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Article

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Sustainable innovation in the metaverse: Blockchain's role in new business models

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ABSTRACT

This research aims to bridge a gap in the existing literature by investigating the role of the blockchain-based metaverse in fostering decentralized sustainable management, leveraging the principles of stakeholder capitalism theory. By conducting a content analysis of thirty-two expert reports from the blockchain-based metaverse industry, the study identifies five key attributes that can potentially cultivate innovation and decentralized sustainable management within the business domain. These attributes include a creator economy, a persistent synchronous virtual environment, decentralization, an interoperable network, and a digitalized mindset. The research underscores the need for stakeholders to adopt a sustainable approach when navigating the blockchain-based metaverse, highlighting the potential benefits achievable in a decentralized, hybrid physical-digital environment. This work stands as a pioneering effort in conceptualizing a theoretical framework that encapsulates decentralized sustainable management within the blockchain-based metaverse, underpinned by the principles of stakeholder capitalism. Thus, it contributes significantly to the academic discourse on the sustainable implications of blockchain technology in new business models.

1. Introduction

The metaverse represents a significant evolution in digital interaction, combining virtual reality (VR), augmented reality (AR), and other immersive technologies to create interconnected, virtual environments where users can interact with each other and digital objects in real-time. This convergence of digital and physical worlds is not just a technological novelty but a transformative force for businesses across various sectors. For instance, in marketing, the metaverse offers unprecedented opportunities for immersive brand experiences and personalized customer engagement (Barrera & Shah, 2023). From a multidisciplinary perspective, it fosters innovative business models and collaboration methods (Dwivedi et al., 2022; Koohang et al., 2023). Entrepreneurs can leverage the metaverse for new venture creation and resource optimization (Weking et al., 2023), while retailers can enhance shopping experiences through virtual stores and try-before-you-buy options (Yoo et al., 2023). In logistics, the metaverse can streamline operations through virtual simulations and real-time tracking (Tan et al., 2023). As such, the metaverse holds immense potential for driving business innovation, operational efficiency, and customer satisfaction, marking a

pivotal shift in how businesses operate and compete in the digital age.

Integrating blockchain technology within the metaverse further amplifies these benefits, providing secure, transparent, and decentralized systems for transactions, data management, and contract execution. This integration leads to the emergence of new blockchain-based business models that capitalize on the metaverse's immersive environments and blockchain's robust security and decentralization features, paving the way for a revolutionary approach to digital commerce and enterprise operations (Tan & Salo, 2023).

In general, *the metaverse* refers to a virtual universe that allows users to experience immersive digital environments and interact with each other in real time (see, e.g., Dwivedi et al., 2022, 2023; Yoo et al., 2023). Thus, the metaverse represents a new type of platform or marketplace where various stakeholders—such as consumers, content creators, and businesses—can interact and engage with each other in a virtual setting (Barrera & Shah, 2023). These stakeholders have different interests and goals, and the design and governance of the metaverse can have a significant impact on their experiences and outcomes. For this reason, we draw from stakeholder capitalism theory (Freeman et al., 2007). The theory plays this role in creating long-term value for society,

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governments, industries, and civil society, where the theory “works” in this engagement that fulfills multi-stakeholders’ best interests (Bhandari et al., 2022). Further, stakeholder capitalism is found to contribute to decent work and economic growth, including promoting decent work, employee engagement and empowerment, and the convergence of digitalization and sustainability solutions (Mhlanga & Moloi, 2020).

To the best of our knowledge, no paper has identified the key attributes of the blockchain-based metaverse using theoretical explanations (Tan et al., 2023). No research has outlined the key characteristics that describe how the blockchain-based metaverse is conceptualized differently from the three-dimensional (3D) virtual environment that we have experienced in most existing gaming and social-networking worlds (Kaplan & Haenlein, 2019). In parallel with the rise of the metaverse as a research topic, research topics linking to and focusing on sustainability have been given increasing attention in business studies and curricula (Barrera & Shah, 2023; Dwivedi et al., 2022; Tan et al., 2023). However, no underlying theory has been provided to explain the theoretical connection between the metaverse and sustainability-related literature with a concrete implication, even though a previous study has rationalized the linkage between the metaverse and sustainable management (Allam et al., 2022; Go & Kang, 2023; Pamucar et al., 2022).

The absence of these theoretical frameworks and key characteristics can be attributed to several factors. One significant reason is the multidisciplinary nature of the metaverse, which spans various fields such as computer science, sociology, economics, and environmental studies. This breadth of scope often results in a fragmented understanding and lack of cohesive theoretical development, as each discipline approaches from different perspectives and methodologies (see Linsley & Shrivives, 2006). Additionally, the rapid evolution of metaverse technologies outpaces academic research, making it challenging for scholars to develop and disseminate comprehensive theoretical explanations in a timely manner. The novelty and complexity of integrating blockchain technology into the metaverse further complicate the establishment of clear conceptual frameworks. Moreover, the novelty of the blockchain means that many of its implications, especially those related to sustainability, are still emerging and not yet fully understood (see Kwok & Treiblmaier, 2023). This study seeks to address these gaps by providing a robust theoretical framework that elucidates the key attributes of the blockchain-based metaverse and its connection to sustainability, thereby enhancing the novelty and significance of our research.

In order to address these existing gaps, this research delineates the pivotal elements of the metaverse and explores their connection to decentralized sustainable management. Consequently, we formulated the following research questions (RQ):

RQ1: What are the defining attributes of the blockchain-based metaverse?

RQ2: Which foundational theories can elucidate the concept of decentralized sustainable management within the metaverse?

In this study, we performed a content analysis of 32 metaverse industry expert reports on the metaverse. These reports were published by prestigious expert firms who have been researching the metaverse since 2019, including Ernst & Young, J.P. Morgan, KPMG, Deloitte, and the Pew Research Center. Turning to the theoretical contributions of our study, our research first enriches the literature concerning business and the ethical ramifications of technology (Martin et al., 2019). We advocate for conscientious attention towards societal aspects like decentralized trust. Our findings illuminate the potential of autonomous entities in a physical-digital landscape, offering potential benefits to stakeholders and emphasizing the unique role businesses play in ethical technological innovation. Further, our research first adds to the established literature on the metaverse (Aytas & Can, 2022; Ball, 2022; Belk et al., 2022; Bojic, 2022; Christodoulou et al., 2022; Dwivedi et al., 2022; Ersoy & Gürfidan, 2022; Goldberg & Schär, 2023; Kim, 2021; Mourtzis et al., 2022; Tan & Salo, 2023; Yoo et al., 2023) by identifying the following five essential attributes of the metaverse (which can be

applied to any research context): a creator economy, a persistent synchronous virtual environment, decentralization, an interoperable network, and a digitalized mindset. Third, we contribute to the literature on sustainable management within the metaverse (e.g., Go & Kang, 2023; Koochang et al., 2023; Ooi et al., 2023), which serves to provide new scholarly thought on decentralized sustainable management.

Our research holds substantial relevance for practitioners aiming to understand the intricate dynamics of how the metaverse, conceptualized as a socially-oriented virtual world (Kaplan & Haenlein, 2019), can be leveraged as a strategic technological asset. We pioneer the introduction of a novel business model wherein decentralized management amalgamates a synergistic physical-virtual cooperation, polycentric governance, and sustainable digitalization within the framework of the burgeoning metaverse landscape. This model beckons a transformative approach to governance and management, fostering resilience and adaptability in the face of rapidly evolving digital frontiers.

2. The background literature

2.1. The metaverse

The word *metaverse* is a composite of two components, the prefix “meta” refers to “beyond” and the suffix “verse” is related to “universe”. To date, there is no commonly accepted definition for the metaverse when used in the context of business research. This is due to the fact that the technology is still in an early phase (Tan & Saraniemi, 2023). Pioneer researchers claim that the metaverse is a universe beyond the physical world, which implies the convergence of virtually enriched physical reality and physically persistent virtual space (Dionisio et al., 2013; Kaplan & Haenlein, 2019; Tikkanen et al., 2009). On the other hand, the metaverse is referred to as the compilation of virtual worlds that underlies blockchain technology (Tan & Salo, 2023; Tan & Saraniemi, 2023), which consists of non-fungible token (NFT) galleries, virtual lands, a decentralized play-to-earn gaming ecosystem, and the use of virtual currencies (Vidal-Tomás, 2022). In this regard, the metaverse is not controlled from the servers of a single firm; rather, the metaverse enables the reflection of reality by allowing users to teleport across different blockchain-based metaverses using a single identity (Ahn et al., 2022). Recently, Ball (2022, p. 42) defined the metaverse as “a massively scaled and interoperable network of real-time rendered 3D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments.”

Dwivedi et al. (2022) stated that the metaverse can be considered a simulated virtual world platform or virtual shared space wherein users can take part in various activities without any physical restrictions by using avatars. In this sense, the users can connect, interact, communicate, and collaborate with virtual objects and virtual environments in real-time by teleporting themselves to the metaverse through their smartphones, personal computers, or virtual reality (VR) headsets. Specifically, Mystakidis (2022) argued that the metaverse is based on the convergence of VR and augmented reality technologies that enable users’ multisensory interactions with a virtually socialized digital environment, which is due to the latest developments and the growth of popularity of immersive technologies. On the other hand, the metaverse consists of four distinct dimensions—online collaboration, high consumer immersion, unique digital assets, and digital personas—which refers to a digital space comprised of 3D environments aimed at facilitating online collaboration between users, utilizing advanced immersive technologies to reduce the perception of technological mediation and enhance the overall experience for users, and allowing for the creation and transfer of unique digital assets and establishment of user-generated digital personas (Yoo et al., 2023).

2.2. The underlying theory in the metaverse: stakeholder capitalism

In this research, we draw from stakeholder capitalism theory (Freeman et al., 2007) due to two reasons: First, previous studies have found that this theory is relevant to the metaverse, which involves long-term value creation among stakeholders in the ecosystem (Bult, 2022; Tan & Salo, 2023). Second, the metaverse itself is a universal and interoperable platform (Ball, 2022), which is closely related to the philosophy of stakeholder capitalism as that focuses on the interests of stakeholders (Freeman et al., 2007).

Stakeholder capitalism (Freeman et al., 2007) is a new vision of capitalism that emphasizes satisfying the interest of the stakeholders (e.g., employees, customers, suppliers, financiers, and communities) by creating long-term value and maintaining sustainable relationships (Freeman & Liedtka, 1997). Stakeholder capitalism provides a stepping stone for a business model that requires companies and private individuals to be able to compete freely, which brings creative energy and the work ethic of people in society (Schwab & Vanham, 2021).

Stakeholder capitalism theory underlies six principles (Freeman et al., 2007): The principle of *stakeholder cooperation* refers to cooperation between stakeholders to ensure continuous motivation resulting from their values and subsequently leads to value creation (Tóth et al., 2020). The principle of *stakeholder responsibility* relates to maintaining a sustainable value-creation process; stakeholders have to be accountable for their responsibilities, including the consequences of their actions (Freeman et al., 2007). The principle of *stakeholder engagement* refers to successfully creating and maintaining value, companies, and channels by engaging stakeholders in the ecosystem for the purpose of satisfying their needs (Tan & Salo, 2023). The principle of *continuous creation* highlights how collaboration between stakeholders in the ecosystem continually creates new sources of firm value (Freeman & Liedtka, 1997). The principle of *emergent competition* refers to a healthy and relatively free society for competition among stakeholders, which enables stakeholders to adapt and sustain themselves in the ecosystem by innovating and gaining more emergent properties (Freeman et al., 2007). The principle of *complexity* is defined as value can be created, traded, and sustained because human beings are complex psychological creatures whose actions may be based on many different values and points of view (Freeman et al., 2007).

2.3. The decentralization and the blockchain-based metaverse

Paredes-Frigolett and Pyka (2023) explore the intersection of blockchain and stakeholder capitalism theory, suggesting that blockchain technology can enhance stakeholder engagement and credibility within the extended decentralized ecosystems of digital platforms. Similar to previous studies (e.g., Tan & Salo, 2023; Tan & Saraniemi, 2023), blockchain's decentralized nature and transparency features can ensure secure, verifiable interactions among stakeholders, thereby aligning with the principles of stakeholder capitalism. Following this notion, blockchain may promote more equitable value distribution and collaborative innovation, fostering a decentralized business model where stakeholders collectively contribute to and benefit from the ecosystem, enhancing both accountability and inclusivity in metaverse operations. For instance, in the fields of information technology and engineering, previous studies have suggested that the blockchain-based metaverse could result in a greater level of stakeholder interactions and decentralization through mutual incentive mechanisms (Nguyen et al., 2022), interconnected decision-making processes (Crowell, 2022), digital credentials (Ersoy & Gürfidan, 2023a, 2023b), and electronic commodity trading (Chen et al., 2023).

3. Methods

To address the posed research questions, we implemented a structured content analysis approach, as delineated by Eschenfelder et al.

(2018), scrutinizing 32 metaverse industry expert reports published between late 2021 and 2023. It is pertinent to note that sourcing expert reports prior to 2021 proved challenging, as the metaverse began its ascension to a mainstream business strategic focus only from 2021 onward. Our content analysis is based on an existing theoretical framework, thus employing a deductive approach to systematically analyze the reports (McKibben et al., 2020). This methodology involves four key steps: unitizing data for analysis, sampling units, recording categories, and reducing units into categories.

The first step involved identifying the unit of analysis. Each industry expert report was treated as a unit of analysis, focusing on the comprehensive text within each report. This approach ensured that we captured all relevant information and context provided by the experts. Our focus on industry expert reports rather than academic literature is rooted in the dynamic and rapidly evolving nature of the metaverse. Industry expert reports offer real-time insights and up-to-date analysis that academic publications may not provide due to longer publication cycles. Industry expert reports are crucial for understanding current trends, technological advancements, and market dynamics, as they are often based on the latest data and expert opinions. Furthermore, industry perspectives are vital in connecting to the underlying theory of stakeholder capitalism, as they provide a comprehensive view of how various stakeholders—including businesses, consumers, developers, investors, and policymakers—perceive and engage with the metaverse.

Industry expert reports also play a critical role in identifying emerging business models and strategic approaches within the metaverse, which are essential for our study. As highlighted by Giones and Brem (2017), the industry perspective matters because it reflects the real-world applications and implications of advanced technology, offering practical examples and case studies that enrich our theoretical framework. Thus, the analysis of industry expert reports ensures that our study remains relevant and grounded in the current landscape of the blockchain-based metaverse, thereby enhancing the robustness and applicability of our theoretical contributions.

The second step is related to sampling units. We collated data exclusively from reputable, English-language expert reports published between 2021 and 2023, which are publicly accessible via search engines such as Google, Bing, and Yahoo!. Utilizing a targeted query string that included phrases such as “Metaverse industry expert reports,” “Metaverse report,” “Metaverse expert report,” “Metaverse consulting report,” “Metaverse industry analysis,” “Metaverse market research,” “Metaverse trends report,” “Metaverse future projections,” “Metaverse ecosystem insights PDF,” “Metaverse economic impact study PDF,” and “Metaverse future projection report,” we sought to pinpoint reports pertinent to the current research.

We meticulously examined each result within the first 100 outcomes for each query string on every search engine utilized, further delving into the “related searches” section to broaden our dataset. Notably, only official metaverse reports available in PDF format were selected for deeper analysis. This criterion excluded articles, academic journal articles, short reviews, and expert interviews available on consulting firms' webpages from consideration in our research. The decision to focus on PDF format reports was driven by the need for consistency, reliability, and thoroughness in our data collection. PDF reports are typically comprehensive, officially published documents that include detailed analyses, statistical data, and formal disclaimers, ensuring a high standard of credibility and authenticity. In this regard, the PDF format serves as an important and common extraction source for academic review (Bui et al., 2016). This facilitates easier citation and ensures that the content remains unaltered, providing a stable reference for our research.

After excluding reports that did not adhere to the established inclusion criteria—namely, those that were anonymous or lacked official authorship and firm disclaimers, exhibited an absence of statistical analysis, were published outside of the designated time frame, or were not centered specifically on the metaverse (instead focusing on VR/AR more broadly)—we ensured a robust and reliable dataset for our study.

A total of 32 reports remained as viable candidates for analysis. These selected reports are detailed in [Table 1](#).

The third step involves recording categories, which entails identifying and describing interpretable categories within the data units. The last step, associated with reducing units into categories, involves the actual coding process, where researchers infer categories from the data based on the predefined codebook. This step follows a primarily deductive process, although it may also allow for the inductive identification of new categories that emerge from the data. These two steps will be discussed in the next section as they relate to data analysis.

4. Data analysis

To guarantee the precision and reliability of coding for recording categories (i.e., Step 3), all authors operationalized categories by developing clear definitions for each category or theme to be coded, ensuring these definitions are replicable and valid. Operationalizing categories often involves assigning numerical codes to create categorical variables, which can be binary or have multiple levels. These predefined categories are organized into a codebook that includes concrete operational definitions and numerical codes. The codebook serves as a reference for coders, enhancing the consistency and reliability of the coding process. Additionally, a coding sheet is designed to systematically document the assignment of units to categories. This preparatory work ensures that the subsequent coding is grounded in a structured and transparent methodology. As part of this process, the authors engaged in a training session. During this session, the authors collaboratively coded the initial batch of reports (index 1 to 5), compared their findings, identified discrepancies, and refined the coding guidelines concerning the characteristics of the metaverse and the methodologies to facilitate decentralized sustainable management within the metaverse.

In the final step of reducing units into categories, as guided by [McKibben et al. \(2020\)](#), we categorized the units into interpretable categories. This process began with a pilot test phase, during which the authors coded a subset of reports together to ensure consistency and refine the coding process. In the main coding phase, the first and third authors individually examined the remaining 28 reports (index 6 to 32), achieving an intercoder agreement rate of 87%. To address inconsistencies, the second author held separate consultations with the first and second authors, leading to an increased intercoder consistency rate of up to 98.5%. Unfortunately, a consensus could not be reached regarding the remaining 1.5% of the inconsistencies, and thus these were omitted from the final analysis.

Subsequently, all authors embarked on a rigorous process of identifying prominent themes that resonated strongly with the data. The team meticulously reviewed and honed the identified elements to forge a coherent pattern that accurately encapsulated the nuanced information present in the dataset. This endeavor necessitated revisiting the reports to authenticate that each discerned element precisely mirrored the overarching themes evidenced in the entire data compilation.

To aptly contextualize these insights within the broader metaverse phenomenon, the authors diligently defined and labeled the elements, fostering a comprehensive understanding of their roles and implications within the metaverse ecosystem. This process was iterative, involving several rounds of fine-tuning and revisions, persevering until a unanimous agreement was reached on the representation and categorization of the identified elements. In [Table 2](#), we delineate five distinct attributes associated with the metaverse alongside six fundamental elements integral to decentralized sustainable management, as discerned from the analysis of 32 expert reports. It is noteworthy that each theme has been identified with a frequency count exceeding 50%, spanning a range from 53% to 84%.

5. Findings

5.1. The blockchain-based metaverse attributes and their synergies with stakeholder capitalism

Upon conducting a meticulous content analysis, we discerned that two pivotal attributes predominantly define the metaverse: a *creator economy* and an *interoperable network*, accounting for 81% and 84% of the thematic prevalence, respectively. Further crucial attributes that emerged from the analysis encompass the presence of a *persistent synchronous virtual environment* and *decentralization*, both registering a 72% occurrence rate, followed closely by the adoption of a digitalized mindset, which was evidenced in 78% of the analyzed content. These attributes cohesively sketch the foundational essence and prospective pathway of the burgeoning metaverse, paving the way for a novel paradigm of economic coordination and governance within a 3D, real-time rendered virtual domain.

It is crucial to emphasize that, according to our analysis of expert reports, the delineated attributes of the metaverse are not intrinsically linked to the utilization of VR devices, such as a Meta Quest VR headset (e.g., report 1). As such, users could immerse themselves in the metaverse via an interactive display in order to control their virtual movements, with or without a full-body suit (e.g., a Teslasuit). The evolving phenomenon under discussion will be further elucidated in the following sections, supported by insights gleaned from current literature and their intersections with the principles of stakeholder capitalism.

5.1.1. A creator economy

According to [Bojic \(2022\)](#), the metaverse enables a new economic system that would allow creators (e.g., artists, designers, software engineers, and other types of developers) to earn their rewards directly from audiences. For instance, the creators can convert the metaverse into a revenue-generating marketplace by tokenizing their products (e.g., NFTs) and utilizing tools and applications to produce metaverse experiences and virtual assets ([Dey, 2022](#)). Importantly, the creator of a specific virtual environment could own a virtual land as part of his or her virtual property ([Belk et al., 2022](#)). Thus, the creator economy is expected to accelerate the distribution of individual creativity at an unprecedented scale as the creators could own their virtual world without the absolute control of legalized entities, as users experienced in the current Web2.

Expert reports ($n = 26$) claimed that the creator economy is driven by innovation and creativity as creators are constantly seeking for new ways to create and monetize their virtual assets by engaging their audiences (e.g., report 8). That is, the creator economy enables creators to earn rewards directly from their audiences for the digital assets and virtual experiences they produce (e.g., report 12). This attribute aligns with the principles of emergent competition and continuous creation as the metaverse emphasizes the active involvement of multi-creators in the production and distribution of new virtual assets and novel experiences owned by the creators—this enables the creators to gain more emergent properties in the metaverse with which to adapt and survive in a new economic system (e.g., report 4). Overall, the creator economy serves as a key driving force for the metaverse, promoting the distribution of creators' continuous creativity for emergent properties (e.g., virtual lands, NFTs, and novel experiences) at an unprecedented scale.

5.1.2. An interoperable network

As argued by [Ball \(2022\)](#), the metaverse should exist in one single 3D virtual environment rather than in different versions of “metaverses,” or it should be referred to as “a metaverse.” The metaverse is intended to describe the unified experience of all interconnected or interoperable virtual worlds with unlimited users ([Kim, 2021](#)). Interoperability is one of the most complex and yet essential elements of the metaverse as it refers to different autonomous systems, independently operated simulations, and 3D-rendered virtual worlds being able to process and

Table 1
Comprehensive overview of blockchain-based metaverse industry expert reports.

Index	Reporting agency	Report title	Published year	Number of pages	Industries involved within the metaverse	Technology involved within the metaverse	Relevant SDGs
1	World Economic Forum	Social Implications of the Metaverse	2023	62	Education and health care	Blockchain, VR, AR, AI, XR, NFT, Web3, and Edge & cloud computing	11 and 13
2	Deloitte	Metaverse Report - Future is here Global XR industry insight	2022	46	Health care, education, transportation, entertainment, and gaming	Blockchain, 5G/6G, cloud computing, AI, AR, VR, MR, XR, and IoT	N/A
3	Essence	Manifest Metaverse - A Realistic Look at the Next Digital Frontier	2022	17	Cryptocurrency, gaming, entertainment, virtual workspace, and retail	Blockchain, NFTs, AR, and VR	9 and 13
4	Ernst & Young	EY Metaverse Whitepaper	2022	44	Cryptocurreny, fashion & beauty, automotive, gaming, health care, education, entertainment, and finance	Blockchain, NFTs, VR, and AR	N/A
5	HFS Horizons	Metaverse Services Providers	2023	32	Consulting services	Blockchain, AR, VR, and XR	N/A
6	J.P.Morgan	Opportunities in the Metaverse. How Business can Explore the Metaverse and Navigate the Hype vs. Reality	2022	17	Retail, amusement, gambling and recreational, and gaming	Blockchain, VR, and AR	8
7	McKinsey	Value Creation in the Metaverse. The Real Business of the Virtual World	2022	77	Cryptocurrency, gaming, entertainment, virtual workspace, and retail	Blockchain, AI, AR, and VR	9 and 13
8	Pew Research Center	The Metaverse in 2040	2022	204	Healthcare, education, entertainment, and arts, culture, and entertainment travel	Blockchain, AR, MR, XR,VR, AI, and Web3	3
9	Siemens	The Emergent Industrial Metaverse	2023	24	Industrial metaverse	Blockchain, IoT, AI & ML, Edge & cloud computing, 5G, 6G, AR, and VR	7, 9, and 11
10	Unicef	The Metaverse, Extended Reality and Children	2023	35	Education & healthcare	Blockchain, and XR	3 and 4
11	United Nations Development Programme	Web3 for 2030 How Can Web 3 Help Achieve the Sustainable Development Goals	2022	35	Cryptocurrency, gaming, entertainment, virtual workspace, and retail	Blockchain	1,4,8,13,16, and 17
12	Credit Suisse	Metaverse: A Guide to the Next-Gen Internet	2022	34	Technology, media, gaming, and telecommunications	Blockchain, AR, VR, and micro-LED	N/A
13	Wunderman Thompson	Into the Metaverse	2021	93	Cryptocurrency, gaming, entertainment, virtual workspace, and retail	Blockchain, VR, AR, MR, and XR	3 and 8
14	Activate Consulting	Beyond the Hype Cycle: The Metaverse Matters Now More Than Ever	2023	61	Gaming	Blockchain and AI	N/A
15	Acumen Research and Consulting	Metaverse Market - Global Indruy Size, Share, Trends and Forecast 2022–2030	2022	203	Marketing	Blockchain	N/A
16	Analysis Group	The Potential Global Economic Impact of the Metaverse	2022	47	Telecommunications, sports, art and music, gaming, and retail	Blockchain, VR, AR, and MR	8
17	AYO Innovation Conculting	China's Metaverse and Its Retail Applications	2022	59	Gaming, finance, fashion, tourism, and marketing	Blockchain,VR, AR, MR, XR, AI, Cloud computing, and 5G	N/A
18	Deloitte	The Metaverse in Asia. Strategies for Accelerating Economic Impact	2022	116	Gaming, entertainment, retail, manufacturing, e-commerce, healthcare, education, and finance	Blockchain, AI, IoT, AR, and VR	7, 8, 9, and 13
19	Deloitte	The Metaverse and its Potential for Türkiye	2022	50	Gaming and retail	Blockchain, VR, AR, 5G, and Cloud computing	4, 8, 9,11, and 13
20	Deloitte	Enabling the Metaverse in Sub-Saharan Africa	2023	64	Gaming and retail	Blockchain, AR, AI, VR, and Edge & Cloud computing	3, 4, and 8
21	Deloitte	The Metaverse and Its Potential for MENA	2023	66	Tourism, real estate, education, retail, and gaming	Blockchain, AR, VR, AI, and Edge & Cloud computing,	8
22	Deloitte	The Metaverse and Its Potential for the United States	2023	46	Retail, telecommunications, aviation, financial healthcare, education, environmental, and fast food	Blockchain, AR, VR, AI, Edge & Cloud computing, and 5G	3, 4, 8
23	Deloitte	The Metaverse and Its Potential for Canada	2023	48	Manufacturing, transportation, retail, education, health care, media & entertainment, and gaming	Blockchain, AR, VR, AI, Edge & Cloud computing, and 5G	4 and 8
24	FTI Consulting	Charting a Path to the Metaverse. Understand the Metaverse and How It May Impact Your Business	2022	7	Retail, gaming, entertainment, tourism, fitness, education, and real estate	Blockchain, AR, VR, XR, AI, 5G, and Cloud computing	N/A

(continued on next page)

Table 1 (continued)

Index	Reporting agency	Report title	Published year	Number of pages	Industries involved within the metaverse	Technology involved within the metaverse	Relevant SDGs
25	IBM Institute for Business Value	7 Bets	2023	50	Finance, manufacturing, and technology & IT services industry	Blockchain, AR, VR, and AI	N/A
26	KPMG	KPMG Metaverse Investor Perspectives Survey	2023	32	Education	Blockchain, and 5G	8
27	KPMG	Why the Metaverse is a Massive Opportunity for Companies to Get Diversity Right	2023	11	Industrial, retail, and education	N/A	4 and 8
28	KPMG	Shaping Your Strategy for Web3 and the Metaverse	2022	46	Health care, professional services, and gaming	Blockchain, Web3, VR, and AR	N/A
29	Meta	The Metaverse and the UK Opportunity	2022	25	Sports, gaming, software, education, industrial, and healthcare	Blockchain, Web3, VR, AR, AI, and ICT infrastructure	4
30	Meta	The Metaverse and the Opportunity for the European Union	2023	70	Services, manufacturing, agriculture, retail, and education	Blockchain, AR, VR, AI, and ICT infrastructure	8 and 13
31	TT Consultants	Metaverse	2022	72	Health care, education, financial, retail, and manufacturing	Blockchain, AI, AR, VR, XR, 5G, Edge & Cloud computing, and IoT	N/A
32	Visa Consulting & Analytics	The Metaverse as a Strategic Inflection Point	2022	10	Financial, retail, and music & entertainment	Blockchain, VR, and AR	N/A

Notes: SDGs = Sustainable Development Goal; VR = Virtual reality; AR = Augmented reality; AI = Artificial intelligence; XR = Extended reality; NFTs = Non-fungible tokens; ICT = Information and communication technologies; IT = Information Technology; IoT = Internet of things; MR = Mixed reality; N/A = Not applicable.

operate coherently; it also refers to people communicating to one another in a privacy-secured environment (Ball, 2022).

According to expert reports ($n = 27$), an interoperable network refers to the ability of different systems, simulations, and virtual worlds within the metaverse to communicate and operate cohesively with one another (e.g., report 3). Interoperability is essential in order for the metaverse to function as a unified and seamless environment, and it is necessary for the smooth and continuous integration of different virtual worlds (e.g., Decentraland, The Sandbox, and Roblox) and simulations within the metaverse (e.g., report 6). This attribute aligns with the principles of stakeholder cooperation and continuous creation as it involves voluntary cooperation among different stakeholders in order to ensure the seamless integration of the virtual environment and as it requires the coordination of multiple complex systems to achieve interoperability for new governance setting (e.g., report 12). To achieve interoperability, expert reports claimed that the metaverse relies on standardized protocols and application programming interfaces that facilitate communication between disparate systems (e.g., report 7). This process can be particularly complex, particularly when different settlement blockchain layers are involved (such as Ethereum vs. Solana vs. Polkadot; e.g., report 3), which can accelerate digital transformation (Kaplan & Haenlein, 2019) and distributed control (Harrison et al., 2023). Thus, people who are involved in interoperability focus on their mission of providing benefits not only for themselves but also for others in a continuous process of creating new sources of value to the metaverse via interoperable networks (e.g., report 14).

5.1.3. A persistent synchronous virtual environment

Ball (2022) stated that in the metaverse, users should experience a persistent synchronous virtual environment. A *persistent virtual environment* refers to an environment that continues to exist and develop internally even when no people are interacting with it (Bartle, 2004), whereas a *synchronous virtual environment* allows users from different environments (e.g., psychical and virtual platforms) to coexist at the same time for a real-time rendered experience (Ball, 2022). In this sense, the metaverse serves to massively manifest users' histories by maintaining digital continuity as part of the experiential layer (Ball, 2022).

The analysis of expert reports ($n = 23$) reveals that the persistent synchronous virtual environment facilitates users' cohabitation in the same virtual space, enabling them to witness events like concerts, conferences, meetings, and educational sessions in real-time rendering (e.g., report 12). As such, it involves the coordination of multiple complex

systems in order to provide a seamless and immersive experience for users in the metaverse (e.g., report 9). To maintain its continuity and real-time nature, the persistent synchronous virtual environment requires a highly complex level of technical expertise and infrastructure, including servers, networking equipment, and software tools (e.g., report 1). As such, value can be created, traded, and sustained by requiring naturally/intrinsically complex human beings to contribute to the metaverse with many different values and from many different points of view (e.g., report 30). Further, the persistent synchronous virtual environment also requires a high level of user willingness to accept social responsibility as users who actively participate in the metaverse must be willing to be accountable for the consequences of their actions in order to experience its full potential (e.g., report 13). Thus, this attribute follows the principles of stakeholder complexity and responsibility.

5.1.4. Decentralization

In contrast to a centralized, controlled 3D virtual environment (e.g., the Facebook/Meta world), in most recent studies, researchers have argued that the philosophy of the metaverse has shifted, becoming decentralized in the same way as has been seen in manufacturing (Mourtzis et al., 2022), entertainment (Aytas & Can, 2022), and Web3 applications (Christodoulou et al., 2022). As such, openness, delegation of authority, and the distribution of power are the key features of the metaverse, and it does not belong to a single authority. Ultimately, decentralization may drive a scalable ecosystem and enable business owners or users to have more comprehensive specialized digital assets and voting rights (Goldberg & Schär, 2023) in a distributed virtual environment. An important fact is that, from the governance perspective, it is near to impossible to develop absolute, fully decentralized governance in the metaverse as different virtual environments (e.g., Decentraland vs. The Sandbox) should have their own decentralized autonomous organization. Thus, the governance of the metaverse should be a more polycentric approach per se.

Based on the analysis of expert reports ($n = 23$), decentralization correlates with the metaverse's distributed and open nature, wherein power and control are dispersed across various entities instead of being consolidated under a singular authority (e.g., report 11). This attribute aligns with the principles of stakeholder cooperation and emergent competition as it emphasizes the importance of multi-stakeholder (e.g., users, developers, firms, service providers) cooperatives, including an increasing number of social co-operatives and community co-operatives,

Table 2
A content analysis of blockchain-based metaverse attributes and decentralized sustainable management.

Index	Reporting agency	Blockchain-based metaverse attributes					Decentralized sustainable management					
		A creator economy	An interoperable network	A persistent synchronous virtual environment	Decentralization	A digitalized mindset	Improves the scalability	Fosters coordination & recruitment of highly skilled experts	Enables distributed inclusive finance	Facilitates a new class of asset	The credentials for a sustainable digital identity	Decentralized trust in sustainability efforts
1	World Economic Forum	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Deloitte	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
3	Essence	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
4	Ernst & Young	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	HFS Horizons		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	J.P.Morgan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	McKinsey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Pew Research Center	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	Siemens	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
10	Unicef		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	United Nations Development Programme	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
12	Credit Suisse	✓	✓	✓	✓	✓	✓		✓	✓	✓	
13	Wunderman Thompson	✓	✓	✓	✓	✓			✓	✓	✓	✓
14	Activate Consulting	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
15	Acumen Research and Consulting	✓		✓					✓			
16	Analysis Group	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
17	AYO Innovation Consulting	✓	✓		✓	✓	✓	✓	✓	✓	✓	
18	Deloitte	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19	Deloitte	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20	Deloitte	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
21	Deloitte	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
22	Deloitte	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
23	Deloitte	✓	✓	✓			✓	✓	✓	✓	✓	✓
24	FTI Consulting	✓		✓	✓	✓		✓		✓	✓	
25	IBM Institute for Business Value		✓			✓	✓	✓				✓
26	KPMG		✓			✓		✓	✓			
27	KPMG		✓					✓			✓	
28	KPMG	✓	✓		✓			✓	✓			
29	Meta	✓	✓	✓	✓	✓	✓	✓	✓	✓		
30	Meta		✓	✓	✓	✓	✓	✓	✓	✓		
31	TT Consultants	✓	✓		✓	✓		✓	✓	✓	✓	
32	Visa Consulting & Analytics	✓				✓		✓	✓	✓	✓	
	Counts (%)	26 (81%)	27 (84%)	23 (72%)	23 (72%)	25 (78%)	23 (72%)	24 (75%)	23 (72%)	24 (75%)	22 (69%)	17 (53%)

which directly lead to new forms of emergent property within the metaverse (e.g., report 2). The metaverse’s decentralization is based on the idea that no single entity should have exclusive control over the metaverse and that all stakeholders should have institutional power in its development and governance (e.g., report 5). To achieve decentralization, the metaverse may rely on distributed ledger technologies that enable users to have more specialized digital assets and voting rights (e.g., emergent properties) in a particular distributed virtual environment (e.g., report 1). Decentralization also requires a high level of transparency and accountability in order to ensure that all stakeholders are able to cooperate together and participate in the decision-making process (e.g., report 16).

5.1.5. A digitalized mindset

Tan and Salo (2023) suggested that, in an immersive virtual environment, such as the metaverse, users would form a digitalized mindset and develop a strong congruence between their virtual and physical identity. The reason given is that users and business entities will spend a considerable amount of time in the socially focused, 3D-rendered experience, for instance, during their daily conversations, meetings, product presentations, training, and while in the virtual office (Purdy, 2022). Thus, the virtual experience of the metaverse enhances one’s virtual identity and individual sense of presence (Yoo et al., 2023) with a parallel plane of existence—a second place in which we can live, coexist, and socialize (Ball, 2022).

Findings from expert reports (n = 25) illustrate that user engagement within the metaverse can significantly influence individuals’ sense of self and identity, fostering a digitized mindset. The digitalized mindset requires users to have a strong congruence between their virtual and physical identity, and to be adaptable and flexible in order to navigate and succeed in the metaverse (e.g., report 14). As users spend more time in the metaverse, they may develop a stronger sense of virtual identity and presence and may begin to see the virtual environment as a parallel plane of existence in which they can live, work, and socialize (e.g., report 26). The digitalized mindset is a crucial characteristic of the metaverse since it enables users to deeply engage and immerse themselves in the virtual environment, thereby fostering a sense of community and fostering participation in collaborative virtual projects (e.g., report 18). Thus, users (including firms) who engage with the virtual environment shall be responsible for their daily usage, behaviors, actions, and consequences in the metaverse—this follows the principles of stakeholder engagement and responsibility.

5.2. Decentralized sustainable management within the blockchain-based metaverse

As illustrated in Table 1, a notable proportion, specifically 63% (n = 20), of the selected metaverse expert reports, have highlighted the

relevance of the metaverse in the context of Sustainable Development Goals (SDGs). Further detailed in Table 2, our content analysis revealed six critical components illustrating the relationship between decentralized sustainable management and the metaverse. These include improving scalability (72%), fostering better coordination and recruitment of highly skilled professionals (75%), enabling inclusive distributed finance mechanisms (72%), facilitating the emergence of a new class of assets (75%), fortifying the foundations for credible sustainable digital identities (69%), and nurturing decentralized trust in sustainability initiatives (53%).

Previous studies have found that stakeholder capitalism has significantly resulted in positive shifts in a cooperative organization (Iliopoulos & Valentinov, 2022; Strand & Freeman, 2015), governance (Bebchuk et al., 2023; Hemphill et al., 2021), and sustainable digitalization (Beck & Ferasso, 2023). Based on these three domains, we further classify our findings into three domains in decentralized sustainable management with the metaverse technology (see Fig. 1).

The first domain, a physical–virtual cooperative organization, epitomizes a modern paradigm wherein real-world cooperatives amalgamate with virtual realms within the metaverse. This facilitates enhanced stakeholder collaboration and decision-making processes, fostering real-time sustainable development and innovation across diverse industries (e.g., report 29). This is achieved through amplified scalability and the coordinated involvement of highly skilled experts (e.g., report 25).

The second domain, denoted as polycentric governance in sustainable management, entails a decentralized modus operandi in the metaverse that harmonizes a myriad of stakeholders. This facilitates innovative and ecologically responsible decision-making processes, driven by a distributed inclusive financial mechanism (e.g., report 11) and a new class of digital assets (e.g., report 18). This approach strives to achieve pervasive acceptance and a durable positive impact.

The third domain, designated as sustainable digitalization, signifies the fusion of cutting-edge technology with eco-conscious initiatives within the metaverse. This integration fosters a seamless, transparent, and secure exchange of users’ sustainability data and initiatives across diverse platforms, thereby enhancing the credentials for sustainable digital identities (e.g., report 32) and cultivating decentralized trust in sustainability endeavors (e.g., report 11). Next, we delve deeper into these three crucial domains, elucidating how the attributes of the metaverse contribute to fostering a decentralized approach to sustainable management.

5.2.1. A physical–virtual cooperative organization

The cooperative organization follows the principles of democratic member control, economic member participation, and autonomy and independence (Iliopoulos & Valentinov, 2022). Previous researchers have found that cooperative organizations contribute significantly to the stakeholder perspective by demonstrating the jointness of interests, a

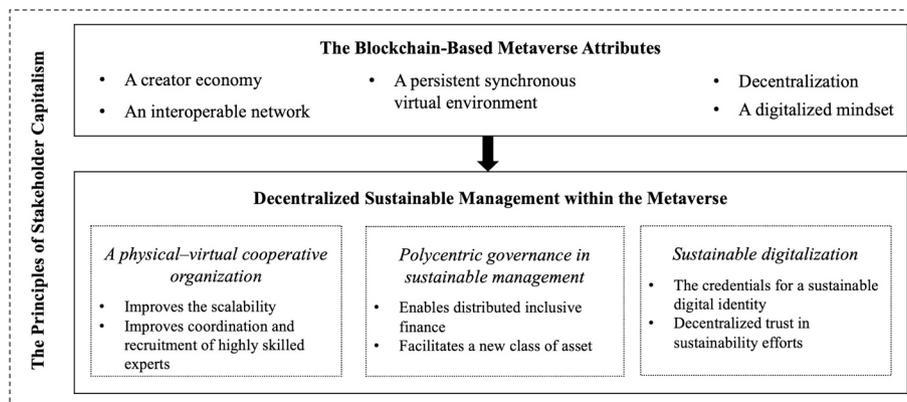


Fig. 1. Decentralized sustainable management within the blockchain-based metaverse.

cooperative strategic posture, and the rejection of a narrowly economic view of a firm—in line with the notion of stakeholder capitalism (Freeman et al., 2007). Importantly, cooperatives hold substantial market shares in the European market share in several industries, which accounted for 83% in the Netherlands' agriculture, 60% in Sweden's forestry, 50% in France's banking, 36% in Finland's retailing, and 21% in Spain's pharmaceuticals and health care (European Parliament, 2019).

Our findings show that the metaverse technology is still a rapidly developing field, and thus, experts anticipate that the evolution of the metaverse serves to revolutionize the stakeholder approach to a business model for cooperatives (e.g., report 25). Due to the attributes of the creator economy and a persistent synchronous virtual environment, the stakeholders of cooperatives (e.g., the consumers, suppliers, retailers, wholesalers, farmers, food companies, scientists, environmentalists, environmental NGOs, and local community associations) can coexist at the same time for a real-time, persistently rendered experience, even if they are from different physical locations and virtual platforms (e.g., report 20). Previous study also found that the type of cooperative structure serves to cultivate and maintain active participation in the digital realm (Porter et al., 2011).

As found in the metaverse expert reports (e.g., reports 6 and 7), experts and suppliers globally could collaborate seamlessly through the metaverse, irrespective of their physical location, contributing their expertise to various projects in real time. Much like the advanced automation technologies utilized in various industries as to incorporate innovative tools and systems, such as AI analytics, machine learning algorithms, and real-time data monitoring, enhancing business operations' scalability and efficiency. Upon the initiation of a project or business venture, the physical manpower needed could be significantly reduced, as many operational controls and strategies can be managed online. This could encompass everything from managing logistics in supply chains to real-time adjustments in manufacturing setups, based on analytics provided from various experts globally.

Furthermore, as claimed by the expert reports (e.g., reports 18 and 23), businesses could create virtual spaces within the metaverse, fostering environments where globally dispersed teams can gather for training sessions, knowledge sharing, brainstorming, and problem-solving, leveraging the collective expertise to drive innovations and best practices across industries. This could also be a platform for showcasing products and services in permanent virtual marketplaces, enhancing customer experiences through immersive tours and interactive information sessions, educating them on the sustainability and benefits of the products or services offered. This not only fosters transparent and real-time access to crucial data and insights but also cultivates a community where each member's roles, contributions, and virtual presence are clearly delineated, fostering a collaborative and productive environment.

Ultimately, the blockchain-based metaverse can serve as a revolutionary platform, synergizing physical and virtual elements, empowering stakeholders across different geographical locales and virtual platforms. Relatively, this finding explains how blockchain serves as an economic driver and provides dynamic capabilities for business development, human capital, and systems infrastructure improvement (Kwok & Treiblmaier, 2023). This fosters real-time innovation and sustainable development, paving the way for a new era of business models characterized by heightened collaboration, transparency, and efficiency.

5.2.2. Polycentric governance in sustainable management

In line with previous study (Goldberg & Schär, 2023), our findings from the expert reports demonstrate that the metaverse governance is a key element to structure a decentralized network. Due to the decentralization attribute of the metaverse, the results show that polycentric governance is essential in the governance setting of using the metaverse in different industries, an approach that is used to balance centralized and fully decentralized (or community-based) governance (Imperial,

1999). Such an explanation is supported a well-constructed sustainable governance that consist of two key factors (Prové et al., 2015): (1) external governance characteristics (i.e., partnerships, legitimation processes, and public policies) and (2) internal governance characteristics (i.e., project objectives, scalability, the time frame, stakeholders, power relations, resources, and an urban agriculture initiative).

Polycentric governance is a form of governance that involves the coordination and cooperation of multiple stakeholders who may have different interests, goals, and perspectives (Gatignon & Capron, 2023), which is in line with the principle of stakeholder cooperation (Freeman et al., 2007). This approach seeks to balance the interests and perspectives of stakeholders in decision-making processes, rather than relying on a single decision maker or group of decision makers (Ostrom, 2010), which allows stakeholders to have the autonomy to act on their behalf and account for others through processes of cooperation, competition, conflict, and conflict resolution (Carlisle & Gruby, 2019); this subsequently enables stakeholders to innovate and gain emergent properties (e.g., a new class of digital assets).

A significant advantage of polycentric governance is the inclusion of a wide variety of stakeholders, as indicated in the metaverse expert reports. This encompasses retailers, consumers, government agencies, producers, industry specialists, scientists, environmental non-governmental organizations, and local community associations, fostering a richer, multifaceted dialogue and collaborative decision-making (Nagendra & Ostrom, 2012). In this regard, it allows for a range of stakeholders to be involved in the decision-making processes related to sustainability issues and, subsequently, leads to more comprehensive and nuanced approaches to problem-solving, as well as generating solutions that are widely accepted and have long-term viability (Patala et al., 2022). Drawing on this feature, the polycentric governance systems of the metaverse may serve to overcome the issue of the huge set-up costs by exchanging investors with a new class of asset, as explained in the next paragraph.

Previous research has demonstrated that blockchain-enabled supply chain finance solutions can significantly reduce various types of agricultural transaction costs, including those associated with information search, negotiation, contracting, and accessing finance (Bhatia, Chaudhuri, Kayikci, & Treiblmaier, 2023). Building upon this foundation, our findings illuminate how entrepreneurs and business entities can leverage metaverse-distributed inclusive finance to secure the necessary capital for adopting climate-sensitive practices (e.g., report 6). The growth of decentralized finance (commonly known as DeFi) and cryptocurrencies, along with a desire for transparent carbon offsets, has created an opportunity to use these liquidity pools of *carbon credit* to transfer financial risks away from actors in the metaverse network who are implementing eco-friendly techniques (e.g., report 8). A *carbon credit* is a permit that allows a business entity to emit a certain amount of greenhouse gasses, a credit that can be bought and sold to incentivize the reduction of emissions and investment in clean energy (Caney & Hepburn, 2011). Due to the persistent synchronous virtual environment and digitalized mindset of the metaverse, which enable transparency and an audit trail, users and business entities may hold a greater level of accountability and responsibility for their behavior and actions in the metaverse (see Tan & Salo, 2023).

It is crucial to note that an effective polycentric governance system, as highlighted in the expert reports, should encompass the participation of at least one established carbon market stakeholder within the metaverse. This could include entities like the European Union Emission Trading System, the Chicago Climate Exchange, or the Regional Greenhouse Gas Initiative, thereby integrating seasoned perspectives and resources in the efforts towards sustainable management in the blockchain-based metaverse.

5.2.3. Sustainable digitalization

As indicated in the expert reports, in the existing Web2 online infrastructure, users are required to establish numerous online

identities, with each distinct online platform maintaining its individual database management system. This means that users cannot share or transfer their historical records and profiles from one platform (e.g., Facebook or a renewable-energy subscription company) to other platforms (e.g., LinkedIn and Instagram); users have to rebuild their profiles and activities (e.g., sustainable consumption) on every different social and e-commerce platform.

However, our findings from the expert reports present that due to the interoperable network of the metaverse, users can log in to different virtual platforms via a single Web3 login credential MetaMask (e.g., report 24). Thus, users could use a particular unique wallet address to position their digital identities and access decentralized storage (e.g., Filecoin and The InterPlanetary File System; [Schmeiss et al., 2019](#)) in order to store assets used across virtual platforms in the metaverse. As such, users and business entities can benefit from a sense of presence and a digitalized mindset as the decentralized identity and storage can be cryptographically shared with different virtual environments once they grant permission for it to be shared ([Tan & Salo, 2023](#)). Intrinsically, both users and business entities can embrace a sustainable consumption and production identity through the utilization of non-transferable NFTs within the blockchain-based metaverse (e.g., report 1). In this context, innovative business models centered around tokenization can emerge, founded on principles of decentralization, and such models enable consumers to gain deeper insights into a brand's commitment to sustainable consumption and production practices ([Treiblmaier, 2023](#)).

6. Conclusion

6.1. Theoretical implication

In response to recent opinion papers that accentuate the importance of the metaverse research ([Barrera & Shah, 2023](#); [Dwivedi et al., 2022, 2023](#); [Koochang et al., 2023](#); [Tan et al., 2023](#); [Weking et al., 2023](#); [Yoo et al., 2023](#)), our study set out to provide a list of theoretically driven attributes that describes how the blockchain-based metaverse is conceptualized differently to a 3D virtual environment ([Tan et al., 2023](#)), as well as to establish the connection between the metaverse and sustainability-related literature with a concrete implication ([Allam et al., 2022](#)). In this regard, this research has a three-fold contribution.

First, our study significantly enriches the literature concerning business model and the ethical ramifications of technology ([Martin et al., 2019](#)). Precisely, the present research furnishes a theoretical compass that informs the roles firms and managers undertake in the conceptualization, production, and dissemination of emerging technologies such as the metaverse and blockchain within their organizations and broader communities. In this context, we invoke the principles of stakeholder capitalism ([Freeman et al., 2007](#)) to inform dialogue about ethical considerations within firms that spearhead technological innovation. Our research underscores the necessity for attentiveness to the societal facets of technology—namely decentralized trust—while being cognizant of the unique nature and merits of businesses. Businesses function as pivotal social engines that propel large-scale innovation and economic advancement, often facilitating inclusive and distributed finance as demonstrated in our research. We cast light on the potential for autonomous entities—exemplified by autonomous organizations—to deliver ostensible benefits to all stakeholders within a hybrid physical-digital cooperative business model.

Therefore, businesses play a pivotal role in shaping the discourse on technology ethics. This influence, when exercised responsibly and ethically, could steer us towards a more sustainable path of digitalization. Our research serves as a reminder of this potential and a call to action for businesses to uphold their ethical responsibilities in this era of rapid technological advancement.

Second, we contribute to the literature of the metaverse ([Aytas & Can, 2022](#); [Ball, 2022](#); [Belk et al., 2022](#); [Bojic, 2022](#); [Christodoulou et al., 2022](#); [Dwivedi et al., 2022](#); [Ersoy & Gürfidan, 2022](#); [Goldberg &](#)

[Schär, 2023](#); [Kim, 2021](#); [Mourtzis et al., 2022](#); [Tan & Salo, 2023](#); [Yoo et al., 2023](#)) by identifying five attributes of the blockchain-based metaverse (i.e., a creator economy, a persistent synchronous virtual environment, decentralization, an interoperable network, and a digitalized mindset) that underlie the theory of stakeholder capitalism ([Freeman et al., 2007](#)). Remarkably, the creator economy is related to the principles of emergent competition and continuous creation. The persistent synchronous virtual environment is associated with the principles of stakeholder complexity and responsibility. The decentralization is linked to the principles of stakeholder cooperation and emergent competition. The interoperable network is relevant to the principles of stakeholder cooperation and continuous creation, whereas the digitalized mindset is connected to the principles of stakeholder engagement and responsibility. Thus, our research rationalizes how firms should have a responsibility to balance the interests of all stakeholders in the metaverse in order to create long-term value and success for the business, which has moved beyond the focus on customer, retailer, and brand perspectives ([Yoo et al., 2023](#)). In this regard, together with the identified four dimensions of the metaverse (i.e., online collaboration, high consumer immersion, unique digital assets, and digital personas; [Yoo et al., 2023](#)), business scholars could have a better understanding of the operational definition of the blockchain-based metaverse (as opposed to a virtual reality focused metaverse) and construct a better research design for their studies. Essentially, scholars should avoid overlapping the concept of the metaverse with a technological-driven explanation, such as would result from solely focusing on a 3D VR environment (e.g., [Hennig-Thurau et al., 2023](#); [Yoo et al., 2023](#)).

Third, we contribute to the literature on sustainable management within the blockchain-based metaverse (e.g., [Go & Kang, 2023](#); [Koochang et al., 2023](#); [Ooi et al., 2023](#)), which serves to provide new scholarly thought on decentralized sustainable management that combines a physical–virtual cooperative, polycentric governance, and sustainable digitalization. Our research delineates a decentralized approach to achieving transparent and immediate governance, aimed at engaging a diverse group of stakeholders—retailers, producers, government bodies, experts, scientists, environmental NGOs, and local community organizations. This approach incentivizes their commitment through benefits such as carbon credits and sustainable digital identities. It emphasizes enhancing sector scalability, recruiting top-tier talent, promoting distributed inclusive finance, and introducing a novel class of assets within decentralized networks. Consequently, our study contributes to the discourse on how blockchain decentralization catalyzes the emergence of innovative business models (refer to [Bhatia et al., 2023](#); [Kwok & Treiblmaier, 2023](#); [Treiblmaier, 2023](#)).

6.2. Managerial implication

In terms of managerial implication, this research highlights the metaverse as a revolutionary approach for developing new business models, addressing existing challenges in the business environment through the coordination of stakeholder responsibilities and accountability. This coordination encourages collaboration and leads to the achievement of decentralized sustainable management. By leveraging the metaverse, organizations can foster a more cooperative and accountable ecosystem, facilitating the transition towards decentralized governance and enhancing sustainable business practices. Such efforts include the active involvement in the metaverse of public actors in government, retailers, firms, experts, producers, scientists, environmental NGOs, and local community associations. For instance, a *consortium mode* governance approach could be implemented in which multiple organizations collaborate to jointly coordinate and exercise distributed control ([Harrison et al., 2023](#)) over activities within a decentralized network ([Goldsby & Hanisch, 2022](#)). Critically, new classes of digital assets could be formed in the blockchain-based metaverse—such as carbon credits, persistent sustainability credentials, or a

persistent sustainability reputation—that would allow cooperative members to be incentivized by engaging in the decentralized ecosystem.

Remarkably, this research underscores the potential for decentralized business models to redefine traditional management structures and operational strategies. By adopting the blockchain-based metaverse, managers can create transparent, immutable records of transactions and interactions, thereby enhancing credential and accountability among stakeholders. This shift towards decentralized governance allows for a more resilient and adaptable business environment, where decision-making is distributed, reducing the risks associated with centralized control. Managers can harness the power of decentralized autonomous organizations (commonly known as DAO) to enable democratic participation in corporate governance, ensuring that diverse stakeholder voices are heard and valued. Additionally, leveraging smart contracts can automate compliance and streamline operational processes, leading to increased efficiency and reduced costs. Ultimately, these innovations foster a culture of shared responsibility and collaborative problem-solving, driving sustainable growth and long-term value creation in a decentralized economy.

6.3. Limitations and future research

Future research endeavors ought to concentrate on examining the correlation between the five attributes identified (Hennig-Thurau et al., 2023) and social interaction, as well as psychological well-being (Sun et al., 2020) within the context of blockchain-based metaverse. Furthermore, there is a pressing need to conduct more empirical research with the objective of validating the framework established in this present study. Moving forward, utilizing longitudinal empirical research that encompasses multi-method approaches and data triangulation could provide significant insight into the intricate relationships between each attribute of the blockchain-based metaverse and decentralized sustainable management practices within specific industries.

Moreover, while this study provides foundational insights into the potential of decentralized business models within the blockchain-based metaverse, future research should delve deeper into the practical implementation and scalability of these models across various sectors. There is a need to investigate the operational challenges and strategic advantages that decentralized autonomous organizations present, including governance, legal implications, and stakeholder engagement dynamics, and the risk of centralization (Fracassi et al., 2024). Research should also explore how decentralized business models can be tailored to different industry contexts to maximize their benefits and mitigate potential risks (Chen & Bellavitis, 2020). Additionally, examining the impact of these models on traditional business structures and their capacity to drive sustainable innovation and inclusivity will be crucial. Understanding these dimensions can help refine theoretical frameworks and offer practical guidelines for businesses looking to transition towards decentralized governance and operational strategies.

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This article does not contain any studies with human participants or animals performed by any of the authors.

CRedit authorship contribution statement

Le Bei Sze: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation,

Conceptualization. **Jari Salo:** Writing – review & editing, Validation, Supervision, Conceptualization. **Teck Ming Tan:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

Declaration of competing interest

All authors declare that they have no conflict of interest.

Data availability

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