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MetaMoney: Exploring the intersection of financial systems and virtual worlds

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ABSTRACT

As digital assets and decentralized finance (DeFi) rapidly evolve, the integration between financial systems and virtual worlds—increasingly known as the metaverse—is expected to gain momentum. The metaverse promise to be a critical use-case for DeFi—a financial field that has so far struggled to find convincing use-cases. Digital finance, in return, offers a means of financing, developing, and incentivizing metaverse citizens, especially at a time when virtual worlds are struggling to convince the public of a compelling case for their existence. In this study, we review existing research on financial applications within the metaverse, including virtual financial services, instruments, intermediaries, and markets. Building upon this foundation, we introduce a conceptual design for the integration of financial systems with the metaverse. Through this study, we highlight emergent areas and provide valuable insights to guide future academic and practical endeavors in the financial and virtual space.

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NFT
Literature review
Trend

1. Introduction

As the world shifts from traditional payment methods to digital transactions and currencies, new technology continues to propel the financial sector towards innovative solutions that address the evolving needs of financial markets. Cryptocurrencies and non-fungible tokens (NFTs) have emerged as the latest buzzwords, with NFTs being unique digital assets representing ownership or proof of authenticity on a blockchain network (Katterbauer et al., 2022). Additionally, smart contract technology facilitates digital enforcement of financial agreements between parties on a blockchain network enabling a new swathe of 'trustless' financial contracts to emerge (Abou Jaoude & Saade, 2019). These technologies enable new forms of financial activities and value creation, such as decentralized finance (DeFi) applications, digital property ownership, and virtual asset trading. Our study makes the case that these developments, in turn, accelerate the financial sector's transition towards finance in the virtual world—and this 'metaverse finance' has significant potential for industry disruption and transformation.

Coined by SciFi author Neal Stephenson in 1992 in his novel 'Snow Crash', the term *metaverse* referred to a virtual world where large portions of the population chose to spend their time for a combination of work and entertainment purposes. Now the concept refers to real-world efforts to create such digital spaces. Current examples include Decentraland and Meta's (formerly Facebook) Horizon Worlds. While there are severe technical challenges in the development process (Narula, 2022), they offer the potential to revolutionize business and social aspects of life, similar to the internet's impact a few decades ago (Barrera & Shah, 2022; Bobier et al., 2022; Foutty and Bechte, 2022; Morino, 2022).

Specifically, the metaverse is a virtual environment where users engage in augmented reality (AR), mixed reality (MR), or virtual reality (VR) interactions and replicate real-world experiences (Mohamed et al., 2023). The spaces are intended to be immersive, interactive, and interconnected. As Alang (2021) puts it, the metaverse is "the layer between you and reality." While the global market for the metaverse in online gaming is projected to exceed USD 800 billion (Bloomberg Intelligence, 2021), its potential reaches beyond gaming to encompass business transactions, real estate, and other related areas (Wohlgenannt et al., 2020).

Major corporations like Meta, Microsoft, IBM, and Nvidia are investing heavily in building the metaverse as the future of the internet (Banerjee, 2021; Cross, 2021; Wong and Duncan, 2021). Facebook CEO Mark Zuckerberg, in rebranding his company as Meta, described this movement as an "embodied internet that you are inside of rather than just looking at" (Wong and Duncan, 2021). Part of this movement is due to the COVID-19 pandemic accelerating the transition to online and hybrid models for daily financial activities, driving the adoption of digital solutions to address challenges in the financial sector. As digital interfaces become the norm, there are increasing attempts to integrate these spaces into the financial ecosystem.

As a result, financial institutions like J.P. Morgan Chase & Co. and Goldman Sachs Group Inc. are actively engaged in blockchain technology and the virtual world, positioning themselves as early metaverse investors (Dubey et al., 2022). Goldman Sachs Group Inc. has also launched a cryptocurrency trading platform called Circle Trade. These developments demonstrate that the metaverse is becoming a reality for companies, transitioning from an aspirational dream to an imminent phenomenon. This growth of online infrastructure for the virtual financial system showcases the potential tangible impact of the metaverse within the financial sector.

Public interest in the metaverse, as illustrated by the sustained interest shown in Fig. 1, is mirrored by the increasing number of scientific publications on the topic as seen in Fig. 2. With the rapid advancement of technology and adoption of virtual infrastructure in the financial sector (Katterbauer et al., 2022), it is timely to explore this literature to understand current areas of interest and extrapolate to future avenues of focus. This question resonates with the calls in the scholarly community for new conceptual research to advance understanding of the metaverse (Abbate et al., 2022).

To address this timely issue, our study presents a conceptual understanding of the integration of the financial system with the metaverse. We synthesize the diverse existing literature on the subject and establish a theoretical foundation, exploring the metaverse's potential to revolutionize the global financial system. In this regard, this study aims to answer three major research questions (RQs):

Fig. 1. Public interest in the "metaverse" (
Source: Google Trends).

RQ1.. How has research on the metaverse evolved over time?

RQ2.. What is the scope for integrating the metaverse within finance?

RQ3.. What are the prominent research hotspots related to the integration of the metaverse and finance?

The remainder of the study is structured as follows. Section 2 outlines the study's methodology. Section 3 presents the evolution of research on the metaverse and finance. Section 4 identifies four components of the virtual financial system and provides a framework for approaching metaverse and finance understanding. Section 5 highlights the major research hotspots in the field and proposes future research directions. Section 6 concludes the study.

2. Methodology

The emergence of the metaverse has necessitated an exploration of various definitions established over the years to allow us to compile a corpus related to its role in finance. As noted in the introduction, the concept of a metaverse first appeared in the computer science fiction literature during the 1990 s, popularized by Stephenson (1992). Since then, numerous definitions of the metaverse have emerged (Allbeck and Badler, 1998; Davis et al., 2009; Dionisio et al., 2013; Duan et al., 2021; Frey et al., 2008; Lee et al., 2021; Perlin and Goldberg, 1996; Wright et al., 2008). These prominent definitions were examined to identify relevant keywords associated with the metaverse, helping to create a comprehensive search string and ensure maximum search results. The scientific literature recommends this process for identifying search keywords (Kraus et al., 2022; Sureka et al., 2022).

The search string we use consists of a Boolean combination of metaverse and finance terms. The first half of the search string includes all metaverse-related keywords connected by the Boolean "OR" while the second half contains all terms related to finance. This approach broadened the scope of the search and ensured the maximum retrieval of existing literature. The final search string formulated was (("metaverse" OR "augmented reality" OR "virtual reality" OR "mixed reality" OR "augmented virtuality" OR "immersi*") AND ("financ*" OR "investment" OR "bank*" OR "insurance" OR "stock market*")).

Scopus and Web of Science (WoS) serve as two major databases encompassing various scientific disciplines (Aksnes and Sivertsen, 2019; Donthu et al., 2021). Unlike Google Scholar, both Scopus and WoS facilitate the effortless extraction of bibliometric information from scholarly articles (Kraus et al., 2022; Paul et al., 2021). Given this advantage, we chose to limit our reliance on Google Scholar.

Due to the novelty of the metaverse concept (Kraus et al., 2023), this study utilizes both databases to ensure a comprehensive review. The initial search in WOS and Scopus primarily retrieved articles focused on the technological aspects of the metaverse in the computer science domain. Consequently, subject filters relating to finance and economics were applied in both databases to obtain literature relevant to metaverse integration into the financial field.

Additionally, we conducted a manual filtering process to exclude documents unrelated to the integration of finance and the metaverse by reviewing abstracts in accordance with past review guidelines (Lim et al., 2022; Kraus et al., 2022; Paul et al., 2021). A snowball approach was adopted, examining references to ensure no relevant documents were overlooked (Tham et al., 2023). This process resulted in a final sample of 62 documents, as depicted in Fig. 3. However, the literature in this field is relatively limited, which meant that studies that even partially addressed the metaverse's role in finance were retained and examined to understand the foundational research in this area. This is in line with the study's objective to comprehend the conceptual basis of metaverse-related research in finance and identify promising future research directions to advance this field of study. Therefore, this study is a conceptual

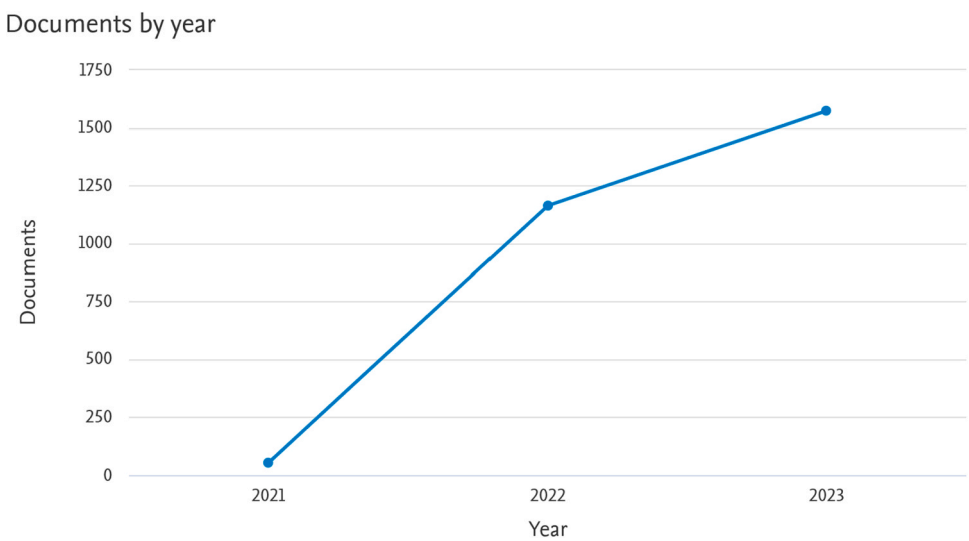

Fig. 2. Scholar interest in the "metaverse" (
Source: Scopus).

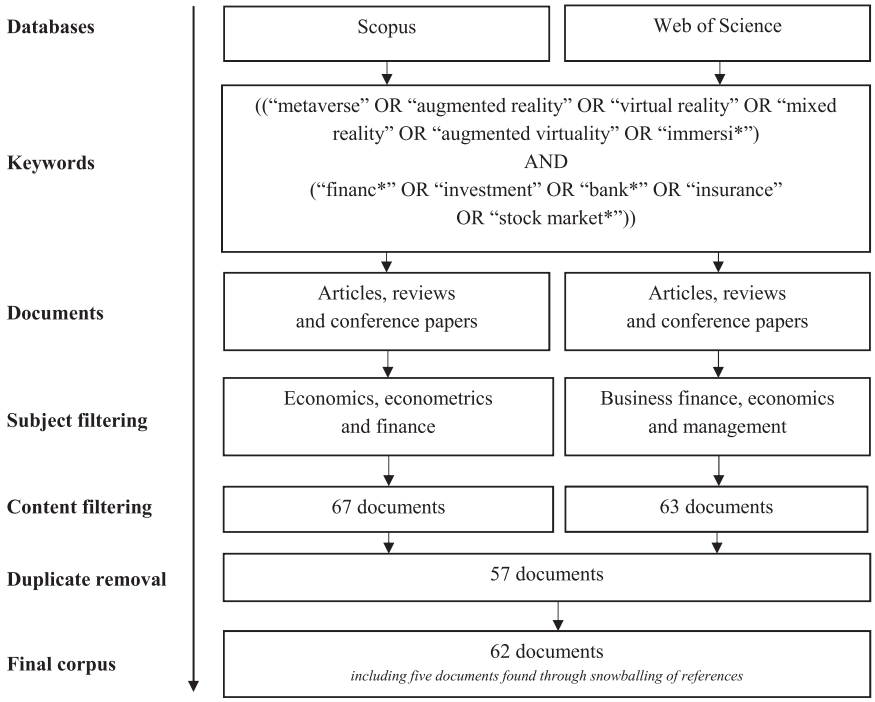

Fig. 3. The research identification and review process.

review using a combination of critical and content analyses in line with past review guides (Lim et al., 2022; Kraus et al., 2022; Paul et al., 2021).

3. The evolution of metaverse research in finance

The metaverse has become a force of rapid transformation across multiple industries, particularly within the financial sector. This

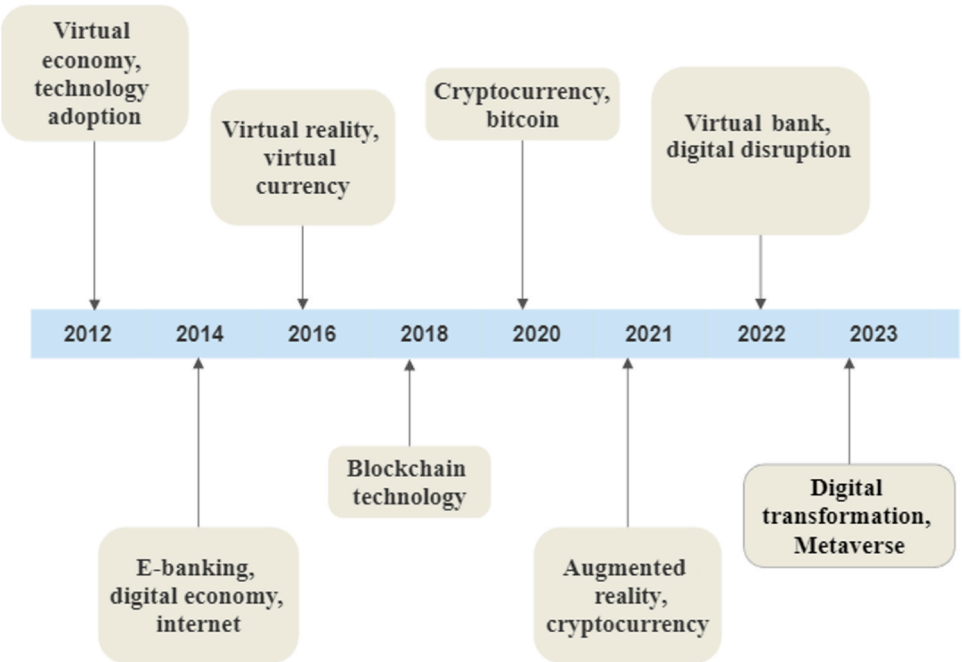

Fig. 4. The trajectory leading to the establishment of metaverse in finance research.

dynamic virtual realm offers an unprecedented opportunity to establish a decentralized, interconnected, and more accessible financial ecosystem. In this context, a comprehensive investigation of research related to the metaverse in finance is crucial. The 62 articles were contributed by 57 unique authors. We first examine the author keywords of these documents via sensemaking (i.e., scanning, sensing, and substantiating) to comprehend the evolution of this field (Lim and Kumar, 2022). Author keywords can serve as a powerful tool in effectively representing the content and central themes of the documents under scrutiny (Lim, 2023; Thakur & Kushwaha, 2023).

Following its introduction in fictional works (Davis, 2009; Perlin and Goldberg, 1996; Stephenson, 1992), the scientific definition of the metaverse has undergone significant evolution. Initially, the idea was defined as an immersive 3D virtual world of avatars (Davis et al., 2009), but has since expanded to include a 3D virtual environment connected to a network with the capacity to host a significant number of people simultaneously (Wright et al., 2008). Subsequently, the definition has progressed to encompass immersive realism and the interconnectedness of various virtual worlds (Dionisio et al., 2013). More recently, the emergence of mixed reality (MR) has introduced the convergence of physical and virtual reality, where tangible and intangible elements fuse to the point of blurring the distinction between them (Duan et al., 2021; Lee et al., 2021; Reid, 2021). While the impact of the metaverse on the financial system is still understudied, studies have begun to integrate the technological components of this virtual world into finance (Fig. 4). Despite being in its early stages, the concept of the metaverse is rapidly gaining traction, with clear potential to revolutionize the financial industry.

In the early 2000 s, the financial research community referred to the digital economy as the virtual economy due to the growing influence of the digital world, especially the internet, on the traditional financial system. As the internet became more widely adopted in the financial sector, online banking and e-commerce proliferated (Kumar et al., 2021, 2022), and researchers delved into topics such as online investing, electronic markets, and the challenges of technology adoption (Balasubramanian et al., 2003; Gabriela & Catalin, 2009). The focus gradually shifted to the virtual economy and environment, and the integration of financial markets led to the initial mention of the metaverse (Chambers, 2011; Irwin et al., 2012; Mellado and Escobari, 2015).

By the mid-2010 s, the financial system had undergone significant transformation, shifting from physical to virtual markets and traditional to virtual payment systems. The emergence of virtual currency and assets was observed (Dilla et al., 2013; Smith & Kumar, 2018), along with the development of blockchain technology and AR (Barren & Shah, 2022). The integration of these concepts into finance research gained prominence after 2016 (Dimbean-Creta, 2018; Lee, 2018).

In recent years finance research has more directly focused on virtual concepts for physical assets and instruments, such as cryptocurrency and non-fungible tokens (NFT). Financial services such as decentralized finance (DeFi) and virtual institutions like virtual banks and markets also emerged. Furthermore, technological advancements like blockchain and AR continued to gain traction, and ideas such as the metaverse became a significant means for digital transformation (Smaili & de Rancourt-Raymond, 2022; Wu et al., 2022). This research views financial innovation through a lens of how the financial sector can remain at the forefront of digital innovation.

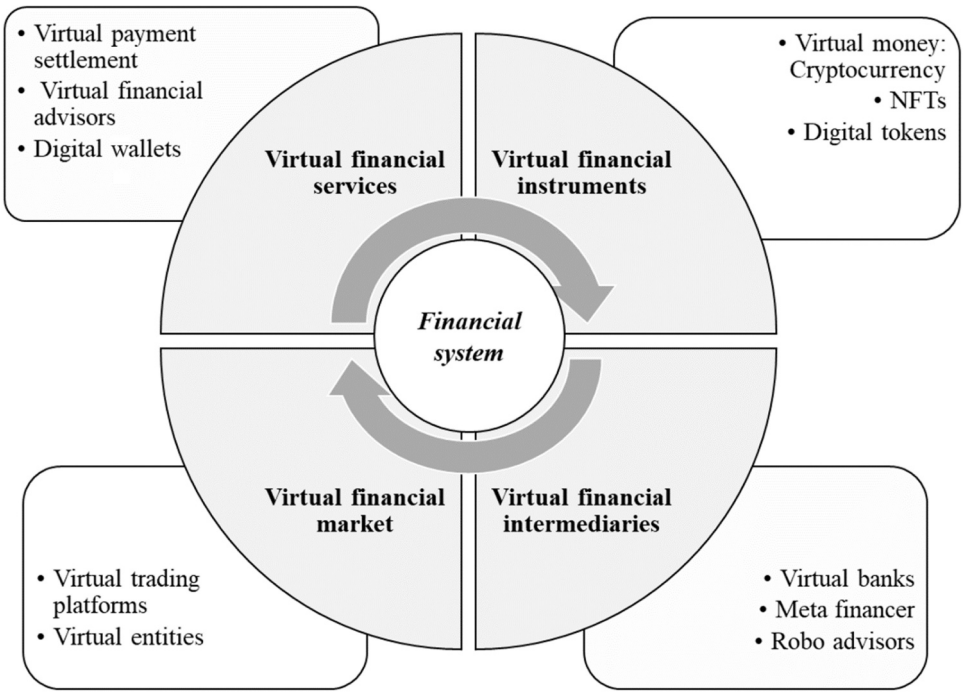

Fig. 5. Revolutionizing the financial system through the metaverse.

4. Revolutionizing the financial system

The metaverse's potential applications in finance are extensive and diverse, with the power to transform our perception and interaction with financial systems. From virtual stock market trading to digital asset management, the financial metaverse has the potential to revolutionize the entire financial landscape. It will be a virtual, digital counterpart to the traditional financial system, complete with virtual stock exchanges, banks, assets, exchanges, and other financial services. Moreover, the metaverse is poised to enable decentralized and secure financial transactions and activities using blockchain technology, making it an attractive proposition for businesses and society alike. As the metaverse continues to evolve and expand, its impact on the financial industry will only become more significant.

A financial system consists of financial institutions, financial markets, and a regulatory framework that oversees its operations (World Bank, 2016). A mature financial system typically combines financial intermediaries and markets, enabling the smooth flow of financial assets and services (Allen and Gale, 2004). Thus, a financial system generally includes financial intermediaries, financial markets, financial instruments and services, and regulatory mechanisms that govern its operations.

There is growing interest in integrating the metaverse into finance, particularly in the banking industry (Dubey et al., 2022). However, incorporating the metaverse into the financial system as defined in the previous paragraph requires various virtual infrastructure prerequisites. As we will see, there are advancements in each of these aspects of the financial system indicating the emergence of a new financial infrastructure (Fig. 5).

4.1. Virtual financial services

The integration of Web 3.0 and the metaverse has the potential to completely redefine financial services as we know them today. For example, credit services, which provide essential liquidity in financial markets, could be significantly restructured with this new technology (Melnyk et al., 2022). The metaverse represents a revolutionary shift in how lenders assess borrowers' creditworthiness. Using the technologies powering the metaverse, lenders can swiftly and efficiently evaluate a borrower's holistic financial standing based on diverse factors such as income history, job stability, credit score, and total assets (Renduchintala et al., 2022). By harnessing the power of artificial intelligence (AI) and machine learning (ML) algorithms, the metaverse and its associated technologies can deliver a more accurate, comprehensive, and engaging assessment of a borrower's financial situation than traditional methods.

More directly, the nascent metaverse economy has already revolutionized digital transactions, ushering in a new and more convenient era of finance. With metaverse digital identities, cryptocurrencies, and transactions, users can now enjoy a seamless and secure digital experience like never before. Through the metaverse's advanced digital identity system, users can establish their digital identity on the blockchain network (Dubey et al., 2022). This identity serves as a secure and tamper-proof record of a user's personal information. With their metaverse digital identity, users can conduct transactions involving cryptocurrency or other assets in a decentralized manner (Dubey et al., 2022). This eliminates the need for debit or credit cards, which can be lost or stolen, and reduces the risk of fraudulent activity. Moreover, users can transact more privately and securely, without relying on intermediaries such as banks or credit card companies. Financial services like distribution systems, payment settlement systems, credit distribution, financial advisory services, and money storage wallets are all taking on the shape of the metaverse, demonstrating the infrastructural possibilities in this area.

Moreover, one of the key advantages of using metaverse associated technologies for mortgages is the implementation of smart contracts, which ensure transparency and fairness in loan terms and conditions. Smart contracts operate on peer-to-peer (P2P) networks, allowing multiple trusted parties to manage data concurrently (Andoni et al., 2019). Each chain in the blockchain network contains its own data, which is then stored in the ledger based on the agreed consensus mechanism (Watanabe et al., 2016). In this regard, metaverse-based smart contracts provide a tamper-proof and immutable record of mortgage agreements, reducing fraud risk and minimizing loan default likelihood. This eliminates dependencies on third parties in financial transactions (Elghaish et al., 2021) and makes the entire process more secure, transparent (Mason et al., 2019), affordable, and trustworthy (Kuang, 2022; Mystakidis, 2022).

4.2. Virtual financial instruments

Money serves as the lifeblood of a financial system. In addition to traditional currency and assets, the world is now witnessing the emergence of new digital financial instruments. Among these, digital currency has become the most popular. Cryptocurrency, which has been gaining attention since its creation in 2008 (Urquhart, 2018), is backed by blockchain technology. This digital currency uses encryption techniques in a decentralized and secure ledger that records all transactions and controls the creation of new units. Noteworthily, cryptocurrency operates independently of central banks and can be transferred directly between individuals without the need for intermediaries such as banks or payment processors. The most well-known and widely used cryptocurrency is Bitcoin. Several studies have confirmed the growth and efficiency of the Bitcoin market (Urquhart, 2016; Nadarajah and Chu, 2017; Bariviera, 2017). Cryptocurrency offers advantages over traditional currency, as it eliminates the need to carry physical wallets and cards and provides the convenience of transacting from anywhere, at any time (Dubey et al., 2022). Furthermore, with the creation of a metaverse digital identity, users can easily and securely access a variety of digital services and platforms without having to repeatedly create new accounts and remember multiple passwords. This simplification of the login process not only saves time but also reduces the risk of identity theft and fraud.

Moreover, NFTs backed by blockchain have ushered in a new world of digital assets. NFTs maintain a unique and distinct identity

for non-fungible digital media, such as digital artwork, music (Chohan and Paschen, 2023), and digital land (Narin, 2021). Utilizing blockchain-based smart contracts, NFTs securely and immutably record ownership of digital assets, establishing their authenticity and uniqueness. This provides greater trust and security for buyers and sellers in the digital marketplace. In essence, NFTs create a digital ledger of ownership that guarantees the integrity and legitimacy of digital media, ensuring that each asset possesses a unique and unalterable identity. NFT sales during the first months of 2021 reached $2 billion, a more than 20-fold increase from the previous quarter (Versprille, 2022). Examples of digital assets that can move from one metaverse to another include Habbo Hotel and World of Warcraft (Park and Kim, 2022). Furthermore, the financial sector has already transitioned to digital equity, digital bonds, and digital gold, with securities traded on virtual platforms and virtual receipts for these assets.

4.3. Virtual financial intermediaries

As infrastructural developments of financial institutions embrace VR and blockchain technology, the metaverse will soon become a significant part of the financial industry. The world already has virtual banks like Ally Bank, which operate entirely online without a physical presence, confirming that financial institutions can function solely in digital mode. Furthermore, major financial institutions such as J.P. Morgan Chase & Co. and Goldman Sachs Group Inc. are aggressively investing in AR, VR, and blockchain technology to integrate the metaverse into their operations (Dubey et al., 2022). This demonstrates that financial institutions are already halfway to achieving the infrastructural developments needed to incorporate the metaverse. The FinTech industry has also enhanced its efficiency and profits through the use of metaverse-created virtual worlds and big data, enabling quicker and more informed decisions (Cuțitoi, 2022).

Moreover, in the rapidly evolving banking industry, customer-centricity is increasingly critical for the success of financial institutions. The metaverse offers a user-friendly platform for storing, accessing, and managing customer data, enabling banks to better understand their customers' needs and preferences (Seth et al., 2022). Additionally, the metaverse allows for easy integration with other financial systems and applications, creating a seamless and efficient ecosystem that reduces costs and streamlines processes (Allam et al., 2022). This interconnectivity allows banks to expand their service offerings and reach new customers while minimizing risks and improving operational efficiency. With features like seamless cross-border payments and digital identity verification, the metaverse has become a compelling option for the banking industry (Dubey et al., 2022). Noteworthily, by leveraging the metaverse, financial institutions can enhance their operational efficiency and gain a competitive edge (Allam et al., 2022).

4.4. Virtual financial markets

One of the most significant technological breakthroughs in the financial sector has been the emergence and rapid growth of the internet. The internet has replaced physical securities markets with virtual ones, offering real-time data on virtual platforms. The rise of cyberspace has extended traditional markets into the virtual realm, where information is processed and virtual value chains are created (Weiber and Kollmann, 1998). Marketspace refers to a virtual marketplace where businesses and customers interact through data networks (Rayport and Sviokla, 1994). The virtual stock market has become the new normal.

Building upon the development of the internet is the integration of AR and VR into virtual markets, creating a mixed reality (MR) experience. AR and VR have already been used to enhance customer experiences in various sectors, such as retail (Javornik, 2016; Soon et al., 2023), decision-making, repurchases, post-consumption evaluations, and appraisals (Wedel et al., 2020). Yet, the convergence of AI, AR, VR, and blockchain technology could lead to an MR that blurs the lines between the physical and digital worlds.

In the metaverse, investors will be able to enter a virtual trading floor where walls display real-time market data and the floor pulsates with the activity of digital assets being traded. This environment will enable investors to visualize and analyze complex data in real-time using advanced analytics and AI. The implementation of blockchain ensures that every transaction is recorded on an immutable ledger, making data manipulation or falsification virtually impossible (Kumar et al., 2023; Sahoo et al., 2023). This fosters trust and confidence in financial markets while reducing the risk of fraud.

5. Discussion and future research hotspots

The financial system is on the brink of its fifth evolution as the metaverse emerges. This new frontier will introduce MR experiences by incorporating AR and VR technology. The metaverse enables the creation of virtual financial institutions, allowing customers to engage with their finances in a wholly immersive manner. AR and VR technology will let users experience financial services in a more personal and intuitive way, eliminating the need for physical bank branches.

As we approach the end of this decade, it is widely anticipated that 50% of banks worldwide will use AR or VR as an alternative channel for customer transactions and employee engagement (Khurana, 2022). The Bank of America (2021) has already launched a VR training program for its employees, simulating real-life customer interactions. The metaverse presents new opportunities for the financial sector to connect with customers by creating immersive and engaging experiences that offer a new level of personalized service. Yet, the metaverse also introduces new challenges. These frontiers are explored as potential hotspots for future research.

5.1. Innovation in financial sector

Recent projections indicate that nearly one-third of all businesses worldwide are expected to develop products and services specifically for use within the metaverse by 2026 (Julian et al., 2023). To ensure seamless onboarding of businesses into the metaverse, it

is crucial to integrate the financial system with it. While this review outlines the infrastructural developments across all four components of the financial system, innovation and development in certain areas are still needed to foster a fully-fledged financial system using the metaverse.

One key area that demands attention is the reliance on digital currency for buying and selling products and services in the metaverse. While digital assets like NFTs and virtual concert passes are gaining popularity, digital currency is set to be the primary mode of payment (Dubey et al., 2022). Central banks across nations need to address this issue. Additionally, the metaverse enables interactions through VR platforms, which may allow users to switch between various tools without logging in to multiple channels (Krnjajic & Wesslén, 2022).

Despite the rapid pace of development in the metaverse and digital finance, it remains unclear how traditional financial institutions can adopt this new technology and provide an enhanced experience for their users. Therefore, research must be conducted to develop innovative solutions that integrate various financial services and assets under one umbrella for the banking and financial services sector. This presents an enormous opportunity for future researchers to create more integrated and innovative financial solutions that incorporate metaverse developments. To guide future research, the following questions merit exploration:

- Future RQ1. What key financial sector innovations are required for successful adoption and integration with the metaverse?
- Future RQ2. How can blockchain technology be utilized to create a secure and efficient payment system in the metaverse?
- Future RQ3. What potential benefits and risks are associated with implementing protocols in the metaverse?
- Future RQ4. How can traditional financial institutions adapt their products and services to cater to the needs of metaverse users?
- Future RQ5. In what ways can smart contract technology be leveraged to develop new financial products and services within the metaverse?

Answering these questions will help develop a more comprehensive understanding of the metaverse's potential impact on the financial industry and pave the way for innovative solutions to emerge.

5.2. Technological and financial literacy

The adoption and use of innovative financial solutions require both technological and financial literacy. In a world where the internet enables cross-cultural information exchange and virtual communities consist of people from diverse cultural backgrounds, being technologically literate also involves effectively communicating across cultures (Luke, 1997). Financial literacy plays a vital role in promoting financial inclusion among people (Klapper et al., 2013; She et al., 2023) and maintaining economic stability (Honohan, 2004; Kar et al., 2011). Therefore, appropriate measures must be taken to improve financial literacy to enhance inclusion among people towards new financial assets, instruments, and services. Gamification is one option that can simulate real-world scenarios in the metaverse, enabling people to acquire financial literacy without risking their hard-earned money.

To prepare people for the metaverse and enhance their technological and financial literacy, future research should focus on proposing innovative methods for improving literacy. This presents the following future RQs:

- Future RQ6. How should educational programs be designed to improve technological and financial literacy involving the metaverse?
- Future RQ7. What are the most effective strategies for promoting financial literacy within the context of the metaverse?
- Future RQ8. What role can financial institutions play in promoting technological and financial literacy among their clients and customers in the context of the metaverse?
- Future RQ9. What impact might increasing technological and financial literacy have on the adoption and use of metaverse technology in the financial sector?
- Future RQ10. What kind of initiatives and programs are needed to sustain the technological and financial literacy of metaverse users for financial activities?

5.3. Adaptability, onboarding, and training

The unique characteristics of the metaverse, including immersiveness, hyper spatiotemporality, sustainability, interoperability, scalability, and heterogeneity, present challenges for ensuring effective security (Wang et al., 2023). Security measures designed for traditional digital environments may not be sufficient or adaptable enough to accommodate metaverse applications. For instance, the fully immersive real-time experience of the metaverse complicates the secure integration of vast amounts of multimodal user-sensitive data for interactions between users and avatars/environments. The use of VR in the metaverse introduces complexity in managing trust among users (Nevelsteen, 2018). Onboarding into a financial system within metaverse will require secure digital wallets, which must be linked to real bank accounts. This linkage presents several challenges, including issues related to fraud and security, regulatory uncertainty, and interoperability. Consequently, it is imperative for researchers to explore and develop adaptable and effective security measures. Such measures are crucial to ensuring secure interactions within the metaverse, particularly for financial transactions.

Additionally, as remote work becomes the norm due to the pandemic, the metaverse offers a unique opportunity for financial service professionals to work alongside their digital avatars and interact with each other in much the same way as they would in a physical office. However, this also aligns to the challenge of training and onboarding employees in the virtual world of the metaverse. The field's researchers must explore this area to ensure effective training and onboarding for employees in the financial sector.

To address these challenges, researchers must explore the following future RQs:

- Future RQ11. What are the key factors that influence financial institutions' decisions to adopt metaverse technology?
- Future RQ12. What are the key challenges and barriers that financial institutions may face in adopting metaverse technology, and how can they be overcome?
- Future RQ13. How can we address potential barriers to the adoption of metaverse technology, such as concerns about security and privacy?
- Future RQ14. What are the key skills and competencies that employees of financial institutions need to develop to effectively work in the metaverse, and how can these be effectively trained and assessed?
- Future RQ15. What are the key challenges and barriers that financial institutions face in adopting and integrating metaverse technology

5.4. Policy formulation

The advent of the metaverse is set to create a highly digital, inclusive, yet decentralized legal, social, and economic landscape (Barrera and Shah, 2023). As the virtual environment of the metaverse connects users from diverse countries, clusters, and economies, concerns about data privacy, inclusivity, equity, and fairness arise. The use of AI algorithms in some metaverse worlds could lead to biased and overly personalized content, thus risking privacy breaches and criminal activity (Lee et al., 2021). Furthermore, the financial sector's adoption of the metaverse could expose critical financial data to risks of cyberattacks and other financial crimes. Additionally, property and intellectual rights issues arise since the metaverse is a universal digital space where digital assets are traded across countries (Reed Smith, 2021). The metaverse could also pose a threat to national security since adversaries could exploit its vulnerabilities and launch devastating attacks on critical digital assets, including biometric data and financial information, crucial to national security (Kshetri, 2022). Issues such as tax policy, data privacy policy, consumer protection, intellectual property rights, and criminal liabilities emerge as major concerns in policy formulation associated with this immersive technology. Addressing these issues is imperative to promote inclusiveness and ensure equity and fairness for all participants (Barrera and Shah, 2023; Kshetri, 2022; Onwukwe and Adeniran, 2022). Future research must delve deeper into these concerns, providing effective solutions and suggesting necessary policies to mitigate risks and protect users. Addressing these critical issues should also help to balance the benefits of emerging metaverse technologies with the need for ethical and responsible practices. Accordingly, future research should explore the following RQs:

- Future RQ16. What are the ethical and regulatory considerations associated with using metaverse technology in financial services?
- Future RQ17. What new policies and regulations are necessary to ensure the safety and security of financial transactions in the metaverse?
- Future RQ18. What role should governments play in regulating virtual currencies and assets in the metaverse?
- Future RQ19. What steps can be taken to ensure the privacy and security of financial data in the metaverse?
- Future RQ20. How can policy promote the responsible and sustainable development of the metaverse financial sector?
- Future RQ21. What international cooperation and coordination are necessary to effectively regulate the metaverse financial sector?
- Future RQ22. What kind of legislation might be necessary to ensure property rights on digital instruments such as NFTs?
- Future RQ23. What types of public-private partnerships could facilitate the development of policy frameworks that support the responsible growth of the metaverse financial sector?
- Future RQ24. How can existing financial sector regulations be adapted or revised to address the unique challenges and opportunities presented by the metaverse while maintaining customer protection and market integrity?
- Future RQ25. In what ways can international regulatory bodies collaborate to establish harmonized policies and standards for the metaverse financial sector, ensuring a consistent global approach to oversight and risk management?

6. Conclusion

This paper presents a conceptual review of current developments in the financial sector with regard to the metaverse, highlighting the potential for transformative change in the financial services industry. The metaverse, a realm where the boundaries between virtual and real worlds blur, has the capacity to revolutionize the financial services industry, as demonstrated by the emergence of NFTs that offer digital ownership and create new asset classes for trading. Virtual-to-physical redemptions and financial systems further support payments and financing, while advances in AR MR, and VR technologies may bridge the gap between online and offline experiences, leading to greater engagement and participation in financial services and driving convergence between traditional financial services and innovative new approaches.

The financial services sector is already exploring the possibilities of the metaverse, with payment companies actively pursuing crypto propositions and partnerships to enhance their market position. In addition to improving the user experience, the benefits of the metaverse extend to the development of smart FinTech platforms that can streamline infrastructure and enhance human intelligence in financial services, allowing for more efficient and robust aggregation and analysis of client information. This development provides an opportunity for financial services to reach a wider range of users with more targeted products and services.

This study offers contributions to both academia and practitioners in the field. First, by delving into the applications of the metaverse in finance, this work enhances the scholarly understanding of the metaverse. It synthesizes and critically evaluates prior

research, thereby contributing to the ongoing academic discourse on this burgeoning topic. Second, the study proposes a conceptual design for integrating the metaverse with the financial system, shedding light on previously unidentified components that facilitate the convergence of the metaverse and finance. This conceptual framework serves as a roadmap for future research activities, sparking academic interest and encouraging scholars to explore innovative ideas. Third, it provides FinTech and blockchain practitioners with a logical rationale and descriptive blueprint for deploying decentralized financial solutions.

The essential infrastructure needed to incorporate the metaverse into the financial system is advancing across multiple dimensions, including financial services, assets, markets, and intermediaries. These developments indicate that the metaverse is not merely a speculative or futuristic concept but a rapidly unfolding reality. The pertinent question now is not if the metaverse will integrate with the financial system, but rather how and when this integration will transpire.Top of Form.

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