SEPTEMBER 2022 | REPORT

The metaverse and the UK opportunity

Meta

Table of contents

Executive summary

The metaverse presents a unique opportunity for the UK to assert itself as a global leader in technological innovation and influence the trajectory of its development. There is the potential for significant economic benefits for the UK, which we estimate to be £40 billion-£75 billion in additional GDP annually by 2035.

The metaverse is the next evolution in social connection and the internet.

It consists of interconnected digital spaces, many of them immersive 3D experiences. The defining quality of the metaverse for users will be a feeling of presence, achieved through the convergence of several separate technologies. These technologies include virtual and augmented reality (VR and AR), blockchain and artificial intelligence.

Development of the metaverse is still in the early stages, **and the UK is in a strong position to take a leading role**. The UK is:

- Europe's largest data economy, worth 4% of UK GDP and with an overall impact close to £125 billion in 2021.[1]
- A world leader in research and innovation, with 4 of the top 10 universities and ranked 4th in the Global Innovation Index.[2]
- The fastest growing market in Europe for VR and AR, with spending expected to grow at 78% annually and VR and AR expected to add £63 billion to the UK economy by 2030.[3]

UK companies are already embracing core technologies of the metaverse.

For example, engineers at companies such as Jaguar Land Rover are developing new products in VR environments, helping to optimise design and manufacturing processes and increasing productivity.[4]

The UK can build on this momentum.

A secure, competitive and innovative metaverse can be achieved with UK-led collaboration to **build consensus on interoperability standards across hardware, platforms and experiences** as well as data governance and security. Partnerships across the ecosystem will be key to achieving this. Meta is committed to supporting international and industry-wide collaboration.

> Development of the metaverse is still in the early stages, and the UK is in a strong position to take a leading role.

SECTION 01

The metaverse in the UK

The metaverse is the next stage in the evolution of the internet. It will be composed of interconnected digital spaces that users experience in an immersive way. Users will have a presence in these virtual worlds similar to being in the physical world, with close convergence between the 2 worlds.

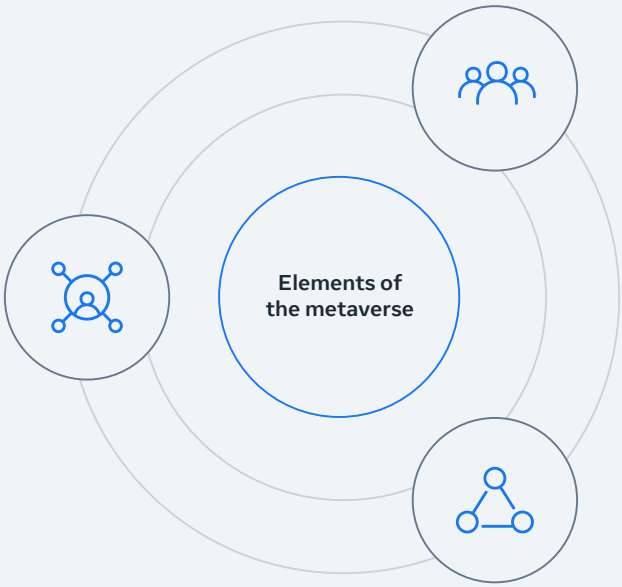
The UK is well-placed to take a lead in the development of the metaverse. For example, the UK VR market is worth £1.2 billion and is growing at a rate of 34% annually.

The metaverse is often described as the next evolution in social connection and the internet.

It will be a set of digital spaces that are immersive, interoperable, available in real time and synchronised for all users. These elements will come together to produce a massive scaled network of virtual worlds that mesh with the physical world.[5]

> A set of digital spaces that you can move seamlessly between and that will help people in different locations connect and feel like they are together in person. The metaverse will include 2D experiences, as well as ones projected into the physical world and fully immersive 3D ones too.
>
> **Meta,** What is the metaverse?

FIGURE 1: Elements of the metaverse



Immersion

In the metaverse, people will communicate in ways that make them feel as if they were actually in a specific space with other people—shared environments where social interaction feels natural, like conversations at home or in a coffee shop.

Interoperability

The mechanics of the metaverse will allow seamless transition of user experience across the many platforms, spaces and worlds.

Availability and synchronicity

The metaverse will provide a living experience that is available for everyone in real time.

The growth of the metaverse will need a complex ecosystem.

Producing this network of virtual worlds will require the combination and convergence of several core technologies.[6] Immersive technologies such as virtual reality (VR) and augmented reality (AR) will be required to create the "physical" element of the experience. The metaverse will also likely necessitate the use of new verification technologies based on ledgers of permanent entries—blockchains, broadly referred to as 'Web3'—to support its decentralised nature.[7]

The metaverse and its component technologies will be an ecosystem of hardware, software and content layers. These layers will consist of[8]:

- **Hardware, protocols and standards:** ICT infrastructure will enable connectivity and data hosting and transfer. User devices to access the metaverse will include laptops and smartphones initially, but as immersion becomes deeper, AR and VR devices will be necessary. This layer will also include standards and protocols to govern how devices interact and to create interoperability between platforms.

- **Platforms and networks:** Platforms and networks will be built on the standards and protocols. This layer will host the digital spaces of the metaverse and enable movement and interaction between them.

- **Experiences:** Within digital spaces, the end users will experience the metaverse and its content. They will also shape the development of the metaverse, as users will enjoy higher levels of interactivity with content than they do on the internet in its current form.

Momentum behind the metaverse is building in the UK.

UK businesses, investors, consumers, universities and the government are showing growing interest in the metaverse and its ecosystem.

Among UK enterprises, over 1,000 are now involved in the UK VR market, worth £1.2 billion and growing at a rate of 34% annually.[9] Over 48,000 people in the UK are working across more than 2,800 companies in developing technology which is expected to be a foundation for the metaverse.[10] Investors expect this market to grow further: for example, according to ImmerseUK, VR and AR are expected to add close to £62.5 billion to the UK economy by 2030.[11]

International companies developing metaverse technologies are expanding their operations in the UK. For example, Queppelin (an India-based metaverse development company) recently established operations in the UK to benefit from access to a larger tech economy and to international capital.[12]

Consumer interest also appears to be high: online searches in the UK for "metaverse" are among the highest in Europe and among the top 20 globally.[13]

Leading academic institutions in the UK are involved in metaverse-related research. For example, the University of Oxford is working with industrial partners through the Oxford X-Reality Hub to improve efficient use of AR and VR.[14] And in 2022, the University of Glasgow opened their Advanced Research Centre, which houses ARC-XR, one of the largest VR and AR studios in the UK. ARC-XR will focus on researching applications in fields such as healthcare and the wider life sciences.[15]

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In 2018, as part of its measures to provide innovative companies with support and funding to create an environment that attracts businesses to the UK, the government announced £33 million of investment in immersive technologies, to be matched by £25 million of private funding.[16] Looking forward, initiatives such as the Digital Catapult work with businesses, government, investors and researchers to develop advanced technologies (such as immersive technology) and open up new markets.[17]

The metaverse will be a complex ecosystem, and the timeline for building it is uncertain. The UK can take a leading role in shaping its development and can realise substantial economic benefits by aligning its broader digital and innovation strategies with the requirements for the metaverse. This report seeks to investigate what role the UK will play and what it needs to get there.

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SECTION 02

The potential of the UK as a metaverse leader

The economic benefits from the metaverse for the UK could be in the range of £40-£75 billion annually by 2035. The metaverse is expected to offer opportunities for the development and growth of several sectors of the economy through the creation of new marketplaces, increased efficiencies, access to more and better information and new employment opportunities.

There is a large opportunity for the UK as a metaverse leader.

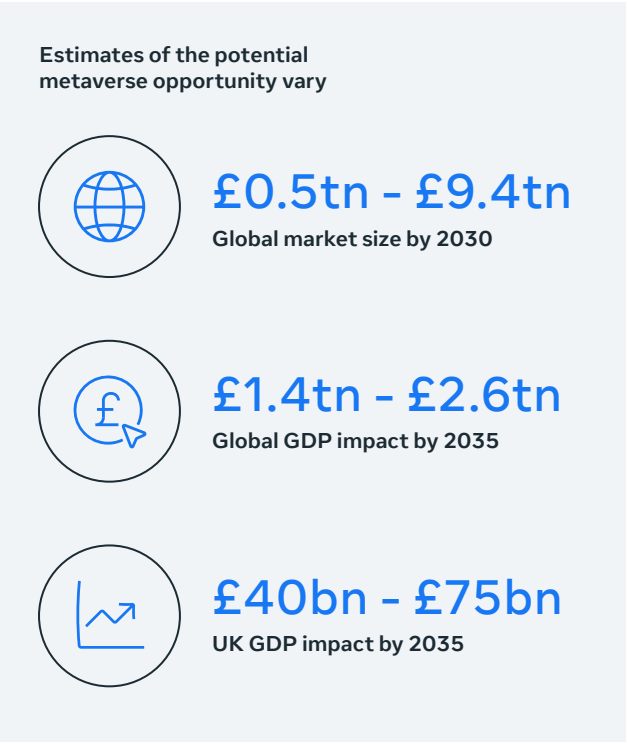
The metaverse is in the early stages of development. However, recent reports from various companies suggest that there is an enormous opportunity globally. Some of these reports focus on the potential market size (i.e., revenue) and estimates range from £490 billion (Grand View Research)[18] up to £9.4 trillion (Citi GPS) per year by 2030.[19] Other reports estimate the potential impact on GDP of the metaverse and related technologies, such as VR and AR. These include £1.1 trillion per year by 2030 (PwC—VR and AR only),[20] £2.2 trillion per year by 2031 (produced for Meta by Analysis Group)[21] and £1.4-£2.6 trillion per year by 2035 (produced for Meta by Deloitte).[22] For Europe (including the UK), Analysis Group estimates that the annual contribution to GDP could be £320 billion per year by 2031.[23]

The metaverse is in the early stages of development, so the full scale of the economic opportunity remains uncertain. Previous studies have considered the economic potential of the metaverse on a global or regional scale, but there have been no specific estimates for the UK.

To produce an estimate for the UK, we have adopted a methodology previously used by Deloitte to estimate country-level impacts. Using this approach, we estimate that **the benefits for the UK economy could reach up to £40–£75 billion per year in additional GDP by 2035**, equivalent to 1.3%-2.4% of GDP in 2035.[24]

For a summary of the methodology we have used, see the section titled *Estimating the potential economic benefits of the metaverse*. More details can be found in the Appendix.

FIGURE 2: The potential metaverse opportunity



The metaverse can unlock value for businesses and consumers across the UK's economic sectors.

The metaverse will drive the creation of new types of businesses, such as marketplaces, to trade virtual services and assets. In addition, the immersive nature of the metaverse will help reshape work culture and behaviour. For example, it will allow users to realise productivity gains from working from home, while also integrating the social aspect of the office into the employee's experience.

Estimating the potential economic benefits of the metaverse

Various methods are used to estimate the economic opportunity of the metaverse. Taking a broad perspective on the literature, most studies find the potential contribution to be in the range of $1.9 trillion to $3.6 trillion by 2035.

To get a sense of the potential opportunity for the UK, we use IMF and World Bank GDP forecasts to calculate the share of global GDP accounted for by the UK in 2035. This share is then used to allocate the metaverse opportunity.

Using this approach, **we estimate that by 2035, the potential impact on the UK GDP could reach up to $54–$103 billion (£40–£75 billion) annually**.

In reality, these numbers may understate the potential for the UK, given its technological leadership and high level of technology literacy. It should also be noted that these estimates assume sustained investment in the metaverse in future years. The investment estimates do not include metaverse investments that have already been made, nor do they consider wider complementary investments that may be needed to support the metaverse (such as improving telecommunications networks and infrastructure). Finally, how global investment is distributed among countries is uncertain, and spillover effects of investment are not captured.

FIGURE 3: Metaverse value drivers

New markets and business models

The metaverse will provide a space for the creation and transaction of digital assets and digital content of value. This will in turn provide new opportunities to generate value through new markets and business models.

Greater access to information, digital content and infrastructure

At the heart of the metaverse is the idea of social connection and access to information. This facilitates the connection of individuals and new ways to interact with data.

Skills development

There will be growing demand within the virtual world for digital content and labour. This growing demand would likely translate to skills development as well as new categories of jobs.

Better ways of working

The metaverse has the potential to facilitate remote working, training and collaboration across different locations, resulting in higher productivity, working flexibly and reduced employment costs.

Economic value will be created by new markets, business models, skills development and better ways of working in the UK.

New markets and business models

The metaverse will open up new markets and business models, creating new sources of value. These will cover a range of sectors in the economy, and some initiatives are already in development.

Sports

Sports contributed £39 billion to the UK economy in 2020, and the Premier League (PL), the most watched football league in the world, on its own contributed £7.6 to UK GDP in the 2019-20 season.[25, 26, 27] In a sign that the PL is investigating digital opportunities, it recently filed 2 cryptocurrency and NFT trademarks.[28] Some PL teams have already ventured into the realm of digital assets: in March 2022, Liverpool FC launched an NFT collection and generated revenue of £1.13 million, even though 95% of the digital collection did not sell.[29] The metaverse could streamline the leveraging of this intellectual property to create new marketplaces. Liverpool's foray into NFTs highlights the fact that digital assets are not yet part of daily life, but it nevertheless provides an illustration of the potential opportunity for the UK economy.

Gaming

The UK is the leading market for video games in Europe and the sixth largest in the world, generating £7.2 billion for the UK economy in 2021.[30] Through the metaverse, players would be able to interact with one another in a more immersive way and potentially even experience physical contact using haptic gloves and jackets.[31, 32] A large customer base of around 40 million UK adults were gaming in 2020, and coupled with the improved experiences that the metaverse will bring, video game expenditure per capita is likely to increase.[33]

Software

The UK has strength in AI software development, with over 1,700 companies and 31,000 people involved.[34] The metaverse will need software to tackle metaverse-specific issues, such as realistic avatar renditions using artificial intelligence (AI). The development of software in this area presents an opportunity for British companies to compete on a global stage, not just a regional one. For example, the venture capital fund Sure Valley Ventures raised £95 million to support British software start-ups in sectors such as the metaverse and, more specifically, artificial intelligence.[35]

Greater access to information, digital content and digital infrastructure

The metaverse will provide new ways for users and businesses to consume content. For example, virtual worlds and immersive user devices will enable users to access and engage with virtual experiences that are complementary to and sometimes substitutes for experiences in the physical world. This will not only deliver benefits to users, but it will also enable content creators, artists, event organisers and even traditional industries to realise new revenue streams, save costs and innovate.

Education

UK universities are consistently ranked amongst the best in the world, and 4 UK universities are currently ranked in the top 10. There are 8 in the top 50.[36] The metaverse therefore creates an opportunity to increase the UK's £25.2 billion of education-related exports by giving more students access to UK education through flexible programmes at potentially lower costs.[37] The metaverse could help transform classroom settings while allowing students to avoid the costs of moving to and living in the UK. This could be a boon for the approximately 600,000 international students currently attending UK universities. The metaverse could also make UK education accessible to more students.[38]

Virtual live entertainment

The creative economy contributed to £116 billion of gross value added (GVA) to the UK economy in 2019.[39] The metaverse could give more people access to live entertainment without compromising on immersive elements. As an example, the 5G Festival was the first UK immersive festival connecting 21 artists over 3 different locations in real time. The metaverse and its supporting technologies could also provide a new avenue for the UK live entertainment sector to develop new markets by offering access to people that would previously have been unable to attend.

Digital twins

Digital twins, online replicas that blend reality and VR, will help transform industrial sectors. Companies are creating digital twins for process optimisation, to reduce costs by trialling changes to the production process in the metaverse. The UK manufacturing sector is responsible for 10% of the economy's output and 44% of all UK exports.[40] Improvements in manufacturing production efficiency enabled by metaverse technologies could therefore have a big impact on the UK economy.[41]

Industrial

Jaguar Land Rover engineers have been developing **new vehicles in VR environments** that enable them to visualise the vehicles in 3D, helping the company **optimise the design and manufacturing processes**.[42] BAE systems is **integrating AR into the bridges of naval ships** to enable officers responsible for the ship's safety to work outside the operations room and still see tactical situation data and other vital information from anywhere on the ship.[43]

> This will not only deliver benefits to users, but it will also enable content creators, artists, event organisers and even traditional industries to realise new revenue streams, save costs and innovate.

Skills development

Development of the metaverse could see VR-enabled learning methods become more prevalent, delivering key benefits. For example, employees could safely practise their skills in fields such as healthcare and manufacturing in real-world simulations and based on real-time data.[44]

Industrial

Metaverse technologies could be used to develop skills in industrial workplaces. For example, VR can be used to reduce errors and accidents in the manufacturing process through improved skills training.[45] In the UK, **Morgan Advanced Materials uses VR to reinforce safety training and reduce the risk of accidents** in the workplace.[46]

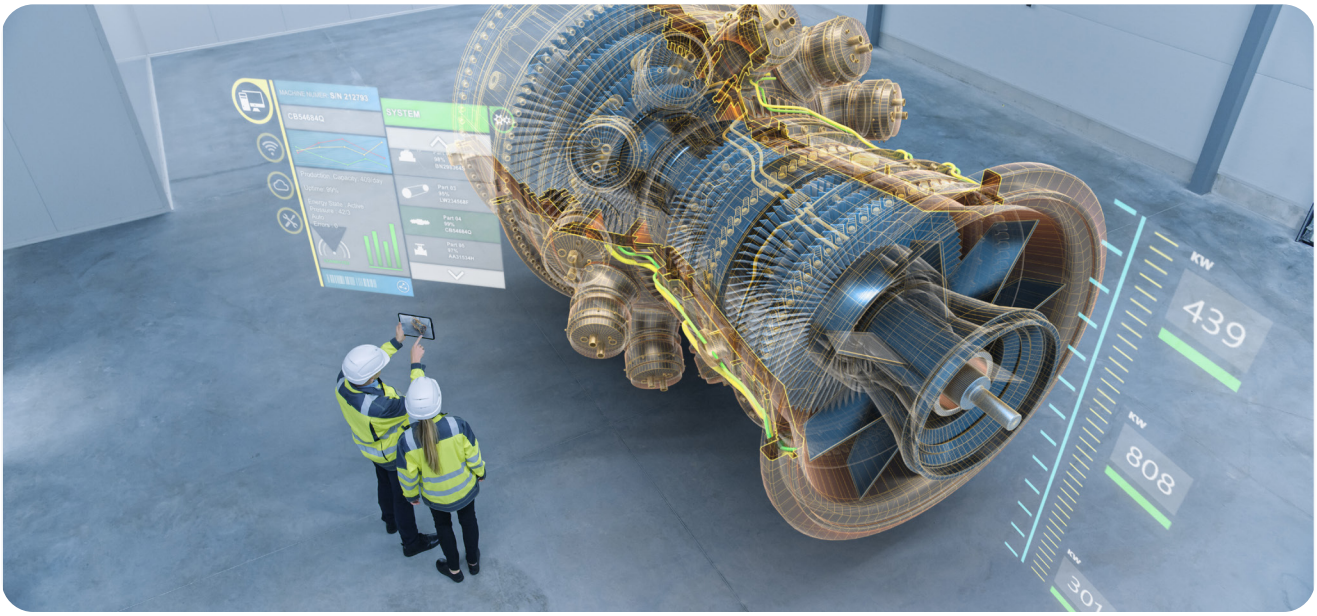
Healthcare

St Bartholomew's Hospital in London is **using VR to train staff in a range of clinical procedures**. This type of training has shown to reduce risks of injury, increase the speed of operations and improve the overall outcome for patients.[47]

Better ways of working

Flexible working is estimated to contribute just under £40 billion to the UK economy annually.[48] Flexible working allows employees to design their schedules in a way that suits them, including flexible start and finish times and working from home.[49] The metaverse could augment the impact of flexible working, as its immersive nature will re-create the office workplace without the need for physical displacement. Flexible working would allow workers to be present and collaborate with others while maintaining the productivity and flexibility generated from deciding their own schedules. In addition, flexible working would also have effects on the economy. For example, avoiding commuting to work could help save around 300 kg of CO_2 emissions annually per person, roughly 5% of 2019 UK territorial emissions per person.[50]

> VR can be used to reduce errors and accidents in the manufacturing process through improved skills training.



SECTION 03

Realising the opportunities of the metaverse in the UK

The UK has the potential to be a global leader in the development of the metaverse. To seize the opportunity, it should continue developing an enabling environment aligned to the UK Digital Strategy. It will also depend on industry and government supporting the emergence of the metaverse, with a key focus on skills, collaboration and governance.

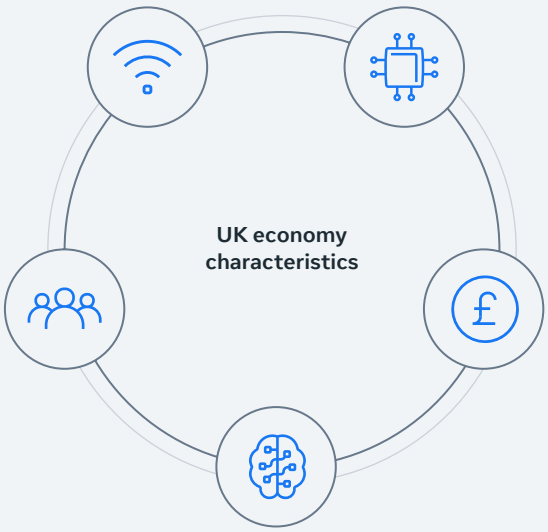
The UK can leverage the metaverse as a growth driver.

The UK has a digitally mature, service-based economy with a high degree of readiness for new technology and a growing tech sector that is outpacing other European countries.[51, 52] Services accounted for about 80% of the UK's total economic output in 2022, and it is here where many initial metaverse applications are found.[53]

Key characteristics of the UK economy suggest that it has strong potential to exploit the metaverse opportunity (see Figure 4).

The UK has a digitally mature, service-based economy with a high degree of readiness for new technology and a growing tech sector that is outpacing other European countries.

FIGURE 4: UK economy characteristics



Digital infrastructure

Superfast broadband (30 Mbit/s or more) coverage has increased from 58% of UK premises in 2011 to over 97% today.[54] Currently, over 67% of UK premises can access gigabit-capable broadband: an increase from July 2019, when **coverage was just 8%.**[55]

Data-driven economy

The **UK is Europe's largest data market.**[56] The UK data economy has the biggest overall impact of any European country in absolute terms, an estimated **£125 billion in 2021**, which is **double that of France.**[57]

Investment community

More money than ever is flowing into UK tech. In 2021, venture capital investment into the **UK's tech sector grew 2.3 times from 2020, to £27.4 billion.**[58] The £27.4 billion raised by UK startups was almost double the figure raised in Germany (£13.8 billion) and over 3 times that raised in France (£8.7 billion).[59] Today, **UK tech investment accounted for a third of the total £89.5 billion that flowed into the European tech ecosystem this year.**[60]

Research and innovation

The UK houses 4 of the global top 10 universities.[61] The UK is also ranked fourth on the Global Innovation Index.

Pool of UK talent and global talent

The UK had approximately 1.7 million jobs in the digital sector in 2020, a 31.5% increase since 2011.[62] Over the period from October 2021 to January 2022, the number of UK job postings with the word 'metaverse' increased more than fivefold.[63]

The UK government has already set out its Digital Strategy, which aims to support the UK's digital ecosystem by focusing on areas such as infrastructure and skills.[64] OECD researchers consider the UK's Digital Strategy to be comprehensive relative to other countries' strategies, in particular promoting access, use and innovation.[65]

Infrastructure, skills and governance are needed to maximise the opportunity from the metaverse.

Many digital capabilities in the UK must come together to connect the components of the metaverse ecosystem. 2 sets of factors that are crucial for the success of the metaverse in the UK are digital foundations and support for the metaverse ecosystem.

Metaverse digital foundations

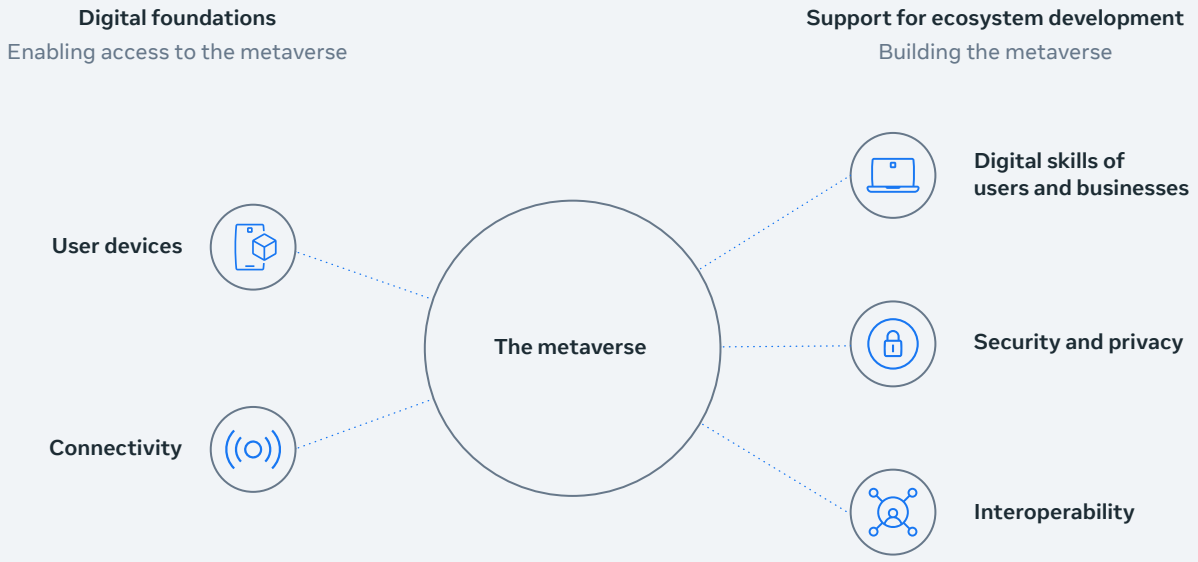
'Digital foundations' are the devices and connectivity required for the metaverse to exist and operate. They do not guarantee the success of the metaverse, but they are the minimum requirements for it to grow in the UK.

User devices

The success of the metaverse and the opportunities it offers will depend on high-quality, immersive experiences and devices that are readily accessible to everyone. A key challenge will therefore be to develop better, more affordable and easily accessible device technology.

The UK is already one of the biggest European markets for immersive technology. UK spending on AR and VR is expected to deliver a 5-year annual growth rate of 78%, and the impact of the space is estimated to reach £62.5 billion by 2030.[66] Deloitte's Digital Consumer Trends survey found that 8% of UK respondents owned a VR headset in 2022, and of those with access to a headset, 18% used one daily. This suggests that there is an opportunity for additional scaling and further growth.[67]

FIGURE 5: Metaverse success factors



Connectivity

Connectivity is needed to facilitate real-time interactions and transactions. It will require users to have access to reduced latency and symmetrical bandwidth (sending and receiving the same amount of information).[68]

Expansion and improvement of digital infrastructure is a key pillar of the UK's Strategy and it will support the metaverse.[69] The UK government aims to accelerate the commercial delivery of nationwide gigabit broadband whilst ensuring that rural areas are not left behind. The aim is to achieve at least 85% gigabit coverage by 2025 and at least 99% coverage by 2030. The UK is also making progress in rolling out wireless connectivity, with 92% of the UK currently covered by a 4G signal from at least one operator. Ensuring that high-speed connectivity reaches as many in the UK as possible will provide the best basis for the metaverse to thrive.

Support for ecosystem development

Ecosystem development depends on factors that will facilitate widespread adoption and innovation. These include the digital skills of users and businesses, data security and privacy and system interoperability.

Digital skills of users and businesses

Metaverse accessibility (and therefore uptake) may require basic digital skills to use the devices for accessing the metaverse and participating meaningfully in virtual environments.

Current skills levels, however, may restrict widespread participation in the metaverse ecosystem. Several initiatives have been launched to support basic digital skill development, such as new digital skill qualifications and the Digital Skills Partnership working across the public, private and charity sectors.[70] However, according to the International Telecommunications Union in 2019, only 55% of the UK population had basic digital skills, less than Korea (72%), Germany (65%) and Japan (60%).[71]

Specialised digital skills are also essential for those involved in developing the content and platforms that comprise the metaverse in the UK. There were more than 2 million job vacancies in tech last year, more than in any other area of employment.[72] The government has identified that 46% of businesses have struggled to recruit employees with data skills.[73] Closing the gap between demand and supply for specialised skills is needed to maximise the potential of the metaverse ecosystem and support the ability of the UK to take a leading role.

> Expansion and improvement of digital infrastructure is a key pillar of the UK's Strategy and it will support the metaverse.

Security and privacy

In the metaverse, users will interact with content and with each other in new ways. This has implications for both data privacy and online safety.

The metaverse may involve large increases in transmission of user data through the ecosystem. The immersive nature of the metaverse will also mean that users are likely to spend more time online and, as a result, they will share more data. How data is governed and user trust will therefore be key requirements in driving adoption of the metaverse.

The UK recognises the value of the data economy and is forward-thinking in its approach to data protection. The government is accelerating the development of Privacy-Enhancing Technologies (PETs), which enable data to be analysed and shared in a way that preserves the privacy and trust of data subjects.[74] This emerging group of technologies will create an important opportunity to harness the power of data in a way that protects privacy and intellectual property and also enables cross-border and cross-sector collaboration to resolve shared challenges.

Online safety means protecting users from harmful behaviours and content (for example, preventing access to inappropriate content).[75] The metaverse will change how we interact with technology, content and other users. This will require a new understanding of the potential harm to which users could be exposed online, so that the risks can be mitigated. The UK aims to be the safest place in the world for going online, and the government is already prioritising online safety through its Online Safety Bill to tackle harmful content.[76,77]

As the metaverse develops, it will also be important to ensure that the technology and standards protect users and that rules are appropriate for the next evolution of the internet.

> The UK recognises the value of the data economy and is forward-thinking in its approach to data protection, which is essential to encouraging adoption and protecting users.

Interoperability

Interoperability will be a crucial enabler of the metaverse. It has been described as "the interconnectedness of standards, systems and applications that enable people to travel seamlessly between one part of the metaverse and another."[78] Interoperability creates a common and open landscape for developers and creators. As a result, it enables greater competition and innovation by providing greater choice to users.

In its Vision 2035, the UK government highlighted the need for interoperable digital tools and platforms to support innovators, such as digital twins and simulation environments, which could be hosted and made available in the metaverse.[79]

Interoperability must be based on global standards and rules, and developing these will require international effort and coordination between policymakers and the industry. The UK must collaborate with stakeholders in the industry and on the international stage to shape these key principles and standards for operating the metaverse. Meta is committed to collaboration and supporting the development of this interoperable metaverse.

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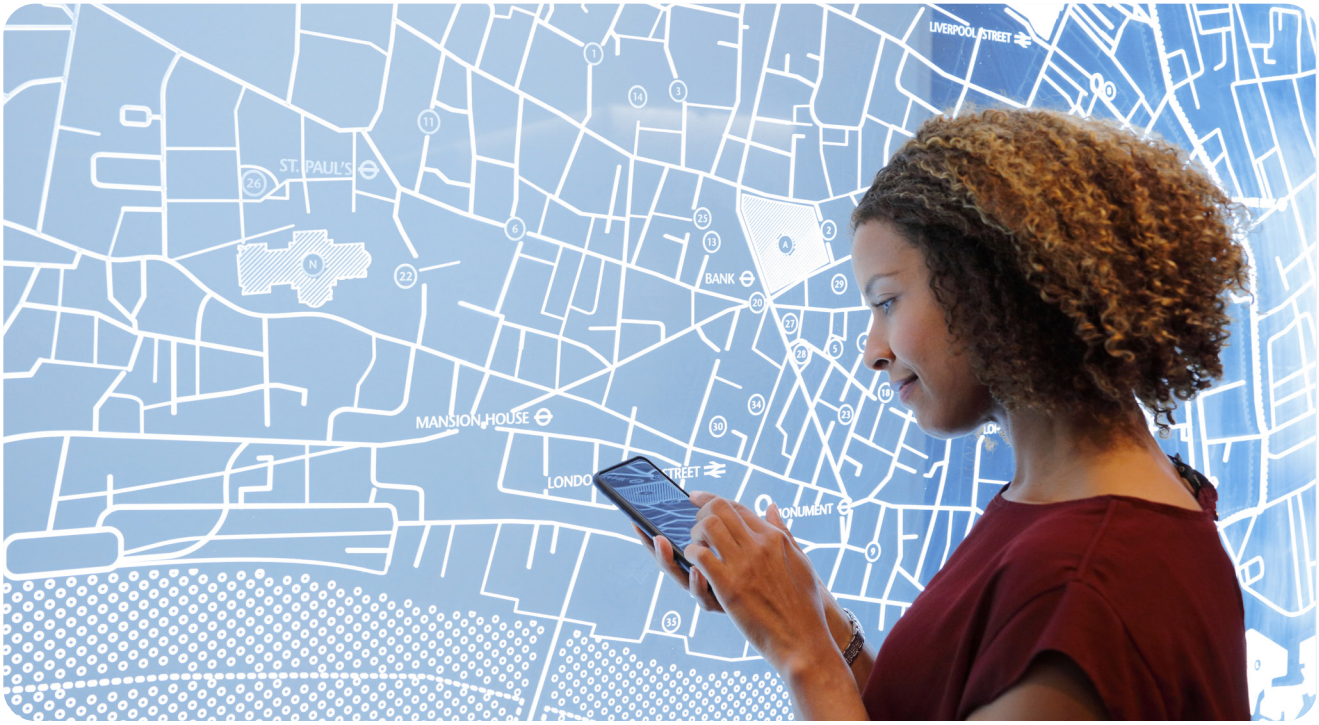

Conclusion

A proactive approach, with cooperation across the UK and internationally, will help realise the opportunities from the metaverse in the UK.

The metaverse will be the next stage in the growth and development of digital society. The collection of technologies comprising the metaverse promises a transformation in digital communication and interaction, encompassing new virtual worlds and immersive experiences.

The UK ranks high as a digital economy, and its ambition to be a global hub in the next stages of digital development and innovation is set out in its Digital Strategy.

The metaverse presents a major opportunity to achieve this and could add £40-£75 billion annually to UK GDP by 2035. The timeline for the development of the metaverse is uncertain and will depend on the impact of government policies and stakeholder actions. However, the UK is set to benefit from the creation of new businesses and marketplaces by leveraging its position as a technology and innovation hub. In education, the metaverse could expand access to the UK's world-leading institutions with immersive learning settings. Cultural activities may also benefit: for example, metaverse technologies could offer fans new ways to engage with UK sports and live events. Broader industry and service sectors may benefit from virtual environments to optimise physical processes (e.g., manufacturing) and from more collaborative and productive remote working.

In addition, the UK will need to ensure that policies for the metaverse are future-proofed so that they remain effective as the technology continues to evolve. For example, it will be important to ensure that connectivity and access to devices is not limited to those in urban areas or on high incomes. Supporting the growth of digital skills will enable the metaverse ecosystem to develop and adoption to be widespread. Collaboration across the ecosystem and internationally, including with Meta, will be required to fully exploit the opportunities from the metaverse. Its successful development and uptake will depend on the agreement and adoption of effective standards and protocols, with a particular focus on data security and privacy, as well as interoperability.

The metaverse presents a major opportunity to achieve this and could add £40-£75 billion annually to UK GDP by 2035. The timeline for the development of the metaverse is uncertain and will depend on the impact of government policies and stakeholder actions. However, the UK is set to benefit from the creation of new businesses and marketplaces by leveraging its position as a technology and innovation hub.

Methodology

This appendix describes the method used to produce estimates of the potential economic benefits for the UK from the metaverse.

Estimating the global economic opportunity of the metaverse

The potential benefits for the global economy from the metaverse have been estimated in various ways in previous studies. While these estimates vary by size and time period, they are broadly consistent. These methods can be broadly broken down into: adoption driven impact, potential market size, use case driven impact and investment driven impact.

Adoption driven impact: This method considers the potential impact associated with adoption of the metaverse. Analysis Group estimates the impact of mobile broadband adoption on economic growth and assumes that metaverse adoption will have the same marginal impact as mobile adoption. This results in an estimated economic impact of $3.0 trillion by 2031.[80]

Potential market size: This method estimates the total addressable market of the metaverse—in other words its global revenue potential. Reports using this method include Grand View Research which estimates a potential market size of $678.8 billion by 2030,[81] Goldman Sachs which estimates a potential market size of $2.6-$12.5 trillion[82] and Citi GPS which estimates a potential market size of $13 trillion by 2030.[83]

Use case driven impact: This method looks at the estimated impact of use cases of metaverse technologies. PwC research based on potential use cases of VR and AR estimates that the impact of these technologies could be $1.5 trillion by 2030.[84]

Investment driven impact: This method considers the impact of investment in the metaverse, using estimates of metaverse investment and elasticities of ICT capital to GDP (i.e., the rate of increase in GDP as a proportion of the increase in ICT capital). Deloitte estimates that the global impact of metaverse investment could be $1.9-$3.6 trillion by 2035.[85]

Estimating the UK economic opportunity of the metaverse

Adopting a similar approach to Deloitte, this report takes estimates of the potential global contribution of the metaverse and allocates them to countries according to GDP shares.

For this, we have estimated the UK's share of global GDP in 2035 (real GDP with a 2021 base) based on historical growth rates and forecasts from the IMF and World Bank. On this basis, we estimate that the UK's share of global GDP in 2035 may be 2.9% (data suggests this was 3.3% in 2021). We estimate that by 2035, the potential economic impact on UK GDP could reach up to $54-$103 billion annually, expressed in 2021 USD.

Region	Base case ($bn, 2021 USD)	Upside potential ($bn, 2021 USD)
Global impact		
Global	$1,900.0	$3,589.8
Country-level impact		
UK	$54.5	$103.0

These estimates assume that there will be sustained investment in the metaverse, which is not a substitute for other investment that would otherwise be undertaken. Investment scenarios also do not consider wider complementary investments that may be needed to support the metaverse (such as improving telecommunications networks and other supporting infrastructure). Further, it is uncertain how the global impacts of the metaverse may be distributed across countries, as this could be driven by a number of factors and potential enablers.

End notes

1 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

2 TopUniversities. "QS World University Rankings 2021." 2021.

3 Immerse UK. "The Immersive Economy in the UK 2019." 2019.

4 Land Rover Newsroom. "The Future in Virtual Reality." 2022.

5 Ball, M. "Framework for the Metaverse. The Metaverse Primer." 2021.

6 Ball, M. "Framework for the Metaverse. The Metaverse Primer." 2021.

7 The World Bank. "Blockchain & Distributed Ledger Technology (DLT)." 2018.

8 The Medium. "Making the Metaverse: What It Is, How It Will Be Built, and Why It Matters." 2022.

9 Department for Business, Energy and Industrial Strategy. "UK Innovation Strategy." 2021.

10 RSM UK. "Is UK Tech Ready to Move into the Metaverse?" 2022.

11 Immerse UK. "UK Immersive Tech: VC Investment Report." 2021.

12 Department for International Trade. "Augmented Reality and Virtual Reality." 2022.

13 Google Trends. "Metaverse." 2022.

14 Oxford X-Reality Hub. "Oxford X-Reality Hub." 2022.

15 University of Glasgow. "ARC-XR." 2022.

16 HM Government. "Industrial Strategy: Creative Industries Sector Deal." 2022.

17 Catapult Digital. "Immersive." 2022.

18 Grand View Research. "Metaverse Market Size, Share & Trends Analysis Report." 2022.

19 Citi GPS. "Metaverse and Money." 2022.

20 PwC. "Seeing is Believing." 2019.

21 Analysis Group. "The Potential Global Economic Impact of the Metaverse." 2022.

22 Deloitte. "The Metaverse and Its Potential for Türkiye."

23 US dollar values were converted to pound sterling using the spot exchange rate of USD:GBP = 1.3757 in 2021, as given by the Office for National Statistics (ONS).

24 Opportunity estimates are expressed in real terms using 2021 as a base.

25 Sport England. "Economic Development." 2022.

26 Premier League. "Entertaining Audiences." 2022.

27 Goal. "How Much is the Premier League Worth to the World Economy?" 2022.

28 Decrypt. "English Premier League Files Crypto and NFT Trademarks." 2022.

29 INews. "Premier League Pushes Ahead With Plans to Launch Its First NFT Collection Despite Collapse in Market." 2022.

30 Ukie. "UK Consumer Games Market Valuation 2021 — How Much Money Did People in the UK Spend on Video Games?" 2022.

31 Ukie. "UK Consumer Games Market Valuation 2021 — How Much Money Did People in the UK Spend on Video Games?" 2022.

32 Medium. "How Does Metaverse Powers the Future of Gaming?" 2022.

33 Ofcom. "Adults' Media Use and Attitudes Report" 2021.

34 RSM UK. "Is UK Tech ready to move into the Metaverse?" 2022.

35 Metaverse Insider. "Sure Valley Ventures' Newly Minted £95 Million Fund Targets to Take Special Aim at Metaverse Startups." 2022.

36 TopUniversities. "QS World University Rankings 2021." 2021.

37 HM Government. "UK Revenue From Education Related Exports and Transnational Education Activity." 2021.

38 UniversitiesUK. "International Student Recruitment Data." 2022.

39 HM Government. "DCMS Economic Estimates 2019 (Provisional): Gross Value Added." 2021.

40 MAKE UK. "Why Manufacturing Matters to the UK Economy." 2022.

41 Office for National Statistics. "Manufacturing and Production Industry." 2022.

42 Land Rover Newsroom. "The Future in Virtual Reality." 2022.

43 BAE Systems. "BAE Systems on Track to Put Augmented Reality Technology Into a Headset the Size of a Regular Pair of Glasses." 2019.

44 Association for Talent Development. "Measuring Learning in the Moment: The KPIs of VR Training." 2019.

45 Luminous. "Supercharge Your Training With XR." 2022.

46 Luminous. "Reducing Injury's With XR and Hand Tracking." 2022.

47 NHS Barts Health. "Virtual Reality Helps Simulation Team Tackle Covid-19." 2020.

48 Pragmatix Advisory. "Flexonomics: The Economics and Fiscal Logic of Flexible Working." 2021.

49 HM Government. "Flexible Working." 2022.

50 University of Reading. "Working From Home: Can Emissions Really Be Reduced and What Are the Broader Implications for Cities?" 2021.

51 United Nations Conference on Trade and Development. "General Profile: United Kingdom." 2022.

52 HM Government, Department for Digital, Culture, Media & Sport. "UK Tech Sector Achieves Best Year Ever as Success Feeds Cities Outside London." 2021.

53 House of Commons Library. "Industries in the UK." 2022.

54 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

55 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

56 Data Landscape. "Final Study Report: The European Data Market Monitoring Tool Key Facts & Figures, First Policy Conclusions, Data Landscape and Quantified Stories."

57 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

58 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

59 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

60 HM Government, Department for Digital, Culture, Media & Sport. "UK Tech Sector Achieves Best Year Ever as Success Feeds Cities Outside London." 2021.

61 HM Government, Department for Business, Energy & Industrial Strategy. "Evidence for the UK Innovation Strategy." 2021.

62 HM Government, Department for Digital, Culture, Media & Sport. "DCMS Sector National Economic Estimates: 2011 - 2020." 2022.

63 Adzuna Blog. "Metaverse Jobs Rising Exponentially." 2022.

64 TechUK. "The 2022 Digital Strategy: Does It Provide the Ambition We Need for UK Tech?" 2022.

65 OECD Digital Economy Papers. "Assessing National Digital Strategies and Their Governance." 2022.

66 Immerse UK. "The Immersive Economy in the UK 2019." 2019.

67 Deloitte. "Devices: Growth on Pause, for Now." 2022.

68 Tech at Meta. "The Next Big Connectivity Challenge: Building Metaverse-Ready Networks." 2022.

69 HM Government, Department for Digital, Culture, Media & Sport. "UK Digital Strategy." 2022.

70 UK Parliament. "Developing Essential Digital Skills." 2021.

71 International Telecommunication Union. "Digital Development Dashboard." 2022.

72 Tech Nation. "People and Skills Report 2022." 2022.

73 HM Government, Department for Digital, Culture, Media & Sport. "Quantifying the UK Data Skills Gap." 2021.

74 HM Government, Department for Digital, Culture, Media & Sport. "US and UK to Partner on Prize Challenges to Advance Privacy-Enhancing Technologies." 2021.

75 HM Government, Department for Digital, Culture, Media & Sport. "Online Safety Bill: Factsheet." 2022.

76 HM Government, Department for Digital, Culture, Media & Sport. "World-First Online Safety Laws Introduced in Parliament." 2022.

77 HM Government. "A Summary — Online Harms White Paper." 2022.

78 The Medium. "Making the Metaverse: What It Is, How It Will Be Built, and Why It Matters." 2022.

79 HM Government, Department for Business, Energy and Industrial Strategy. "UK Innovation Strategy: Leading the Future by Creating It." 2021.

80 Analysis Group. "The Potential Global Economic Impact of the Metaverse." 2022.

81 Grand View Research. "Metaverse Market Size, Share & Trends Analysis Report." 2022.

82 Goldman Sachs. "Framing the Future of Web 3.0." 2021.

83 Citi GPS. "Metaverse and Money." 2022.

84 PwC. "Seeing is Believing." 2019.

85 Deloitte. "The Metaverse and Its Potential for Türkiye."