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RESEARCH ARTICLE

Models for Positioning Public Spaces in the Metaverse

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ABSTRACT
The Metaverse plane constitutes an ever-evolving virtual universe that encompasses various digital platforms. These platforms allow users to engage in diverse experiences and create virtual environments using technologies such as virtual reality, augmented reality, and artificial intelligence. Within the Metaverse, public spaces serve as virtual arenas where users gather, share ideas, collaborate, and enjoy themselves. These spaces include environments where political, cultural, and social matters are discussed, catering to users with diverse characteristics. The objective of this study is to examine the significance of public spaces within the Metaverse and explore user experiences. To this end, the study compares public spaces in virtual reality platforms such as Decentraland and Sandbox, analysing different features, preferences, and experiences. The study uses literature review and quantitative data collection methods. Statistical data related to public spaces in the Decentraland and Sandbox platforms were gathered and assessed based on various criteria. These analyses highlight similarities and differences between public spaces on both platforms. This study aims to understand the diversity, functions, and user experiences within public spaces in the Metaverse. By emphasising the distinct features and user preferences offered by platforms like Decentraland and Sandbox, the research aims to contribute to the evaluation of public spaces within the Metaverse. It has been determined that Decentraland stands out with its DAO and contributions to public welfare, while Sandbox contributes to technology and innovation by supporting developers. It is concluded that both platforms can expand their user base and increase engagement.

Keywords: Metaverse, Public Spaces, Decentraland, Sandbox, Metaverse and Public Spaces

Introduction

The Metaverse is a constantly evolving and changing digital universe that encompasses many diverse Metaverse platforms. These platforms enable users to participate in various activities and subjects through technologies such as virtual reality, augmented reality, and artificial intelligence. Users can interact with others, create their own virtual environments, or enter existing ones. Metaverse platforms offer experiences in virtual art, culture, entertainment, education, business, sports, and gaming. They empower users to establish their own virtual communities or join existing ones (Şenkardeş, 2023).

Public spaces in the Metaverse are virtual environments where users gather to meet, chat, share ideas, debate, collaborate, compete, have fun, or learn (Şenkardeş, 2023). Public spaces are defined as areas that enable citizens to come together and discuss political, economic, and social issues. The opportunity for interaction provided by a public space, allowing for the exchange of ideas and information, enables individuals to evolve from passive listeners to potential participants (Şenkardeş, 2023). Public spaces in the Metaverse, in line with this definition, provide an environment for users to discuss political and cultural topics (Şenkardeş, 2021).

The characteristics, functions, benefits, and activities of public spaces in the Metaverse vary depending on the specific features, rules, objectives, and users of each Metaverse platform. Therefore, to compare public spaces within the Metaverse, it is necessary to identify and evaluate criteria such as the qualities, functionalities, access conditions, levels of participation, degrees of freedom, security and privacy policies, censorship and moderation practises, social and cultural interactions, and economic and educational benefits provided by these platforms.

The aim of this study was to investigate public space selection models in the Metaverse. This study examines the characteristics, functions, benefits, and activities of different public spaces across Metaverse platforms, exploring why users choose these spaces, how they experience them, and their assessments.

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The scope of this study includes conducting a literature review on the Metaverse and public spaces, examining their development processes and applications, and comparatively analysing public spaces in platforms like Decentraland and Sandbox. While both platforms are compatible with VR headsets, their public space selection models differ based on their unique features, rules, objectives, and user bases. By comparing these two platforms, this study aims to understand public space selection models in the Metaverse.

The methodology involves a literature review, quantitative data collection, and analysis. As part of the quantitative data collection, statistical data related to public spaces in Decentraland and Sandbox will be gathered. This data includes visitor numbers, durations, levels of participation, economic values, social interactions, and other metrics to illustrate the functions, benefits, and activities of these spaces. The collected data will be evaluated and compared using appropriate analytical methods to highlight the differences and similarities in public spaces across Decentraland and Sandbox platforms.

1. The Metaverse and the Public

The term "Metaverse" is a compound word derived from two components: "Meta" (a prefix in Greek meaning 'after', 'beyond', or 'transcending') and "universe". In other words, the Metaverse can be described as universes that transcend reality, representing a continuous and permanent multi-user environment that merges physical reality with digital virtuality (Mystakidis, 2021).

Public spaces refer to urban areas that are open to everyone. This concept is organised around the idea of being "open to the public" or "accessible to all." Public spaces are a crucial part of urban areas because of their role in supporting urban activities. Public areas such as urban squares, streets, and parks are among the most frequently used spaces in cities because they facilitate interactions among city residents. Well-designed and clearly defined public spaces can enhance the image of a city and support the creation of more harmonious spaces. Consequently, the way people perceive and define a city varies according to the characteristics and environmental quality of its public spaces (Özkoç, 2020). Public spaces in the Metaverse platform are environments where users gather in a virtual space to discuss political, economic, entertainment, and social topics. These spaces are part of a decentralised and participatory virtual universe, where various digital environments coexist and transitions between reality and virtuality are possible. These platforms are typically blockchain-based and open-source. In the Metaverse, public spaces recreate spatiality in a virtual form, enabling individuals to move beyond the constraints they face in physical environments and to take advantage of new communication opportunities.

Public space ownership in the metaverse is a complex and multifaceted issue that encompasses various forms of ownership such as private, collective, and shared ownership. Research highlights the challenges in managing the ownership of virtual objects and metaverse assets, particularly in the context of distributed systems with complex ownership forms (Wang et al., 2023).

Moreover, the metaverse's decentralised nature and the existence of various ownership forms raise important considerations for intellectual property rights, content licencing, and ownership within the metaverse (Mitrushchenkova, 2023). This underscores the need to address issues related to ownership, creation, and use of intellectual property rights in metaverse space (Kim, 2022).

In conclusion, the metaverse presents a paradigm shift in public space ownership, offering new opportunities for democratisation, recognition of digital works, and reimagining the concept of public spaces. However, it also brings forth challenges related to intellectual property, regulatory concerns, and data hegemony that need to be addressed to ensure responsible and equitable public space ownership within the metaverse.

1.1. Metaverse and the Development Process

The Metaverse is defined as a digital universe created through the combination of virtual reality, augmented reality, and other technologies, where users can experience, participate, and socialise from a first-person perspective. The concept of this new reality was first exemplified in William Gibson's 1984 science fiction novel "Neuromancer". The book can be described as an early and influential representation of modern cyberculture and cyberspace concepts. In the novel, a virtual reality space called the "Matrix" is introduced. This matrix, which later became a frequently encountered theme in popular culture, is a network-connected virtual reality world. "Neuromancer" stands as one of the first and most influential representations of cyberspace and virtual reality in literature, leaving a profound impact on technology and culture. It is particularly significant for exploring visions of how people could interact in digital environments and examining the potential impacts of such technologies on society. Subsequently, the term "metaverse" was first coined in Neal Stephenson's 1992 science fiction novel "Snow Crash" (Stephenson, 2003).

The process began with the use of puzzle theory and artificial intelligence, with the first examples appearing in gaming platforms. One of the earliest applications of artificial intelligence in the gaming world is "Spacewar!", developed in 1962 by Steve Russell and others (Bellis, 2019).

In "Spacewar!", players control spacecraft, and computers also control the ships. These computer-controlled ships display simple movement and combat strategies, representing an early example of artificial intelligence in gaming. Moving forward to 1993, "Doom" is acknowledged as one of the first popular online and multiplayer games (The Ultimate DOOM, 2021). Indeed, "Doom" served as a milestone by enabling players to interact within the same in-game world. This innovation paved the way for Massively Multiplayer Online Role-Playing Games (MMORPGs) like "EverQuest" and "Ultima Online." These MMORPGs offer gaming experiences that combine virtual worlds with social interaction, significantly enhancing the depth and engagement of online gaming (EVERQUEST, 2023). In 2003, "Second Life" emerged as a platform that stood out for offering social interaction, economic aspects, and freedom of personal expression in virtual worlds, attracting a broad user base (Galov, 2023). In the mid to the late 2000s, MMORPGs like "World of Warcraft" significantly increased the popularity of social interaction and community-building in virtual worlds. "World of Warcraft" especially became a cultural phenomenon, drawing millions of players into its expansive fantasy universe (Jones, 2021). In 2016, "Pokémon Go" became the first major mobile game to use augmented reality technology and became a global phenomenon. During the 2010s, the launch of VR headsets like the Oculus Rift and HTC Vive, brought virtual reality experiences into the mainstream.

Throughout the process, there have been several other key milestones. Pong, in 1972, symbolised the start of the video game industry. As one of the first popular arcade games, it introduced video games to a broad audience (Pong Game, 2023). Space Invaders, in 1978, solidified the place of video games in popular culture and introduced the first high score table, thus encouraging competition among players. Pac-Man, in 1980, became one of the first major arcade games to appeal to a wide audience, showing that video games were not just for children and teenagers (Namco, 2023). In 1985, Super Mario Bros significantly influenced the development of platform games and increased the popularity of games featuring complex worlds, characters, and storeys. The Legend of Zelda, released in 1986, was known for its open-world design and complex puzzles, influencing the evolution of adventure games. Pokémon, released in 1996, became a global phenomenon with its cross-platform experience and trading mechanics, emphasising the importance of player communities and interaction. In 2000, the Sims, as the first major game to simulate daily life, targeted a different type of player, expanding the boundaries of video games. In 2011, Minecraft, as an open-world survival game offering unlimited creativity, set new standards in game design and player interaction. Fortnite, in 2017, popularised the Battle Royale genre and introduced a new approach to the industry with in-game events, cross-platform play, and continuously updated content.

When examining the development of the Metaverse concept and realm, the earliest examples of virtual worlds in the 1980s and 1990s, like "Second Life" and "World of Warcraft," laid the initial foundations for the Metaverse concept. These games highlight the importance of social interaction and digital identities. The widespread use of the internet in the 1990s opened up possibilities for interaction and community building in digital worlds. In the 2000s and 2010s, the development of augmented and virtual reality technologies and the release of devices such as Oculus Rift, HTC Vive, and PlayStation VR provided users with more immersive and realistic virtual experiences, bringing the concept of the Metaverse closer to being a part of the near future. From 2010 onwards, the proliferation of smartphones and the rise of mobile technology have made virtual and AR experiences accessible to a broader audience. Games like "Pokémon Go" popularised augmented reality experiences through mobile devices. In 2010, Blockchain technology and cryptocurrencies began providing the necessary infrastructure for the Metaverse with innovations in digital asset ownership, security, and identity verification. In 2020, the COVID-19 pandemic increased the necessity for socialising and working in digital environments, further highlighting the importance and potential of the Metaverse. In 2021, Facebook's branding as a Metaverse-focussed company, adopting the name Meta, marked the recognition of the Metaverse concept as a serious investment area in mainstream media and the technology sector. Investments and project developments by major technology companies like Microsoft, Google, and Apple in the Metaverse have increased interest in this field and its potential future.

Today, with the use of augmented reality (AR) technology, the Metaverse can integrate virtual and physical worlds. This immersive environment is designed to offer users an interaction and experience that is reminiscent of the real world. The continuous and interoperable nature of Metaverses enables user avatars to transition seamlessly between different virtual worlds. These transitions imply that avatars should retain their value, even as they move between worlds created by different entities (Xu et al., 2022).

The main goal now is to be a part of these experiences rather than just looking at a screen. It can be assumed that everything done online, from socialising to entertainment, gaming, and work, will be more natural and vivid. Screens, which are unable to fully transmit human emotions and interactions, lack that profound sense of presence. While avatars are used to represent people in the Metaverse, it can be thought that their use will become as common as today's WhatsApp profile pictures, but they will be accompanied by live 3D representations instead of static images. These avatars could mimic human postures and gestures, possibly enabling richer interactions than those currently available online (Abbate et al., 2022).

This indicates that the Metaverse is too vast and inclusive to be owned by a single company or entity. The shared structure of the Metaverse allows thousands of users to be simultaneously present in a single server session. Users can access this environment anytime, anywhere, and their interactions are globally shared, connecting to the same environment with an equitable approach,

regardless of borders or barriers. This means that an action by one user can affect not only users on a specific server but also all other users (Xu et al., 2022).

1.2. Public in the Metaverse: Decentralised Autonomous Organisations (DAO)

In the Metaverse, the spaces and platforms provided are important as they enable users to communicate with each other, collaborate, share, and come together for a common purpose. These areas and platforms bring together people from different cultures, ages, abilities, and perspectives, forming communities that, in the context of the Metaverse, are considered equivalent to the public. Location choices within the Metaverse are made according to user preferences. Users can explore, compare, try, and select the areas and platforms that suit them in the Metaverse, but they also have the freedom to convert their own lands into public spaces. This is exemplified by social responsibility activities, particularly in the Ed-Tech sector, on the Metaverse, like those undertaken by Open-Campus, which focuses on educational technologies and universal education rights.

Regarding the Metaverse and society, or the public, the recent interest in Metaverses based on blockchain technology has increased, leading to a rapid growth in user numbers. This growing community can be considered public. This increase necessitates a governance structure. In this context, DAOs (Decentralised Autonomous Organisations) are ideal candidates for democratic decision-making and collective resource management. DAOs taking on this role ensure that the Metaverse is managed more democratically and effectively. They adopt a community-centred approach, promoting community participation and empowerment. Within the Metaverse, DAOs virtually represent the interests of users and stakeholders, guiding the development and evolution of digital spaces. This approach makes the Metaverse a more participatory and user-focussed environment. Furthermore, smart contracts used in DAOs automate the governance processes of the Metaverse. This makes processes like digital asset management, access rights, and conflict resolution more efficient and transparent. Smart contracts facilitate transactions within the Metaverse, making it a more orderly and manageable digital world. Lastly, DAOs use tokens to encourage participation and governance. In the Metaverse, these tokens are used to reward contributions, manage digital property rights, and facilitate transactions. This enriches the economic dynamics of the Metaverse, encouraging users to play a more active and effective role in the virtual world. In summary, DAOs play a significant role in the democratic governance, community participation, automation processes, and economic interactions of the Metaverse. These features ensure that the Metaverse is a more participatory, efficient, and dynamic digital environment (Wang et al., 2022).

1.3. Metaverse Usage Areas and Preference Criteria

In 2021, Facebook reinforced its commitment to developing the Metaverse by transforming itself from a "social media company" into a "Metaverse company," branding as "Meta" (Xu et al., 2022). This branding increased attention to this area, particularly affecting its recognition. According to Zuckerberg, Meta's focus is to give people, wherever they are, the ability to feel like they are with another person. Additionally, in the long term, enabling people to interact not only with other humans but also with artificial intelligence, businesses, or places is a secondary point emphasised by Zuckerberg as part of the future of making the world more connected. The mentioned interaction can be parallel to reality through virtual twins (Krietzberg, 2023). Meta, one of the first modern steps towards the Metaverse, was described by Zuckerberg in his 2022 presentation as a network of 3D virtual worlds focussed on social connexion. This definition implies that in addition to the existence of a virtual environment, the component of social interaction is also essential. Moreover, the Metaverse will be more than just a virtual environment for entertainment; it will also be a virtual twin of the real world where individuals can work, learn, and trade. The Metaverse can transport people to distant locations through holograms or virtual rooms. Whether working or learning, virtual models can help delve deeper into a subject and better understand it (Abbate et al., 2022).

Virtual twins and new ecosystems promise a future where users can access 3D virtual or augmented reality environments using devices like virtual reality headsets, digital glasses, and smartphones. In these environments, users can work, communicate with friends, engage in commercial activities, travel to distant places, and benefit from educational opportunities (Abu-Salih, 2022). The virtual nature of this interaction will create an infrastructure for seamless interaction without borders or barriers.

The Metaverse contains various areas and platforms, each with different themes, functions, features, and communities. People can choose areas and platforms in the Metaverse based on their interests, needs, budgets, expectations, and values. Users may consider certain criteria when choosing a platform. Content quality and diversity are crucial; the content offered in the Metaverse should attract, inform, entertain, and satisfy users. Various contents in different categories, formats, languages, and qualities makes it easier for users to choose. User experience and accessibility are important; areas and platforms in the Metaverse should be easily accessible, navigable, interactive, and function smoothly. Compatibility with different devices, connexions, and conditions enhances the user experience. Security and privacy are key; areas and platforms in the Metaverse should protect users' personal

data, private information, financial transactions, and digital assets. A secure infrastructure, transparent policy, ethical behaviour, and legal compliance gain users' trust.

In this context, metaverses can revolutionize service delivery ecosystems in every aspect of life, such as health, education, entertainment, e-commerce, and smart industries. In recent years, more proof-of-concept work has been developed on the metaverse. These prototypes rely on blockchain technology, which allows the archiving, mapping, sharing, and reuse of virtual spaces across different applications (Abbate et al., 2022).

Finally, Metaverses offer end-to-end services such as content creation, social entertainment, and in-world value transfer by providing users with digital identities (DIDs). These services, which transcend the boundaries between physical and virtual worlds, are offered regardless of users' nationalities or countries. Supported by the decentralised structure of blockchain technology, the Metaverse ecosystem continues its path as an independent economic system with transparent operating rules, ensuring sustainability.

1.4. Metaverse Platforms and Purposes of Use

Metaverse gaming platforms have emerged from the desire of users to experience different places and universes, successfully increasing interest and bringing various investment and venture opportunities. In particular, the visual and qualitative superiority of the virtual world over real life makes the metaverse a competing centre of interest and investment with the real world. Following the rapid development of the gaming industry after the 2000s, it reached a size of 252.52 billion dollars in 2018, increased to 406 billion dollars in 2023, and is expected to reach 626 billion dollars by 2028 (Clement, 2023). Especially with these increasing investments, the emergence of popular metaverse universes is expected.

Examples of popular metaverse gaming platforms include World of Warcraft, Pokemon Go, Minecraft, and DragonSB. World of Warcraft offers a sandbox-style experience across different universes, while Pokemon Go presents a unique metaverse adaptation that integrates the game with real-world maps. These games show that there are multiple ways for decentralised metaverses that exist. The aim of these platforms is not just to play a specific game but to offer more liberating experiences. However, the limitation of users with little content in these semi-metaverses drives the search for more free universes and spaces, and metaverse platforms begin to develop and diversify with the motto of decentralisation. For instance, the fact that virtual gold in "World of Warcraft" became seven times more valuable than real money in economically troubled Venezuela shows the power of game mechanics and a loyal community. This led to the emergence of games like New World, developed by Amazon, and Destiny, developed by Bungie. In World of Warcraft, there are public spaces designed for players to have fun, fight, trade, or engage in other activities, which enhance the social, economic, aesthetic, and financial aspects of the game and encourage player interaction.

Each metaverse platform offers unique experiences to its users. For example, while Upload offers virtual property trading based on blockchain, Roblox allows users to create their own games. Sandbox enables users to interact as avatars, and Decentraland allows users to buy and develop virtual lands (Garrett, 2023).

Upland is a blockchain-powered virtual world in which users can trade and interact with virtual properties based on real-world locations. In this digital environment, users can explore and acquire "lands" in various cities, blending the real and virtual realms. The Upland platform, available through iOS and Android apps as well as a web version, enables users to participate in virtual property dealings from any device with internet access. It operates as a simulated real estate marketplace. In Upland, properties are symbolised as non-fungible tokens (NFTs), offering users a chance to invest in and possess digital land. Participants can purchase, sell, and exchange digital assets like virtual properties. They can also earn UPX, the platform's native cryptocurrency by finding new properties, completing tasks, or joining events. This engaging model motivates users to actively contribute to the platform's expansion. Upland supports user-generated content, allowing players to create and customise their own properties, businesses, and artworks. This approach builds a dynamic and diverse community in which users can showcase their creativity and build their virtual identities. Since Upland is created with references to the real world, even though existing public spaces are represented in the virtual world, they are not fully functional as public spaces due to their nature of being subject to purchase and sale.

Roblox Metaverse: Founded in 2004 by David Baszucki and Erik Cassel and launched in 2006, Roblox has established itself as a large-scale game development and online gaming platform. By allowing users to both create and play games produced by other players, Roblox has become one of the largest Metaverse platforms, boasting over 56 million daily active users. The lockdowns during the COVID-19 pandemic significantly boosted the company's growth in game-based content creation and active user base. Roblox offers various products, including the creation and sale of virtual clothing, accessories, and avatar animations. Its virtual currency, Robux, is used for purchasing virtual items, accessing premium features, and game passes. Roblox provides a powerful and intuitive development environment that enables content creators to design, build, and script their 3D games or experiences. Roblox, which is compatible with multiple platforms including PC, Mac, iOS, Android, and Xbox One, enables users to engage with friends across these devices in shared gamelan experiences. Its virtual economy is centred around Robux, which is used to buy in-game items, avatar customisations, and support game developers through a profit-sharing model. The platform

encourages player interaction with features like in-game chat, private messaging, and friend lists, thus nurturing a community-centric environment. Users have the freedom to customise their avatars with various clothing, accessories, and animations, allowing for unique self-expression within the digital world. Additionally, Roblox provides educational content such as coding courses, tutorials, and interactive projects, aiming to enhance learning and creative skills among its users. Currently, Roblox's database contains over 40 million games, each offering unique experiences. Roblox's Robux pricing is as follows: 450 Robux for $4.99 per month, 1,000 Robux for $9.99 per month, and 2,200 Robux for $19.99 per month, offering users various options to purchase Robux for acquiring virtual items and other premium features. The market data for Roblox are as follows: 24-Hour Trading Volume USD $97,533,902 and Market Cap USD $830,434,410. These figures clearly demonstrate Roblox's overall economic size and the intensity of financial activities on the platform. Regarding system size: Roblox maintains its presence with more than 18,000 servers (cloud systems hosting the universes) and over 170,000 devices (G2A, 2023).

The Sandbox Metaverse: Sandbox stands out as a community-focussed and decentralised gaming platform and virtual environment. Utilising blockchain technology, this metaverse platform offers players the opportunity to create, share, and monetise game experiences. Although Sandbox does not offer VR support, the potential look of VR is hinted at through Snoop Dogg's music video "House I Build." Sandbox Metaverse includes the Sandbox Game, where players explore, develop, and play games; the Sandbox Builder, enabling the creation of their own games and experiences; and the Sandbox Marketplace, where content creators can buy and sell virtual assets using the site's native cryptocurrency, SAND. The Sandbox platform is currently engaged in various projects, including a partnership with AXA Hong Kong in Mega City 2, where they aim to create a distinctive interactive space. AXA Hong Kong's acquisition of a 3x3 LAND parcel in The Sandbox is part of their strategy to offer innovative digital experiences to their customers. Within The Sandbox, users and developers can find several games and experiences, from simple puzzles to elaborate multiplayer adventures. For instance, The Sandbox Evolution, a notable platform game, allows players to craft their own pixel art worlds. The Sandbox harnesses blockchain technology for the management and exchange of virtual assets, where users can trade these assets using the SAND currency. It features unique virtual assets, such as virtual lands and in-game items, represented as non-fungible tokens (NFTs). The Sandbox Metaverse includes LAND ownership, a blockchain-driven economy, VoxEdit, and Game Maker, which enable users to build their own virtual environments and monetise their creations. Additionally, The Sandbox offers a secure Marketplace for the exchange of distinct digital assets like NFTs. The $SAND Token Economy is as follows: Market Cap $928,808,327, 24-Hour Trading Volume $184,715,000, Total Supply 3,000,000,000 SAND, and Circulating Supply 2,101,731,926 SAND. These figures indicate the current state of the Sandbox in the crypto market and the general economic size of the SAND token. The market cap and trading volume reflect the platform's financial stability and popularity among users, while the total and circulating supply indicate the token's ($SAND) market presence and accessibility (EOS, 2023).

Decentraland Metaverse: Decentraland is a blockchain-based virtual reality platform that allows users to produce content and applications, use them, and earn money from the process. This innovative platform offers LANDs, virtual land parcels that users can buy and develop. In Decentraland, each LAND parcel serves as a foundation for creating distinctive scenes, games, and apps, supported by the platform's provision of Software Development Kits (SDKs) for developers to craft their own content and applications. Players are also empowered to design their own NFTs for sale in the Decentraland marketplace. The platform hosts various projects, such as virtual casinos, art galleries, and gaming experiences. Noteworthy among these are the Decentraland Art Museum, which displays digital art in a virtual setting, and the Decentraland Conference Centre, a venue for virtual events and conferences. The platform features a diverse range of games, including RPGs, racing games, and first-person shooters. A popular game, Battle Racers, invites players to customise and race cars, while Golf Craft offers wearables that can be exchanged for points, diamonds, or tickets earned within the Metaverse. These wearables are tradable in Decentraland's Marketplace, OpenSea, and other virtual marketplaces. Utilising blockchain technology, Decentraland ensures secure and reliable financial transactions. Transactions within the Metaverse are conducted on the Ethereum blockchain network, with smart contracts overseeing the development and execution of applications as well as the ownership and transfer of LAND. Key features of the Decentraland Metaverse include virtual LAND ownership, VR compatibility, SDKs and tools, a Marketplace, and decentralised governance, enabling users to purchase LAND for various purposes, create content, and engage in social activities within the Metaverse. $MANA, Decentraland's native cryptocurrency, is used for financial transactions on the platform. The market data for $MANA are as follows: Market Cap $911,388,683, 24-Hour Trading Volume $163,287,621, Circulating Supply 1,893,095,371 MANA, and Total Supply 2,193,179,327 MANA. These figures show Decentraland's current status in the cryptomarket and the overall economic size of the $MANA token (Miller, 2022).

The Sandbox and Decentraland were chosen as example platforms because of their typical features of owning a virtual settlement and allowing owners to create their own metaverses on these settlements.

2. Structural and Public Comparison of Decentraland and Sandbox Platforms

Decentraland and Sandbox are two distinct Metaverse platforms, each with its own features and emphases. Decentraland offers several content creation and gaming experiences, allowing users to purchase and develop unique virtual land parcels known as LANDs. It is notable for hosting various game types and facilitating the creation and trading of customised NFTs (Non-fungible tokens). In contrast, Sandbox adopts a community-focussed approach, offering users the opportunity to create and share their games, as well as to generate characters or DIDs (Decentralised Identifiers). It also allows users to trade assets (a set of products usable within the Metaverse) created by them with other users. In this context, Decentraland and Sandbox provide users with rich experiences aimed at different purposes, offering various options in the world of the Metaverse. The diversity and adaptability of these two platforms are reflected in their user numbers, indicating proportional differences.

2.1. Comparative Analysis of Structures

Comparing the number of parcels between Decentraland and The Sandbox, Decentraland, launched in 2017, has 90,000 parcels, while The Sandbox, launched in 2018, has 166,464 parcels. Decentraland, which does not require a cryptowallet, recommends software wallets integrated with browsers and applies a 2.5% MANA fee. In contrast, The Sandbox uses supported cryptowallets like MetaMask, Bitski, and Venly for security and stability, applying a 5% fee on all transactions. This percentage difference in buying and selling implies that Decentraland is more community- or public-oriented, as it provides a direct resource to the company's coffers. Decentraland's monthly user count reaches 300,000, while on the other hand, Sandbox's user base will reach 4.5 million in 2022. The Sandbox was launched in 2018 and currently has 1.06 billion SAND tokens in circulation. There are 1.86 billion $Mana tokens, Decentraland's token, in circulation. This indicates that the Sandbox has a stronger stance on the token side.

As seen in Table 1, using current information on market volumes, the 24-hour trading volumes of Decentraland's ($MANA) and Sandbox's ($SAND) cryptocurrencies can be examined. Decentraland's 24-hour trading volume is $163,287,621, while Sandbox's 24-hour trading volume is $184,715,000. In a comparative analysis, Sandbox's 24-hour trading volume is higher than that of Decentraland. This indicates that Sandbox experiences more intensive trading in the cryptocurrency market and more active trading among its users. However, when considering other factors and long-term trends, this is only a short-term snapshot. However, when considering other factors and long-term trends, this is only a short-term snapshot. Users should determine their preferences by evaluating a range of factors such as market conditions, platform features, and projects (Coin Market Cap, 2023).

Table 1. . Comparison of Sandbox and Decentraland Based ao Specific Criteria (The author has created this figure)

COMPARISON PARAMETER	SANDBOX	DECENTRALAND
Platform Type	Based virtual world platform + game	Blockchain-based virtual world platform + social
Token	$SAND	$MANA
Earnings	Earnings Participating in in-game activities, creating assets, participating in investment programmes Leasing land, organising events, selling assets	Land Ownership Possibility to create your own games and experiences on land Possibility to create your own content on land
Land Ownership	Opportunity to create your own games and experiences on land	Opportunity to create your own content on the land
Management and Stakeholder Involvement: DAO	Token holders and participation to the extent allowed by the Sandbox.	Full participation via DAO.
Token Economy	A total of $3 billion in SAND, decreasing in circulation through investment programmes	Total amount of 3.8 billion $MANA, with a buyback and burn mechanism in place.
Starting Year	2018	2017
Amount of Land	166,464	90,000
Requirements for a Cryptocurrency Wallet	Yes	No, but a software wallet is required to store digital assets.
Supported Wallets	MetaMask, Bitski, and Venly	Browser-integrated software wallets, MetaMask
Marketplace fees	A fee of 5% is applied to all transactions	A 2.5% MANA cost is applied to all transactions.
VR Compatibility	No	No
Aim	Creating, owning, and monetising gaming experiences	Creating, experiencing, and monetising applications and content

Decentraland and Sandbox are Metaverse platforms with distinct management structures and community participation features. MANA and LAND owners control Decentraland through the Decentraland DAO, a decentralized autonomous organization. Decentraland, established earlier than Sandbox, offers fewer lands but has a clear governance structure through its DAO system. Sandbox, on the other hand, provides a more robust gaming experience and has a detailed roadmap for future development.

Both platforms value community participation and the involvement of users in decision-making processes. While Decentraland focuses on decentralised governance and open-source contributions, Sandbox adopts a community-centric approach, encouraging interaction through collaborations and projects. The choice of platform for users depends on individual priorities, levels of participation, and the governance model.

In this arena where the features promised to users create a sharp distinction, Sandbox's commitment, especially in its 2023 plans, to assist in business development by providing specialised resources, teams, and support to more than 300 agencies and studios attracts not only users but also developers.

Decentraland and The Sandbox are two significant virtual world platforms based on blockchain. Each offers unique experiences with its own gaming and social interaction features.

The Sandbox allows participation in in-game activities, asset creation, and investment programmes using the $SAND token. Users can create their own games and experiences on their lands. In its DAO structure, token holders can be active to the extent defined by the Sandbox. It is a platform governed by a token economy of 3 billion $SAND (Coin Market Cap, 2023).

Conversely, Decentraland offers users the opportunity to earn through leasing land, organising events, and selling assets using the $MANA token. Users can create content on their lands. Full participation and governance are facilitated through the DAO structure, and there is a total of 3.8 billion $MANA in its buyback and burn mechanism.

Neither platform offers VR compatibility; instead, they provide opportunities to create experiences through gaming and social interactions and to monetise them. In Decentraland, the price of a land parcel in some areas exceeds $10,000, and owners use these virtual villas for various purposes. The land parcels in Decentraland adhere to design restrictions that allow various artworks to be created quickly, independent of browser speed. These rules function as a set of zoning regulations, determining everything from building heights to how close neighbouring structures should be.

Both platforms offer perspectives on why their land systems are designed on a grid basis. While The Sandbox provides a structure for users to develop creative content, Decentraland prefers a structure that facilitates interactions between users and content. Both systems offer a structural order that regulates and facilitates ownership and interaction in the virtual world.

2.2. Comparative Assessment in the Public Domain

Decentraland is a decentralised and open-source platform. It features a web application that provides a dynamic bird's-eye view of its virtual city map. The map, using Decentraland's open protocols, displays the city's various districts, lands, roads, buildings, and activities (Waldorf, 2018). These areas are constantly changing and evolving because they are being bought and sold by users.

The Decentraland map consists of 90 districts, each with a different theme and function for public space settlement. These districts are connected to a main square located in the centre of the virtual city, known as Genesis Plaza. Genesis Plaza serves as the heart of the public space, facilitating socialisation, entertainment, and learning. Figure 1 shows the social centre of the platform located in the centre, the social area of Decentraland plaza, and the park.

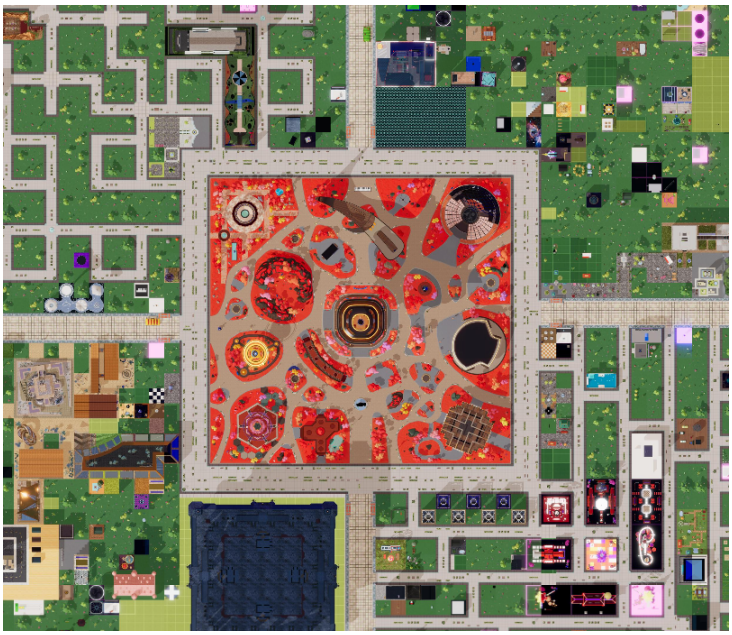

Figure 1. Decentraland's Map (Genesis City Map, 2023)

In terms of public space usage, Decentraland allows individuals to create their virtual identities and interact in public spaces. Individuals can play both consumer and producer roles in these areas. Consumers can navigate the public space, visit different districts, participate in events, and purchase or rent virtual goods. Producers can create, display, sell, or share their own lands, buildings, artworks, games, events, services, or other virtual goods in public spaces. Individuals can make or receive payments in MANA, their own cryptocurrency, for any transaction conducted in the public area (Coin Market Cap, 2023).

Other districts cover a variety of themes such as art, education, sports, gaming, shopping, music, culture, nature, history, science, technology, politics, religion, and philosophy. These areas allow individuals to participate in public spaces according to their interests. Figure 2 shows TMA World, an example of such a concept, in which a landowner has created a public space for experiencing a different form of life.

Decentraland's paradigm places land ownership firmly in the hands of the community, thereby endowing its members with absolute control over their virtual creations. Through a blockchain-based parcel ledger, users assert unequivocal ownership of virtual land, ensuring transparency and immutability in ownership records. Landowners wield authority over the content published on their allocated parcels, delineated by precise cartesian coordinates (x,y). Ownership of land within Decentraland confers not

only governance rights but also facilitates the monetisation of virtual properties, underscoring the platform's commitment to decentralised governance and economic empowerment within the virtual realm.

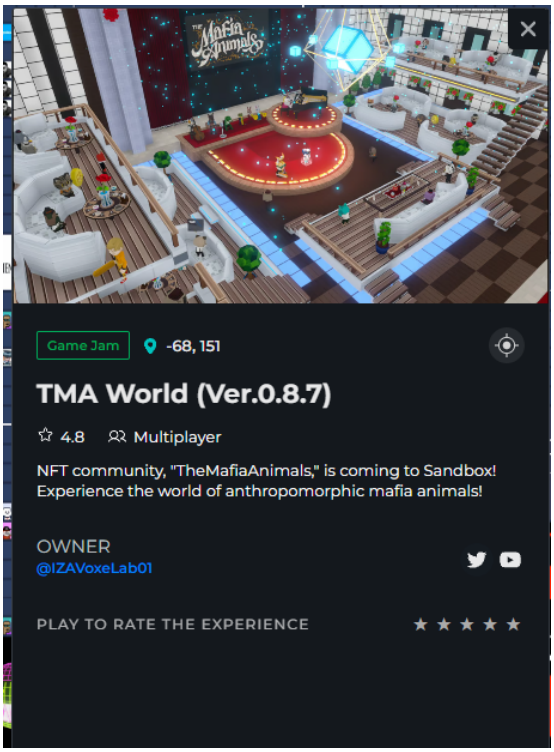

Figure 2. TMA World (Genesis City Map, 2023))

The Sandbox map is a web application that displays the different districts, lands, creators, and games of a virtual city. The Sandbox map has the following features in terms of public space settlement, usage, and urban planning: In terms of public space settlement, it consists of 166 districts with different themes and functions. These districts are connected to a main square located in the centre of the virtual city, known as the Elrond City Hub, as shown in Figure 3. Inside Elrond Hub, there are various centres such as the headquarters, metro, park, museum, hotel, casino, restaurant, airport, gaming centre, stadium, and rocket station. It has a decentralised system based on NFTs for participation (ElrondCityWhitePaper, 2023).

Figure 3. Elrond City Hub: Public Space Example (ElrondCityWhitePaper, 2023).

In Figure 4, the areas labelled "The Sandbox" on the map function as public spaces, facilitating socialisation, entertainment, and learning opportunities for individuals. On the map, the monkey icons represent NFTs (from the Bored Ape Yacht Club NFT

collection), while areas marked “For Sale” are intended for advertising purposes. Additionally, MEDIECS and QuarkChain are represented as companies on the map.

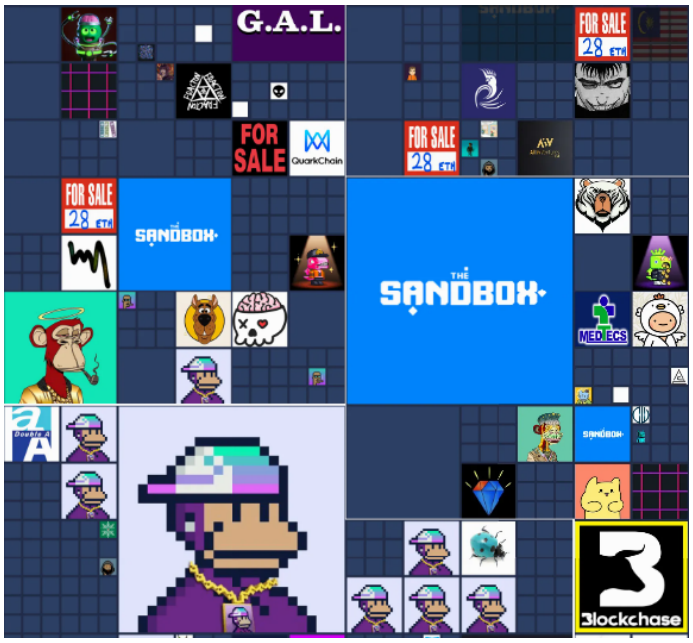

Figure 4. The Sandbox Map (The Sandbox, 2023).

Similar to the Decentraland map, the other regions on the Sandbox map also encompass a variety of themes such as art, education, sports, gaming, shopping, music, culture, nature, history, science, technology, politics, religion, and philosophy. These areas provide individuals with the opportunity to participate in public spaces according to their interests. In addition, unlike the Sandbox, the Decentraland map features active public spaces. It is also noticeable that some areas on the Sandbox map are used for advertising.

In The Sandbox ecosystem, creators maintain full ownership rights over their assets, encompassing a comprehensive 100% control. All assets within The Sandbox adhere to copyright regulations, safeguarding the intellectual property of creators, provided that they do not infringe upon existing copyrights. Upon uploading content to The Sandbox, creators grant the platform an expansive licence, permitting the utilisation, reproduction, public display, distribution, and adaptation of the shared assets and games globally. This licence, devoid of royalty obligations, persists perpetually and irrevocably, empowering The Sandbox to foster the development, distribution, enhancement, and promotion of its services, activities, and assets and games publicly shared by creators.

The primary differences between The Sandbox and Decentraland lie in their approaches to ownership, governance, and control. In The Sandbox, creators retain 100% ownership rights over the assets they create, emphasising individual control over creative content. Conversely, Decentraland adopts a community-centric ownership model in which virtual land is permanently owned by the community as a whole. Users claim ownership of parcels on a blockchain-based ledger, ensuring decentralised ownership and governance. Creators in The Sandbox have complete control over their creations, dictating how assets are used and distributed within the platform. In contrast, landowners in Decentraland exercise control over the content published on their parcels of virtual land, allowing users to curate and manage their virtual environments. While creators in The Sandbox own their assets outright, the platform retains certain rights to utilise and promote these assets for development and service promotion. Monetisation opportunities vary on the basis of agreements between creators and the platform. In Decentraland, ownership of land grants users governance rights and the ability to monetise virtual properties through leasing, selling, hosting events, and participating in the platform’s decentralised economy. In summary, The Sandbox emphasises individual ownership and control over creative assets, while Decentraland prioritises community ownership and decentralised governance. Each platform offers unique opportunities for engagement with virtual environments, characterised by distinct approaches to ownership, control, and monetisation (Blockchain Industry Group, 2023; Decentraland, 2023; The Sandbox, 2023).

The use of public spaces in Sandbox has characteristics similar to those of Decentraland. On the Sandbox platform, individuals can make or receive payments in SAND, their own cryptocurrency, for any transaction conducted in the public area.

In the context of Metaverse platforms, there is a heavy user base, and these users have participatory governance systems through Decentralised Autonomous Organisations (DAOs), especially in the context of decentralised management mechanisms. As mentioned earlier, the percentage of project shares taken from transactions again highlights Decentraland's emphasis on public welfare. On the other hand, considering the support and funding Sandbox provides to developers, it is evident that community creators, or the public, are the primary focus.

3. Conclusion

This study explores the concepts of the metaverse and public, analyzing the strengths and weaknesses of two prominent Metaverse platforms: Decentraland and Sandbox. Decentraland distinguishes itself with its well-established and older infrastructure, resulting in a wider user base and increased interaction and transaction volume. Its use of a DAO contributes to its decentralised nature, affording users greater control and freedom within the platform. However, the absence of a comprehensive roadmap for Decentraland introduces uncertainty regarding its future development, and exposure to competition may impact its user base and engagement.

In contrast, Sandbox benefits from a detailed roadmap and backing from prominent financial institutions, providing a clear direction for future development and fostering user trust. Nevertheless, its centralised nature limits user autonomy and freedom, and as an evolving project with potential competitors, it may face challenges in retaining its user base and engagement.

In terms of a public-oriented focus, Decentraland stands out due to its DAO and its contributions to public welfare, such as organising the Metaverse Music Festival and developing a Mental Health First Aid experience. This demonstrates that the platform extends beyond mere entertainment and can serve the community. Meanwhile, Sandbox's support for developers and development activities highlights its significant role in technology and innovation, indicating that it transcends being solely a gaming platform and can actively contribute to technological advancements and innovation.

Considering preferences for public spaces, both platforms have distinct advantages and disadvantages. Consequently, the choice between them hinges on individual user needs and expectations. Users are encouraged to select the platform that aligns best with their requirements when deciding among Metaverse platforms, as this can enhance their experience and contribute to the sustainable growth of these platforms. This study aims to aid users in identifying critical factors to consider when making choices among Metaverse platforms, serving as a valuable resource for comprehending the relationship between the Metaverse and the public, the prospective development of Metaverse platforms, and strategies for maximising user benefits within these platforms.

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