

Exploring the Metaverse: Uncovering the Investment Opportunity

Diego Cardenas, Research Analyst

Nicole Chanthasoto, Research Analyst

Frederick Grieb, Research Analyst

Sandra O’Keefe, Research Analyst

William Pitkin, Research Analyst

The concept of virtual reality has been a staple of science fiction for a long time. But the advent of the Metaverse has brought the likelihood of a three-dimensional world closer to reality. There are many questions that arise from such a scenario and we assembled key members of our Fundamental Growth and Core equity research team together to tease out what the Metaverse might look like, how far away it is, and what investors should be considering as it takes shape.

At the Outset, Can You Explain What the Metaverse is?

The Metaverse is a term used to describe the aspirational concept of a fully-functioning, immersive, alternative three-dimensional (3D) world. Throughout the pandemic, most of us have attended virtual business meetings and family get-togethers. The Metaverse aims to evolve these two-dimensional (2D) personal and professional activities into 3D activities for both commercial and leisure applications. While realization of the Metaverse is still some time away yet, the concept of an immersive 3D world has been around for decades — author Neal Stephenson coined the term “metaverse” in his 1992 science fiction novel “Snow Crash”. And there have been several movies capturing the concept, including *Ready Player One*, the 2019 science fiction film based on Ernest Cline’s novel.

The early building blocks of the Metaverse are in place, such as widely-available connectivity, real-life rendering on PCs, and virtual (V/R) and augmented reality (A/R) headsets. But it is still unclear how all these pieces will be assembled and how they might change in the process. Different parties are investing in disparate aspects of this world, based on their own commercial interests (e.g., entertainment, commerce, advertising). Facebook's founder Mark Zuckerberg expects that we will be able to teleport ourselves to work without a commute, visit our parents in their living rooms, and attend 'live' concerts. We'll be immersed in the experience, not just looking at it. Mass adoption of an alternative 3D world, however, is much more complex. It requires definition and the adoption of standards by operators of the Metaverse backbone, widespread consumer take-up and affordable price points for user equipment, sufficient computing power, bandwidth, along with acceptable transactional currencies and much more. As they say, "it's complicated"!

In Terms of Working, Learning and Playing in the Metaverse, What Will Consumers and Enterprises Actually be able to do?

Activities contemplated for the Metaverse mirror those conducted on the internet today, but these would be much more immersive:

- Enterprise users will be able to hold meetings with a real in-person feel, rather than the 'Hollywood Squares' view of Zoom and WebEx.
- A/R glasses will potentially allow mechanics to fix engines, engineers to troubleshoot factory problems, and surgeons to perform robotic surgery even if a continent away.
- Gamers will 'become' their characters from head-to-toe and students will be able to walk the floors of Rome's ancient Colosseum.
- Leisure activities might include 'try before you buy' shopping, as well as immersive live gambling, travel and concerts.

As with any new technology, there are likely to be more uses that we have not yet even imagined.¹

Over time, the ability to conduct so much activity in the Metaverse may result in reduced travel as virtual trips prove more cost effective and safe. Just as artificial intelligence may result in more service economy jobs being performed by computers, we expect some job displacement from the Metaverse. For example, reduced demand for travel may necessitate a cut in the number of bus drivers and airline pilots. Separately, as geographic and political territories in the Metaverse evolve, it is unclear what rules of law will prevail or which underlying banking systems emerge. Currencies have yet to be determined and there are significant differences in protections afforded between fiat and crypto currencies.

When Will the Metaverse be 'Real' and How Big is the Opportunity?

Many people argue that the Metaverse already exists, with platforms like Decentraland, Microsoft Mesh and Roblox offering digital experiences to play, meet, work and make money without exiting to the physical world.² Roblox, an online gaming platform, has millions of users enhancing their avatars, developing content, and/or purchasing virtual goods — all through their virtual currency, Robux. During the pandemic, Roblox demonstrated the success of virtual experiences, most notably Lil Nas X's concert in November 2020 and shopping in Nikeland, a showcase of virtual Nike products for users' avatars.

However, there are many technical, security, privacy, interoperability and commercial standards to be ironed out amongst parties looking to build out the Metaverse. These foundational elements are critical to making a fully-functioning 3D world come to life. Concepts usually take longer than anticipated to operationalize, particularly when the parties' interests are not fully aligned. As such, we believe early development of the Metaverse will be more evolutionary in nature rather than revolutionary. That said, once the Metaverse is fully built, we expect to see a revolution in internet usage, similar to what Google and Facebook did for online platforms and how the iPhone kick-started the mobile internet.

Given the still-evolving Metaverse definitions, estimates of how big the opportunity will be vary greatly. For instance, Morgan Stanley and Goldman Sachs estimate a \$6–\$9 trillion total addressable market in the United States — assuming a ~20% penetration of the Metaverse within the digital economy³ — with sectors like Real Estate, Auto, Apparel and Education representing some of the largest opportunities.⁴ Similarly, the Metaverse could serve as a long-term catalyst for growth in key sectors of the digital economy, such as the \$600 billion digital advertising market,⁵ \$130 billion video gaming⁶ and \$2 trillion payments industry.⁷ Others estimate significant growth in application software of up to four times to \$800 billion and in the VR/AR industry by up to 10x to a \$35–\$40 billion market.⁸

For the majority of companies, the Metaverse remains a low investment priority. However, with 4.7 billion global internet users, \$13 trillion of consumer expenditure in the US alone, and tens of billions being invested in necessary technologies (e.g. ~\$38 billion in blockchain in the last six years⁹), the Metaverse represents a transformational opportunity for multiple sectors across the economy. This is attracting interest not only from forward-thinking companies, but also industries left behind in the last internet revolution.¹⁰

What Technologies are Required to Build the Metaverse?

The foundation underpinning the Metaverse is made possible by advances in several key technology trends. Some of these are well established and penetrating rapidly, such as high-performance computing, cloud and 5G, while others remain in the earlier stages, such as blockchain, digital currencies and VR/AR. For each of these secular trends, many underlying technology building blocks and infrastructure are required, with the primary ones being: network/connectivity, semiconductors, hardware, computing infrastructure/platform(s), operating systems (OS) and applications and software (SaaS).¹¹

To become reality, the Metaverse will require:

- 1 persistent, real-time, high-bandwidth, and decentralized networking;
- 2 mature and leading edge semiconductors;
- 3 consumer and enterprise hardware to access, interact with, and develop the Metaverse;
- 4 immersive digital and 3D simulation platforms;
- 5 operating systems to orchestrate the platforms;
- 6 large and established ecosystems of application and software developers.

The Metaverse will have key distinguishing technology features. As Matthew Ball, author of the original modern metaverse primer, indicated in his definition of the Metaverse, it will need to be *real-time, synchronous* and *persistent*.¹² These attributes will be the most difficult to perfect and are also the ones that are ultimately most needed. Consequently, while technological underpinnings exist today to make the Metaverse a reality, it will take years, if not decades, to fully integrate and realize the complete Metaverse.¹³

And What Hurdles Must be Overcome to Make the Metaverse a Reality?

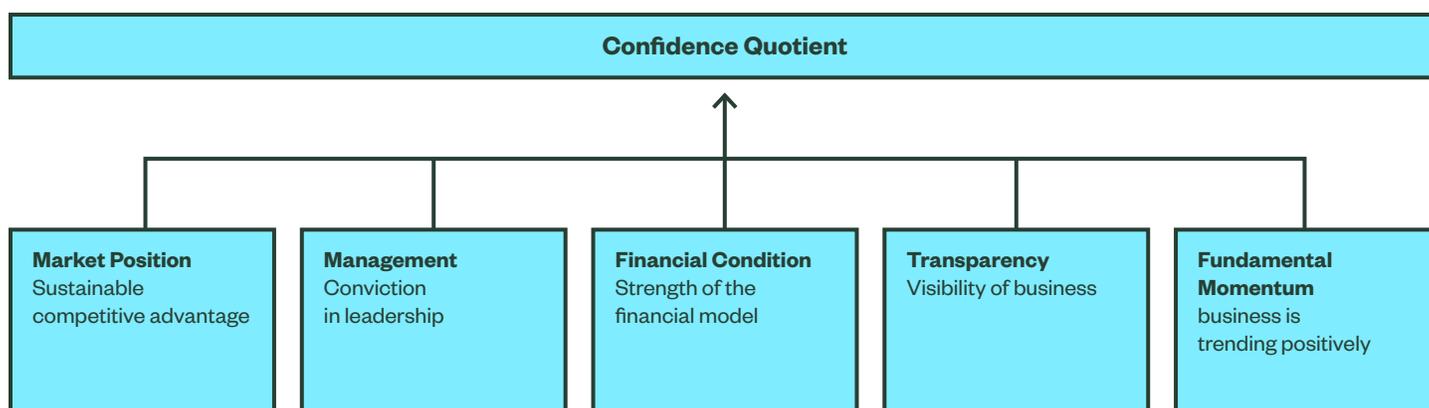
Several hurdles to the Metaverse currently exist, including bulky and expensive VR/AR headsets that will need to be cheaper and lighter to spur adoption. Technically, the Metaverse may evolve to be either open-source (with developers facilitating interoperability) or a collection of closed applications or ‘walled gardens’. With so much personal data being generated in the Metaverse, including biometric, physiological, and eye tracking, regulators will need to pass laws to control interaction, privacy and ethical use of data.¹⁴ Finally, as we have learned with social media and gaming, interacting in the Metaverse may result in increased addiction and mental health issues.¹⁵

How Should Investors Play the Metaverse Theme? Who Stands to Benefit?

The opportunity around the Metaverse theme is vast but there is also a considerable amount of speculation and hype; this is where our team’s investment philosophy and process keeps us grounded. Philosophically, we look for quality companies at reasonable valuations that can deliver stronger and more enduring growth than the market expects and we concentrate our portfolios in our highest conviction names.

Many companies may benefit from the secular growth trends underpinning the Metaverse. One way we identify high quality companies that meet our requirements is through our proprietary Confidence Quotient (CQ) framework. This focuses on the qualitative attributes of a company that are likely to contribute to sustainable earnings growth; these include management team, financial condition and market position. In our experience, high market position companies tend to benefit most from strong secular growth trends like those we see underlying the Metaverse.

Figure 1
Confidence Quotient Process



Source: State Street Global Advisors.

Several companies have articulated strategic aspirations around the Metaverse opportunity and have started investing to achieve those goals. In past technology cycles for software and internet companies, key sectors typically consolidated into oligopolies with the economic benefits accruing to a few large vendor platforms. And we expect that will be repeated in this cycle.

Microsoft and Meta (Facebook) appear to be best positioned as winning platforms in the Metaverse. Microsoft Azure is a key cloud offering which can scale computing power to handle Metaverse workloads and Microsoft Office software will likely benefit from enterprise Metaverse adoption. On the consumer side, Facebook is aggressively repositioning itself, highlighting potential ways its massive user base will be able to interact with friends through its Metaverse platform.¹⁶

Beyond platforms, we also find vendors whose technologies are required to build out the Metaverse to be attractive. Unity Software provides solutions that stand to benefit from Metaverse vendors and were among the earliest developers of VR/AR gaming through the success of Pokémon Go. Today, developers of Metaverse games like Decentraland and Sandbox leverage Unity's gaming engine, which is currently played on web browsers and mobile apps. But with Unity's interoperable technology, this could potentially extend to other gaming platforms. Moreover, Unity — along with Dassault, Hexagon and Nvidia — benefits from adoption of digital twin technology, which includes immersive virtual 3D representation of real-time physical counterparts. Finally, there are new digital products like non-fungible tokens (NFTs) for which the Metaverse provides a natural expansion opportunity.

In hardware and semiconductors, Nvidia will supply real-time rendering graphic chips (GPUs) and expand its enterprise Omniverse for real-time creative collaboration and digital twin factories. Intel and AMD will supply high-performance computing chips (CPUs), while Apple will be a big provider of VR/AR glasses and serve as a major apps platform. Qualcomm will provide VR/AR goggles, 5G chipsets and Edge AI connectivity. Finally, Cisco will provide required end-to-end enterprise networks and security.

What ESG Considerations Arise With the Creation of the Metaverse?

Innovative technologies often bring new environmental, social and governance (ESG) concerns, and we expect the Metaverse to be no different. Environmentally, the Metaverse will increase network traffic and data center processing which will create massive demands for electricity.¹⁷ However, the negative impact of increased electricity usage will be netted against the benefits provided by reduced travel needs as people switch from in-person attendance to virtual attendance. From the social perspective, the Metaverse could break down barriers between geographic and socio-economic groups, although it may also create additional mental health challenges. Finally, governance of the Metaverse must be coordinated globally, between public and private sectors, as well as within the private sector, to maintain users' rights, security and privacy.¹⁸

In summary, the Metaverse, when fully-realized, promises to not only significantly change our everyday experiences, but to generate trillions of dollars in economic value and provide substantial and attractive investment opportunities. We continue to monitor this important and highly dynamic trend to maximize the benefit to our investors.

This information should not be considered a recommendation to invest in a particular security or to buy or sell any security shown. It is not known whether the securities shown will be profitable in the future.

Endnotes

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* Pensions & Investments Research Center, as of December 31, 2020.

[†] This figure is presented as of March 31, 2022 and includes approximately \$73.35 billion USD of assets with respect to SPDR products for which State Street Global Advisors Funds Distributors, LLC (SSGA FD) acts solely as the marketing agent. SSGA FD and State Street Global Advisors are affiliated.

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