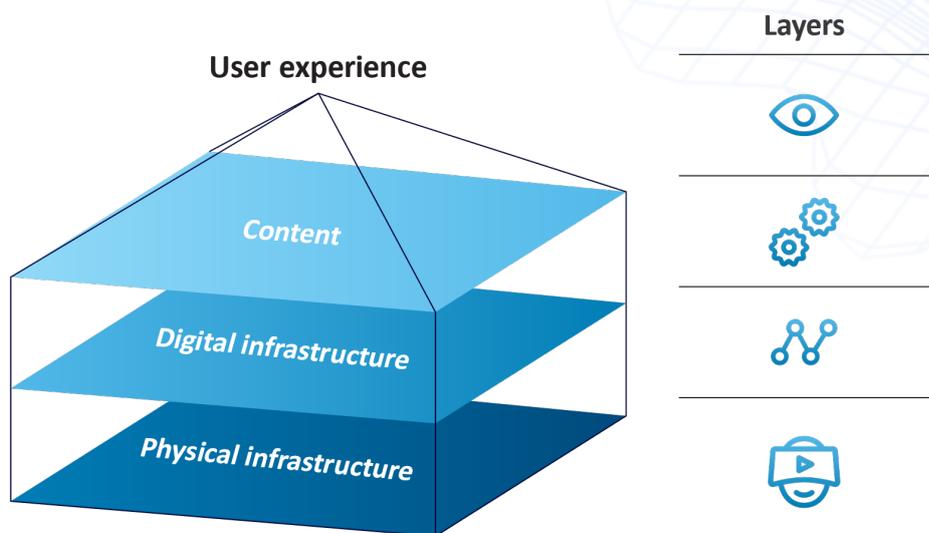
¹³ Rehman, W., Zainab, H. e, Imran, J., & Bawany, N. Z. (2021). *NFTs: Applications and Challenges*. 2021 22nd International Arab Conference on Information Technology.

Interoperability

Currently, apps and video games are mostly stand-alone experiences with limited interoperability compared to the metaverse. Most of the time, items you have in one video game cannot be transferred to another unrelated video game. Moreover, you do not have one single account to log in on all internet websites. In other words, these systems are walled off from each other. Web3 technology can enable interoperability where you have one single “account” that contains your identity and all your digital assets. This allows you to seamlessly travel from application to application and from one virtual world to another. The degree of interoperability between different metaverses is still debated. It will depend on current technological developments and whether the organisations behind the metaverses are willing to offer the possibility to move digital identities and digital assets across (competing) metaverses.¹⁴ In the end, there can be one interoperable metaverse or a myriad of four-walled metaverses (similar to our current, ‘walled’, social media).¹⁵

3.3. Framing the metaverse

It is clear that the metaverse presents unique features in relation to other emerging technologies. To add another piece to the puzzle, it is important to offer an alternative way of framing the metaverse, revealing its most important components. This chapter puts forward three layers to be examined by the user. At each layer, and also through the combination of several layers, potential risks for the user emerge. All layers are interconnected and dependent on each other. Each layer has its own characteristics and has various stakeholders who are engaged in designing, building and using the metaverse. The layers making up the framework are:



- Physical infrastructure layer**
 The first and most tangible layer enabling the metaverse and the base of the framework is the hardware layer, consisting of – among others – servers, nodes, internet infrastructures, XR technology, semiconductors and wearables. These technologies, and the innovations that they are subjected to, enable greater computing power, more accurate sensors, and better resolution. The challenge within this layer is that limited hardware resources can translate to latency problems and a limited number of users that can be supported at the same time.
- Digital infrastructure layer**
 The digital infrastructure layer is second and built upon the physical infrastructure layer. This is comprised of software components and protocols that govern the metaverse. Examples of some components which can be found in this layer are 3D visualization engines, blockchain, payment rails, governance and digital identity protocols. These components contribute to features, such as photorealistic architectural visualisations, safe exchange of data and other services and protection for a user’s identity.
- Content layer**
 The content layer can be characterised as the most visible layer of the framework. It is enabled by the well-functioning of the physical and digital infrastructure layers and it primarily renders generated virtual worlds. It includes components such as user-generated content, virtual avatars and digital economies. Content is the fundamental component that feeds into the metaverse and is used to provide an immersive experience through captivating environments and unique experiences for users. The convergence of the metaverse layers establish the final user experience. This can translate to virtual worlds used for entertainment, commerce & marketing, industrial & enterprise purposes and social experiences.

¹⁴ Ball, M. (2022). *The metaverse: And how it will revolutionize everything*. Liveright Publishing Corporation, a division of W.W. Norton & Company.
¹⁵ EU Policy Department for Citizens’ Rights and Constitutional Affairs Directorate-General for Internal Policies. (2023). *Metaverse*

4. Risks in the metaverse

New technologies create new risks, and the metaverse is no exception.¹⁶ Risks around digital technologies are already a primary concern to EU citizens¹⁷ and the new digital environment will likely prove fertile soil for risks already observed in the physical world and traditional online environments.

The exact way in which these risks will manifest in the metaverse environment remains a relatively unexplored venue. However, it is possible to identify which aspects of life will be impacted by the rise in popularity and use of the metaverse. User's presence online is expected to be transformed and both opportunities and challenges will be amplified in the metaverse environment. In the next section, risks in the metaverse will be explained by highlighting impact areas through fictive user stories.

4.1. Societal Impact

The impact of the internet on our social lives is undeniable. Communication, access to information, entertainment or work are just a few aspects that have been transformed as a result of people joining online environments. This phenomenon will inevitably be magnified when participation in a globally interoperable metaverse will become a reality. Along with the advantages a network of virtual worlds can bring, the disruptive nature of the metaverse also puts forward concerns for users. Would current societal standards, cultural communities or groups with religious affiliation translate seamlessly to the metaverse? Would an

unbounded virtual space develop in harmony or provoke chaos? What would be the values that govern a worldwide virtual space with greater interoperability than the internet itself?

Unfortunately, we cannot predict the full extent of how the metaverse will affect society, but we can point out some inevitable changes which will affect users. With the increase in speed and volume of information received by users, filtering dangerous content is an unfeasible task for humans and it is often assigned to AI models. This creates the possibility of users being met with dangerous online content such as deep fakes, illegally manufactured products, fake news and so on.

Deepfakes and misinformation:

Catherine has always been a great fan of boxing. In her spare time, she enjoys participating in boxing events both in the physical world as well as in the metaverse. To become a better boxer herself, Catherine gathers information from boxers she looks up to on nutrition and exercises. One day, Catherine watched a match of one of her favourite boxers. After this match, he gave an interview on how he prepared for the fight. In the interview, he stated that a questionable new supplement was the secret to his success. Catherine did not realise that she was not only exposed to a deepfake of her favourite boxer, but also to misinformation. Therefore, Catherine was excited to share this information with her fellow boxing fanatics. Luckily, one of them informed Catherine that she had been sharing misinformation, that had been provided to her by a deepfake. Catherine realised that she should be

vigilant when it comes to information coming from the metaverse.

Polarisation: *For the past couple of months, Rose has preferred participating in virtual political rallies and discussions in the metaverse over participating in the physical world. Not only because there are more speakers and opinions available to her in the virtual world, but also, because she feels comfortable with participating anonymously. Over time, Rose found herself becoming more and more isolated from those with different political views. Not only did her interactions in the metaverse become polarised, but she also found it hard to engage in social interactions in the physical world with people who have different views.*

Mental health: *High school student Pete struggled with making friends in the physical world. In the metaverse, on the other hand, Pete easily engaged in social interactions and made many virtual friends. Over time, he started to spend more time in the virtual world and slowly got isolated from the physical world. Not only did he struggle with his two different identities, the one in the physical world and the one in the metaverse, but he also started to feel anxious when he was not present in the virtual world. He experienced pressure from his virtual friends to be online as much as possible and could therefore no longer keep up with being present in the physical world. Pete realised he became reliant on the metaverse and needed help to find a healthy balance between the physical and virtual worlds.*

¹⁶ Ball, M. (2022). *The metaverse: And how it will revolutionize everything*. Liveright Publishing Corporation, a division of W.W. Norton & Company.

¹⁷ European Commission (2022). *EuroBarometer : Europeans show support for digital principles*. See: https://ec.europa.eu/commission/presscorner/detail/en/IP_21_6462

4.2. Economic impact

The internet has already influenced the economy in many ways. E-commerce is one of the concepts that had a massive influence, especially during the period of lockdowns traditional stores that could not adapt went out of business. It is expected that the metaverse becoming a reality will bring forth many new business models, some of which are difficult to imagine before they come into existence. If the metaverse becomes more popular, demand for digital assets such as apparel for avatars or virtual land is expected to grow. Moreover, many services such as online meeting platforms, video gaming and other entertainment platforms are also predicted to expand into the metaverse. Whether these services will be paid for on a subscription basis or a pay-per-use construction is still up for debate. Finally, users themselves are also expected to build some of the content in the metaverse because of the (economic) incentive digital ownership brings. Will a true digital economy in the metaverse emerge? If it does, will users have to pay for everything they do in the metaverse?

Financial insecurity: *Sarah is in her last year of high school and she really enjoys meeting her friends in the metaverse during some classes in school but also in her free time. They spend lots of time together going on adventures in beautiful fantasy worlds, and Sarah is especially fond of playing card games when they have found a nice spot with an ocean view. One day new content for the metaverse is released, it is an entire new planet which is marketed as having the most stunning ocean views you can imagine. However, the price of getting access to this planet is relatively high because it contains brand-new content. Sarah knows she also has to save money to get her driver's license later on in the real world. She has a tough financial decision to make because not buying access to the new planet would mean*

she might not see her friends as often anymore. Her friends' families have all been very fortunate financially and do not face the same difficult decision.

Lock-in effect: *Abraham is an ambitious businessman who has worked very hard to advance his career. He is also a big fan of racing and luxurious cars. The metaverse has proven very welcome for Abraham as it provides him with the opportunity to race his selection of luxury cars on gorgeous fantasy racetracks that do not exist in the real world. He really appreciates meeting with people who share his interest, he surely enjoys the praise he gets for his costly selection of virtual cars as well. However, a different metaverse is gaining popularity and most of his colleagues, friends and family members have moved over and barely appear online in the metaverse where Abraham has all his cars. Because Abraham's metaverse is centralised and not interoperable there is no way for him to move his cars and other assets to the new metaverse. He is also very sad to learn that even the organisations behind his favorite car brands are also not able to help him. All the money he spent along with his achievements are stuck in the centralised metaverse. The feeling of starting over in the new metaverse is unthinkable for him, he is stuck in the old metaverse.*

4.3. Legal impact

While many people use the terms policies and regulations synonymously, they are different by nature, as the former aims to guide decision-making and focuses on general alignment, and the latter ensures compliance and governs behaviour through a set of standards. In order for the metaverse to thrive successfully in a responsible manner, a clear set of policies and regulations must be created that foster and enable an innovative and safe

environment. Otherwise, the metaverse has the potential to become the wild west of Web3 and give rise to many legal disputes.

To provide a clear overview of the legal risks, we will make a distinction between “regulation by law” and “regulation by code”, in which the former refers to regulatory frameworks that are imposed by third parties (countries or institutions), whereas the latter refers to computer software that enables and prohibits the users from performing a set of actions according to the rules that the developers have put in place. There must be harmony between these two elements, otherwise, disorder and confusion will be created for the users of the platform. In this section, we will discuss the risks of the metaverse from a legal perspective that accrue from a lack of clearly defined regulations and policies for this domain, and the disharmony between regulation by law and regulation by architecture.

Jurisdictional differences: *Over the years, Zeke has built a network of friends that are located all over the globe, and every week they come together in the metaverse to interact with one another and play video games. One day, his friends invite him to join a new world/server within the metaverse. Zeke is amazed by this new world; it offers so many opportunities. By design (regulation by code), he is allowed to freely buy and sell digital assets without KYC procedures and is even allowed to gamble on this platform. Zeke is 16 and does not know much about the regulatory landscape of his country. His friends engage in these activities and tell him that it is all fine. In reality, Zeke is not allowed to do so due to the applicable laws in his jurisdiction, but his friends are. One of his friends*

recorded one of their sessions and uploaded it on the internet. Now, Zeke could be in trouble, and all because the regulation by code does not correspond with the regulation by law. But how would Zeke know, he was merely interacting with his friends on the metaverse and broke the law with no ill intent.

Copyright: Geralt is a huge fan of pop music. One day, he decides to create a new account on the metaverse and names himself after a celebrity, while also making his avatar look like him as much as possible. He joins different communities and poses as this celebrity. Other people know that Geralt is not actually that celebrity, yet they find it amusing that someone is impersonating him and as a result, Geralt builds a small following. They ask Geralt all types of questions as if he were that celebrity and he responds with funny answers, not thinking twice about the consequences. Also, why would he, they are all merely having fun anyway and they are not hurting anyone. One day, Geralt decides to take it a step further and make a digital art collection in the form of NFTs which he puts on the marketplace for sale. These NFTs are depictions of the celebrity and digital versions of the album cover. People in the community know that Geralt is not the celebrity he's impersonating, but they play along as it brings attention to the server/world. Ultimately, some NFTs get sold and Geralt benefits financially. Small news outlets pick up the story and write a short article about Geralt and his actions. The celebrity finds out that Geralt used his name to make inappropriate jokes and also profited from his album covers without his consent. He sues Geralt for false impersonation, slander, and copyright violations.

Data security and privacy:

Elif wants to build an application on a decentralised network in which users can match with each other based on their common interests. She always wanted to help people combat loneliness and she believes that building this platform will do just that. Elif has a developer friend and together with some help of open-source code, they build the Friends application. Elif wants to make sure that Friends is doing its intended purpose in an effective manner in terms of matching the users with one another accurately. That is why she is asking all the users to share their information. The more information they share, the better, as the algorithm will have increased performance with more data points. In Friends, it is clearly outlined that parts of the information will be made public, and other parts of the information will be private but still required. Elif wants to create a global community, and most of her user base is from the USA and Europe. However, these two have significant regulatory differences in terms of data harvesting, storage, and usage. This is something that Elif did not take into consideration and as a result, the use of personal data within the Friends application is not compliant with the applicable legislation. As a result, Elif may be held liable for data breaches and could under some circumstances even be held personally liable for damages.

4.4. Impact on (cyber) security

With all the use cases the internet has brought, it equally came with potential security challenges. For many individuals, it is almost impossible to imagine banking without the internet. Cybercriminals in turn have made it their occupation to come up with ways to digitally steal money. Whether the metaverse is centralised or decentralised there is a possibility that digital assets could be lost. In the case of a centralised metaverse, hacks or other forms of cyber-attacks could derail centralised

systems that contain information about digital assets. In the case of a decentralised metaverse, private keys to an account (and the belonging digital assets) could be lost by the user. The digital assets would be gone forever, as there is no party that can recover them. Could these losses be avoided? And in those cases that they do occur, what are the potential consequences?

Digital assets and identity theft: Tom holds a high management position in one of the largest IT organisations in the world. In his free time, he is very fond of playing MMORPG video games. Since the evolution of the metaverse, he has been having the time of his life playing stunning and immersive VR video games. He moves from virtual world to virtual world, taking his assets with him as he switches. One day a friend of Tom sends him a link containing a limited-time special item to be used in a video game. He logs into the environment to claim the item. The item will be available to use the next day. That night he goes to bed excited and ready to play once he wakes up to try the item.

What Tom does not realise is that he has clicked a malicious link, sharing his account details with hackers the moment he entered his details. All the digital assets he worked hard for in the video game can now be stolen. Moreover, what other consequences could this hack have in the metaverse and why did his friend send him a malicious link? In fact, it was not his friend who sent him the link, but it was the hacker who compromised his friend's account and Tom's account is next! To be continued...

Impersonation: While Tom is asleep terrible things are happening. In the morning Tom is expected to upload a PR speech containing his opinion about a delicate IT project that his organisation is working on. The hacker that compromised Tom's account can not

only send text messages impersonating him (the same way as with his friend's account), but he can become Tom's complete persona in the form of his realistic avatar in the metaverse! The hacker creates a speech that has destructive consequences for the ongoing project and for the organisation's reputation. The speech is released before Tom even wakes up. When Tom regains access to his account, he and the organisation swiftly release the news that they were victims of a hack. However, due to the very convincing way the hacker impersonated Tom, the stakeholders are now unsure what to believe. Is the organisation seeking an excuse to change its opinion because the initial broadcast was ill-received? In any case, the confusion has created uncertainty which has hurt their reputation.

4.5. Impact on data and privacy

It is important to consider whether the same data protection and privacy issues that plague the internet today will move into the metaverse as well. When a single organisation or centralised entity controls the metaverse, it could create endless opportunities to analyse user activities within the metaverse and use the resulting data as desired. This data would be much more elaborate than social media data. Data such as eye movements, emotions and complete digital personas could be recorded. The authority collecting this data would be able to design the functioning of the metaverse in such a way that benefits their advertisers and other businesses by giving them access to (part of) this data. When the metaverse is designed in this fashion, is it in the best interest of its users? Moreover, how will national privacy laws be enforced when the metaverse is borderless?

Invasive targeted advertising:

Marc used to travel around the world to attend different kinds of conferences, but now he can visit all kinds of sessions with his own avatar in the metaverse. Marc usually manages to separate his personal life from his professional life, as he deals with confidential information from his clients. Therefore, Marc had no clue that he was receiving personalised advertising when he was visiting a conference in the metaverse. Marc used to be very much aware of the fact that his online activities could be tracked and used for personalised advertising, but now that he was caught off guard, his decisions became influenced by the advertising he received during his working hours. Marc worried that professional online activities and private online activities were made into one profile and had concerns about where this data would be saved and/or shared.

Nudging: Joseph is a fashion designer and to get inspiration, he attends fashion shows in the metaverse from time to time. One day, Joseph received a push notification from the platform suggesting that he should attend a fashion show later that week. Joseph was interested in the push notification and decided to attend the fashion show. The items that were displayed completely matched Joseph's personal style. The next day, Joseph received another push notification to attend another fashion show that week. After attending the second show, Joseph noticed that the items were very similar to the ones that were shown in the previous show. Joseph realised that the platform was nudging him to attend these shows and influencing his behavior. Joseph felt disappointed because as a fashion designer, he wants to get inspiration from different kinds of brands, instead of seeing a lot of the same.



5. Conclusion

When analysing the risks posed by the metaverse it becomes apparent that there are no true unique risks, however, the severity of the risks and their consequences are amplified.

Regarding the societal impact, it is already known that social media can create mental health issues and increase polarisation. Algorithms that provide feeds on social media are intended to keep the user engaged and thus provide more of what you want to see. If that personalised feed is provided with the immersive experiences the metaverse brings, the risk of addiction and other mental health issues increases.

While exploring the economic impact the main concern is that all services could be monetised in the metaverse. Video streaming services like YouTube were free to use in the past, nowadays to view content without advertisements there is a subscription fee. Scenarios are thinkable where simple social interactions or access to certain virtual worlds all require a fee which could lead to exclusion. Web2 services often use a two-sided business model where the application is free to use, but in return, the organisation behind the platform collects user data for commercial purposes.

Without proper regulations, data and privacy issues could remain or worsen in the metaverse. Targeted advertising and nudging will become more intense in the metaverse due to its immersive nature. Moreover, the way users are targeted is potentially much more personal because the metaverse will provide a lot more data about users than traditional online environments. Finally, increased international coordination on privacy regulation might be required as the metaverse is borderless.

Regarding (cyber) security, the severity of identity theft and impersonation increases as impersonators could become somebody's entire digital persona when an account is compromised.

Decentralisation mitigates risks related to data & privacy and societal risks. Users will be owners of their data and they cannot be used for commercial purposes unless they agree to. This leads to a more balanced metaverse where mental health issues and polarisation will be less common. Moreover, deepfakes can be proven to be fake using Web3 technologies that provide immutable data about sources and identity in the metaverse. However, when there is no centralised organization that provides free services in exchange for user data, the risk that all services in the metaverse will be monetised is increased. When there is no centralised organisation, there is also no way for users who lose their private keys to recover their digital assets and identities without opting for a third-party solution. A balance needs to be struck between decentralisation and centralisation to avoid metaverse monopolies where regulations might be needed to incentivise decentralisation.

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