Accounting meets metaverse: Navigating the intersection between the real and virtual worlds

Abstract

Purpose

The ‘metaverse’ is the new buzzword. With the phenomenal growth of the metaverse comes accounting, taxation and jurisdictional challenges, which business and governments have yet to fully address. This paper seeks to highlight and rationalise the lack of regulatory framework and multiplicity of jurisdictions on metaverse transactions. This paper addresses some of the complications in respect to accounting and taxation in virtual environments.

Design/methodology/approach

This study relies on secondary data and emerging literature to understand the multiplicity of jurisdiction and complexity of the accounting transactions. The concept of the metaverse is rapidly evolving, and this study uses extant literature to provide the foundation for understanding the key challenges relating to accounting and taxation.

Findings

Concepts of revenue recognition and deferment are challenged by the transactions in the metaverse. There are novel applications, underpinned by emerging technologies and blockchain supporting new crypto assets, like non-fungible tokens and other decentralised finance (DeFi) tools, however, the caveats of anonymity and jurisdictional issues persist. The paper suggests that the industry must adapt to the unique reporting requirements of these assets and develop new standards for evaluating their value for financial reporting purposes. The paper emphasises the need for a case-based approach in the absence of standardised regulations for the accounting industry in the metaverse.

Originality

This paper adds original contributions to extant literature of the metaverse. advances ongoing debates into the accounting and taxation issues pertinent to the metaverse and DeFi.

Keywords: Metaverse, Blockchain, Tax-Jurisdiction, Accounting, Taxation, NFT

Article Type: Research Paper

Introduction

The metaverse is a term used to describe a virtual world that is fully immersive and interactive. It is a digital space where users can interact with each other and engage in various activities, such as socialising, gaming and commerce. The metaverse is often described as a combination of virtual and augmented reality, where users can fully immerse themselves in a digital world that feels just as real as the physical world (Arora *et al*., 2022; Cantley and Dietrich, 2022). It can have its own economy, where users can buy and sell digital goods and services. The metaverse, built on decentralised blockchain technology also allows users full control over their digital assets and identities.

The metaverse continues to grow at a compounded annual growth rate of 47.2% and will be a $427 billion market by 2027 (Metaverse Market, 2022). With such phenomenal growth comes the challenges of accounting, taxation and jurisdiction, which business and governments have yet to fully address. Although the metaverse is, in many ways, still in its early stages of development, many companies and individuals are working to create the infrastructure and platform that will make it embedded in today's digital age. Examples include virtual worlds, such as Decentraland, where users can create, experience and monetise their content and applications and the Sandbox, a user-generated content platform for creating and sharing voxel-based experiences. Large multinational companies, like Microsoft, Apple, Nintendo, Meta, and others, are developing metaverses for social media, commerce and gaming applications. The metaverse brings significant implications for a range of technological sectors, art and investment markets (Arora *et al*., 2022; Belk *et al*., 2022).

In a society that is becoming increasingly global and digital, the ability of governments to regulate corporate and individual interactions and transactions has become complicated through new digital phenomena. This represents a need for today's leaders to question how a transition into the metaverse should affect existing commercial systems, which have been based on past territorial realities. Issues, such as property ownership, taxation of goods and services, and intellectual property rights, still need resolving. Although a user can 'buy' virtual land within the metaverse, for instance; doing so may not afford the buyer the same rights of ownership as buying real estate in reality. As Cantley and Dietrich (2022) note, the metaverse is simply computer code that exists on the internet and that code belongs to its creator and not the person purchasing the property that was generated by the code. Legal experts are still debating how to tax virtual land and whether virtual land should attract value added tax (VAT). The German Federal Tax Court has recently considered the case of property rentals in the metaverse and ruled that landlords renting land within the metaverse should be exempt from paying tax. The court argues that transactions taking place in the metaverse should not be subject to VAT as they occur in reality (Taho, 2022). It is evident that such decisions, whilst welcomed by business, highlight a lack of important clarity for accounting and taxation purposes.

This paper adds unique contributions to literature on accounting and taxation in three ways. First, the paper seeks to rationalise the lack of regulatory framework and multiplicity of jurisdictions on metaverse transactions and, by doing so, addresses some of the complications in respect to accounting and taxation in virtual environments. Second, it offers insight into how such issues relate to virtual spaces and the metaverse by exploring key accounting and taxation challenges relating to the metaverse, in particular, taxation of assets

and transactions and financial reporting. Third, it offers potential solutions that have been developed to address, or at least mitigate, these issues. This paper argues that regulators are currently plagued by several difficulties related to the migration of commercial activities to the metaverse. It concludes by offering predictions and suggestions for the wider issue of accounting and taxation in the metaverse, highlighting how certain policy changes may make the regulation of the metaverse more streamlined.

Literature Review

Existing Frameworks

The literature highlights that interacting within the metaverse brings a multitude of accounting and taxation challenges. Arora *et al*. (2022) examine the various different classifications for crypto and other digital assets and clarify the issues plaguing the tax infrastructure in terms of addressing those issues. Al-Gnbri (2022) has examined the impact of virtual reality technology, specifically the metaverse, on the future of accounting and auditing and takes a more normative approach to identify a link between accounting, auditing and the metaverse. Al-Gnbri (2022) finds that the metaverse represents a vertical development in accounting and auditing and serves as an auxiliary tool to support the fields' objectives. The metaverse creates new digital assets requiring accounting measurements, which affects the audit process and evidence gathering. It also provides an interactive environment with the potential for use in accounting education and training.

Dwivedi *et. al.* (2022) consider the various logistical challenges with transitioning to the metaverse including the legal and accounting practices that would need to be adjusted for such transitioning. They consider the legal challenges with law enforcement in such a space, specifically, when the issues of jurisdiction applicability still appear unresolved. Johan (2022) examines the sociological effects of a transition into the metaverse and considers how legal consequences manifest in the metaverse, how laws are implemented in the metaverse, and the impact of the metaverse on business and legal standards. As the metaverse constitutes a self-materialising world that no legitimate government can reign over, the effect of most common legal provisions cannot extend as far as many might hope (Johan, 2022). Although moral standards in real life may be affected by the prevalence of the metaverse, people may also bring their real-life solutions to the metaverse (Grinbaum and Adomaitis, p. 268). Therefore, governments must cooperate internationally to counter the possibilities of illicit activities, such as money laundering, illicit trade practices and other crimes that can flourish within the metaverse. Further research is needed to investigate the influence of the metaverse on society from a variety of viewpoints, including the legal status of the metaverse or the legal status of particular economic transactions.

Garon (2022) examines the differing economic and philosophical approaches to the future of the internet and considers the regulatory environment, transactional essentials, and limitations on government intrusion in the metaverse within the context of US law. They specifically focus on the strategies of internet advertising multinational companies, like Facebook and Google, and video game companies, like Roblox, Minecraft, Epic Games and Valve, and compares the strategies of 'Web3' advocates focused on cryptocurrencies, non-fungible tokens, decentralised finance, and distributed autonomous organisations (DAOs). Garon's (2022) study highlights a need for the ongoing evolution of Fourth Amendment protection against search and seizures, limitations on reasonable expectations of privacy under the third-party doctrine, and statutory protections under the Stored Communications

Act relating to the metaverse. It is argued that although these legal issues are not new, the scope and potential impact of the metaverse will reshape them in unexpected ways. A joint report by the Association of International Certified Professional Accountants (AICPA) and Chartered Institute of Management Accountants (CIMA) offers some guidance on how to account for and audit digital assets under US Generally Accepted Accounting Principles (GAAP) for non-governmental entities and Generally Accepted Auditing Standards (GAAS) respectively. The guidance is aimed at financial statement preparation and auditors with knowledge of blockchain technology and digital assets and seeks to address questions surrounding classification, measurement and recognition, investment companies, broker-dealers, fair value measurement, and stablecoins (see AICPA and CIMA, 2022). Thus, it is important for practitioners and regulators to develop the appropriate balance between user control, industry practice and regulatory oversight.

Yet, as Vergne (2021) notes several organisations have diverse conceptions of the metaverse. Facebook, for example, has envisaged the metaverse as a collection of virtual worlds that can be accessed through exclusive channels, like specialised headsets and app stores. The metaverse, however, is also composed of community-owned platforms where users may earn cryptocurrency, and data is openly shared through interoperable blockchains, according to those working on a decentralised Web3. According to Vergne (2021) the degree of trust placed in centralised or decentralised entities in the digital world is the primary distinction between these two points of view.

Nonetheless, there is a need to clarify and streamline auditing issues relating to the metaverse. This is important from the perspective of perceived transaction risk within the metaverse. Such issues include metaverse company auditing risk, which is a consequence of revenue recognition risk, security or technical vulnerability risk, and transaction risk caused by the decentralised characteristics of the entire system. However, for Sunder (2011) the current international accounting standards that operate in reality conflict with the needs of the digital era, in which companies conduct their business. There needs to be a combination of social standards from the business and accounting community and accounting rules from professional accounting bodies. This mixture should include both penalties and social norms to achieve balance in the new digital world. The use of professional judgement and social norms over written rules that are applied for legal purposes and without considering social norms might be a favoured solution and lead to lower fees (Sunder, 2011). As Sunder (2011) further argues, it may be logical to explore alternative (virtual) perceptions in accounting, similar to how science explores alternative perceptions of the material world. Nonetheless, as Al-Gnbri (2022) contends that there remains a need for accounting in the metaverse as long as there is an economic exchange, and the changes will be in applications rather than theories. The metaverse has significant implications for auditing, specifically in terms of audit planning, evidence gathering, and risk assessment and the metaverse represents a vertical development in the fields of accounting and auditing.

Methodology

This paper investigates the intricate issues surrounding taxation and accounting processes encompassing jurisdictional complexity within the metaverse. The study delves into the body of existing scholarly works to gain a comprehensive understanding of the challenges and opportunities presented by the metaverse. These works are examined to explore the

intricacies associated with revenue recognition, regulatory considerations, accounting standards, and the potential impact on financial reporting within the metaverse (see Al-Gnbri, 2022; Arora *et al*., 2022; Boucher, 2017; Deloitte, 2022; DeVerter, 2023; Dwivedi *et al*., 2022; Garon, 2022; PwC, 2022). The literature studied presents a broad view of the dilemmas in the field of accounting and taxation.

The study relied on an analysis of secondary data and employed a semi-systematic review of the literature to identify, appraise and synthesize all relevant studies (see Robson and McCartan, 2016, p. 87; Snyder, 2019, p. 334). For Snyder (2019) employing a semi-systematic review helps to examine key developments in a particular research field towards understanding complex issues. The methodology also incorporated Torraco's (2005) grasp of the literature review process. This is represented through a more integrative approach to undertaking research that "... critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated" (Torraco, 2005, p. 356).

Therefore, this study acquired an in-depth insight into the multifaceted nature of taxation and accounting within the metaverse. The review considered both peer-reviewed journal articles, 'grey' literature (like government and corporate reports, conference proceedings) and industry blogs and narratives that were sourced mainly from Scopus database, Google Scholar, EBSCO, and institutional repositories and databases. The review identified and discerned important keywords and concepts relating to taxation and accounting within the metaverse. These keywords included 'revenue recognition', 'deferment', 'asset valuation', 'transaction recording', 'jurisdictional matters', 'blockchain technology', 'decentralised finance', and 'non-fungible tokens'.

This study finds pertinent gaps in key literature surrounding the domain of accounting and taxation in the metaverse. This study recognises the need for further research aimed at developing innovative methods, robust standards, and comprehensive frameworks for effective tracking, reporting, and evaluating virtual assets in a manner that aligns with traditional financial reporting systems. Therefore, this paper provides a foundation for further research. Some key literature gaps are summarised in table I.

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Findings and Discussion

Taxation Complexities in the Metaverse

Taxation, in the legal sense, refers to the procedure through which a government imposes and collects taxes from both individuals and businesses. It involves collating, examining and managing personal and corporate tax affairs and any other tax-related administrative duties (Evans *et al*., 2023). Income, property, commodities and services, and other forms of wealth are often subject to taxation. Tax revenue is used to pay for public infrastructure and services like transportation, healthcare, and education. The ability to levy taxes is typically regarded as a sovereign authority, which belongs to the state or government. Nonetheless, various constitutions and regulations place restrictions on how this power can be used.

Taxation can be classified into two main categories: direct and indirect taxes (Cremer, 2001). Direct taxes, such as income taxes, are imposed directly on individuals and businesses, and the burden of the tax cannot be shifted to another party. Indirect taxes, such as goods and service taxes (GST), are imposed on the sale of goods and services, and the burden of the tax can be passed on to the consumer through higher prices. Taxation laws and regulations vary depending on the country and jurisdiction. In most countries, there are multiple tax laws and regulations that apply to different types of taxes, such as income tax, service tax, and property tax (Smith, 2015). The laws and regulations that govern taxation are generally complex, and individuals and businesses may need to seek the advice of tax professionals to ensure compliance. Yet, the basis of taxation lies in the fact that societies collectivised as nation-states need certain basic utilities to function optimally. The incidence of tax is to ensure that this collective need can be satisfied (Sekera, 2019). The metaverse, however, lacks the same qualities and, therefore, certain new issues present themselves. These issues have been identified below and prospective solutions have been examined.

Identifying Transactions and Jurisdictional Challenges

Taxing transactions in the metaverse can be difficult because of the unique nature of virtual assets and transactions. In some cases, such as online purchases of real-world commodities, the tax treatment will be similar to recognised rules for everyday online trades. However, in circumstances that require the swap of two different virtual assets, such as an NFT secured with cryptocurrency, it could be less apparent that a transaction has occurred, and the value of that deal for tax reasons may be unclear.

Many countries, including the UK, are grappling with how to tax crypto transactions, which are also relevant to the metaverse (PwC, 2022). The UK's stance on the direct-tax treatment of crypto assets is rather clear, in that capital gains policies ought to be extended to crypto asset dealings, and a clearance of a crypto asset will transpire whenever the asset is sold, gifted, exchanged for another asset, or used to pay for commodities. Yet, it is noted that the UK's His Majesty's Revenue and Customs (HMRC) considers crypto assets that are distinct from any other underlying asset to fall outside of the provisions of the UK's Taxation of Chargeable Gains Act (TCGA) 1992. HMRC (2021) also argues that it is sensible to determine the location of the crypto asset by the residency of the beneficial owner (the natural person who ultimately controls the asset or transaction). However, the indirect tax treatment, such as sales tax or VAT, is unclear, with Spain being the sole European territory with a certain tax ruling stipulating that NFTs should draw VAT categorised under EU VAT as electronically supplied services (PwC, 2022). The plan of the Organisation for Economic Co-operation and Development (OECD) to direct the assessment of the digital financial system (referred to as "pillar I" and "pillar II") may also impact the tax treatment of transactions in the metaverse. Therefore, it is important for jurisdictions to have clear regulations that stipulate the tax treatment applying to crypto trades and the metaverse, to develop an effective tax policy (Cockroft, 2022).

As no country or tax body has control over the virtual world, it is incorrect to presume that exchanges that occur there are exempt from tax. It is crucial to know the tax situation of the real-world participants in the transaction in order to decide which tax authority has the most essential taxing claims over the metaverse exchange. It should be quite simple to determine the tax status of well-known trademarks with actual businesses formed in a certain country. PwC's (2022) report on global crypto tax mentions prospective approaches

by various countries regarding the accountability of indirect tax (VAT/GST) of NFT sales by classifying it to the jurisdiction of the seller and marketplace when there is a marketplace involved. Accordingly, the seller has an obligation to account for indirect taxes on the sale of NFTs in Germany. Notably, the marketplace is accountable for indirect taxes in the case of New Zealand, Australia, Ireland, Netherlands, Singapore, South Africa, and the USA. The report also mentions that the treatment is rather unclear in the cases of the Middle East and the UK.

Further, when a metaverse transaction is conducted by a decentralised autonomous organisation (DAO), a participant-owned and operated organisation supervised by CPU software in the configuration of blockchain-powered smart agreements, it is much more challenging to determine the tax placement of a specific consumer in the metaverse. In order to recognise the proper tax jurisdiction and accumulate tax from parties in the metaverse, the position, and tax abode of DAOs will need to be explained (O'Brien et al., 2021).

Physical Enforcement Issues

Reporting is the initial step in dealing with tax problems relating to the metaverse. The OECD is now proposing a mechanism for the automated exchange of intelligence on crypto assets, and it would require crypto asset network operators, like coin intermediaries to give crucial user identification data and a list of trades in crypto assets (OECD, 2022). This framework for the exchange of information may need to be expanded to include hosts of metaverse platforms to guarantee that authorities have the knowledge they need to tax operations within the metaverse.

Moreover, similar to how online sales platforms have been required to act as tax collectors for transactions on their platforms in several jurisdictions, metaverse platform hosts may need to take on a level of responsibility in monitoring and reporting transactions within their platforms and work with tax authorities to ensure that taxes are being paid correctly. Also, the DAO's structure poses difficulties in fulfilling KYC and AML obligations. These requirements are costly and difficult to comply with, especially due to the anonymity of DAO members. Implementing centralised reporting obligations would compromise the DAOs' anonymity and shared governance. However, both DAOs and traditional entities may benefit from being under traditional securities law instead of banking regulations for KYC and AML purposes (Garon, 2022).

Accounting Concerns in the Metaverse

While accounting in the metaverse can present unique challenges, valuation has generally been termed the most significant issue to tackle. There are a number of reasons why the valuation of digital assets, like cryptocurrencies, has been regarded as most challenging. Technologies are advancing at pace, meaning digital assets quickly devalue and future earnings become tricky to estimate leading to unpredictability in the market (Ruan, 2019, p. 24). Crypto assets are known for their volatility, which means that their value can fluctuate significantly within a short period of time. This makes it challenging to determine the fair market value of a crypto asset for accounting purposes at any given period. Indeed, modern international tax regimes were designed for the traditional, rather than virtual economy (Ruan, 2019, p. 24).

There is also a lack of established valuation methods. There are currently no established method for valuing crypto assets, making it difficult for tax authorities to determine the fair market value of crypto assets as their valuation highly depends upon attributes like rarity, demand and supply, the utility of the asset, change in technology, change in metaverse economy, and user preferences. There have been instances, such as in the case of the cryptocurrency like Shiba Inu, Dogecoin, SafeMoon, BitConnect, etc., often called 'meme coins', where valuations have fluctuated to unprecedented levels without any significant change in the position of the crypto asset (Hemendra and Chaudhary, 2022). Adding to this problem is the lack of acceptable accounting methods. There are no acceptable methods amongst the accountants' communities for accounting for such vagaries in valuations. Further, the reserve balance created for accounting for such increase at the best shall be volatile, uncertain and unreal.

Limited historical data also hinders accurate financial reporting (Ruan, 2019). Crypto assets are a relatively new asset class, and historical data on their value and performance is limited. This makes it difficult in financial reporting to use traditional valuation methods, such as discounted cash flow analysis, to value crypto assets. Due to the lack of regulation and the absence of intrinsic value, the value of a cryptocurrency can experience sudden and drastic fluctuations that can leave investors at a loss. In some cases, this can be due to fraudulent activities, like pump and dump schemes or wash trading, where the value of a cryptocurrency is artificially inflated, only for the promoters to sell their holdings and leave the regulatory authorities puzzled to find the source and jurisdiction (Bani-Khalaf and Taspinar, 2023; Kshetri, 2022; Rahman and Jin, 2023). The anonymity of cryptocurrency transactions only adds to such risks.

The decentralised nature of crypto assets makes it difficult for tax authorities to control transactions within the virtual space (Hadzhieva, 2019). Unlike traditional financial systems, where financial institutions act as intermediaries and are subject to government oversight, the blockchain technology that underpins cryptocurrencies operates on a peer-to-peer network, which enables individuals to transact directly with one another without any intermediary or controlling third party (Gilmour, 2022). Since there is no central authority in a decentralised scenario of cryptocurrency to regulate the transactions, it is challenging for tax authorities to obtain information about who is transacting, how much they are transacting, and where the transactions are taking place. Since cryptocurrencies offer the 'anonymity factor', it makes it even more challenging to identify the parties involved in the transactions (Boucher, 2017).

Unlike fungible cryptocurrencies, like Bitcoin, some crypto assets are unique and not interchangeable, as is the case for non-fungible tokens (NFTs). These are digital assets representing ownership of digital content such as art (Bani-Khalaf and Taspinar, 2023; Rahman and Jin, 2023). Since NFTs are unique, they add complexity to the valuation process. The valuation of NFTs does not solely depend on market demand but also on the underlying digital asset it represents. Factors such as the popularity of the artist, the rarity of the asset, and the historical significance of the asset can all affect the value of the NFT. As a result, a piece of digital content that was once popular could lose value quickly if it falls out of favour with consumers, thus making it challenging to compare them with other assets and determine their true value (Kaczynski and Kominers, 2021).

Revenue Recognition in the Metaverse: Non-Fungible Tokens

Generally, there is a lack of standardisation and regulation in virtual economies, which can make it difficult for companies to accurately report and disclose their virtual assets and transactions. For instance, there are questions about how to value and report in-game NFT items and virtual currencies generated through player interactions, and how to report the revenue generated from virtual economies (United States Government Accountability Office, 2013).

The accounting of NFTs in a metaverse environment involves determining performance obligations, transaction price, license of intellectual property, and principal-versus-agent issues. Such considerations are challenging. Companies that issue or sell NFTs must evaluate whether the rights attached to NFTs are separate performance obligations and determine the unit of account for which revenue should be recognised. The transaction price of NFTs may include various payment streams and may require the estimation of variable consideration, which must be subject to a constraint to ensure that it is probable that a significant reversal in revenue will not occur. In some cases, NFTs may only grant the buyer a license to the underlying intellectual property, rather than control or ownership. Additionally, when intermediaries are involved in the sale of NFTs, the parties must determine which party controls the NFT before it is transferred to the end customer, which affects the recognition of revenue (Deloitte, 2022).

The Accounting Standards Codification (ASC) 606 governs the revenue recognition for companies that issue or develop NFTs for a metaverse (Deloitte, 2022). If a company's arrangement to sell an NFT is considered a contract with a counterparty that receives the NFT in exchange for consideration, and the NFT is part of the company's normal activities, then it will fall within the scope of ASC 606. The company must determine if a contract exists by evaluating various factors, such as enforceable rights and obligations, and collectability of consideration. Generally, revenue is recognised when it is earned and realised or when the goods and services are provided to the customer and payment has been received. However, the process of earning and realisation is not clear-cut in an in-game asset. This can be because in-game assets may be sold on a subscription basis, with revenue earned over time rather than at once. For example, if a company sells an NFT that only provides the purchaser with future revenue streams and retains all ownership and license rights to the underlying intellectual property, it must evaluate if the transaction represents the sale of future revenue, which is subject to the guidance in ASC 470; consequently, the rights associated with ASC 606 may not be applicable (Deloitte, 2022).

Furthermore, comparing and reconciling the values may also be difficult as the values are reported differently by various organisations, leading to inconsistencies in financial reporting (Tafon *et al*., 2022). Since these are not physical goods, the determination of a fair value and point of transfer (when the user obtains control of the asset) will be a challenge as it is a key factor in recognising revenue as per accounting standards.

Approaches to Addressing Accounting and Taxation Complexities

Standardisation and Better Application of Accounting Principles

Applying accounting principles to the metaverse can be challenging due to the unique nature of virtual assets and transactions. However, there are several ways that accounting principles can be applied to accurately report and disclose financial information related to the metaverse.

One approach is to apply existing accounting principles and standards, such as those related to revenue recognition and accounting for intangible assets, to virtual assets and transactions. This can include recognising revenue from virtual goods and services and valuing virtual currencies and digital assets. Another approach is to develop new accounting guidance and standards specifically for the metaverse. This could include new guidelines for recognising and valuing non-fungible tokens, such as for valuing virtual land, digital collectables, and other unique virtual assets.

Another approach is to adopt the fair value principle to estimate the value of the assets and liabilities related to the metaverse, such as virtual currencies, digital assets, and in-game items. It is also important to consider the regulatory and legal environment in which the metaverse operates. For example, virtual assets and transactions may be subject to different laws and regulations depending on the jurisdiction, which could impact how accounting principles are applied. Ensuring compliance with financial reporting regulations can also increase the credibility of virtual financial reports and ensure that the metaverse operates within the bounds of the law.

Decentralised Accounting

Unlike traditional accounting systems that are centralised and often rely on intermediaries, decentralised accounting uses blockchain technology to record, verify, and manage financial transactions in a decentralised and transparent manner. Although literature in this area is lacking, there is a growing body of research exploring how blockchain can be used to benefit accounting practices (Pimentel and Boulianne, 2020). Using blockchain technology to maintain an immutable ledger of transactions, a decentralised ledger system can provide a transparent and trustworthy system of financial reporting in the metaverse, as it eliminates the need for trust in central authority and reduces the risk of fraud, errors, and mismanagement. Gilmour (2022) examines the role of blockchain technology in public registers of beneficial owners and other e-government systems. Gilmour's (2022) study highlights how blockchain might overcome accountability and verification challenges inherent within current centralised recording systems.

Virtual Asset Tracking and Real-time Reporting

It is vital to note that blockchain can provide the industry with traceability and transparency by enabling inventory management, health management, and commodity origin verification (DeVerter, 2023). Implementing systems that track and record the movement of virtual assets, including currency and items, can provide valuable information for financial reporting. For example, a virtual marketplace that tracks the sale and purchase of virtual goods and currency and provides real-time updates on the value of assets. Further, a virtual inventory management system that tracks the movement and ownership of virtual items and provides updated information on their value can be a vital development to the supply chain of a product. Developing real-time financial reporting tools that can quickly and accurately reflect the financial state of virtual entities can increase the accuracy and reliability of financial reports (Jayasuriya and Sims, 2023). Blockchain technology makes it possible by enabling a virtual financial dashboard or an AI-enabled virtual assistant that can provide real-time updates on the financial state of virtual entities, such as virtual businesses or economies. There is also scope for virtual accounting software that integrates with virtual marketplaces and other virtual financial systems to provide up-to-date financial reporting and analysis.

Table I. represents real-life applications of blockchain technology and highlights the necessary transparency and traceability required for virtual asset tracking and implementing real-time financial reporting tools to increase the accuracy and reliability of financial reports. Such utilities can provide the opportunity for futuristic financial reporting or a probable complexity for financial reporting in the metaverse. As blockchain technology offers more real-world applications in various industries, it indirectly calls for the accounting industry to expand financial reporting and taxation considerations in the metaverse.

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Conclusion

This paper has sought to highlight and rationalise the lack of regulatory framework and multiplicity of jurisdictions on metaverse transactions. It has advanced debates concerning accounting and taxation pertinent to the metaverse and DeFi. It has addressed some of the complications in respect to accounting and taxation in virtual environments. There are many issues plaguing taxation and accounting processes within the metaverse. As the metaverse emerges as a novel paradigm in the digital space, it poses a formidable challenge to the conventional concepts of revenue recognition and deferment (Arora et al., 2022). The valuation of assets, recording of transactions and multiplicity of jurisdiction are prominent issues. The use of blockchain technology in finance, supply chain management, and other industries create new types of virtual assets that need to be tracked, recorded and reported, but these largely fall outside of current regulation and accounting rules (DeVerter, 2023; PwC, 2022). The growth of decentralised finance (DeFi) and NFTs has already created a market for virtual assets that are not easily accounted for by using traditional financial reporting methods. Although this paper acknowledges the potential benefits of the metaverse and the role that novel virtual assets play within it, it also identifies several caveats, like anonymity and a lack of jurisdiction, which present obstacles for effective accounting (Boucher, 2017; Garon, 2022).

This paper demonstrates the dearth of scholarship covering accounting, financial reporting, and taxation implications in the context of the metaverse (Al-Gnbri, 2022; Arora *et al*., 2022; Boucher, 2017; Deloitte, 2022; DeVerter, 2023; Dwivedi *et al*., 2022; Garon, 2022; PwC, 2022). This is despite the accounting and taxation industry having an immediate interest in understanding and addressing the implications of such developments. There appears to be little uniformity in the usage of terms, such as metaverse, blockchain, and virtual, which necessitates a need for industry consensus around clearly defining these concepts. Establishing a distinct understanding of these terms is essential to facilitate effective communication and collaboration among stakeholders, practitioners, and policymakers.

Furthermore, this paper observes a crucial absence of a unified and comprehensive accounting and taxation framework specifically addressing the unique implications of the metaverse. The metaverse represents a new frontier with vast economic activity and diverse financial transactions. The lack of clear guidance on accounting practices and tax treatment within the metaverse hampers effective financial reporting and taxation. It is evident that the metaverse and decentralised finance (DeFi) concepts are continuously evolving and expanding, and keeping pace with these developments will be challenging without the developing frameworks that specifically address the implications of the metaverse and DeFi on accounting and taxation practices. The current case-by-case approach to addressing these issues, as observed in current literature, may not provide a holistic and standardised

solution for stakeholders and regulators to navigate the metaverse's globally vast financial landscape.

The authors recognise this study's potential limitations. As the scholarship on the metaverse is rapidly emerging, a deep understanding of the implications for the accounting and taxation profession has not been fully recognised. The study has been unable to capture a broad array of multidisciplinary issues that, perhaps, a detailed synthesis using a more systematic literature review might be able to achieve.

Several questions remain unanswered. Given the global nature of the metaverse, which spans various geographies and jurisdictions, it is of utmost importance to recognise the pressing need for specific recommendations and solutions to tackle the identified gaps and challenges in the accounting and taxation domains. It is crucial to understand the intricate interplay between the metaverse and accounting and taxation frameworks. Further research is needed to address the myriad of accounting and taxation issues highlighted in this paper towards formulating comprehensive accounting and taxation frameworks relating to the metaverse. Future studies should account for the rapid growth of metaverse adoption and mitigating against inconsistent practices due to a lack of understanding, potential loopholes, and unfair accounting or tax advantages. Importantly, proactive frameworks must consider the diverse regulatory landscapes and jurisdictional nuances of the metaverse to ensure a coherent and harmonised approach.

These complications, however, are coupled with an equally large number of viable solutions and alternative solution mechanisms. The accounting industry must consider how to handle emerging technologies and adapt to the unique reporting requirements that they present and further research is needed in this emerging field (Pimentel and Boulianne, 2020). This includes developing new methods for tracking and reporting virtual assets, as well as new standards for evaluating the value of these assets for financial reporting purposes. It is important to reconcile these virtual transactions with traditional financial reporting systems and ensure accounting methods are incorporated into an inclusive and broader financial reporting framework (Tafon *et al*., 2022). As standardised regulations for accounting and taxation in the metaverse are yet to be established (Deloitte, 2022), the paper recommends a case-based approach is advisable.

The accounting industry must embrace a proactive stance towards tackling the challenges presented by the metaverse to ensure the precision in accounting, taxing, and reporting of virtual transactions. By developing new methods, standards, and frameworks, accountancy can leverage the potential of emerging technologies, like blockchain, to augment transparency and accountability in the virtual space. Negligence to do so could lead to the development of regulatory void that could result in the mismanagement of virtual assets and undermine the trust and confidence of investors and stakeholders in the metaverse.

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Table I. Assessing gaps in previous studies.

Paper	Key gaps
Al-Gnbri (2022)	The paper explores future implications of virtual reality technology, specifically, the metaverse on accounting and auditing. It pioneers the identified link between accounting, auditing, and the metaverse, and highlights the metaverse's progression as an auxiliary tool in these fields. It emphasises the emergence of new digital assets in the metaverse, requiring accurate accounting measurements and disclosure methods and the impacts on audit planning and evidence collection. Understanding the impact of the metaverse on taxation, including the tax treatment of virtual assets, virtual transactions, and income generated within the metaverse, remains an important research gap that warrants further exploration.
Arora *et al*. (2022)	This paper focuses on the GST implications in the context of Indian tax laws. The literature broadly mentions NFTs as virtual assets, but with little concern for the unique challenges and tax considerations associated with NFTs transactions through in-game activities. It outlines the integration of cryptocurrencies in the metaverse but fails to explore the accounting and taxation implications of them. There are gaps in exploring other issues beyond taxation, considering the impact of cryptocurrencies, conducting comparative analyses across jurisdictions, and in providing recommendations or solutions in addressing such issues.
Boucher (2017)	The paper explores eight strategic areas where blockchain might have substantial impact on accountancy and taxation and anticipates potential policy issues. Scholarly debate on

	these policy issues in the context of the metaverse or other virtual environment is limited. Taxation implications related to public services impacted by blockchain, such as the utilisation of blockchain for tax collection, is discussed, yet it fails to explore the challenges and considerations associated with taxation or taxing in the virtual or digital economies of the metaverse.
Deloitte (2022)	The literature provides insights into the potential use for NFTs and examines how companies can leverage NFTs to enhance strategies, address regulatory and risk factors, and consider accounting and tax implications. It falls short of examining the broader impact of NFT adoption by traditional accounting models, though, discusses revenue generation and brand extension using NFTs for corporates. The study acknowledges the challenges associated with digital assets, including revenue recognition and jurisdictional issues. It demonstrates that further research is needed in recognising types of NFTs from a taxation and accounting perspective, leaving room for exploring research to better comprehend the implication of the metaverse and transacting via NFTs on traditional accounting frameworks.
DeVerter (2023)	This paper highlights the discourse surrounding the use of blockchain in real-world applications is limited on reporting and taxation implications. The application of blockchain is often only viewed in the context of digital assets, which limits an understanding of the adoption of blockchain in broader contexts. Adopting blockchain can be beneficial for various industries and sectors, including accounting and has implications for transparent and efficient financial reporting and streamlined auditing processes.

Dwivedi *et al*. (2022)	The paper explores the potential of the metaverse, utilising augmented and virtual reality technologies to expand the boundaries of the physical world. It acknowledges the significance of virtual environments and immersive games as precursors to the metaverse and emphasises its transformative impact on sectors like marketing, education, tourism, and healthcare. The paper fails to explicitly examine the implications of the metaverse on accounting and taxation practices; nonetheless, it acknowledges societal effects, trust, privacy, bias, and psychological aspects and alludes to jurisdictional challenges associated with buying and selling within the metaverse. Further research is needed to understand the intricate interplay between the metaverse, and accounting and taxation frameworks.
Garon (2022)	This paper explores the metaverse and Web3 and broad implications, like intellectual property rights, contracts, privacy, and regulation. The paper limits such discussion on the U.S. legal context without concern for the global metaverse ecosystem or broader regulatory frameworks necessary to govern accounting and taxation practices within the metaverse. As the metaverse transcends geographical boundaries, it is essential to consider the international implications, which are crucial for harmonising accounting standards, addressing cross-border transactions, and navigating diverse tax regimes across jurisdictions.
PwC (2022)	This report serves as a comprehensive global overview of the crypto tax landscape as of 2022, providing jurisdiction-specific insights into tax regulations. Although it acknowledges the significance of Web3, DeFi, and the metaverse in driving innovation, it fails to delve into the specific implications for traditional accounting and tax frameworks. The report focuses on the term "virtual event" rather than "metaverse" to provide information about the taxation implications of events conducted

within the metaverse across different countries. The study highlights a lack of comprehensive global policy for taxation concerning digital assets and need for consistent policies that address the risks posed by digital assets in the global tax landscape.

Table II. Various utilities for blockchains and their applications

Blockchain	Utility	Brands and real-world applications
VeChain	Virtual origin verification	VeChain partners with DNV GL, a global quality assurance and risk management company, to provide blockchain-based supply chain solutions for the wine industry.
	Virtual origin verification	VeChain partners with BMW, a luxury automobile company, to provide a blockchain-based platform for tracking the origin and authenticity of BMW car parts.
	Traceability	VeChain partners with Fanghuwang, a real-estate financial service company, to provide a blockchain-based platform for tracking loan information and improving the transparency of the lending process.
	Trust-based services	VeChain partners with PwC, a global professional services firm, to provide blockchain-based solutions for the supply chain, luxury goods, and agriculture industries.
Rarible	Virtual origin verification	Rarible has partnered with NBA Top Shot, to buy, sell, and trade officially licensed digital collectables from the National Basketball Association (NBA).
Ethereum	Supply chain management, financial services, gaming, digital identity.	ConsenSys, Microsoft, UBS
Bitcoin	Digital payments, remittances, investments.	Square, PayPal, Tesla
R3 Corda	Financial services, trade finance, digital identity.	HSBC, ING, Wells Fargo
Hyperledger	Supply chain management, cross-border payments, digital identity.	IBM, Intel, Huawei
Chainlink	Decentralised finance, data management and oracle services.	Google, Oracle