

# Framing the Future of Web 3.0

## METaverse EDITION

In our view, the global Internet is in the middle to late innings of the innovation curve of Web 2.0 (the shift from desktop to mobile computing & from local to cloud storage) and the “leaders” of this wave of the Internet are now firmly established. In framing the next wave of computing (Web 3.0), we see the potential for dramatic shifts in industry structure (decentralized, more local/niche/targeted) that could impact current investor perceptions of platform moat/strength, industry input costs, possible headwinds to monetization driven by personalization and potential for shifting media & commerce trends. One element of Web 3.0 that has recently captured media & investor attention is the “Metaverse” – a term that has taken on many meanings but with common themes around virtual and immersive experiences, online communities and the creator economy. In the report, we examine how the gaming/media landscape has already shown some key elements as to how the Metaverse might evolve and how themes such as decentralized web activity & virtual experiences could become hallmarks of many of the next wave of computing in Web 3.0.



**Eric Sheridan**  
+1 917 343-8683  
eric.sheridan@gs.com  
Goldman Sachs & Co. LLC

**Michael Ng, CFA**  
+1 212 902-8618  
michael.ng@gs.com  
Goldman Sachs & Co. LLC

**Lane Czura**  
+1 917 343-8682  
lane.czura@gs.com  
Goldman Sachs & Co. LLC

**Alexandra Steiger**  
+49 69 7532-3097  
alexandra.steiger@gs.com  
Goldman Sachs Bank Europe SE

**Alex Vegliante, CFA**  
+1 212 934-1878  
alex.vegliante@gs.com  
Goldman Sachs & Co. LLC

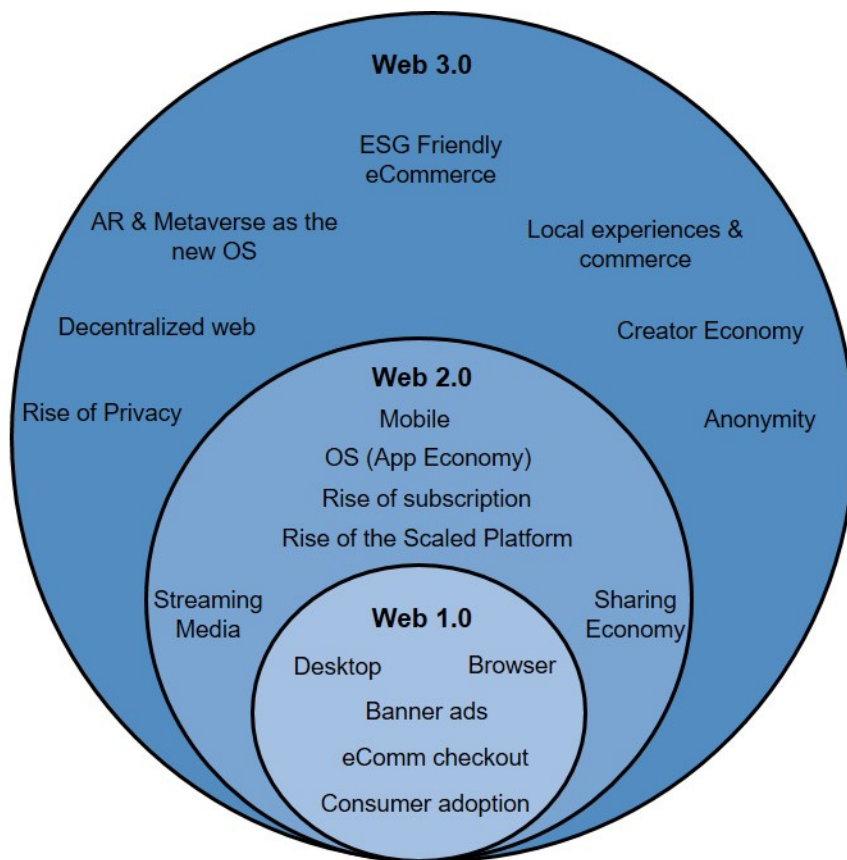
**Katherine Campagna**  
+1 212 902-1151  
katherine.a.campagna@gs.com  
Goldman Sachs & Co. LLC

Goldman Sachs does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to [www.gs.com/research/hedge.html](http://www.gs.com/research/hedge.html). Analysts employed by non-US affiliates are not registered/qualified as research analysts with FINRA in the U.S.

## Framing the Transition to Web 3.0

In our view, the global Internet is in the middle to late innings of the innovation curve of Web 2.0 (the shift from desktop to mobile computing & from local to cloud storage) and the “leaders” of this wave of the Internet are now firmly established. The defining characteristics of a Web 2.0 “leader” are scale of users, utility-like nature of mobile/desktop applications/services (if not a family or ecosystem of apps) & low to no distribution costs (companies have gained broad based familiarity with some turning into verbs). As seen in the figure below, we see dramatic shifts in the industry trends in Web 3.0 (decentralized, more local/niche/targeted, etc) that could impact current investor perceptions of platform moat/strength, industry input costs, possible headwinds to monetization driven by personalization and potential for shifting media and commerce trends as we transition to Web 3.0.

**Exhibit 1: Evolution of Decentralized Web**



Source: Company data, Data compiled by Goldman Sachs Global Investment Research

So what form might “Web 3.0” take? We lay out a few key principles:

- Likely more control by the user of their data (including data residing on-device);
- Likely a more micro focus - a mean reversion on scale (either in end market being tackled or in relationship between the platform and the user);
- The rise of individual as creator & creator monetizing their content more directly with “fans”;
- Increasingly decentralized (with the possible breakdown of the mobile operating system/app store distribution model over the next 5-10 years ); &
- Flexibility (if not innovation) on payment mechanisms aimed at a mix of themes, including decentralized privacy and anti-establishment.

As with any new wave of computing, in our opinion, the disruption that it causes is likely to be more impactful on current industry dynamics than outside forces (e.g., potential regulation).

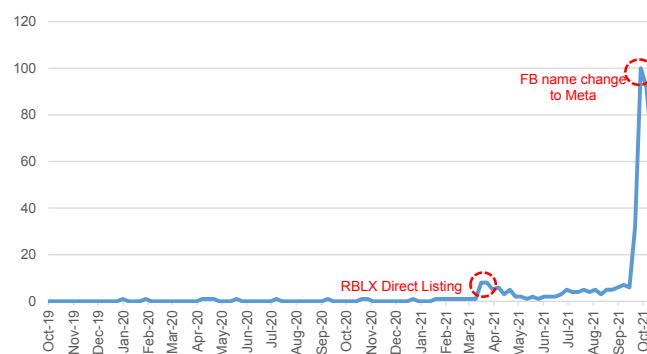
## What is the Metaverse?

In the early '90s, Neal Stephenson first coined the phrase “Metaverse” in his science fiction novel, Snow Crash. Decades later, industry investor/analyst Matthew Ball raised awareness around the phrase “Metaverse” in a series of essays that was focused on the present/future of Epic Games (owner of Fortnite). Both of these thinkers have set a benchmark of themes which investors could envision key elements of the industry shifting from Web 2.0 to Web 3.0. Large tech platforms (which benefited from the rise of mobile computing apps) now look toward augmented reality as the next computing platform shift. Along those lines, repositioning key consumer/enterprise offerings to evolving media consumption applications (gaming, avatars, attending sports/concerts, exercise) seems like the next logical shift in consumption patterns that will likely drive platform unit economic shifts and create new leader/laggard status among industry players.

One interesting aspect of this evolution is the inter-connectivity of such a computing landscape and the possible erosion of the walled garden elements of the mobile computing wave. While there remain key friction points to solve such as hardware form factor (especially cost curve), broadband connectivity and mass appeal use cases, most investors and tech operators (probably most notable is Mark Zuckerberg’s focus at Meta Platforms and the broader gaming industry) are planning and investing toward platform evolution in this direction.

Over the past 12 months, the term Metaverse began to gain traction shortly after Roblox’s direct listing in March and more meaningfully saw higher levels of Google Search interest during the Q3 '21 earnings season as various management teams discussed elements of their business within the future Metaverse. More significantly, Meta Platforms (formerly Facebook) changed its name to reflect CEO Mark Zuckerberg’s vision of Meta’s role within the Metaverse. That said, the term has taken on many forms/definitions with commonalities/themes around virtual experiences, interoperability, creator community, immersive, and many other elements.

**Exhibit 2: Metaverse Google Search Interest**



Google Trends (<https://www.google.com/trends>)

Source: Google Trends, Data compiled by Goldman Sachs Global Investment Research

Similar to elements within Web 2.0 around the iPhone/iOS, we view augmented reality & virtual reality as technology enabling the Metaverse whereby services, content, and more are all layered on top and accessed/consumed through the mvergence of virtual 3-D and physical experiences. However, below we outline how US internet & gaming companies are defining the term.

### **Meta Platforms**

CEO of Meta Platforms, Mark Zuckerberg views the Metaverse as a successor to mobile internet that will:

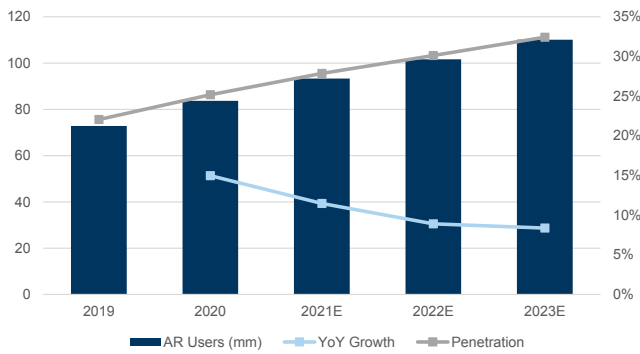
(1) **Elevate physical world experiences.** Through mixed reality and physical-world experiences, the Metaverse will magnify the feeling of presence. Currently, there are multiple use cases of AR (including Spark AR) that serve as a template for the future of Metaverse applications, specifically how businesses have utilized AR to enable consumers to virtually see how certain furniture fits within their home or try on makeup/glasses. In the future, Zuckerberg envisions a world in which many physical objects (e.g., TV, computers, etc.) can simply be holograms designed by creators and consumers will use AR glasses to optimize the physical world and VR to be fully submerged in the virtual world.

(2) **Be co-created & built responsibly.** Similar to a lot of other US TMT companies, Zuckerberg believes that many entities will work together to build the Metaverse (including businesses, creators, policymakers, entrepreneurs, etc.) with integrity, safety, and privacy at the center of its foundation. To support this framework, open standards and interoperability are also core to the Metaverse with new forms of governance likely to emerge.

Zuckerberg believes the Metaverse is coming within the next 10 years, but expects that in the near-term, consumers will first experience the Metaverse through 2D apps, citing examples within commerce (buying physical or digital products) or entertainment (hosting a mixed-reality experience with consumers buying a ticket for in-person or virtual event). Similar to what we saw with the mobile internet, consumer adoption of AR & VR will be a driving factor in business opportunities.

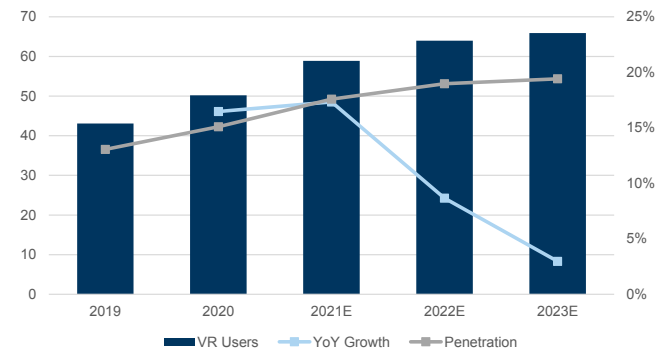
In order to better understand the timeline around the Metaverse opportunity, we look at eMarketer data to assess what current penetration rates are and forward growth assumptions for both AR and VR. While AR represents a larger opportunity when compared to VR, we highlight that penetration rates still remain low with AR users expected to be ~28% of the US population and VR users at ~18% in 2021. We also note that AR numbers are likely to be inflated as they include any individual that experiences AR content as least once per month via any device (e.g., anyone with an Apple/Android device who uses an AR feature in the app, such as AR in Snapchat). With the pandemic removing a lot of physical experiences, the AR and VR market saw strong growth in 2020. Going forward, we expect that technological advances (such as 5G, edge computing) coupled with more use cases (beyond gaming, social media, entertainment) are likely to drive consumer adoption. That said, the low penetration rates in the next 2 years are a key indicator around the timing of the Metaverse opportunity.

**Exhibit 3: US Augmented Reality Users**  
(mm, 2019-2023E)



Source: eMarketer, Data compiled by Goldman Sachs Global Investment Research

**Exhibit 4: US Virtual Reality Users**  
(mm, 2019-2023E)



Source: eMarketer, Data compiled by Goldman Sachs Global Investment Research

**Roblox**

CEO of Roblox, David Baszucki, views the Metaverse as a virtual universe that is persistent and shared where platforms connect people from different realms of life and enables them to communicate in a new way through the combination of technology and high-fidelity communication, borrowing from mobile gaming and the entertainment industry. Baszucki has often referred to Roblox as a human co-experience that predicated on the following fundamentals: identity, social, immersive, low friction, variety, anywhere, economy, and civility.

**Epic Games**

CEO of Epic Games, Tim Sweeney, envisions the Metaverse as an expansive, communal, & virtual world where people can interact with brands, intellectual properties, and each other with experiences spanning across all categories (beyond gaming). Similar to others, Sweeney believes that individuals will build the Metaverse through user-generated content and there must be a free & fair economy in which all users can partake, make money, and be rewarded. Additionally, every participant (from an individual to a brand to a major developer) must participate on equal terms. Aside from the underlying technology, Sweeney believes that opening up walled gardens and applying industry standards and laws will be pivotal to the Metaverse.

**Niantic Labs**

CEO of Niantic Labs, John Hanke, has labeled the Metaverse as a “dystopian nightmare” ([link](#)) and is focused on building a better reality by enhancing the physical world through augmented reality, which he has labeled as “real-world Metaverse” in an effort to differentiate it from the virtual video game version. At the core of Hanke’s thesis is data, information, services, and interactive creations where digital meets physical. To Hanke, the key technical challenges in achieving his goal are synchronizing millions of users globally (“shared state”) and tying these users to the physical world, which he believes represents the larger challenge of the two.

## Nvidia

CEO of Nvidia Jensen Huang has defined the Metaverse as a 3D extension of the internet today and expects the virtual economy to be much larger than the real-world economy. In an effort to build the Metaverse, Huang is focused on the Omniverse at Nvidia which is a platform centered on collaboration and simulation, enhancing existing workflows by creating virtual worlds. As an example, Ericsson has partnered with Nvidia using the Omniverse to build virtual cities that replicate physical cities in an effort to accurately simulate 5G cells and the environment, optimizing for performance and coverage.

## What is the cost?

---

Looking back at the shift from Web 1.0 to Web 2.0, there were various cost components tied to Web 2.0 that all built on Web 1.0. Similarly, there will be significant costs tied to Web 3.0 that build upon Web 2.0 infrastructure. Given the complexity involved in quantifying the investments needed, we look at Meta Platforms' recent segment disclosures for Facebook Reality Labs as a way to better understand what level of costs are required to support the build-out of the Metaverse.

With Meta's last earnings report, management announced plans to break out reporting by two separate segments, Family of Apps and Facebook Reality Labs which will include augmented and virtual reality related hardware and software content. Management guided Facebook Reality Labs to be a \$10bn headwind to total consolidated EBIT in 2021.

More specifically, Meta intends to invest in:

- **Data center infrastructure.** Over the past decade, Meta has invested ~\$17bn against 14 data centers in the US and ~\$4.1bn against 4 data centers internationally, amounting to ~\$21.3bn. Meta's President of Infrastructure & Data Centers, Tom Furlong, has stated that they have 48 active buildings and another 47 buildings under construction, signaling 70 additional buildings in the coming years.
- **Further iterations of VR and AR Products + Content.** In 2014, Facebook acquired

Oculus for ~\$2bn as its first foray into virtual reality products. From 2014 to 2016, Meta had invested \$250mm into VR content and committed an additional ~\$250mm to fund future content projects. During the 2017 Connect event, CEO Mark Zuckerberg commented that it plans to invest \$3bn+ over the next decade against VR products. Since then, Meta Platforms has meaningfully accelerated its investments, purchasing 6 VR content studios in the past 2 years.

- **Hiring talent.** As of March 31, 2021, roughly 10,000 employees have been focused on building out Meta's augmented and virtual reality efforts, representing nearly 1/6 of Meta's employee base. During the last earnings call, management announced their goal to double this by hiring an additional 10,000 employees in Europe for its Facebook Reality Labs segment over the next five years.
- **Responsibility.** In late September 2021, Meta announced plans to invest ~\$50mm in several global partnerships over the next two years in order to ensure Metaverse related products are being developed responsibly. To date, Meta has announced ~18 partnerships that are focused on ensuring responsibility across a few key areas: economic opportunity, privacy, safety & integrity, and equity & inclusion.
- **Content Creators.** During the 2021 Connect event, Meta announced that it will create a ~\$150mm fund to help train and develop the next generation of creators. Specifically, these investments will focus on Metaverse creators' skillset, high-quality training content, increasing global access to Meta technologies, and responsible research. In addition to Meta's ~\$150mm VR/AR learning fund for creators, Meta has also recently announced a ~\$10mm creator fund to support Horizon. Meta will distribute these funds through community competitions offering up to ~\$10k for the top 3 winners, its Creator Accelerator Program which will launch in early 2022, and partnerships for funded opportunities.

That said, we take a look at other public companies investing against Metaverse as well as funding within the private markets and provide an illustrative scenario analysis around the total potential spend against this opportunity in the coming years. Looking at the underlying holdings of the META ETF, we calculate the market cap of each company and apply a percentage to the total market cap of ~\$12,500tn. In addition, we look at the private market across gaming, online games, augmented reality, and virtual world categories - during 2021, ~\$10.4bn of capital has been raised so far across 612 deals (up from ~\$5.9bn in 2020). As can be seen in [Exhibit 5](#), there are a range of potential outcomes with ~\$135bn of investments at the low end to ~\$1.35tn at the high end - however, we view the more likely scenario as ranging from ~\$135-700bn based on our assumption that Meta Platforms investments over the next three years (as a percentage of market cap) will be the largest.



**Exhibit 5: Illustrative scenario Analysis Around Levels of Investments (\$bn)**

		% of Market Cap									
		1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Private Funding	\$ 10	\$ 135	\$ 260	\$ 384	\$ 509	\$ 634	\$ 759	\$ 884	\$ 1,008	\$ 1,133	\$ 1,258
	\$ 20	\$ 145	\$ 270	\$ 394	\$ 519	\$ 644	\$ 769	\$ 894	\$ 1,018	\$ 1,143	\$ 1,268
	\$ 30	\$ 155	\$ 280	\$ 404	\$ 529	\$ 654	\$ 779	\$ 904	\$ 1,028	\$ 1,153	\$ 1,278
	\$ 40	\$ 165	\$ 290	\$ 414	\$ 539	\$ 664	\$ 789	\$ 914	\$ 1,038	\$ 1,163	\$ 1,288
	\$ 50	\$ 175	\$ 300	\$ 424	\$ 549	\$ 674	\$ 799	\$ 924	\$ 1,048	\$ 1,173	\$ 1,298
	\$ 60	\$ 185	\$ 310	\$ 434	\$ 559	\$ 684	\$ 809	\$ 934	\$ 1,058	\$ 1,183	\$ 1,308
	\$ 70	\$ 195	\$ 320	\$ 444	\$ 569	\$ 694	\$ 819	\$ 944	\$ 1,068	\$ 1,193	\$ 1,318
	\$ 80	\$ 205	\$ 330	\$ 454	\$ 579	\$ 704	\$ 829	\$ 954	\$ 1,078	\$ 1,203	\$ 1,328
	\$ 90	\$ 215	\$ 340	\$ 464	\$ 589	\$ 714	\$ 839	\$ 964	\$ 1,088	\$ 1,213	\$ 1,338
	\$ 100	\$ 225	\$ 350	\$ 474	\$ 599	\$ 724	\$ 849	\$ 974	\$ 1,098	\$ 1,223	\$ 1,348

META ETF top holdings include: NVDA, MSFT, RBLX, U, ADSK, SE,AMZN,TCTZF, TSM, AAPL, SNAP, QCOM, FSLY, INTC, SNEJF, TTWO, MITR, GOOG, COIN, AMD, NET, ADBE, EA. Date as of 12/8/2021.

Source: Company data, Goldman Sachs Global Investment Research, FactSet

## What are the potential use cases and TAM?

### Current State of Virtual Reality: Examining Oculus

In March 2014, Meta Platforms acquired Oculus for \$2.4bn as a way to gain a footprint in the virtual reality landscape. Following the acquisition, Meta Platforms launched Oculus Rift (the first consumer model) in March 2016 at a starting price of \$599, followed by Oculus Go in May 2018 (with a starting price of \$199). In May 2019, Meta Platforms debuted Oculus Quest which would replace Oculus Rift for a starting price of \$399. Since then, Meta Platforms released a new version of Oculus Quest, with a starting price of \$299, the lowest price within the competitive landscape. As can be seen below, Oculus Quest 2 (which will later be renamed to Meta Quest 2) has resulted in significant YoY growth rates for Meta Platforms' payments & other revenue segment, whereby consumer hardware represents the vast majority based on our estimates.

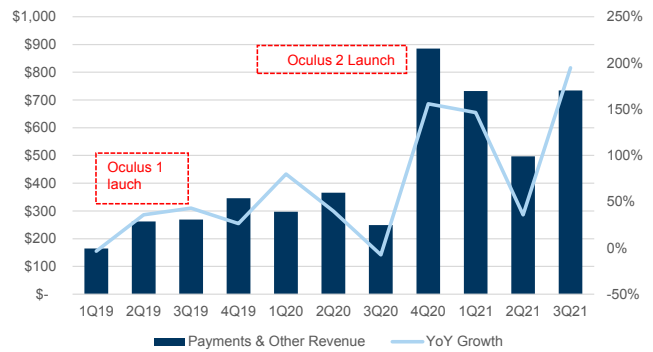
**Exhibit 6: Consumer VR Competitive Landscape**

Competitive Landscape	
Oculus Quest 2	\$299
Playstation VR*	\$399
Valve Index	\$499
Vive Pro 2	\$799
HoloLens 2	\$3,500

\*Sony has announced a second version of Playstation VR but has not yet disclosed the price point

Source: Company data, Goldman Sachs Global Investment Research

**Exhibit 7: Meta Platforms Payments & Other Revenue \$mm, Q1 '19 - Q3 '21**



Source: Company data, Goldman Sachs Global Investment Research

### The Gaming Industry: Setting the Stage for What's Ahead

Prior to COVID-19, video games were already starting to blur the lines between virtual and physical events & activities as demonstrated by in-game events in Fortnite and Roblox (e.g., Star Wars: The Rise of Skywalker, DJ Marshmello concert, Weezer album debut), professional eSports players partnering with celebrities on Twitch (e.g., Drake and Ninja playing Fortnite), and Take-Two's online casino in Grand Theft Auto where gamers could gamble real money. As a result of these in-game events and activities, these key franchises saw user base expansion and increased levels of engagement, consumption, and ultimately monetization. And on the other hand, these events allowed content creators to connect with the next generation in a new forum that boasts high levels of engagement.

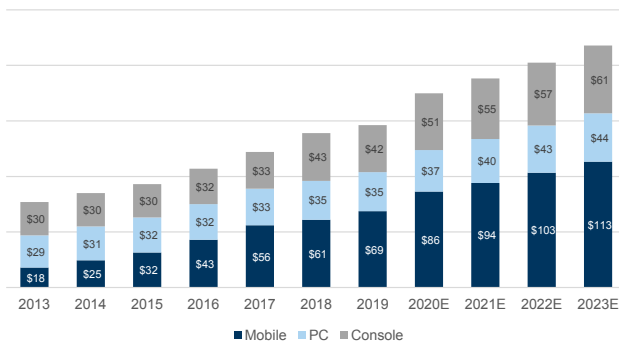
During COVID-19, social restrictions placed an importance on the need to have virtual events and connections, resulting in the social acceptance of virtual existence. During the pandemic, video games, streaming platforms, and communication apps allowed consumers to digitally connect with one another, with cancelled in-person graduations ceremonies, weddings, and many other significant life events taking place via Minecraft, Roblox, and other platforms. These examples demonstrated the many use cases video game platforms can offer. Prior to COVID-19, many of the platforms were more in an experimental phase in terms of integrating live events. During COVID-19, we saw a wave of consumers creating their own virtual worlds in an effort to replicate physical worlds. Coming out of COVID-19, we are now seeing platforms invest in a greater sense of presence and individuality (e.g., gamer's avatar connecting directly with an artist in Roblox) in an effort to further blur the lines between virtual and physical existence.

### Large and Growing Market Makes Gaming an Attractive Platform to Connect with Others

The video games market was approximately \$175bn in 2020, marking a 13% 3-year CAGR (2017-20), and is projected to grow at an 8% 3-year CAGR (2020-23), according to

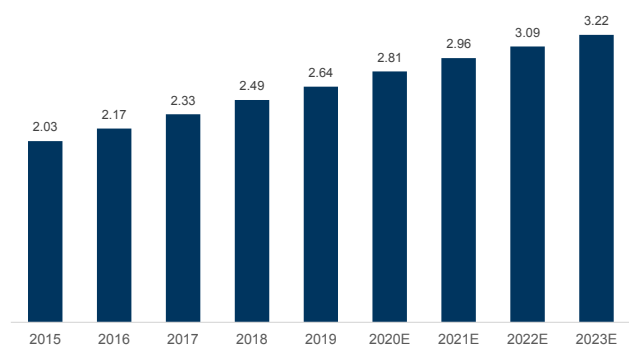
Newzoo (see [Exhibit 8](#)). Within the global games market, mobile is the largest segment at ~\$94bn in 2021 and has realized a 25% CAGR (2013-19), making it the fastest growing platform (i.e., faster than PC and console), well above overall industry growth of 11% over the same time period. In addition, we note that the global player base is estimated to grow to ~3.22bn by 2023 (according to Newzoo) from 2.03bn in 2015 driven by a growing installed base of smartphones, the rollout of 5G, and a new generation of gamers adapting mobile games coupled with a growing number of high-quality games made for mobile. We note that COVID-19 accelerated many of the long-term tailwinds as many consumers turned to video games as a way to connect with others virtually.

**Exhibit 8: Global Games Market**  
\$bn, 2013-2023E



Source: Newzoo, Data compiled by Goldman Sachs Global Investment Research

**Exhibit 9: Global Players**  
bn, 2015-2023E



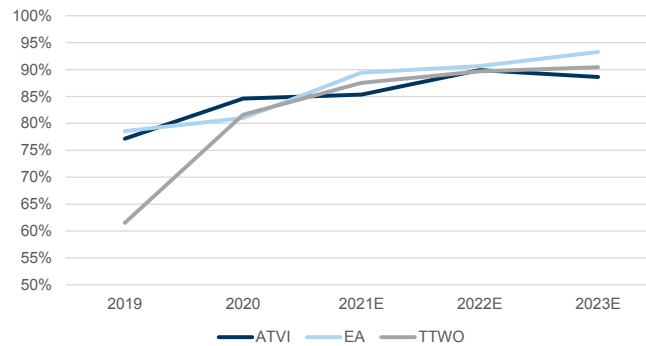
Source: Newzoo, Data compiled by Goldman Sachs Global Investment Research

### Breaking Down Walled Gardens Unlocks the Digital Transformation and Monetization of Long-Tailed Engagement

Looking back on the history of video games, traditional games were typically purchased with an upfront fee of ~\$60 with players only allowed to play with others based on the player’s platform (e.g., Xbox vs. Playstation). In 2017, Fortnite was released as a free-to-play Battle Royale game that was cross-platform (by Sep 2018), which opened up the addressable market and drove a myriad of competitive and social elements given the ability to play with other players regardless of the platform - all of these elements allowed Epic Games to create an ecosystem in which they can promote live services (e.g., monetize skins that have no direct impact on game play) and host virtual events (e.g., Ariana Grande) for gamers to connect with each other as well as the artist. Since then, the business model across video game companies has transformed from physical unit sales for premium games to in-game content (events, competitions, skins, etc.) layered on top of premium games and monetized through various forms (premium, in-game purchases, advertising, battle/season passes), which has led to the rise of virtual currency. Furthermore, live streaming platforms (e.g., Twitch) and eSports have also driven long-tail engagement around key gaming franchises as an additional way to interact with other gamers, further strengthening the community and expanding the economic opportunity (through tips, sponsorship, advertising, etc.). Over time, AAA publishers have increasingly focused on developing in-game content to drive engagement and ultimately monetization - as can be seen below, the vast majority of

AAA publishers has seen an increasing mix towards digital revenues (vs. physical).

**Exhibit 10: Digital Bookings by AAA Publishers**  
%, 2019-2023E

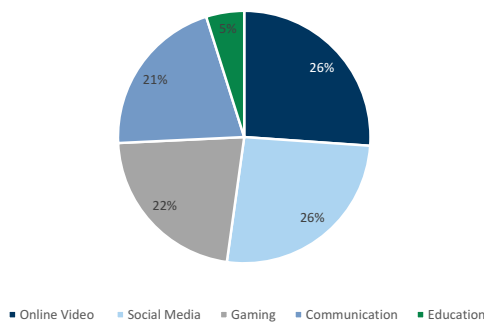


Source: Company data, Goldman Sachs Global Investment Research

**Next Generation of Users Places Importance on Social Elements and Virtual Worlds Within Gaming**

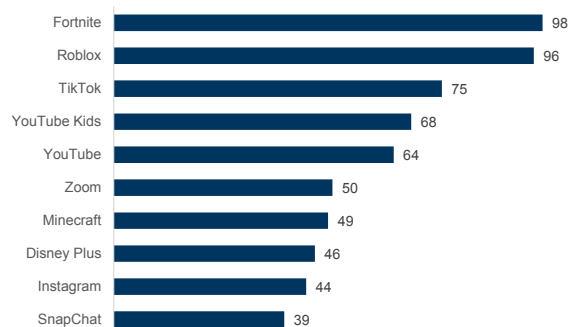
Looking at how the next generation of users spends their digital time in 2020 across the US, UK, Spain, online video and social media both represent ~26% of screen time at ~45 minutes, with gaming falling closely behind at ~22% of screen time or ~38 minutes. However, when looking at the top apps by time spent, Fortnite and Roblox rank first and second with more than an hour and a half spent in the games, both of which are open environment multi-player games, signaling the value the younger generation places on social elements and virtual worlds within gaming.

**Exhibit 11: Time Spent by App Category**  
%, 2020



Source: Data compiled by Goldman Sachs Global Investment Research, Qustodio

**Exhibit 12: Time Spent by App**  
minutes, 2020



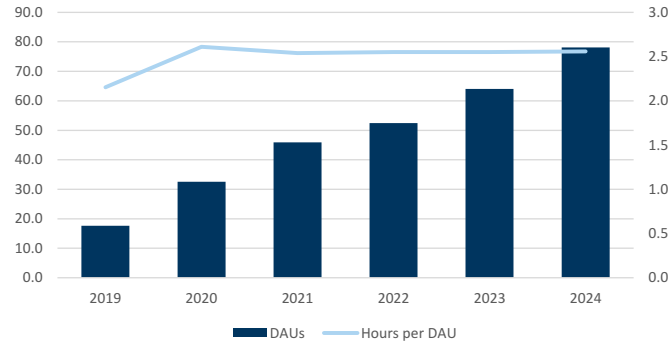
Source: Data compiled by Goldman Sachs Global Investment Research, Qustodio

**Emergence of Virtual Experiences and Widespread Gamer Adoption Highlights the Opportunity Ahead**

Looking at Roblox specifically, the company currently has ~47mm DAUs with expectations to grow to ~78mm by 2024 consuming ~2.6 hours per DAU per day of “experiences”. Roblox monetizes its user base through the sale of its virtual currency, Robux (R\$), which can be used to enhance game experiences, customize a player’s

avatar, or acquire development resources. Developers are compensated in Robux, which can be exchanged for fiat currency or spent back into the platform. As laid out in Goldman Sachs initiation, Roblox’s platform includes content developed by individual creators and video game studios, as well as non-endemic businesses such as film/TV studios (e.g., Warner Bros, Netflix) and musical artists (e.g., Lil Nas X) demonstrating the use cases for non-gaming general entertainment.

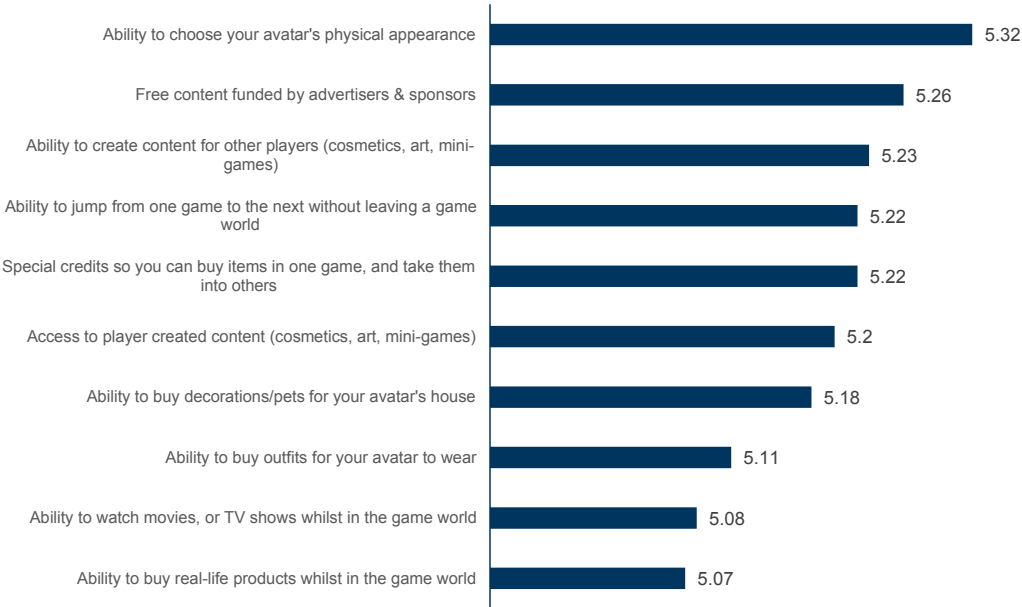
**Exhibit 13: Roblox DAUs (mm) and Hours per DAUs**



Source: Company data, Goldman Sachs Global Investment Research

According to a survey conducted by Newzoo, consumers view the ability to choose their avatar’s physical appearance as a key feature in terms of driving overall enjoyment within the metaverse, followed by free content funded by advertisers & sponsors, and ability to create content for other players. These are all elements that Roblox has been investing behind in order to enhance the users’ virtual experience.

**Exhibit 14: Metaverse features and benefits**



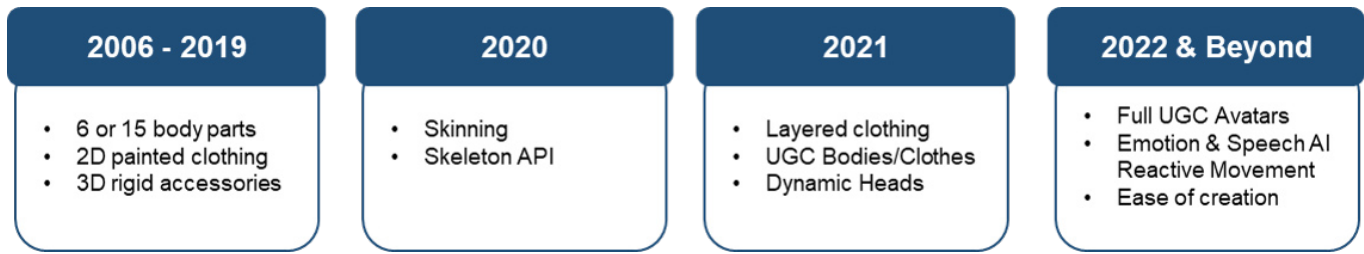
Q: How good or bad do you think each of the following content and features would be, in terms of your overall enjoyment? [Mean score out 7]

Source: Newzoo, Data compiled by Goldman Sachs Global Investment Research

### Investing in Virtual Identity Through User-Generated Avatars

While the Roblox marketplace (where gamers can purchase clothing accessories and simulated gestures for their avatar) only represents ~25% of total revenue, Roblox is investing heavily in the avatar marketplace by improving fidelity (e.g., layered clothing, facial animations, photorealistic skin meshes) in an effort to enhance the feeling of presence & individuality among the gamer base. Despite representing the minority of revenue, avatars are a key element of the Roblox experience as 20% of users change their avatars daily - the more personalized a gamer’s avatar is, the more engaged they are, the more invested they are in the platform, and the more time they spend.

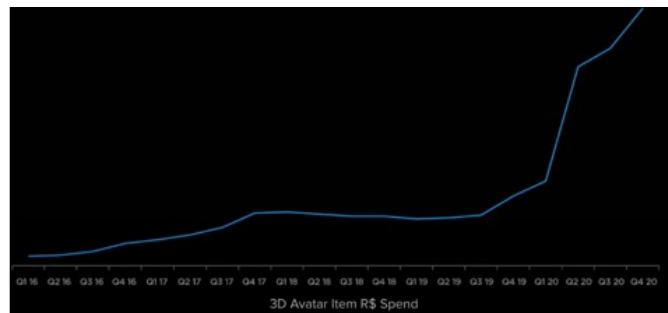
**Exhibit 15: Roblox Avatar Timeline**



Source: Company reports, Goldman Sachs Global Investment Research

Prior to 2019, Roblox developed all content sold within the avatar marketplace in-house. Roblox then shifted to a user-generated content (UGC) model in 2019, which it trialed with a select group of Roblox developers. Notably, Roblox experienced a 250% increase in avatar marketplace transactions upon turning the avatar marketplace over to the developer community. Currently, the marketplace is open to ~500 developers who release ~350 items per week representing ~65% of all 3D avatar item sales. Going forward, Roblox plans to continue to invest behind UGC items by opening new items to UGC creation including layered clothing and avatar body & faces. Following that, Roblox will enable every new item type on the platform to be UGC and will also look to open up the current closed list of ~500 developers to all users (similar to how anyone can develop a Roblox experience). Over the long-term, management envisions a fully decentralized model whereby various brands and creators can build their own stores to sell virtual goods to consumers to further build out their virtual identity and beyond that, management also envisions a world in which consumers can virtually buy anything that you could in real life (e.g., pets, art, houses, cars, etc.) further expanding one’s identity within the Metaverse.

**Exhibit 16: UGC Drives Avatar Marketplace Spend**



Source: Company data, Goldman Sachs Global Investment Research, Company reports

## Real-Life Use Cases Beyond Gaming Signify Potential for Other Categories

In a Web 2.0 world, we have already seen open-environment games (e.g., Roblox, Fortnite, Minecraft) start to create and develop “Metaverse”-like experiences for all constituents, starting with Fortnite hosting an in-game concert with DJ Marshmello which had ~11mm concurrent players in attendance and nearly 27mm views on YouTube. Since then, Roblox, Epic Games, Microsoft, and many other companies have continued to build and create immersive virtual experiences by partnering with brands, musicians and labels, and educational institutions as can be seen below.

### Exhibit 17: Examples of Virtual Experiences & Collaborations on Roblox, Fortnite, & Minecraft

Date Announced	Platform	Category	Name
Feb-19	Fortnite	Concert	DJ Marshmello
Jul-19	Roblox	Entertainment	Stranger Things
Jul-19	Fortnite	Entertainment	Stranger Things
Jul-19	Roblox	Sports	Liverpool FC
Aug-19	Roblox	Sports	NFL
Nov-19	Roblox	Entertainment	Star Wars
Dec-19	Fortnite	Entertainment	Star Wars
Mar-20	Roblox	Other	Dr. Who Items
Apr-20	Fortnite	Entertainment	Punk'd
Apr-20	Minecraft	Concert	Nether Meant
Apr-20	Fortnite	Concert	Travis Scott
May-20	Minecraft	Music Festival	Block by Blockwest
May-20	Minecraft	Education	Cal Poly Graduation
Aug-20	Fortnite	Entertainment	Marvel
Aug-20	Fortnite	Entertainment	Tenet
Sep-20	Roblox	Music	Ava's Launch Party
Nov-20	Roblox	Concert	Lil Nas X
Jan-21	Fortnite	Entertainment	Terminator
Apr-21	Minecraft	Education/Music	College Green
May-21	Roblox	Fashion	Gucci
May-21	Roblox	Music	Zara Launch Party
Jun-21	Roblox	Entertainment	Stranger Things
Jul-21	Roblox	Music	Sony
Aug-21	Roblox	Music	KSI launch party
Aug-21	Fortnite	Music Tour	The Rift Tour ft. Ariana Grande
Aug-21	Fortnite	Concert	J Balvin
Sep-21	Roblox	Fashion	Vans
Sep-21	Fortnite	Fashion	Balenciaga
Sep-21	Roblox	Concert	21 Pilots
Sep-21	Roblox	Concert	(Qīshū) Launch Party
Sep-21	Roblox	Concert	Listening Parties
Oct-21	Fortnite	Entertainment	Batman
Oct-21	Roblox	Music Festival	Electric Daisy Concert
Oct-21	Fortnite	Concerts	Soundwave
Nov-21	Fortnite	Fashion	Moncler
Nov-21	Roblox	Concert	Verdes Concert
Nov-21	Roblox	Fashion	Nike
Nov-21	Roblox	Fashion	Fashion Award

Source: Company reports, Goldman Sachs Global Investment Research

Below we outline existing and potential use cases for music, retail, education, and



advertising as well as the existing market opportunity and digital penetration in an effort to better understand what the potential opportunity is by segment. As can be seen in [Exhibit 18](#), advertising and music have seen the highest levels of digital penetration while retail and education lag behind. In the following sections we outline Roblox's efforts and adoption by brands, music, and education. Similar to the current digital penetration rates outlined below, Roblox has seen more adoption by brands/artists while education is still in early phases.

**Exhibit 18: 2021 TAM (\$bn), 2021 Digital Penetration, and Virtual Use Cases - By Segment**

	Music	Retail	Education	Advertising
TAM	~\$68	~\$16,614	~\$5,500	~\$1,138
Digital Penetration	31%	17%	5%	37%
Use Cases	<ul style="list-style-type: none"> <li>• Streaming Music</li> <li>• Virtual concerts</li> <li>• Virtual Awards</li> <li>• Meet &amp; Greet</li> <li>• Virtual Studios</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual clothes</li> <li>• Virtual stores</li> <li>• Virtual fashion shows</li> <li>• Ability to purchase physical items in virtual worlds</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual labs</li> <li>• Virtual field trips</li> <li>• Virtual classrooms</li> <li>• Virtual clubs</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual billboards</li> <li>• Branded worlds</li> <li>• Branded stores</li> <li>• Branded clothing</li> <li>• Branded games</li> </ul>

Source: Goldman Sachs Global Investment Research, eMarketer, Euromonitor, IFPI Global Music Report 2021, Music & Copyright, OMDIA, PWC

### Integration of Brands Partnering with Roblox Accelerates Driven By Strong ROI

Over recent years, Roblox has seen accelerated adoption among brands in an effort to connect with a large and engaged user base through immersive experiences. Roblox's original brand partnerships were centered around creating virtual items or branded missions/scavenger hunts into existing experiences. Now, brands are going directly to the developer community on Roblox to create limited time events to promote physical experiences and/or products (e.g., In the Heights). Over the long-term, management expects brands will look to have a constant presence on Roblox through a persistent experience, such as Vans World. Below we outline a few key examples of how Roblox has evolved its relationships with brands across fashion & beauty (Gucci), entertainment (Warner Brothers), sports (NFL, Nascar), and retail (Chipotle) from selling digital items to limited time events by partnering with developers.

- Gucci Gardens.** During the pandemic, Gucci partnered with Roblox to recreate a virtual version of the Gucci Garden in Florence that includes a Gucci Store, Gucci Museum, and Gucci restaurant. In the virtual world, players were able to shed their avatars transforming into mannequins that then allowed these visitors to try on different Gucci virtual items which they could then purchase. While the Gucci Garden experience only lasted for two weeks, nearly 20mm people visited. Notably, the Queen Bee Dionysus bag was initially sold for ~475 Robux (or ~\$5) but given the scarcity behind it in terms of only being available for an hour a day on two days, the highest price sold was \$4,115 which compares to the real-life bag which is sold for \$3,400. This digital-only asset is not an NFT and can only be used within the Roblox platform, further highlighting the importance this generation of players

places on virtual identity.

- **Chipotle.** In October 2021, Chipotle partnered with Roblox to open its first virtual location and provided the first 30,000 Roblox users who visited the virtual restaurant in a Chipotle-inspired costume to receive a free burrito. In addition, Chipotle created a maze that unlocked exclusive virtual items. The event took place during the Halloween weekend in an effort to mimic trick-or-treating. The Roblox/Chipotle partnership represents Roblox's first food-related partnership, signifying the many use cases that Roblox can offer.
- **Vans World.** In September, Vans partnered with Roblox to launch Vans World, which is a persistent 3D skate park that allows users to compete, connect with others, design virtual skateboards and van shoes. Similar to Gucci Gardens, it also replicates its flagship skate park in London "House of Vans." To date, the virtual skate park has attracted ~48mm+ visitors and has allowed Vans to generate an additional source of revenue through the sale of virtual items. While brands are able to make incremental revenue through the sale of virtual goods, companies have not yet been able to sell physical products on the platform, which could represent a meaningful opportunity should Roblox choose to open up the platform.
- **Nikeland.** A few weeks ago, Nike partnered with Roblox to build Nikeland, which is a virtual space that includes fields, arenas, & courts for game play and product showrooms for virtual shoes and apparel to dress their avatar. Gamers can use real-life movements to power their game play if they have accelerometers on their mobile devices. While Nikeland is currently free to users, the brand is able to connect to the younger generation while also gaining real-time feedback as users try out new products in a virtual world.

### **Music on Roblox Provides a New Way for Artists to Connect with Fans While Driving Engagement**

Working with artists and labels, Roblox has been focused on new ways to connect artists to their fans through:

- **Virtual Concerts.** Roblox has partnered with several artists to host avatar-based performances and create virtual worlds with mini games (e.g., scavenger hunts) and virtual merchandise. In November 2020, Roblox partnered with Sony and Lil Nas X to create a virtual world and concert that resulted in ~37mm+ visits, ~60mm social media views, and ~\$10mm virtual merchandise sales (as of 9/30/2021).
- **Launch Parties.** Roblox has hosted several launch parties, which are video-based experiences with virtual worlds imagined by the artist that are intended to build on recent album releases by featuring top songs and hosting exclusive Q&As. A key example of a launch party is KSI who hosted his first launch party in August 2021 that has resulted in ~17mm+ visits, ~50mm social media views, and ~\$1mm+ in virtual merchandise.
- **Listening Parties.** In September 2021, Roblox announced Listening Parties for musicians, which builds on Launch Parties, whereby artists can release a new album in select top experiences on Roblox. Partnering with Roblox, Grammy-nominated artist Poppy released her new album in 9 Roblox experiences (four of which had 3bn

lifetime visits). Poppy's listening party drove 4x streams vs. all DSPs combined, 10mm+ free Poppy virtual merchandise, and 40k+ Roblox group members.

Going forward, Roblox is focused on persistent experiences, such as Roblox's partnership with music event promoter Insomniac that brought Electric Daisy Carnival music festival to the Roblox platform in October. Given Roblox's vast user base and the platform's ability to enhance creative connections between the artist and the fans, management foresees a world in which artists look to leverage the platform to reach millions of fans around the world (without travelling to multiple venues) and imagines that venues will start to scale back to more intimate settings allowing artists and fans to connect more meaningfully both in the physical and virtual world.

### **Virtual Educational Experiences Provide Students With a New Immersive Way to Learn**

Roblox Education is focused on allowing both students and educators to explore learning online through its Roblox Studio in STEM curricula and through its educational experiences. Since inception, Roblox has been in the education space and has seen 240+ organizations teaching with Roblox Studio across 74 countries. In addition, Roblox created "Learn and Explore" which allows aspiring developers to build their own game featuring educational experiences - as of Sep 30, 2021, Roblox has seen 7mm+ monthly users in educational experiences. To further strengthen educational use cases on the Roblox platform, management announced the Roblox Community Fund in November 2021. Initially, the ~\$10mm fund will be used to support:

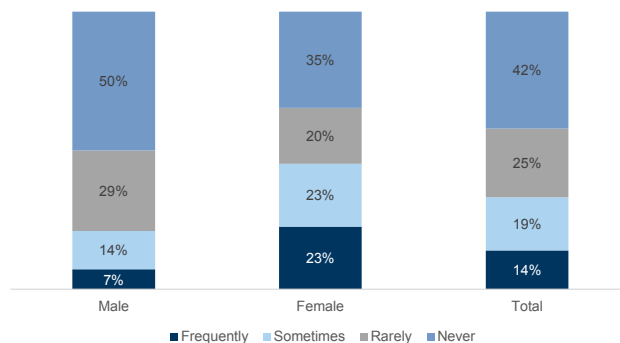
- **Project Lead The Way Partnership.** Roblox is partnering with Project Lead the Way (a non-profit organization that provides STEM curricula for K-12) to create 25 hours of curriculum around computer science, with expectations for 250k students in school to engage with the content.
- **FIRST Robotics and Filament Games.** FIRST Robotics (high-impact robotics organization that partakes in large in-person competitions) will partner with Filament Games to bring their competitions to Roblox in an effort to expand access for all students. Roblox expects 70k students to engage in these virtual events.
- **Museum of Science and Filament Games.** Through this partnership, Filament Games will focus on developing a Mission To Mars by partnering with the Museum of Science (STEM focused organization that reaches 1.4mm students a year). In Mission to Mars, students will be able to virtually learn what it is like to be a NASA scientist preparing for landing and inhabiting Mars. Enabling students to learn and explore through virtual experiences while also feeling a sense of presence opens up learning opportunities that were not previously possible.

### **Release of Wii in 2006 Served as Precursor To Fitness in the Metaverse**

In 2006, Nintendo released the Wii which allowed gamers to control game play with their body motions. Fast forward ~15 years, we have now seen other companies build online fitness games that also act as a pre-cursor for what's to come in the Metaverse. Specifically:

- **Peloton.** With COVID-19 restricting consumers’ ability to attend offline workout classes, Peloton’s connected fitness product saw significant adoption as users looked to workout while still being able to connect with others in a live setting. To further drive adoption of the product and engagement among existing users, Peloton is focused on bringing gaming to the platform through a rhythm-based game called Lanebreak. Management expects to release the game in early 2022. Along the virtual track, users are challenged to match and sustain the resistance or cadence to get to the highest score possible using the resistance knob. While Lanebreak represents the first step into a more interactive gamified experience, we still view “Metaverse” like experiences as further out - we could envision a world in which a combination of a VR headset and bike controller enables the user to partake in virtual races (e.g., Tour de France).
- **Meta Platforms.** In October 2021, Meta Platforms acquired Within, the developer of Supernatural. The Supernatural app is a subscription-based app (starting as low as \$15/month) that provides users with an immersive VR fitness experience that can be used with Oculus Quest headsets. In Supernatural, the player uses two hand controllers (that act as two sabers) in an effort to deflect flying objects, ultimately providing the user with an upper-body workout. The Supernatural workouts span across boxing, flow, meditating, and recovery while also allowing users to connect with coaches face-to-face in virtual reality. As discussed early (Exhibit 4), VR headsets have yet to gain widespread adoption. A common theme that we have heard over the years that has been a challenge for adoption of VR headsets is the motion sickness that stems from VR. As can be seen below, ~67% of total survey respondents have never or rarely experienced motion sickness with male respondents at ~79% while females lagged significantly behind at ~55%. Going forward, we believe VR hardware makers will focus on this element in order to capture a larger portion of the addressable market. That said, fitness apps will likely remain more under pressure when compared to other use cases.

**Exhibit 19: Percentage of Survey Respondents that Experience Motion Sickness in VR**



Data collected June 2020

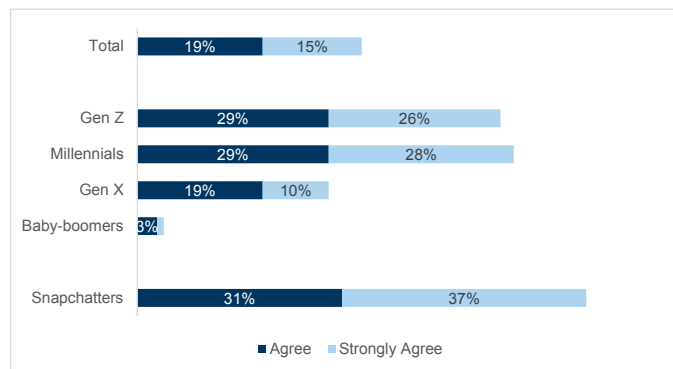
Source: VRHeaven, Data compiled by Goldman Sachs Global Investment Research

### The Rise of Visual Search and Social Commerce

Technology advances coupled with large-scaled adoption of social media channels (by consumers, brands, and influencers) have resulted in the rise of visual search and social commerce. Over the past decade, we have seen search evolve from text-based search to voice-based search to visual search with Google, Snap, and Meta leading the way.

- Google.** In 2017, Google announced Google Lens which is an AI-powered image recognition technology that provides users with various use cases when the user points the camera at an object. These use cases include: translating text with Google Translate, smart text selection (e.g., copy and paste of wifi password), smart text search via Google’s search engine, shopping, and search around you (e.g., provides details of your surroundings such as details on monument). At Google’s annual I/O developer conference, the company announced Multitask Unified Model which will be able to take information across an array of formats (from text to videos to images) and provide a user with an enhanced search result. As an example, you point the Google Lens to a hat you like and ask Google (via text) to find the pattern of the hat but in the form of a shirt. With the Multitask Unified Model combining the visual and text component, Google will be able to provide the user with enhanced search results.
- Snap.** To date, Snap has 200k Lens creators, developers, and partners building millions of AR experiences, with nearly ~2mm lenses created with Lens Studio, and ~2tn Lens views with use cases spanning across utility (e.g., taking spatial measurements), entertainment (new form of storytelling for entertainers), shopping (e.g., trying on shoes in AR and purchasing directly), self-expression for creative communication, games allowing multiple players to compete in shared AR gaming experiences, and education. According to a report published by Snap and Foresight Factory, ~35% of shoppers view social platforms as a better place to discover new products vs. searching online, with Snapchat users significantly above the average at ~68%.

**Exhibit 20: Percentage of Survey Respondents that Prefer Social Platforms for Product Discovery**



Source: Company data, Goldman Sachs Global Investment Research, Foresight Factory

- Meta.** In 2018, Meta Platforms announced Instagram Shopping which incorporated elements of visual search by allowing users to click on a product seen on an

Instagram story or page and then providing them with a link to either buy the product or learn more about it. Similar to features Snap and Pinterest have, Zuckerberg announced Instagram Visual Search in June 2021 to provide users with a list of search products similar to what was seen in the Instagram post or story, allowing the user to compare benefits and prices of the respective product. Looking ahead, we expect Meta will focus on its AR advertising efforts as the company invests significantly behind AR and VR products and content.

### Metaverse Market Opportunity

While Fortnite, Roblox, Minecraft, and many other games are typically viewed simply through the lens of video games, all of the aforementioned examples across fashion, music, & education highlight the convergence of virtual and physical experiences in a Web 2.0 world, which gives us confidence in continued adoption of virtual experiences as well as the expansion into other categories (such as fitness, enterprise, and more). Currently, these use cases only represent a small minority of their respective total addressable market.

Below we provide an illustrative scenario analysis around what percentage of the global digital market will shift towards the virtual world and also apply a range of how the Metaverse may expand the total addressable market (as evidenced by the Gucci example whereby digital fashion becomes an incremental revenue stream). According to the United Nations, the global digital economy represented 15.5% of total GDP in 2018 - we forecast the digital economy's share growing ~125bps to 16.8% by 2021, representing ~\$15tn. In the most bearish case with ~15% of the digital economy shifting towards the virtual world and ~2.5% market expansion from current estimated levels, we arrive at a ~\$2.6tn total market opportunity and in the most bullish scenario of ~33% of the digital economy shifting to the Metaverse and ~25% market expansion, we arrive at a ~\$12.5tn opportunity. While the range is quite broad, we acknowledge that we are still 20 years into web 2.0 and expect the timing of web 3.0 will be similar, if not longer.

**Exhibit 21: Scenario Analysis - Potential Metaverse Market Opportunity (\$tn)**

		% of Digital Economy Shifting to Metaverse									
		15.0%	17.0%	19.0%	21.0%	23.0%	25.0%	27.0%	29.0%	31.0%	33.0%
% of TAM Expansion	10.0%	\$ 3.75	\$ 4.05	\$ 4.35	\$ 4.66	\$ 4.96	\$ 5.26	\$ 5.56	\$ 5.86	\$ 6.16	\$ 6.46
	15.0%	\$ 4.51	\$ 4.81	\$ 5.11	\$ 5.41	\$ 5.71	\$ 6.01	\$ 6.31	\$ 6.61	\$ 6.91	\$ 7.21
	20.0%	\$ 5.26	\$ 5.56	\$ 5.86	\$ 6.16	\$ 6.46	\$ 6.76	\$ 7.06	\$ 7.36	\$ 7.66	\$ 7.96
	25.0%	\$ 6.01	\$ 6.31	\$ 6.61	\$ 6.91	\$ 7.21	\$ 7.51	\$ 7.81	\$ 8.11	\$ 8.41	\$ 8.71
	30.0%	\$ 6.76	\$ 7.06	\$ 7.36	\$ 7.66	\$ 7.96	\$ 8.26	\$ 8.56	\$ 8.86	\$ 9.16	\$ 9.46
	35.0%	\$ 7.51	\$ 7.81	\$ 8.11	\$ 8.41	\$ 8.71	\$ 9.01	\$ 9.31	\$ 9.61	\$ 9.91	\$ 10.21
	40.0%	\$ 8.26	\$ 8.56	\$ 8.86	\$ 9.16	\$ 9.46	\$ 9.76	\$ 10.06	\$ 10.36	\$ 10.66	\$ 10.96
	45.0%	\$ 9.01	\$ 9.31	\$ 9.61	\$ 9.91	\$ 10.21	\$ 10.51	\$ 10.81	\$ 11.11	\$ 11.41	\$ 11.71
	50.0%	\$ 9.76	\$ 10.06	\$ 10.36	\$ 10.66	\$ 10.96	\$ 11.26	\$ 11.56	\$ 11.86	\$ 12.16	\$ 12.46

Source: Goldman Sachs Global Investment Research, World Bank, United Nations

## Gatekeeper vs. Decentralization

One of the key elements that management teams and industry experts have stressed is

that the Metaverse must be an interoperable experience whereby consumers can seamlessly take virtual assets and experiences throughout the Metaverse. In Web 2.0, we have witnessed large-scaled walled platforms that require users to operate within the confines of the respective app, device, etc. While these walled gardens have allowed companies to collect vast amount of data and innovate & enhance products, the experience ultimately disadvantages consumers (by confining them to only operate within the respective ecosystem) and developers (by forcing their hand to develop for multiple devices and operating systems). Looking ahead, we anticipate that many large-scaled platforms will need to disrupt their business models in order to operate within the Metaverse. While we are still many years away from an interoperable world, we have started to see some progress being made on opening up walled gardens.

Using video games as an example, Sony did not support cross-platform play on PlayStation for many years, which confined a gamers’ experience to only that platform, meaning they could not connect and play with friends on other platforms and could not transfer in-game currencies as well as in-game progression outside of PlayStation. Ultimately, PlayStation opened up its platform and now accounts for nearly half of Fortnite’s revenue. The enablement of cross-platform play in the video games market was a pivotal moment that enhanced the user experience significantly by allowing gamers to connect and build a community within a game. In addition, developers have been able to innovate beyond game-play features and create experiences (e.g., virtual concerts) that further benefit the consumer while also bringing more constituents into the ecosystem (e.g, artists, brands, etc.).

**Exhibit 22: Social Aspects of Gaming**



Source: Accenture, Data compiled by Goldman Sachs Global Investment Research

Over recent years, we have seen increased scrutiny (by both regulators and third parties) around mobile app stores and their business practices with app developers. Specifically, there have been a number of lawsuits (Utah State AG et. al. v. Google; separate lawsuits from Epic Games v. Apple and Google; etc.) alleging certain business practices by app stores constitute monopolistic behavior, including commission fees on in-app purchases, limitations placed on communications between developers & consumers, and restrictions on developer’s ability to list on other app stores. Apple recently announced a settlement of a class-action lawsuit filed by a group of app developers, including several changes to its app store policies and a commitment to maintain its reduced 15% commission for small developers (<\$1m in annual revenue)

for the next three years.



# Disclosure Appendix

## Reg AC

We, Eric Sheridan, Michael Ng, CFA, Lane Czura, Alexandra Steiger, Alex Vegliante, CFA and Katherine Campagna, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

## GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our coverage universe) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

**Growth** is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

## M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

## Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

## Disclosures

**The rating(s) for Roblox is/are relative to the other companies in its/their coverage universe:** ANGI Homeservices Inc., Activision Blizzard Inc., Blend Labs, Bumble Inc., Cinemark Holdings, Compass Inc., Coursera Inc., Doximity Inc., Duolingo Inc., Electronic Arts Inc., Fiverr International Ltd., Frontdoor Inc., Funko Inc., Groupon Inc., Hasbro Inc., IAC/InterActiveCorp, IMAX Corp., Match Group, Mattel Inc., Opendoor Technologies Inc., Playtika, Poshmark Inc., Roblox, Sciplay Corp., Take-Two Interactive Software Inc., ThredUP Inc., Ubisoft Entertainment SA, Upstart Holdings, Xometry Inc., Yelp Inc., ZipRecruiter Inc., Zynga Inc., ironSource Ltd.

**The rating(s) for Meta Platforms, Inc. and Snap Inc. is/are relative to the other companies in its/their coverage universe:** Airbnb Inc., Alphabet Inc., Amazon.com Inc., Booking Holdings Inc., Chewy Inc., DoorDash Inc., Expedia Group, Lyft Inc., Meta Platforms, Inc., Netflix Inc., Peloton Interactive Inc., Pinterest Inc., Rent the Runway Inc., Snap Inc., Spotify Technology S.A., Twitter Inc., Uber Technologies Inc., eBay Inc.

## Company-specific regulatory disclosures

The following disclosures relate to relationships between The Goldman Sachs Group, Inc. (with its affiliates, "Goldman Sachs") and companies covered by the Global Investment Research Division of Goldman Sachs and referred to in this research.

Goldman Sachs has received compensation for investment banking services in the past 12 months: Meta Platforms, Inc. (\$329.82), Roblox (\$116.30) and Snap Inc. (\$52.36)

Goldman Sachs expects to receive or intends to seek compensation for investment banking services in the next 3 months: Meta Platforms, Inc. (\$329.82), Roblox (\$116.30) and Snap Inc. (\$52.36)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: Meta Platforms, Inc. (\$329.82), Roblox (\$116.30) and Snap Inc. (\$52.36)

Goldman Sachs had a non-securities services client relationship during the past 12 months with: Meta Platforms, Inc. (\$329.82)

Goldman Sachs has managed or co-managed a public or Rule 144A offering in the past 12 months: Roblox (\$116.30)

Goldman Sachs makes a market in the securities or derivatives thereof: Meta Platforms, Inc. (\$329.82), Roblox (\$116.30) and Snap Inc. (\$52.36)

Goldman Sachs is a specialist in the relevant securities and will at any given time have an inventory position, "long" or "short," and may be on the opposite side of orders executed on the relevant exchange: Snap Inc. (\$52.36)

## Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	50%	35%	15%	65%	58%	47%

As of October 1, 2021, Goldman Sachs Global Investment Research had investment ratings on 3,017 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage universe and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

## Regulatory disclosures

### Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage.

**Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

**Distribution of ratings:** See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at <https://www.gs.com/research/hedge.html>.

## Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for “wholesale clients” within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client’s objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client’s own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs’ Australian Sell-Side Research Independence Policy Statement are available at: <https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html>. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at <https://www.gs.com/worldwide/brazil/area/gir/index.html>. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above). Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for “professional investors” within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither “registered banks” nor “deposit takers” (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for “wholesale clients” (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: <https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html>. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

**European Union and United Kingdom:** Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom’s departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at <https://www.gs.com/disclosures/europeanpolicy.html> which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

**Japan:** Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

## Ratings, coverage universe and related definitions

**Buy (B), Neutral (N), Sell (S)** Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock’s total return potential relative to its coverage universe. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Coverage Suspended or Not Covered), is deemed Neutral. Each region’s Investment Review Committee manages Regional Conviction lists, which represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction lists do not represent a change in the analysts’ investment rating for such stocks.

**Total return potential** represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

**Coverage Universe:** A list of all stocks in each coverage universe is available by primary analyst, stock and coverage universe at <https://www.gs.com/research/hedge.html>.

**Not Rated (NR).** The investment rating, target price and earnings estimates (where relevant) have been suspended pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or in a strategic transaction involving this company, when there are legal, regulatory or policy constraints due to Goldman Sachs’ involvement in a transaction, and in certain other circumstances. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target price. The previous investment rating and target price, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company. **Not Available or Not Applicable (NA).** The information is not available for display or is not applicable. **Not Meaningful (NM).** The information is not meaningful and is therefore excluded.

## Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or [contatogoldmanbrasil@gs.com](mailto:contatogoldmanbrasil@gs.com). Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou [contatogoldmanbrasil@gs.com](mailto:contatogoldmanbrasil@gs.com). Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by either Goldman Sachs Canada Inc. or Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Effective from the date of the United Kingdom's departure from the European Union and the European Economic Area ("Brexit Day") the following information with respect to distributing entities will apply:

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

**European Economic Area:** GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland, Portugal, the Republic of Cyprus and the Republic of Ireland; GS - Succursale de Paris (Paris branch) which, from Brexit Day, will be authorised by the French Autorité de contrôle prudentiel et de résolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de résolution and the Autorité des marchés financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFSÅ as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject (to a limited extent) to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d'Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinspektionen) disseminates research in the Kingdom of Sweden.

## General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (<https://www.sipc.org>).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage universe as described herein.

We and our affiliates, officers, directors, and employees, excluding equity and credit analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at <https://www.theocc.com/about/publications/character-risks.jsp> and [https://www.fiaadocumentation.org/fia/regulatory-disclosures\\_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018](https://www.fiaadocumentation.org/fia/regulatory-disclosures_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018). Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

**Differing Levels of Service provided by Global Investment Research:** The level and types of services provided to you by the Global Investment

Research division of GS may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to <https://research.gs.com>.

Disclosure information is also available at <https://www.gs.com/research/hedge.html> or from Research Compliance, 200 West Street, New York, NY 10282.

© 2021 Goldman Sachs.

**No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.**