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# 5 Metaverse: Business Design and Applications

**Abstract:** The metaverse has been described as the next generation of the Internet. Others have dismissed it as hype. To understand and assess the competing assertions, this chapter discusses the new medium's various dimensions: origins, size and type of activities, business models, and technical and economic constraints. This is followed by an analysis of potential problems, emerging opposition, and policy implications. The conclusion is that although the metaverse as a medium is much over-hyped in the present, it has real potential in the long run as a way to meld people's physical and digital experiences, and as an option to transact commercially and socially.

**Keywords:** Metaverse, business models, market structure, virtual reality, virtual assets, NFT, social networks, edge computing, cryptocurrency, market power, goggles

## Metaverse

What exactly is a metaverse? The word is a portmanteau of "meta," denoting transcendence, and "verse," signifying a form of universe. A simple definition is that it is an online platform in which individuals and organizations are represented by icons that interact with each other, often in a three-dimensional projection. But once the term was popularized, in particular, by Facebook's Mark Zuckerberg who renamed his company Meta, it spawned increasingly complex definitions fueled by expectations of a powerful impact. Such definitions include:

- ". . . a fully immersive, hyper spatiotemporal, and self-sustaining virtual shared space blending the ternary physical, human, and digital worlds" (Wang et al., 2022).
- An "expansion of the domain of human activity by overcoming spatial, temporal, and resource-related constraints imposed by nature" (Momtaz, 2022).
- ". . . a series of other worlds that a society imbues with meaning" (Narula, 2022)

In a more technical description, Matthew Ball (2022) writes:

> 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.

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Industry insiders are more modest or succinct. Says Apple CEO Tim Cook: "I'm really not sure the average person can tell you what the metaverse is." Snap CEO Evan Spiegel called the metaverse "pretty ambiguous and hypothetical." Perhaps the best way to think of the metaverse is as a way for the real physical world – people, buildings, meeting spaces, events – and the virtual digital world to link up with each other more closely than in the past, including in their respective three-dimensionalities. A more intuitive description is that of a virtual shopping mall and office park where people visit to experience, socialize, work, and shop. The basic functions of metaverse platforms are like those of a shopping mall management that provides heat, cooling, lights, security, overall marketing, and synergies.

## Founding Ideas and Principles

Because the term "metaverse" is vague and difficult to explain, authors tend to refer to the origins of the word itself, which can be found in Neal Stephenson's science fiction novel *Snow Crash* in 1992. But novelists and academics have been writing about "extended reality" and "virtual worlds" for a long time (Kraus et al., 2022). William Gibson's 1984 *Neuromancer* describes a virtual reality space called the "matrix" (Kevins, 2022), a concept that inspired a noted film by that name (1999), as well as the term "cyberspace" itself. Others credit the French postmodernist guru Jean Baudrillard. Baudrillard imagined a fusion of the real and fictional worlds in what he termed a "hyperrealistic reality" (Beaudrillard, 1994). More generally, there were many other strands of science fiction literature that inspired the concept of the metaverse. Most were dystopic. Examples are the 2018 Steven Spielberg film *Ready Player One*, where a company offers the single platform, the Oasis, which provides an escape for people fleeing the actual reality.

In parallel with the vague but overencompassing definitions, the technological elements of the metaverse are sprawling and cover much of recent digital development. These building blocks include computer vision, mobile technology such as 5G and 6G, cloud and edge computing, blockchain, artificial intelligence, user interactivity, machine learning (ML), and human-computer interaction (HCI). Some of these elements came together in "virtual reality," where computer-based imagery was displayed on goggles, immersing the user inside a three-dimensional presentation. An attempt to commercialize the technology was initiated in the early 1980s by the computer technologist and visual artist Jaron Lanier, who founded VPL Research. Virtual reality creates an entirely simulated environment and is used for purposes of entertainment, education, or skills training. A less ambitious technology is augmented reality (AR), which does not create a new visual image, but is an overlay of text or instrument data onto the actual world before the user and hence integrates the virtual and the real.

Other elements were combined into "virtual worlds." In 2003, the company Linden Labs unveiled its virtual meeting place *Second Life*, using regular 2D computer screens, with users, represented by avatars that interacted with each other and with gaming

sites set up by organizations. Second Life got much attention and soon reached over a million monthly users, though after initial curiosity interest soon peaked. But it pioneered the elements of participation, engagement, and transactions in a visual computer-based environment. It was therefore only a matter of time before another round of entry came up from two directions.

The first was the emergence of "proto-metaverses" in video games, where gamers established far-flung self-organized communities. The video game companies Epic Games (Fortnite) and Roblox became huge platforms for content creation, interaction, and event experiences. This drove down prices of visual imaging graphics hardware and software, and created a community of expert users/creators (Suderman, 2022). The second major initiative in the metaverse was in 2021 when the giant online social network company Facebook made it a corporate focus, even renaming itself Meta Platforms, having already acquired the leading goggle maker Oculus. It aimed to create a vertical integration from the user device to content and transactions to platform. Microsoft engaged in similar efforts, though more aimed at enterprise users.

# Opportunities and Challenges

## Business Opportunities for Metaverse Services

Metaverse service providers employ different strategies. They can be specialists, offering specific functions listed below, or they can bundle some of them:

- Training, education, recruiting
- Meetings, collaborations, work from home
- Customer service
- Market research, product testing
- Tele-medicine and health
- Games
- E-commerce
- Entertainment
- Events
- Social interaction
- Adult and companionship
- Experiences
- Governmental services
- "Digital twinning" of infrastructure and manufacturing plants

## Business Forecast

The optimism of a metaverse future shows in the following consultancy predictions.

- **McKinsey,** "Almost 60% of consumers using today's early version of the metaverse are excited about transitioning everyday activities to it . . . Some 95% of business leaders expect the metaverse to have a positive impact on their industry within five to ten years . . ." McKinsey estimates a $5 trillion impact by 2030 (Elmasri et al., 2022).
- **Matthew Ball,** in a major book on the subject, estimates that the metaverse could be worth up to $30 trillion in the next 10 years (Ball, 2022).
- **Accenture**'s analysis was that "over the next decade we will witness a complete transformation of nearly every environment that enterprises currently do business across" (Byrnes et al., 2022).
- **JP Morgan** reported a market opportunity of over $1 trillion in yearly revenues (Moy & Gadgil, 2022).
- **PricewaterhouseCoopers** estimated VR's and AR's potential to raise global GDP by 2030 by up to $1.5 trillion (Dalton & Gillham, 2019).
- **Reuters** reported that over the following five years, Meta will be responsible for the production of an additional 10,000 jobs inside the EU (Reuters, 2021).
- **Bloomberg Intelligence:** Metaverse may be a $783.3 billion market in 2024 with 13% CAGR (Kanterman & Naidu, 2021).
- **Statista:** The market for AR and VR will have nearly reached $300 billion by the year 2024 (Clement, 2023). Statista projects the total market to be about $14 trillion.
- **Goldman Sachs** created a model based on the market cap of the metaverse companies, and found a market size of ~$2.6T (Goldman Sachs, 2021).
- **Nvidia** CEO and founder Jensen Huang: "the economy in the Metaverse . . . [will] be larger than the economy in the physical world (Ball, 2022)."

Are these predictions realistic? Inaccurate forecasts have a long history in the online world. The noted tech consultancy Gartner, for example, forecasted in 2007 that 80% of all worldwide Internet users in 2011 would become active in Second Life and similar virtual worlds. But at the same time while people tend to overestimate the short term, they underestimate the long-term impact. In accordance with these expectations, several of the largest companies in the world, including Meta, Amazon, Apple, Microsoft, Nvidia, and Tencent, have made large investments in metaverse activities. According to McKinsey, tech companies, VCs, and PE firms have invested more than $120 billion in the metaverse in the first half of 2022, more than double the $57 billion invested in all of 2021.

## Technological Challenges

The technical resource requirements are high. Transmission bandwidth for a 360° horizontal, 180° vertical, 3D, 8K resolution, 60 frames per second video stream must be significantly higher than for past generations of online video streaming. On top of that, since fast and seamless interactivity is important, latency must be short, and therefore, processing must move close to the end user. This means a redesign of the network that is more distributed, with more processing at the edge and less centered around giant distant data centers. Partly as a consequence, truly interactive games with quality are severely limited in the number of people they can accommodate. At the same time, interoperability is important for most applications, be it social media, events, games, commercial transactions, or virtual assets. One does not want to buy a virtual hat for each metaverse but one that can be ported over. Similarly, the 5G technology of mobile communications is insufficient for true metaverse speeds and data needs. 5G might reach a maximum throughput of 10–20 Gbps, but that is not enough under current techniques for a quality metaverse.

Beyond data throughput and latency is the issue of storage. It is in the nature of a metaverse to be able to go back and track everything that a user has done and to update everyone's representations of actions continuously. The implications are vast 5 Metaverse: Business Design and Applications 71 data and storage requirements. Things will improve with investments in infrastructure, which will move processing closer, reduce potential congestion, speed up processing, and reduce the number of amplifications of the signal. It will also simplify the transmission protocols to straighten out routing, etc. This will bring down the extra time over the speed of light that it takes to move a signal. Right now, it takes about 2–10 times as much time, depending on the route. But even if the causes of delay are eliminated, the basic constraint is the physics of transmission. Even at the speed of light, distance makes a difference, and some delay will creep in.

## Opposition and Policy Issues

A large number of criticisms have been leveled against the metaverse medium. Some are similar to those identified for online activities more generally. Concerns include:

- Large-scale and market power inherent to online and network activities, with the potential to create gatekeeping, exclusion, monopolization, and manipulation
- The expense of devices, subscriptions, and skill acquisition exacerbate digital divides and inequalities
- New forms of sexual harassment, bullying, and hate
- More misinformation and outright fakes
- Addiction to metaverse activities
- Threats to privacy and security

- Further monetization of basic human activities (Anderson & Rainie, 2022)
- "Gated communities" controlled by corporate owners who function as largely unchallenged authorities over users
- Global dominance by a few advanced countries with economic and cultural supremacy
- Lack of interoperability and the consequent fragmentation of digital society

To critics, virtual reality is a way to escape the messy real world in favor of an ordered, controlled, virtual world, and in the process avoid the need to improve conditions in society. They fear that metaverses will accelerate the move toward information-intensive activities, whose side effects are deindustrialization and the loss of middle-class employment. There is also opposition to the Meta Networks company, based on its track record, from both the political left and the right.

# The Creative Next Step

## Business Design and Applications

Are these investments sensible, or is the metaverse a vague initiative searching for a concrete market? One must analyze the business design and applications. The potential revenue streams for metaverse use and application include:

- Sale of hardware devices
- Marketing and advertising
- Enterprise services
- Sale of virtual assets such as virtual land or NFTs (nonfungible tokens)
- Subscriptions and tickets
- Commissions on transactions
- Social networking
- Governmental subsidies and contracts
- Donations and contributions
- Sale of data

## Sale of Hardware Devices

The sale of goggles and other user interface devices is not likely to be very profitable. Where the device maker is vertically integrated with the metaverse platform, the incentives may prove to be a loss leader to (1) increase the user base of the platform to gain a scale advantage over other platforms, (2) provide the platform with a role in securing access to it, and (3) provide the platform with a tool to preclude technical

standards that would disfavor it. Given the loss-leader structure of the market, unaffiliated goggle makers, to compete, must also drop prices considerably. A different situation exists for hardware devices aimed at professional/enterprise usage. Apple's and Microsoft's goggles are priced at over $3,000, aiming at that market with its lower price elasticity. But sales for all goggle makers have been lagging, as has actual usage. Thus, it is unlikely that hardware sales will be a major generator of profits.

## Marketing and Advertising

Metaverse represents a potential medium for advertising, marketing, and public relations. Its strengths are immersion, individualization of the customer, individualization of the product, data collection on the user, and product placement. Yet to date, advertising has not made much use of virtual reality design and capability. Only a tiny amount of video game revenue is derived from advertising. Partly, this is due to pushback by the gamers themselves. And partly, it is based on the difficulty of measuring impressions. There is also the technical challenge to consider; specifically, the ability to insert individualized ads into fast-moving games. At the same time, there is the potential for experiential marketing, such as test-driving a high-performance car. Some companies have tried marketing efforts, such as one fast food vendor's "Wendyverse" that takes consumers into a virtual restaurant where people hang out, play games, win coupons, and do almost everything – except actually eat. The concept is for consumers to not just read and look at an advertisement as in the past but interact with products (Gooding, 2017). An example would be picking a holiday destination or hotel. Some ads or games could become a fun experience to anticipate the actual travel (Lithodomos, 2017). All of this is predicated, however, on a large user base that can be reached.

## Consumer Subscriptions and Tickets

A platform could charge fees to use it. But is this likely? Browsers and other platforms on which applications ride do not seem to require payments by users. Their model is to collect from those who transact with users, such as retailers or news providers, and to deliver as many such users to the applications. The same is likely true for metaverse platforms. It is the applications that might set subscriptions, depending on their own business model, for content or transactions, whether for dating, exercise, entertainment, education, adult content, accessories for avatars, etc. That economic logic applies to special events hosted on a metaverse, such as a concert by a noted artist. Thus, charging consumers for using a platform defeats the strategy of making it a major user destination.

## Enterprise Services: Business-to-Business (B2B)

A metaverse platform might supply basic tools such as meeting room functionality to organizations or a classroom environment to colleges. For example, Microsoft has prioritized the "Industrial Metaverse," such as applications used by skilled labor to perform complex repairs by the book. Other examples include teaching surgical procedures, simulating battlefield conditions for soldiers, or instructing aircraft mechanics. Microsoft also created a system called "Mesh," which enables users to attend virtual meetings, exchange presentations, and do other tasks in a virtual environment. This market is potentially large, but competition combined with low marginal costs is likely to keep prices relatively low and provides incentives to create highly specialized modules.

## Sale of Virtual Assets such as Fashion Accessories, Land, or NFTs

Some of the items sold on a metaverse platform or store could be virtual products such as a digital image. To prevent them from being widely copied and hence destroying their value, their uniqueness could be protected by blockchain applications. Once uniqueness is assured, one can sell objects to users, such as accessories for their avatar, a work of art, or the exclusive rights to a segment of a metaverse. This has led to the emergence of NFTs, which are unique identifiers linked to a specific item, usually a digital asset. They serve as proof of ownership and are often used for digital artwork, collectibles, items in video games, or music. There are marketplaces and exchanges that handle the sale of NFTs. Similarly, locations on a metaverse can be made unique as virtual "land" and be traded. Such virtual land has fetched considerable amounts of real money, yet the very concept may seem odd. But the sale of virtual land is much like the sale of a particular advertising space in a magazine, with a contract covering each future issue for a year. Price will depend on "location" (front page, back cover, etc.), the size of the land plot (like the size of an ad), proximity to valued neighbors (magazine ads for films and plays in the culture section, not in the sports pages), etc. Another analogy is the purchase, by an online retailer, of rights to be listed near the top of search results ("sponsored links"). The contract rights can be resold to a third party. When the magazine is "hot," or when the retail economy is booming, the resale value of the contract rises. But there are differences, too. In contrast to actual real estate, which is scarce almost by definition – location, location, location – there is no real limit to supply in a metaverse. Want to sell more lakeshore lots? Just reshape the shoreline and add to the supply. The only way to avoid an expansion of supply is by a self-imposed restriction, and one that is also credible for the future.

A similar story can also be told about the sale of NFTs, which has become a frequently used way to sell virtual art. Many of these transactions are often speculator-generated. This is similar to what happens in the world of "real art" where galleries are said to sometimes sell to themselves through fronts, to create buzz and raise the

market price for an artist. When it comes to virtual merchandise, the sellers range from individuals extending a hobby to a side-hustle, to big-name brands. The fashion house Balenciaga moved into Fortnite and racked up a high volume, while Ferrari is selling virtual cars and merchandise on videogames. And who are the buyers? Why would anyone spend money on digital fashion? One answer is that people use fashion, just as in the real world, to make a statement about themselves. And on a metaverse, they can let their fashion imagination run wild but pay fairly little money to dazzle.

### Commissions on Transactions

An important source of revenue for the metaverse could be commissions on transactions by stores and others located on their platform. For example, Meta charges a platform fee of 30% for sales made by stores and service providers that have located themselves on its metaverse Horizon Worlds. In addition, the platforms tend to denominate transactions in their own private virtual currency and gain from selling and redeeming these currencies. In addition, the seller might have to pay for advertising on the metaverse and to acquire the "land" for its virtual store. The platform collects at each step. Added together, the platform might take about half of the retail price. It would be as if the owner of a shopping mall collected a substantial share of the sales revenues of its tenants. In the process, it would transform a platform's basic business from, for example, a social media company based on advertising revenues, to an e-commerce/e-transactions platform. However, it would require some special attractiveness to be able to retain users and vendors while taking a big bite from their revenues. And such market power is mostly one of having a large user base of consumers so that sellers cannot afford to ignore that user segment.

## Discussion

### Market Structure: Metaverse Versus Metaverses

We are still in the beginning stages of metaverse design and development. Will the future be one large metaverse platform, as some have suggested, that hosts multiple metaverse activities in much the same way that companies have a presence on Facebook? Alternatively, imagine a scenario that features multiple metaverses, whereby an organization might have its own version of a metaverse in ways that are similar to maintaining a website. And yet, the technological and business challenges are complex and require significant investment, coordination, and control. Scale economies and network effects are high. There is a major incentive to do things in-house that is both vertically integrated and proprietary. A walled garden, in terms of technology and economics,

can not only improve product quality but also create a lock-in situation that makes it more difficult for users to leave. This, in turn, creates an ability to charge prices above their competitive levels and to run virtual gated communities owned by a landlord, in this case, the owner of the platform.

Thus, it seems unlikely that there will be a singular metaverse platform run by a single organization. There are several reasons for this including rival technology, business competition, specializations, complexity, nationality, and in particular, public policy. Currently there are multiple metaverses, offered by several companies such as Decentraland, the Sandbox, Microsoft, Roblox, and others. It is difficult to imagine a scenario in which the Meta Networks company, for example, would be permitted to be the only platform available worldwide.

When it comes to market dominance, if the future metaverse does not emerge as an important industry, there is no need to worry much. But if the long-term future of the metaverse proves successful, it cannot and should not be dominated by a single company. Otherwise, it becomes empowered to be the quasi-government for a virtual world, setting rules on behavior, speech, business conduct, morality, etc.

Dominant systems have been part of communications for centuries, from the original postal service to telecom monopolies, TV oligopolies, cable TV monopolies, as well as many of today's big Internet platforms. Each generation of technology starts with the hope that it will bring openness and competition, and then disappoints, possibly because such technology sets into motion a number of economic consequences. Stated differently, the tools define fundamental economics and industry structure. But each of these technology generations has been eventually replaced by a stronger and more effective one, with competition becoming inter-generational rather than intra-generational.

## Final Thoughts and Considerations

The promoters of an innovation are always fully committed to their venture and investment. They have been ambitious in pushing the envelope for users to be represented by computer-generated life-like 3D images (avatars), acting in computer-generated worlds, assisted by artificial intelligence, interacting with each other instantly at large distances, transacting with each other and with vendors for real and computer-generated products, paying with cryptocurrencies, experiencing new styles and genres of video content, and doing so using interface devices that require skills and active participation, while being closed off from real life.

The optimism of early entrants has led to an overestimation of what the future of the metaverse will become in the short term. At present, however, the pathway is arduous. After an initial curiosity, people will use metaverses only if there is a perceived value proposition for them. In 2022, there were only 26 million VR headsets worldwide (Lebow, 2022). Actual usage lagged further. On average, headset owners use their de-

vices just 6.2 h a month. About 65% of goggle owners reported fewer than 5 h of monthly usage (Roettgers, 2019). Metaverse socializing is clunky and time-consuming and requires some tech skills. Two-dimensional interactivity didn't work. So why should 3D? Therefore, is the metaverse concept too ambitious?

As with any kind of tech adoption, there will be several basic types of users: early adopters, followers, reluctant adopters, and resisters. Most people will adopt new types of content or new types of systems of delivery. Rarely will they be comfortable changing both at the same time. Printed books, recorded music, film, broadcast, and cable TV all began as a new way to deliver information and entertainment content. Changing both distribution technology and content styles is the province of true artistic and tech innovators as well as early adopters. It is, however, a difficult sell for mass marketers as they face consumers. And if one adds a change in the very nature of transactions and payment methods, most people will be slow to respond. Most people change their habits and preferences in small steps.

What must emerge is a "killer app" that features a compelling value proposition. Without a killer app, a promising software design may never reach self-sustainable growth. And without growth, scale economies and network effects remain low and do not reach the all-important "critical mass." It is the classic chicken and egg situation. Yet, the positives tend to assert themselves, eventually. The clunky goggles will give way to nonintrusive connectivity. Networks will be upgraded. Compelling specialized services will be offered. Artists will create new genres of content. There will be new economic opportunities. People will make and sell virtual goods in virtual worlds and perform services. The physical and virtual worlds will coexist, interact and intermingle. Metaverses are not just about games and marketing but about an expansion of the horizons of human imagination, communal interaction, and cultural enrichment. We could always imagine better worlds than the real ones, and now we can construct them.

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