2022 Immersive Economy Report

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This report was co-authored by Immerse UK and Oxford Insights & Data City, funded through the UK Research and Innovation 'Audience of the Future' Challenge Fund. It provides evidence of the growth of the sector and looks at its key drivers and barriers.

Immerse UK is the UK's leading membership organisation and innovation network for immersive technology professionals.

Oxford Insights helps public sector organisations understand how to harness the potential of technology.

The Data City contributes to the definition of the emerging economy in the UK by analysing how companies define themselves on their websites.

UKRI UK Research and Innovation brings together the UK Research Councils (including The Arts and Humanities Research Council (AHRC)), Innovate UK and Research England into a single organisation to create the best environment for research and innovation to flourish. The vision is to ensure the UK maintains its world-leading position in research and innovation.

Funded by UK Research and Innovation (UKRI), Audience of the Future focuses on the development of new immersive technologies such as virtual, augmented and mixed reality including a world-leading demonstrator programme, with collaborations including the Royal Shakespeare Company and Aardman. This coordinated programme of research and development ensures the UK can become a world leader in creative technology.

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Foreword from Immerse UK

Welcome to the 2022 Immersive Economy Report.

This is our third study of the UK's immersive technology ecosystem, which follows on from the last report in 2019, after a hiatus in reporting as the industry navigated a tumultuous few years.

Overall the results have been incredibly positive, with industry turnover estimated around £1.4B, consistent growth in the number of XR companies operating in the country, sustained growth across various industry verticals, and recent trends in private investment indicating a healthy and growing sector.

Two important highlights of the report to note are the fact that two unexpected global factors have had a net positive impact on the sector: the COVID-19 pandemic, which created a culture shift that helped many XR companies accelerate pilots with clients to larger scale deployments across organizations, and the global Metaverse trend which helped to drive further private investment into the XR ecosystem. Although the 'Metaverse', in terms of infrastructure, does not exist yet and will require the convergence of several different technologies to enable it, it is widely accepted that immersive technologies will play a crucial role in its development.

The growth of applications of XR technology across various sectors has remained consistent since previous reports, with the media & entertainment, gaming, and education & training sectors having the highest turnover.

Past Immersive Economy reports have highlighted the strong publicly funded agenda in the UK, rarely seen in other countries. This report looks at the significant results of this public funding over time, with a focus on the culmination of the Audience of the Future & Creative Industries Clusters Programmes, and how fundamental they have been to the growth of the industry.

Further support from public institutions will continue to drive this growth. For example, the NHS leading discovery work to accelerate XR adoption into their health services, and upcoming publicly funded programmes for the development of XR applications in healthcare, and the development of virtual production infrastructure across the UK.

With private investment trends reaching new yearly highs, and public funding programmes attracting significant co-investment, from both public and private funders, the UK's immersive economy is poised to continue taking advantage of the momentum the industry is seeing globally.

The insights and evidence from this report highlight how the UK has set the groundwork over the past few years to position itself as a global leader in XR technology, and looks to identify upcoming opportunities and barriers to growth that need to be addressed to ensure the UK XR ecosystem continues to thrive.

Asha Easton
— Immerse UK

Foreword from UK Research and Innovation

Immersive technologies such as virtual reality (VR), augmented reality (AR) and mixed reality (MR) will fundamentally change products and services over the next twenty years and transform how we experience the world. The UK, a leader in elements of this technology, needs to seek out new audiences, partnerships and markets which will support its further growth in this innovative space.

In 2018 there were estimated to be around 1000 active immersive specialist companies in the UK - those who generated over 50% of their revenue from the creation, development or production of immersive content, software, or hardware, as well as consultancies that focused mainly on immersive technologies. By 2019 that number had increased to 1250 and the 2022 Immersive Economy Report estimates that number to be 2106.

Increased private investment in UK immersive companies (up to £224m in 2021) promises a continuation of this growth going forward and suggests that companies are beginning to get access to the support necessary to mature. This potential is similarly reflected in a report by PWC, which forecasts that VR and AR alone will bring a $69.3bn boost to the UK economy and enhance over 400,000 jobs by 2030.

The growth of the immersive economy in the UK owes much to the country's unique combination of several complementary factors: an established production infrastructure, a world class VFX supply chain, and a skilled and adaptable workforce.

Agile innovation around Creative Technologies in the UK have allowed experimentation with new virtual production processes within live production environments and has seen exponential growth in the development of large-scale virtual production capacity.

The Audience of the Future Challenge Fund has invested 39.3 million GBP to date in bringing together creative businesses, researchers, and technologists to create striking new experiences that are accessible to the public, creating the next generation of products, services and experiences that will capture the world's attention and position the UK as the global leader in the creative and commercial implementation of immersive technologies.

In terms of its workforce, the UK is home to world-class creative businesses, researchers, and technologists, combined with expertise in arts, design and computer science. The UK is also home to some of the top universities in the world, their research output helps drive global innovation and UK universities continue to attract the second highest number of international students globally.

The UK Government is embracing the opportunity for the UK to establish itself as a world leader by investing heavily in the Immersive Technology sector through programmes such as 'Audience of the Future' and supporting groups like Immerse UK. As a consequence, the UK is rapidly attracting a reputation as an unrivalled centre of excellence.

I hope the insights and analysis provided in this report will further support that continued growth and help realise the full potential of this developing sector of the UK economy.

Matt Sansam
— Head of Delivery - Audience of the Future - UK Research and Innovation

Executive Summary

The 2022 Immersive Economy Report examines trends in the immersive industry in the aftermath of the coronavirus (COVID-19) pandemic. The Immersive Economy Report was last published in 2019, and there is a clear need for new data and insights to understand how the immersive economy is operating in the post-pandemic landscape. The 2022 Immersive Economy Report identifies the key trends in technology adoption and business model transformation in the UK emerging in the wake of the pandemic, and aims to inform policymakers, businesses and investors of the key application growth areas, the investment landscape, and success stories that have emerged from government-funded R&D programs.

Data has been drawn from surveys of industry stakeholders, from interviews with industry experts and through state-of-the-art text mining methods of immersive company websites.

Our key findings are the following:

1

The immersive economy has grown considerably in recent years.

There are an estimated **2,106** immersive technology companies in the UK, representing an **83%** growth in the last five years.

2

A significant proportion of immersive economy companies are micro-SMEs.

80% of companies have between one and nine employees.

3

Access to finance and skills remain the key barriers to industry growth.

57% of survey respondents said that access to funding was a key barrier.

79% of survey respondents said that finding immersive talent was a key barrier. This is a significant increase from the **45%** of survey respondents that cited talent as a barrier in the **2019** report.

For example, real-time 3D skills are viewed as one of the most important skills for immersive that is in short supply. Additionally, there is currently sparse education for children about immersive technologies, presenting an important barrier to inspiring the next generation.

4

The pandemic was generally viewed to have been a net positive for the industry.

Interview and survey respondents claimed that the benefits of COVID-19 for the industry included: increased demand for online, virtual experiences; a culture shift in how people and businesses expected services to be delivered; and better international recruitment.

Some of the drawbacks of the pandemic included: increased hygiene costs from needing to clean headsets; a general fear from the public around sharing experiences in person; and the risk of public funding being re-prioritised post-COVID.

5

The most common application growth areas for companies to be operating in are Education and Training and Entertainment and Media.

'Education and Training' and 'Entertainment and Media' were the two largest application areas in terms of both turnover and the number of companies operating in the sectors.

Additionally, healthcare has experienced the highest growth rate in the number of businesses over the past **5** years (**88%**) out of the application growth areas included in the report.

6

Although regional innovation programmes are beginning to deliver for immersive, underlying economic factors still drive the industry.

Interviewees from several regions, such as Dundee, York and Ulster, stressed how the Creative Industries Clusters Programme has created new value and opportunities that otherwise wouldn't have existed.

However, London still boasts half of the total immersive company turnover, **41%** of all companies and **55%** of employees in the industry.

7

The Metaverse is now a central part of the immersive economy - bringing with it a series of new challenges.

The number of Metaverse companies has increased by **241%** in the last five years. Whilst the Metaverse, in terms of infrastructure, does not exist yet and the vision for what it might be is yet to be agreed, the rapid development of Metaverse companies prompts the need to answer questions about upcoming challenges around standards and IP to the industry.

8

The Audience of the Future and Creative Industries Clusters Programmes have been an influential part of the funding landscape for immersive companies since 2018.

The two programmes have funded **906** R&D projects and businesses and secured an additional **£247m** in co-investment, from both public and private funders.

9

Private investment in immersive technologies reached a new yearly high in 2021 and looks set to rise further in 2022.

Private investment in immersive technologies reached **£224m** in **2021** and looks set to rise further in **2022** with investments in the first half of the year totalling at nearly **90%** of the amount raised in **2021**.

10

New policy positions are required to address challenges that are arising, such as:

- Addressing the real-time 3D skills gap (especially developers in Unity and Unreal Engine);
- Creating more immersive experiences for communities with visible and invisible disabilities;
- Developing appropriate standards and IP regimes;
- Providing new, innovative ways to educate children about immersive applications.

Fact Sheet

2,106 — Estimated number of immersive companies.

12,609 — Number of full-time employees (excluding freelancers).

83% — Company growth in the last five years.

80% — Of companies have between one and nine employees.

£1.4bn — Industry turnover.

79% — Of stakeholders surveyed that found finance a key barrier to growth.

88% — Fastest growing immersive application sector (healthcare).

£164m

Media and entertainment is the immersive application sector with the highest turnover.

55%

Percentage of immersive employees from London.

124%

Fastest growing area in the last five years (Wales).

118

City with the most immersive companies outside of London (Manchester).

241%

Growth in the number of Metaverse companies in the last five years.

40%

Of companies surveyed received at least one government grant and loans.

£224m

Private investment in immersive technologies in 2021.

Introduction

This report provides an overview of the scale, nature, and economic value of the UK's virtual, augmented, and mixed reality ecosystem. It examines the immersive technology marketplace and organisations involved, and analyses the economic value derived across different sectors and regions in the UK.

What is the immersive economy?

The term 'immersive economy' refers to the group of organisations (including businesses, university researchers and communities of developers and practitioners) developing or applying immersive technologies to create economic, social, and cultural value.

These technologies transcend traditional formats for interacting with digital information (screens), immersing users in digitally generated or enhanced realities.

Definitions used in this report

Virtual Reality (VR)
Closed and fully immersive three-dimensional environments. 6DOF (degrees of freedom) experiences.

Augmented reality (AR)
Open and partially immersive environments that allow digital objects to be overlaid onto the physical world.

Mixed reality (MR)
Blending physical and virtual worlds to produce new environments and visualisations where physical and digital objects co-exist and interact in real-time.

360 Reality
a form of VR that gives users the ability to control the content by looking around in different directions while wearing a VR headset. 3DOF experiences.

Purpose of report

This report enables businesses, policymakers, investors, and educators to make more informed decisions by tracking the progression of the immersive economy, and providing analysis to drive the industry forward.

It also looks at the growing numbers of innovative products, services, applications, and hubs in the UK. Expert interviews helped to draw out key case study companies that demonstrate best practices in the immersive landscape.

A wide range of Immerse UK stakeholders were surveyed for the report, including distributors, technology developers, manufacturers, R&D organisations, industry networks, and public funders.

The report structure is mostly consistent with the most recent, **2019** edition, with sections covering:

State of the Nation
Data on the economic value of the industry as a whole, export, and drivers and enablers of industry growth.

Understanding Immersive Geographies
Exploring how the immersive economy in the UK's different regions has developed over time, with data on key clusters and companies in each region.

Application growth areas
Exploring how the different sectors in the immersive economy have developed over time.

Exploring the Metaverse
Including data and interview insights on how the ongoing development of the Metaverse is impacting the immersive industry.

Research and Development
Examines recent place-based strategies deployed by Innovate UK, including the Audience of the Future Challenge and the Creative Industries Clusters Programme.

Private Funding
Considering the evolution of UK venture capital investment into the immersive economy, the most significant funding rounds, and trends to keep an eye on.

Future Shaping
Looks to the near and long-term challenges that the industry faces, based on the report's research findings.

Methodology

Data was collected from three different sources; a survey of industry stakeholders; interviews with industry experts; and state-of-the-art text mining methods of immersive company websites. The Data City reads the websites of millions of UK businesses and analyses them using state-of-the-art text-mining methods to understand what they do. This method was able to identify any company that mentioned immersive keywords on its website, regardless of whether it was a developer, a creator or a user. This allows us to create real-time classifications of the sector and generate important business-specific data on financial information, location, and growth over time.

This is a more accurate classification system than the current Standard Industrial Classification system, with many codes being incorrect. This is especially a problem for emerging sectors such as immersive. With an accuracy of sector lists between **90** and **95%**, The Data City provides the highest quality large-scale sector analysis.

Our survey of industry stakeholders used similar questions to the **2019** report, enabling comparison over time. The survey questions helped to identify key challenges, opportunities and interactions within the wider ecosystem.

This analysis was supplemented with semi-structured interviews with representatives from relevant companies, higher education institutions, non-profits, universities and policymakers to ensure that the findings are as reflective of the industry viewpoint as possible.

The Data City reads the websites of millions of UK businesses and analyses them using state-of-the-art text-mining methods to understand what they do. This method was able to identify any company that mentioned immersive keywords on its website, regardless of whether it was a developer, a creator or a user.

State of the Nation

This section summarises the survey findings relating to the sector landscape, economic value and growth. The key takeaways include:

- There are an estimated 2,106 immersive technology companies in the UK, representing an 83% growth in the last five years.
- Access to talent and finance remain the key barriers to industry development.
- Reflecting on the pandemic, there is a sentiment that it had a net-positive impact on the industry. 43% of survey respondents said COVID-19 had an overall positive impact on the growth of the organisation, compared to 23% who found it had an overall negative impact.

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The Landscape

There are currently around **2,106** immersive companies in the UK[1]. Collectively, this report estimates that there are **12,609** full-time employees (FTEs) working for these immersive technology companies[2 3].

The business models of the surveyed companies were:

69% product-based
(compared with **59%** in the **2019** Immersive Economy Report).

65% consultancy-based
(compared with **51%** in **2019** Immersive Economy Report).

75% service-based
(compared with **70%** in **2019** Immersive Economy Report).

This indicates that many of the companies surveyed have combined these three offerings together in their business model.

In terms of the ways in which companies are involved in the immersive economy, a survey found that:

85%

identify as a content provider.

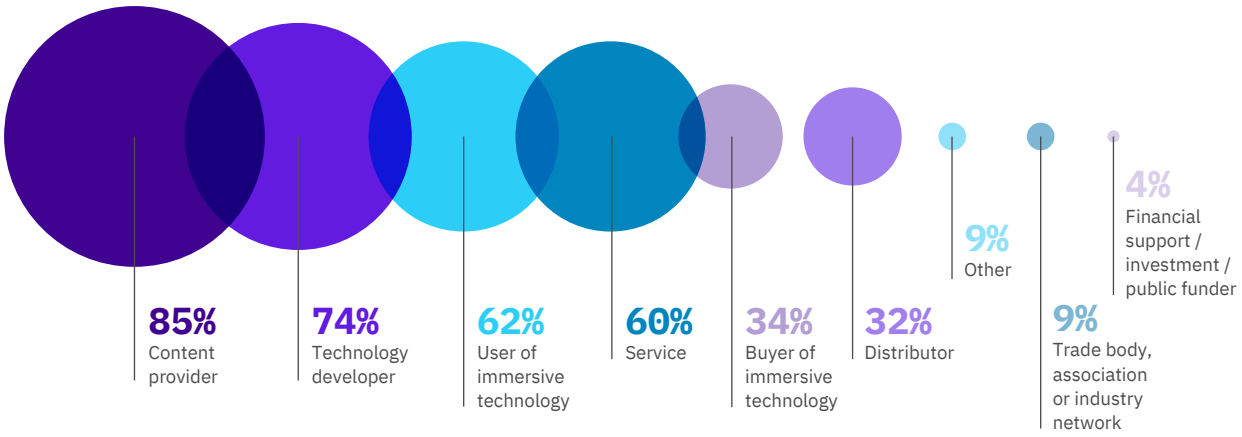
74%

identify as a technology developer.

62%

identify as a user of immersive technologies.

In which of the following ways, if any, is your organisation involved in immersive technology?



% of respondents

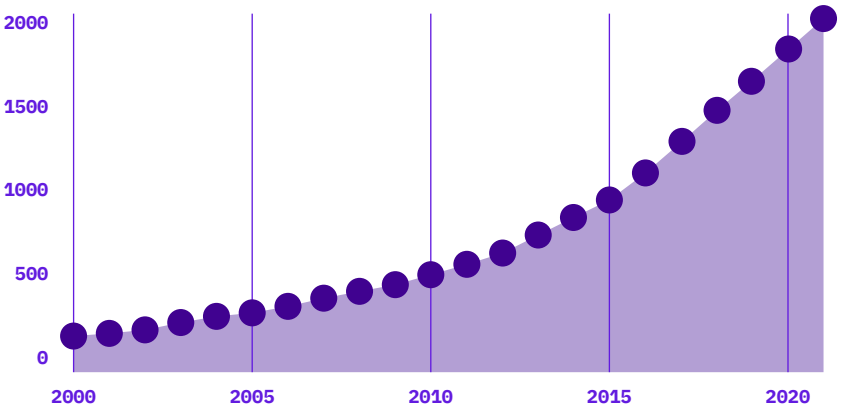
Source: Oxford Insights/Immerse UK Survey

1 This figure was calculated using The Data City's machine learning text-mining method.
2 This figure excludes freelance staff who work for immersive companies. The Creative Industries Policy and Evidence Centre's RADAR survey of firms in the creative economy has shown that small and micro SMEs similar to the immersive firms identified in this report use a significant number of freelancers. They found that "41% of [small and micro companies] worked with as many or more freelancers than they had employees, and 47% of supermicro (1-5 employees) companies worked with more freelancers than they had employees".
3 Company financial data on employment and turnover for immersive companies was obtained from Companies House.

Growth

The story of the industry over the last five years has largely been a story of steady growth. Between **2016** and **2021**, the number of immersive companies has grown by **83%**[4].

Cumulative number of immersive companies in the UK



Source: The Data City

Export

68%

of organisations surveyed export their immersive-related products, services, or content. This represents an increase from the **62%** of survey respondents that were exporting in **2019**.

Economic value

A big feature of the immersive economy is micro-businesses. **80%** of immersive companies with available financial data had between one and nine employees.

16%

had between 10 and 49 employees

3%

had between 50 and 249 employees

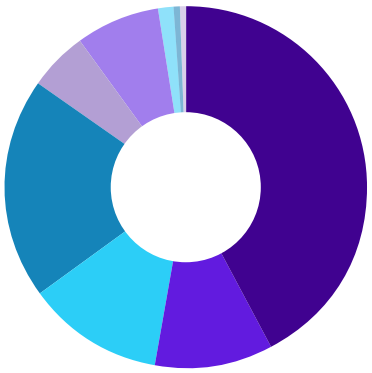
<1%

Less than 1% had over 250 employees

According to The Data City, the total turnover for the industry is estimated to be £1.4bn.

According to the analysis of data from The Data City, **40%** of immersive economy companies are currently pre-revenue. This indicates that many parts of the immersive economy are still at an early R&D phase, and not yet at high enough technology readiness to commercialise output.

Estimated company turnover



42.5% Pre-revenue	**19.8%** £100k-500k	**1.4%** £5m-10m
10.6% Under £50k	**5.3%** £500k-1m	**0.6%** £10m-25m
12.1% £50k-100k	**7.3%** £1m-5m	**0.5%** £25m+

Source: The Data City

4 In the charts in this report, we use 2021 as the most recent year. This is because at the time of releasing the report, the year 2022 had not completed, and current data points would therefore not accurately reflect an entire year of growth.

Top UK Companies

The largest UK companies identified in data from The Data City are Framestore by headcount and the UK subsidiary of Niantic by turnover. It is notable that amongst the top companies, there are many whose revenue streams are diverse and only partially made up of immersive technologies. For example, the likes of Framestore and A-Vision create VR, AR, and MR content and experiences as part of their broader range of media products. The involvement of these larger, non-specialist companies in the immersive economy suggests that customer awareness about immersive products is broadening and becoming more mainstream. The immersive offerings of non-specialist companies will only broaden this awareness further. With many of these larger companies investing internally in research and technology development, they are also likely to play a role in advancing the capacities of immersive technologies going ahead.

By Headcount

Company[5]	Estimated headcount	Involvement in Immersive
Framestore	**1,042**	VR studio to create worlds for the likes of HBO and National Geographic.
Improbable	**639**	Metaverse company that builds interconnected virtual worlds.
A-Vision	**300**	Specialise in creating screen content for corporate communications, TV ads and the internet.

Source: The Data City

By Turnover

Company	Turnover	Involvement in Immersive
Niantic (UK subsidiary)	**£102.4m**	AR developer, including for mobile games Ingress and Pokémon Go.
Framestore	**£84.9m**	VR studio to create worlds for the likes of HBO and National Geographic.
The Mill	**£42.3m**	Creative and production partner for agencies and brands.

Source: The Data City

5 Companies are identified as part of the immersive economy based on the text included on their company website. The proportion of revenue that comes from and number of employees working on immersive technologies is unknown.

Drivers of Growth

Businesses that are focused on their audience/market

Ultimately, immersive is a content-driven enterprise. Understanding what content is valuable to audiences is, therefore, a big driver of success. According to interviewees, some companies focus on this less because academic-led businesses do not consider what problem the market needs to solve sufficiently.

This is not a purely academic problem, with finding the right product-market fit being a harder problem for general purpose technologies such as immersive than other, more sector-focused technologies.

Public funding from a range of sources

Public funding from various sources particularly: the Arts and Humanities Research Council (AHRC); the Engineering and Physical Sciences Research Council (EPSRC); Innovate UK; and the Industrial Strategy Challenge Fund (ISCF) Programmes, Audience of the Future (AOTF), and the Creative Industries Clusters Programme (CICP); have collectively invested significant funding across the spectrum from pure research investigations to highly applied industry research and innovation programmes (Deep Dive p. 17), which have contributed significantly to the growth of the immersive sector in the UK. These sources of public funding are explored in greater detail in the Research & Development section of the report.

Scalability

Generally, interviewees claimed that immersive companies that leverage Software as a Service (SaaS) models possess greater capability to be scaled to market. This means that areas such as AR mobile phone applications, which are predominantly SaaS models, have enormous opportunities. However, the lack of funding available to the industry as a whole currently prevents any potential of this kind from being realised.

Enabling institutions

Accelerator programmes were seen as an important way that companies could develop commercial expertise and work with larger partners. Such programmes can be private, such as Entrepreneur First, or public, such as Digital Catapult's Augmentor program, or their AR accelerator programme with Niantic. These programmes help provide 'cash plus connections' in order to develop technology readiness levels and help founders understand their market better.

Cross-sector networks such as Immerse UK also play important roles in facilitating the exchange of knowledge and informing the policymaking ecosystem.

Barriers and Enabling Factors for Growth

Access to Talent

79% of survey respondents state this is a barrier to growth - more than any other factor. This is a significant increase from the **45%** of survey respondents that cited talent as a barrier in the **2019** report.

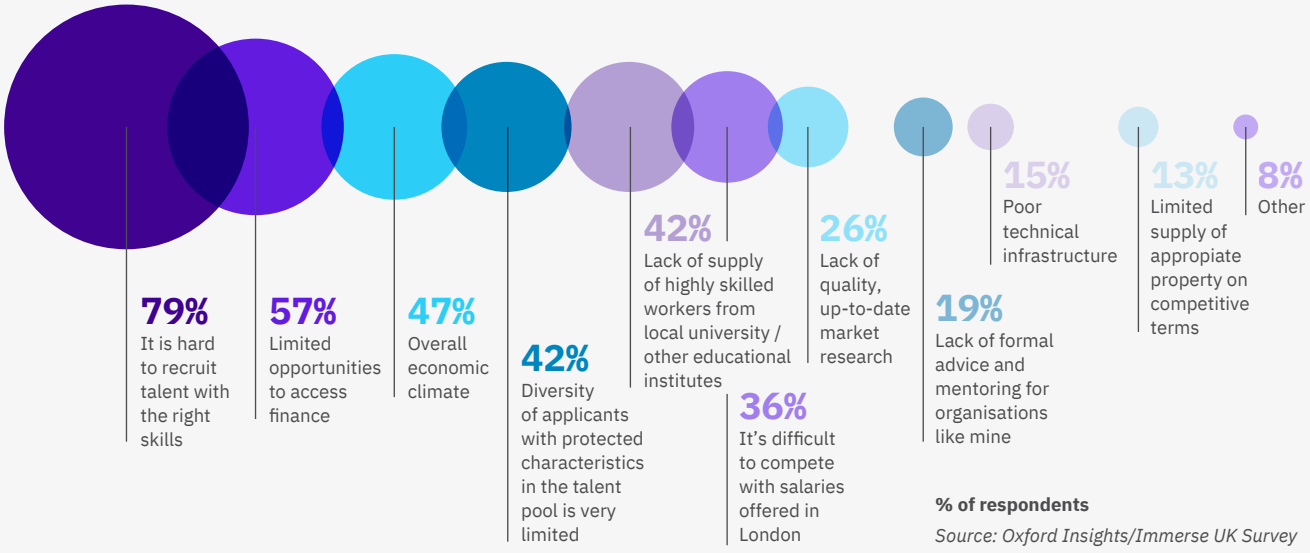
According to interview and survey responses, these skills gaps were:

- **Technical -** Unreal & Unity game developers with C++ & C# skills, and technical artists were frequently identified as being in short supply in the industry, particularly at a senior level. It was acknowledged that a mix of skills and hybrid roles were pivotal to success, which remains consistent with findings from the **2019** report. Work from ScreenSkillls has also identified the importance of 'technical artists' as an occupation in short supply.
- **Commercial -** Interviewees claimed that many immersive founders, particularly those with academic backgrounds, lacked the commercial expertise to find a product market fit and scale it appropriately. Similar problems have been uncovered in other general purpose emerging sectors such as AI.

Furthermore, many artists and engineers from 'legacy industries' (media, manufacturing, etc) are available but require 'reskilling' to ensure that they can apply their domain skillset to immersive experiences.

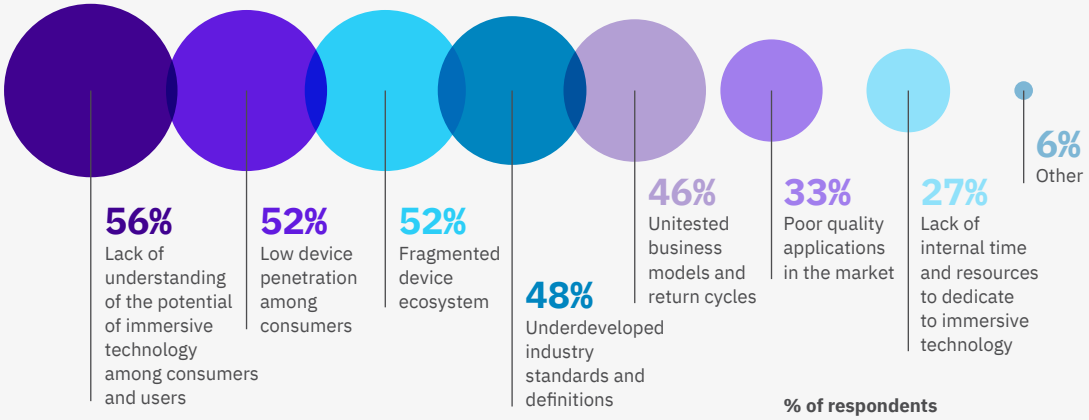
It is important to note that this skill shortage is not just a problem for high-level programming and engineering. Skills shortages in the education sector were flagged as a long-term problem. Primary and secondary education was touted by interviewees as integral to generating early stage shifts of mindset about the kinds of industries that schoolchildren aspire to work in.

Regarding access to resources, do you regard any of the following as key barriers to growth for your organisation?



Source: Oxford Insights/Immerse UK Survey

Regarding the technoloogy ecosystem, do you regard any of the following as key barriers to growth for your organisation?



Source: Oxford Insights/Immerse UK Survey

Accessibility of devices

Despite increasing levels of adoption, particularly as a result of the pandemic, **52%** of survey respondents listed low device penetration amongst consumers as a barrier, something that was also noted in the **2019** report. Part of this is an 'accessibility problem' that can be viewed through a few different lenses:

- **Economic -** The cost of headsets has dropped significantly, but remains a barrier to a wider market.
- **Geographic -** Location-based experiences have some constraints here. However, it is worth noting that immersive technologies, in general, offer solutions to traditional geographical barriers to doing business, such as with VR training.
- **Physical -** There are still a variety of factors that continue to make devices inaccessible to many people with physical disabilities.

Access to finance

To be explained in greater detail in the 'Research and Development' and 'Private Investment' sections.

57% of survey respondents listed access to finance as a barrier for businesses, compared with **52%** in the **2019** report. Public funding was seen as small in scale and requiring long application processes for grants. Private funding in the UK was seen as lacking in ambition and being risk averse.

Short-termist mindset

Several interviewees mentioned that investing in trends is a feature of the industry. As a result, companies and investors are sometimes 'looking for quick wins' rather than demonstrating the long-term, ambitious vision necessary to help the immersive economy mature.

This short-termism can create market uncertainty, due to eroding a sense of what a sustainable business model in the immersive economy looks like.

The emergence of the concept of the Metaverse could increase this risk, with it becoming one of the most hyped technology concepts. Whilst it offers enormous promise, it will also attract people and companies that are looking to make quick wins, potentially leading to instability in a manner similar to the cryptocurrency industry.

Other barriers raised in interviews and surveys included:

A lack of understanding ofthe potential of immersive technology (**52%** of survey respondents said this was a barrier). Several interviewees noted that educating the general public about the role and uses of immersive technologies could help to address this issue.

Underdeveloped industry standards (**48%** of survey respondents said this was a barrier).

COVID Impact

43% of survey respondents said COVID-19 had an overall positive impact on the growth of the organisation, compared to **23%** who found it had an overall negative impact.

Significant negative impacts cited by interviewees and survey respondents included:

- **Hygiene -** Many businesses faced increased costs from needing to clean headsets, as well as a trend of people not wanting to share public immersive devices. Additionally, the pandemic saw a restriction of numbers going through experiences due to social distancing rules.
- **Funding -** Several interviewees feared that public funding may be re-prioritised away from immersive technologies, following a growing national debt.
- **Project cancellations -** As well as production delays by clients created disruptions and cash flow problems for immersive companies.

On the other hand, the positive impacts cited by interviewees and survey respondents included:

- **Increased demand for online, virtual experiences.**
- **Culture shift -** remote work became the norm and led to more companies examining new ways to collaborate. Companies became more willing to experiment with and adopt XR solutions for things like training & collaborative design.
- **Recruitment -** businesses were able to attract international talent that worked remotely.

Among survey respondents, there is a perception that the pandemic increased interest in immersive technologies, and in particular, in remote collaboration.

43%

of survey respondents had an overall positive impact.

23%

of survey respondents had an overall negative impact.

Understanding Immersive Geographies

- London is dominant when it comes to immersive businesses - boasting half of the total immersive company turnover, 41% of all companies and 55% of employees in the industry.
- The fastest growing areas in the last five years were Wales (124%), Scotland (95%), and London (93%).
- Apart from London, the cities with the most immersive companies were Manchester (118), Brighton (115), and Bristol (99).
- Many of the largest companies by headcount and turnover in each NUTS1 region have been part of the Audience of the Future and Creative Industries Clusters Programmes.

Contents

For most of this analysis, NUTS1 statistical regions have been used to capture and compare the economic value of different parts of the UK[6]. This unit has been selected for two main reasons:

- NUTS1 statistical regions are the unit most similarly used in regional innovation work by government departments such as; the Department for Levelling up, Housing, and Communities; and the Department for Business, Energy, & Industrial Strategy (BEIS).
- It was important to keep the classification unit consistent with Office for National Statistics (ONS) data, so as to enable the best possible comparison between different geographic areas.
- The data collected enabled the identification of important cities and towns in each NUTS1 region.

Conclusions from our geographic analysis

London is dominant when it comes to immersive businesses. According to data from The Data City, London boasts half of the total immersive company turnover, **41%** of all companies and **55%** of employees in the industry. Whilst this shows how London can benefit the wider industry, it demonstrates that regional innovation efforts to rebalance the immersive economy still have to deal with the forces of the UK's regionally unequal economy.

When it comes to relative specialisation, the South East of England scores the highest. 'Relative specialisation' measures a region's industrial specialisation relative to a larger geographic unit (the UK).[7]

Here, a relative specialisation score of **1** implies that the region is as specialised in immersive technologies as the UK. The South East has a score of **1.52**, suggesting that the region is **1.52** times more specialised in immersive technologies than the UK.

London is dominant when it comes to immersive businesses.

The South East of England scores the highest when it comes to relative specialisation.

6 NUTS1 regions classify countries such as Wales, Scotland and Northern Ireland as 'statistical regions'.

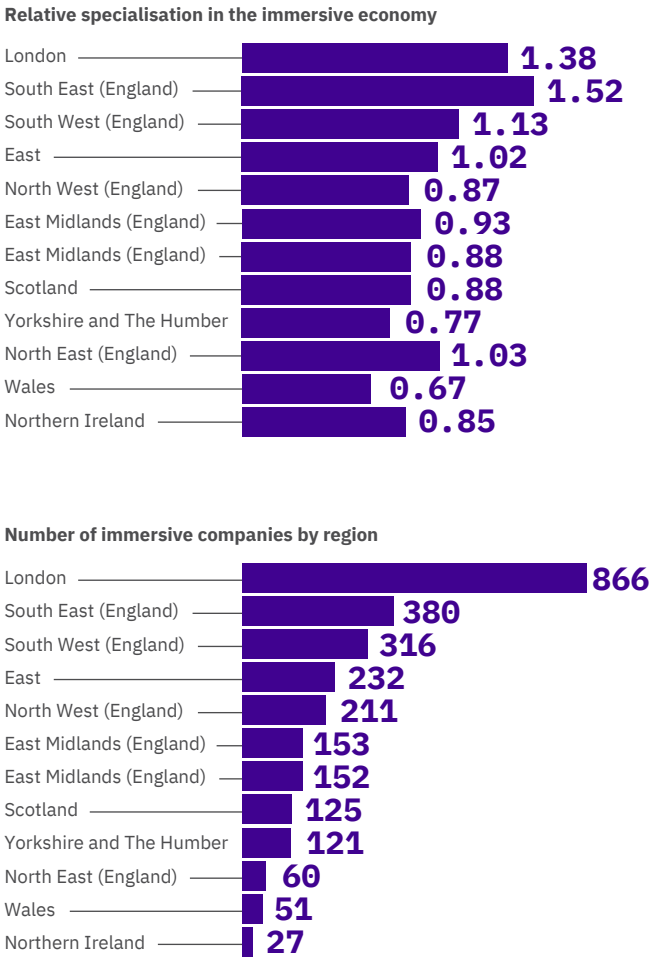
7 Relative specialisation is calculated as an industry's share of a regional total for a chosen economic statistic (e.g. immersive economy turnover, employment, business count, etc) divided by the industry's share of the national total for the same statistic.

The fastest growing NUTS1 regions in the last five years were Wales (**124%**), Scotland (**95%**), and London (**93%**). The slowest growing NUTS1 region in the last five years was Yorkshire and the Humber (**47%**). Interviews and desk research suggest that universities played an important role in the innovation process for immersive technologies across different economic hubs in the UK.

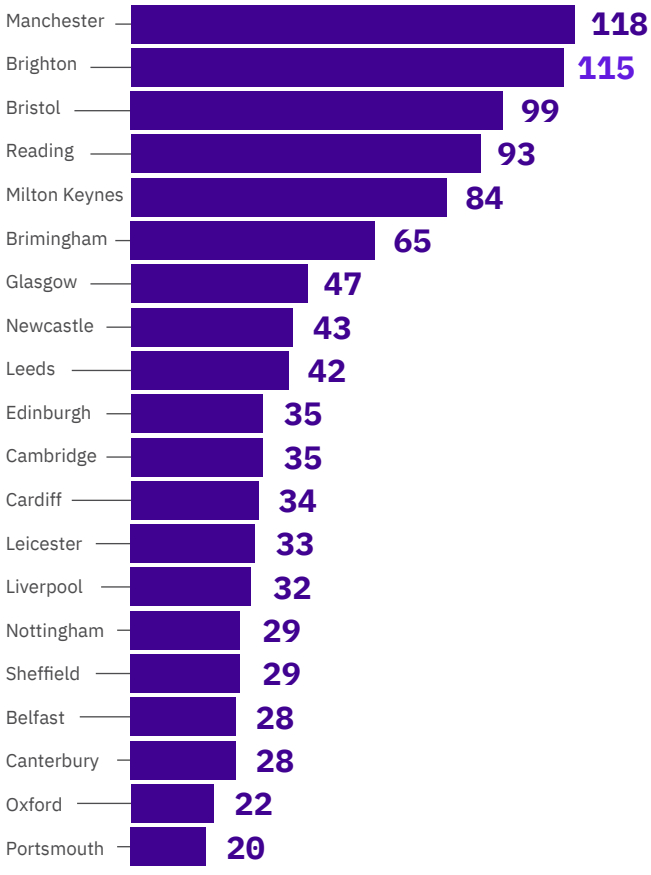
At the city level, apart from London, Manchester and Brighton host the most immersive companies, with **118** and **115** respectively.

The below chart showcases that there are over **20** cities with over **20** immersive companies based in the city[8].

Number of immersive companies and relative specialisation by region

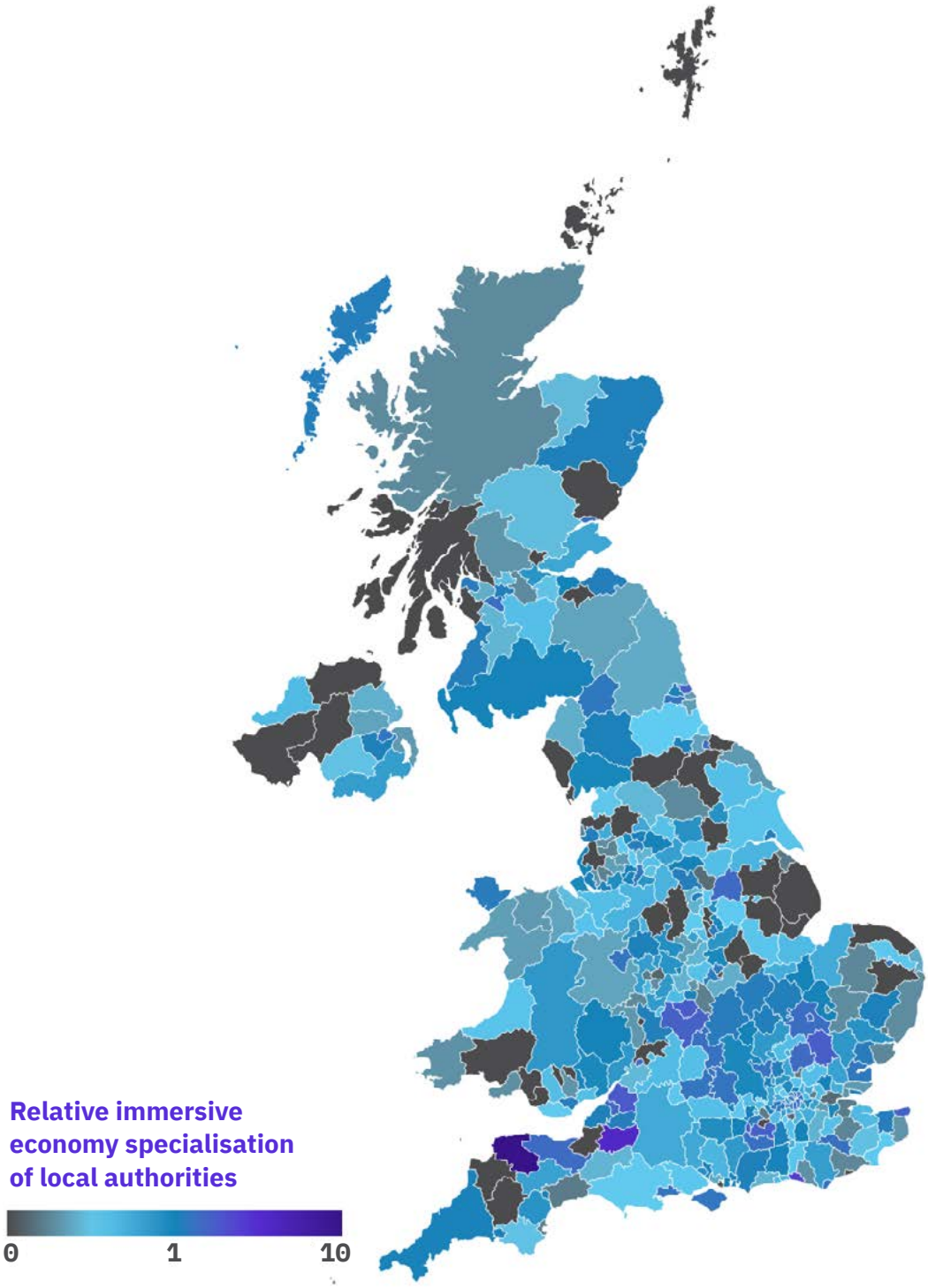


Number of immersive companies by city



Source: The Data City

8 London was removed from this chart because of its sheer dominance - to include it would reduce the scale of other bars and make the chart unreadable.

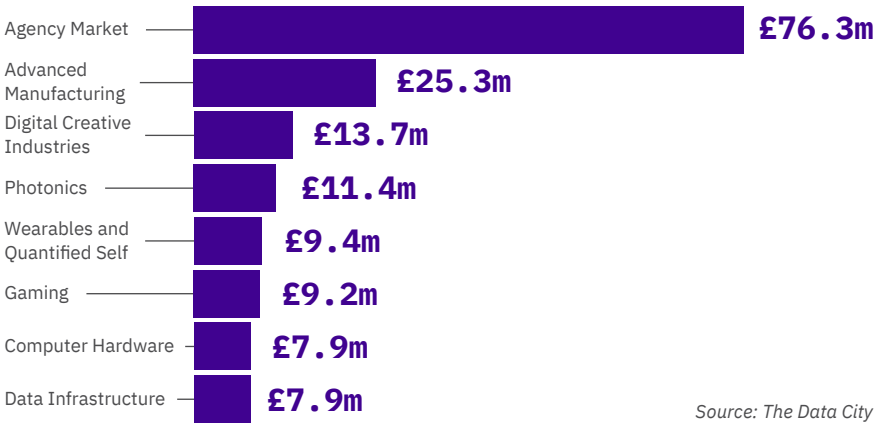


Map data: © Crown copyright and database right 2021 • Created with Datawrapper
Source: The Data City

Finally, the benefits of regional innovation programmes are beginning to take effect. Many of the largest companies by headcount and turnover in each NUTS1 region have been part of the Audience of the Future Challenge and Creative Industries Clusters Programme.

East

Turnover by immersive sector application



Source: The Data City

Overview

232 Companies

1,379
Full-time Employees

£190m Turnover

73%
Growth rate of the number of immersive businesses (past 5 years)

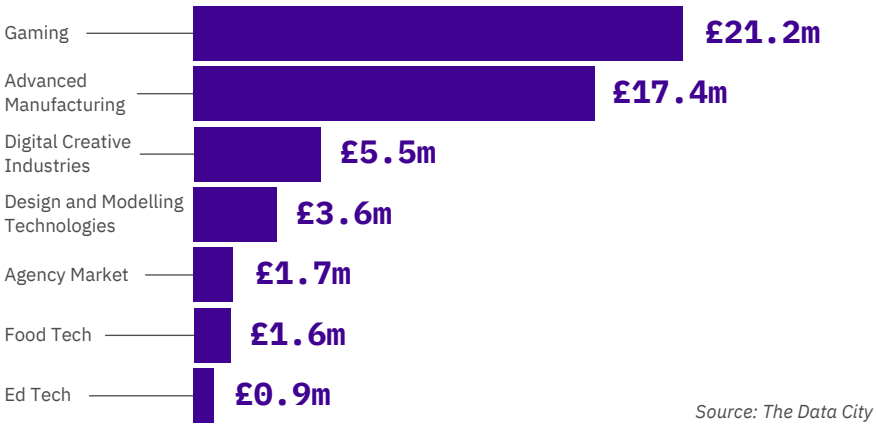
The East of England is home to several large immersive technology companies. Cambridge Mechatronics, who developed hardware for haptic and AR technology, are currently shipping tens of millions of units globally and are estimated to have over **100** employees.

According to the analysis of data from The Data City, a significant part of the East's immersive economy consists of advertising, where the agency market has the highest turnover of immersive sectors. The likes of Smyle, who have created gamified digital customer experiences for the likes of Samsung, capture some of these key regional trends, with the company being estimated to employ around **100** members of staff.

Private funding of immersive companies in Cambridge has helped to spur on the region. For example, holographic lens company VividQ recently closed a funding round of **£11m**. The funding round was led by Innovation Platform from the University of Tokyo. The new funding will enable VividQ to expand the team and scale operations in the US and Asia-Pacific regions.

East Midlands

Turnover by immersive sector application



Source: The Data City

Overview

126 Companies

1,296
Full-time Employees

£116m Turnover

63%
Growth rate of the number of immersive businesses (past 5 years)

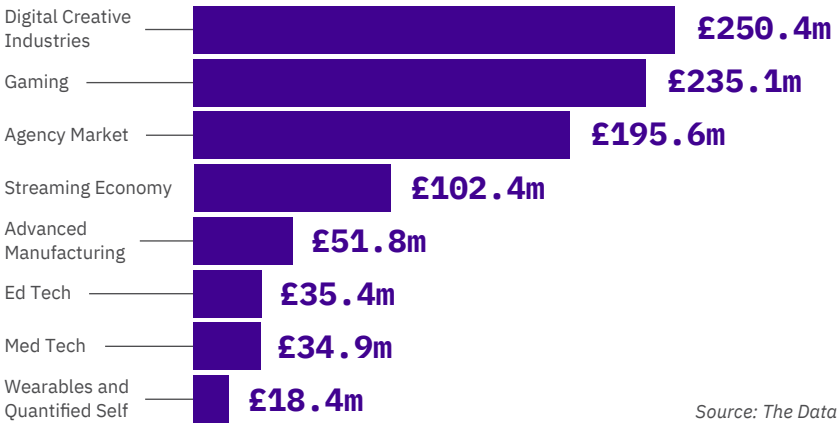
The East Midlands is a region that is home to many of the leading companies in the UK's immersive economy including industry heavyweight, Improbable. The multinational software giant has over **900** employees globally and raised **$600M** in investment to develop its metaverse technology. They acquired Nottingham-based, The Multiplayer Guys, to work on multiplayer immersive gaming experiences as part of an independent subsidiary of Improbable. Nottingham itself has **29** immersive companies working in the city.

Text mining from The Data City also picked up another key company in the region, Holovis. Holovis, from Hinckley and Bosworth, creates real-time immersive media and data-driven experiences such as **360** Golf, immersive tunnels and motion platforms. The company recently teamed up with Malaysian firm Azimuth International to bring their technology to Malaysia and the wider Southeast Asian region. Holovis is also working with the Malaysia Digital Economy Corporation on the **£14.8m** project with Azimuth.

Along with gaming, The Data City found that advanced manufacturing was also an immersive sector that performed well in the East Midlands, especially from the perspective of turnover (**£17.4m**). For example, West Northamptonshire's CAD-IT specialises in service lifecycle management, combining AR with advanced diagnostics to increase the efficiency and quality of manufacturing services.

London

Turnover by immersive sector application



Source: The Data City

Overview

866 Companies

6,991
Full-time Employees

£757m Turnover

93%
Growth rate of the number of immersive businesses (past 5 years)

London is driving a significant proportion of economic value in the immersive economy. Over half of immersive company turnover is generated in London, boasting **41%** of all companies and **55%** of employees in the industry.

The area's universities help to meet the intense demand for talent. Examples of academic programmes include; UCL's Computer Graphics, Vision and Imaging MSc & MA in Immersive Factual Storytelling; UAL's London College of Communication BA (Hons) in Virtual Reality; Goldsmiths, University of London: Virtual & Augmented Reality MA/MSc, and Royal Holloway, University of London: Immersive Technology MSc; and PhD programs at the Royal College of Arts Computer Science Research Centre.

As part of the Creative Industries Clusters Programme, StoryFutures[9] also offers a unique collaboration between the National Film and Television School (NFTS) and Royal Holloway. This creative 'Gateway Cluster' lies immediately to the west of London, and works to fund R&D projects for creative SMEs in the area, and to collaborate with a wide range of national stakeholders to support the region's growth.

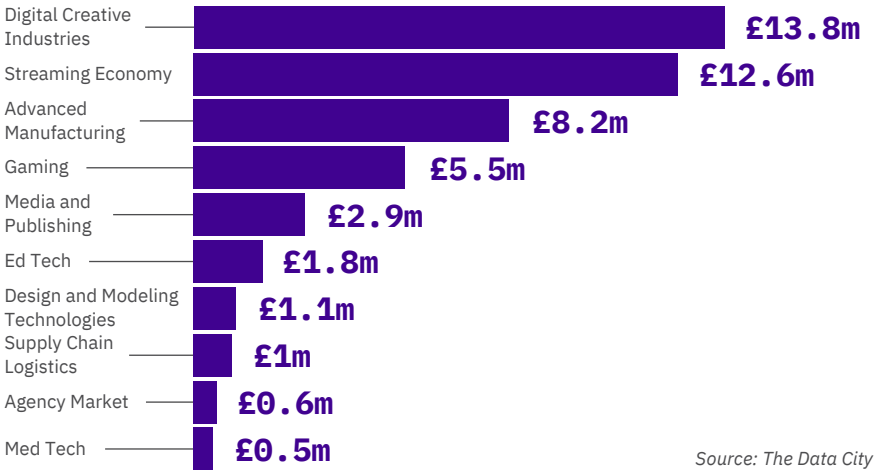
While interviews and surveys suggest that access to private funding is a major issue for the immersive economy, London remains a strong hub for venture capital investment, which is beneficial to XR companies in the London area. Between **2013** and **2018**, **£538m** worth of VC deals were completed in London's game and e-sport sectors, one of the most important sectors for immersive in London. The pull of the capital also means that global brands are more likely to work with London-based companies. For example, VR and AR animation company Pebble Studios work with Adidas, Samsung and L'Oreal to produce new forms of experiential advertising.

The risk of the industry remaining London-centric due to the intensity of economic activity in the region remains a concern, which stakeholders agreed made the presence of a national network like Immerse UK with a remit to promote regional talent even more important.

9 The StoryFutures cluster is different from StoryFutures Academy, although both are run by the National Film and Television School and Royal Holloway, University of London. StoryFutures helps create and fund R&D projects with creative businesses in the Gateway Cluster and Greater London. StoryFutures Academy was established as The National Centre for Immersive Storytelling to establish training and research programmes at a national level to develop a world-leading skilled workforce in VR, AR & real-time production. eliv

North East

Turnover by immersive sector application



Source: The Data City

The North East has overseen a boom in immersive economy activity in recent years. The region possesses particular strengths in digital creative industries, gaming, and the streaming economy. North East universities offer a strong supply of skills to the region. For example, Teesside University provides a range of undergraduate and postgraduate courses dedicated to computer games design. In addition, Gateshead-based digital production company PROTO, partnered with Durham University Energy Institute to secure **£1.2m** for innovation in renewable energy utilising immersive technology. These efforts represent examples of collaborative R&D that can drive regional innovation, with **43** immersive companies being based in Newcastle.

Mini-clusters in the region include Gateshead, with The Data City identifying several businesses offering a range of Mixed Reality products. The local authority is also doubling down on skills, working with HOST (Home of Skills & Technology) and Digital Catapult to deliver a six-week programme to support people gain skills across a broad spectrum of immersive tools and technologies. Furthermore, data analysis from The Data City found Middlesbrough has a budding gaming immersive sector, supported by a healthy local university ecosystem.

According to The Data City, the biggest immersive employers in the region include VR training firm from North Tyneside, 3T Energy Group, and cloud-based 3D visualisation specialists, ZeroLight.

Overview

60 Companies

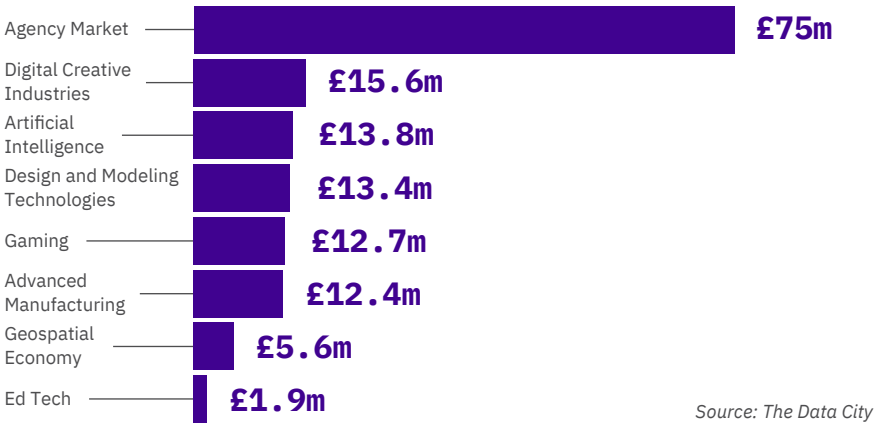
666
Full-time Employees

£51.4m Turnover

90%
Growth rate of the number of immersive businesses (past 5 years)

North West

Turnover by immersive sector application



Source: The Data City

The North West of England has a thriving immersive ecosystem, with a strong combination of public and private partnerships to support the creation of new opportunities.

The region benefits from having a strong creative sector to anchor its development. Digital Catapult's Immersive Lab was set up in **2019** at MediaCityUK in Salford.

Part of this sector includes the advertising space, where the agency market netted a relatively high turnover for the region. Smyle has offices in the region, whilst Manchester-based Image Metrics uses machine learning and computer vision to create custom AR experiences for the brands such as Electronic Arts and Disney.

As well as Manchester (**118** immersive companies), Liverpool also is a successful local authority in the immersive space, with **32** immersive companies. Immersive content studio Draw & Code is a VR and AR content studio that has worked with global brands such as Mercedes, Sony Music, Warner Bros and Nokia. The firm has a global presence, and recently announced an R&D and product development studio in Malta.

Furthermore, Local Enterprise Partnerships have helped to power R&D in the area. Edge Hill University in Lancashire recently announced the development of a **£13m** Tech Hub for immersive 3D virtual environments. The four-screen CAVE (Computer Augmented Virtual Environment) offers students and businesses a chance to fully immerse themselves in a virtual room. As a result of real-time data, users will be able to simulate real-life scenarios such as complex surgery and lab reactions in 4k resolution.

Overview

200 Companies

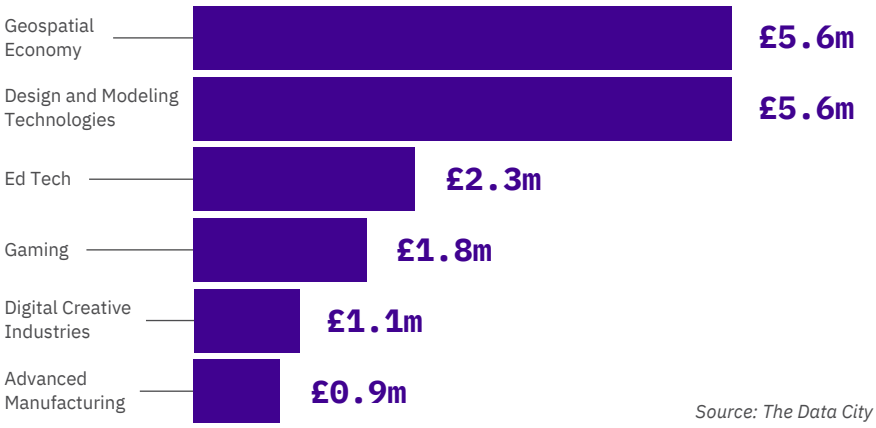
1,238
Full-time Employees

£143m Turnover

70%
Growth rate of the number of immersive businesses (past 5 years)

Northern Ireland

Turnover by immersive sector application



Source: The Data City

Although a relatively small industry, Northern Ireland has many characteristics that create the necessary conditions for a mature immersive ecosystem to develop.

The region has digital agencies such as Northern Ireland Screen, and R&D partnerships such as Future Screens Northern Ireland at the frontier of developing creative applications for immersive technologies.

Northern Ireland Screen, the national screen agency, runs apprenticeship and placement schemes for people in the immersive film industry. Meanwhile, as part of the Creative Industries Clusters Programme, Future Screens Northern Ireland funds new R&D projects. For example, the Belfast-based Ulster Touring Opera recently completed an R&D project exploring how immersive technology can play a central role in developing the future audience for opera.

Interviewees also pointed toward a culture of creative technologies being important to education.

Such a recognition of the immersive application at the level of primary, secondary and tertiary education could help create a culture where young people are more open to working in the industry.

Overview

27 Companies

226
Full-time Employees

£14.5m Turnover

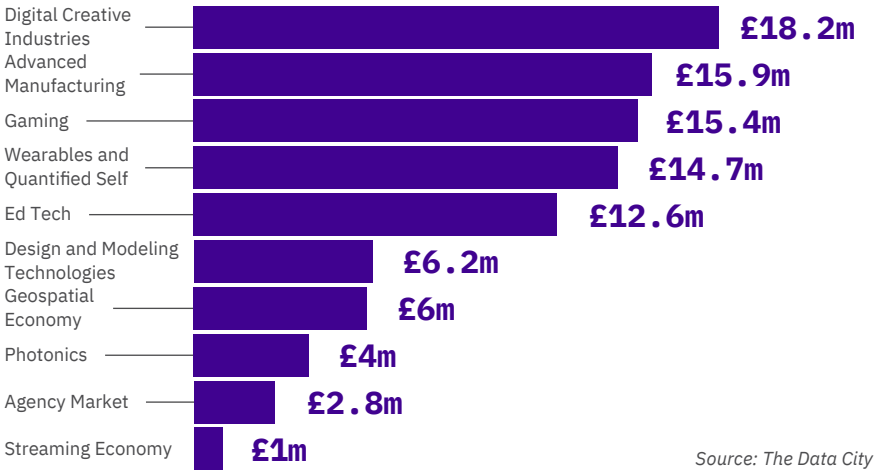
80%
Growth rate of the number of immersive businesses (past 5 years)

"Tech and creative tech education are critical to the growth of the Northern Ireland economy and can help ensure an end-to-end workforce pipeline. If we do this right, we can ensure an inclusive approach, so that there are opportunities for all young people and adult returners across the region. Since the pace of change in tech can be rapid and constant, we need to be agile by future proofing investment, programmes, education, apprenticeship schemes."

Deepa Mann Kler
— CEO, Neon

Scotland

Turnover by immersive sector application



Source: The Data City

Overview

125 Companies

1,138
Full-time Employees

£69.9m Turnover

95%
Growth rate of the number of immersive businesses (past 5 years)

Scotland is overseeing a series of interesting developments within the immersive economy.

Valuable immersive applications in Scotland include mixed reality, gaming, and wearables. Edinburgh (**35** immersive companies) demonstrates specialism in gaming and wearables, whilst Glasgow (**47** immersive companies) has a focus on the creative industries and advanced manufacturing. An example of the creative industry jumping head first into immersive experiences includes the University of Glasgow's Scottish Heritage Partnership conducting research into immersive applications in cultural institutions such as the Robert Burns Birthplace Museum.

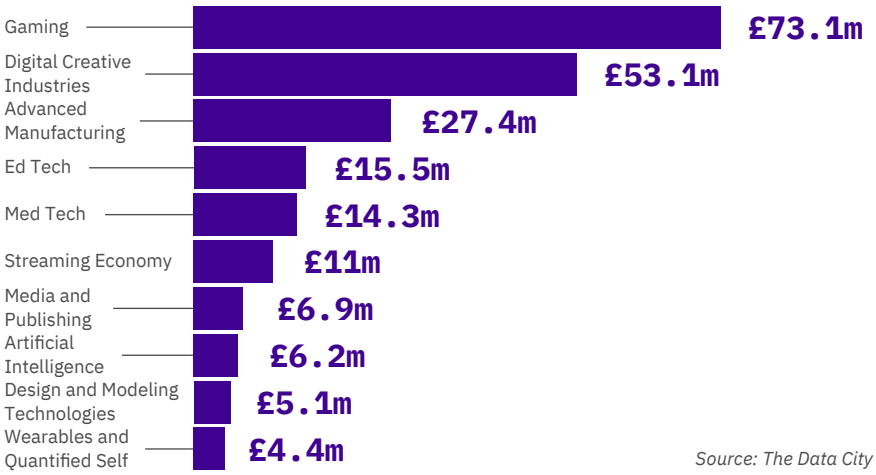
Scotland's universities also showcase best practices for collaborative R&D. Abertay University hosts one of the Creative Industries Clusters Programmes, InGAME, with the Universities of Dundee and St Andrews. The cluster is helping to support Dundee's vibrant video games industry. Beyond the CICP, Abertay has completed over **150** R&D projects with the industry since **2018**, also upskilling over **1,000** people in training programmes and launching a challenge competition in immersive storytelling.

Like Northern Ireland, one interviewee explained how COVID-19 helped with Scotland's recruitment drive for international immersive talent.

Some of the biggest immersive employers in Scotland include eCom Learning Solutions, who provide bespoke training strategies to a range of public sector clients, as well as Soluis Group, a Glasgow-based mixed reality experience company, and their spinout company, Edify.

South East

Turnover by immersive sector application



Source: The Data City

The South East of England attracts a lot of immersive companies, with the most outside London. Milton Keynes-based WaveOptics design optical engines for AR eyewear, employing over **100** people in the UK. The company was acquired by Snap for **$500m** in **2021**, having previously been the supplier to the tech giant's new Spectacles glasses. Games and experiences studio nDreams, who according to The Data City, employ around **100** people, station their work in Reading.

One common sector where immersive thrives in the south east is the digital creative industry. The city of Brighton hosts **118** immersive companies, with Bafta-winning game studio Preloaded having a turnover of **£3.2m**.

Furthermore, Caresoft Global, which employs almost **100** people, develops digital twin datasets and engineering sets for car companies such as Tesla.

In terms of the fusion of knowledge exchange between academia and industry, the Oxford X-Reality (OXR) Hub harnesses immersive technologies within the University of Oxford, receiving companies from the likes of AWS, DELL, Nvidia and HTC Vive.

Overview

380 Companies

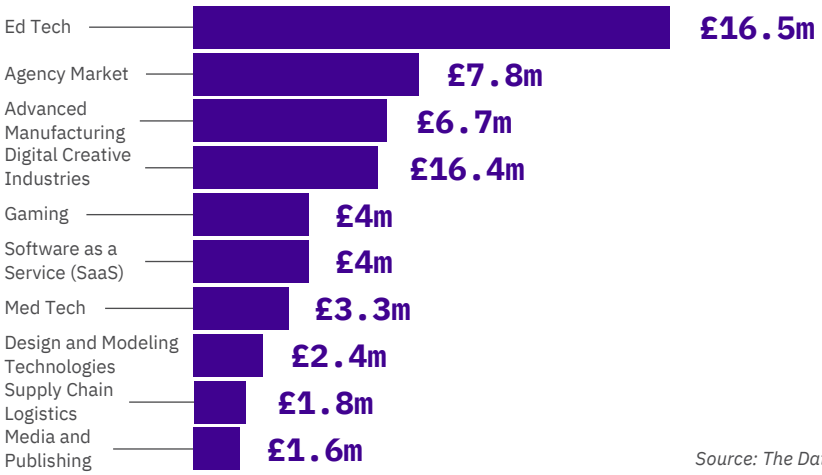
1,859
Full-time Employees

£194m Turnover

57%
Growth rate of the number of immersive businesses (past 5 years)

South West

Turnover by immersive sector application



Source: The Data City

Overview

211 Companies

1,257
Full-time Employees

£199m Turnover

77%
Growth rate of the number of immersive businesses (past 5 years)

In terms of raw economic value (turnover, number of companies and employees) for the immersive economy, the South West is one of the most prosperous areas in the UK.

Honing expert talent is a priority of the region. The South West Creative Technology Network recently hosted a large Immersion Fellows programme, where experts receive funding to think deeply about the potentials, challenges and opportunities in the realm of immersion. Furthermore, universities play a key role in the South West. Both UWE and the University of Bristol are involved in big investment projects in the field, with research specialisms including the health benefits of VR and VT storytelling. For example, MyWorld, an immersive media project at the University of Bristol, has received **£30** million in government funding through UK Research and Innovation's flagship Strength in Places fund. Additionally, the Bristol VR Lab at Watershed, a co-working space for VR developers and designers, illustrates new practices of knowledge exchange.

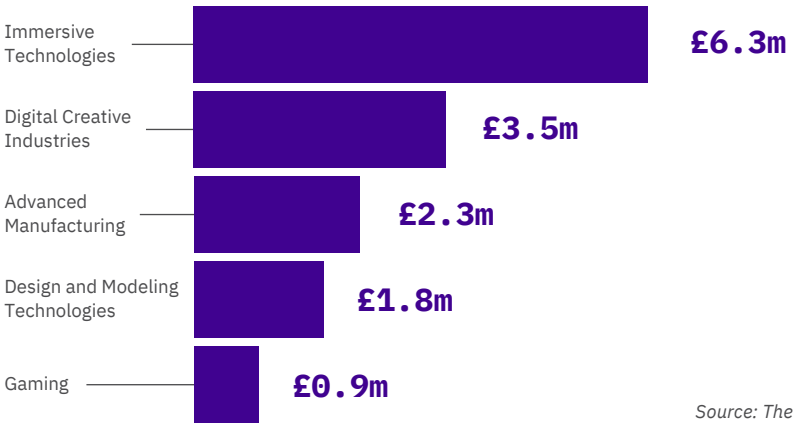
Experts identified Plymouth as an important South West hub for creative industries, who according to The Data City, host **13** immersive companies. The area recently received a **£7.6m** investment to develop an immersive dome and 360 film production suite. However, experts suggested that Plymouth also suffers from a problem similar to other hubs, in that creatives are not always collaborating across disciplines to help develop immersive content and solutions.

The South West also boasts areas such as Bristol (**99** immersive companies), which has a strong digital creative industry. The likes of Pytch, offering virtual production, hybrid and live events for businesses across the country.

The region also benefits from the CICP. The Bristol + Bath Creative Industries Cluster is a **£6.8m** partnership aiming to improve the performance of the Creative Industries in Bristol and Bath. The cluster hosts a range of programmes, including 'Inclusion Action Research' and 'Creative Ecologies' with the latter having supported Celestial, a firm that uses drones to create light shows.

Wales

Turnover by immersive sector application



Source: The Data City

Overview

51 Companies

179
Full-time Employees

£6.3m Turnover

124%
Growth rate of the number of immersive businesses (past 5 years)

Cardiff is a national creative hub, with an increasing amount of film and TV produced in wales. According to The Data City, the city is the home to **34** immersive companies. In addition to this, the Millenium Centre is launching a new space that will be dedicated entirely to immersive theatre, showcasing further the nation's strength in immersive digital creative industries.

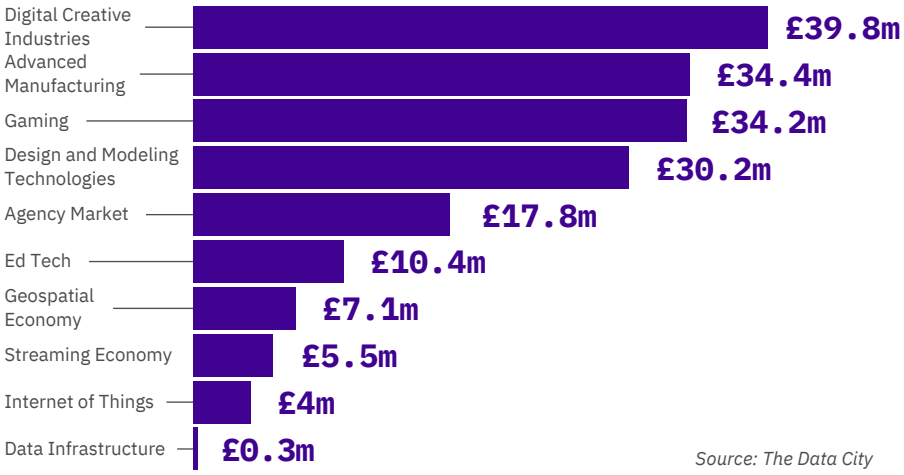
Clwstwr is a five-year programme supported by CIPC that is aiming to build on South Wales' success in creative content making to generate innovative new screen experiences. Clwstwr funded one of the nation's top immersive companies, Cloth Cat Animation, an animation studio that employs over **40** people and offers services for broadcast series, interactive and online games. Moreover, Clwstwr has a large suite of ongoing projects. These range from supporting the Cardiff Animation Festival, to exploring how to make the industry achieve Net Zero by **2030**, to helping Googleminds introduce gamification methods for training healthcare professionals.

Whilst Cardiff is where a significant proportion of Welsh immersive activity takes place, there are other exciting pockets in the country. Futurium, based in Anglesey, is another top performer. The company, estimated by The Data City to make up to **£1.4m** in turnover, has developed an integrated 3D interactive visual system for architecture, engineering and construction sectors. Similarly, Swansea-based iCreate provides CGIs, 3D flythrough animations, and marketing packages to the property sector.

Data and interviews suggested that a significant proportion of funding provided to Welsh immersive companies takes the form of public support. Although this could be understood as a feature of an early stage industry in Wales, this poses the risk of constraining the development of immersive if the nation fails to attract private investment.

West Midlands

Turnover by immersive sector application



Source: The Data City

The gaming industry is already significant in the West Midlands, which helps to explain why immersive applications for gaming are present in areas such as Warwick and Stratford. Stratford-based Slightly Mad Studios works on VR for franchises such as Need for Speed, employing over **80** people.

According to the analysis by London Economics and glass.ai, the region is home to the largest emerging technologies cluster outside of London. The Emerging Tech Capabilities in the West Midlands study also found that the region has significant R&D power, with **£2.4bn** of investment in R&D made by businesses in the West Midlands in **2019**.

The region is also creating the conditions for a young, digital, and diverse population. Companies such as Birmingham Open Media (BOM) are generating resources to help Autistic adults access and thrive in the digital and creative industries, whilst BBC3 has moved youth programming to the region. More broadly, Birmingham has **65** immersive companies working in the city.

Other specialisms in the region include edtech and training. Virti operates at the intersection of immersive learning, artificial intelligence and game design to provide training to companies. The Shropshire-based firm recently received **£7.2m** in Series A investment led by deeptech investor IQ Capital. Their technology has been deployed in healthcare settings around the globe to create scalable training opportunities and improve human safety.

Overview

152 Companies

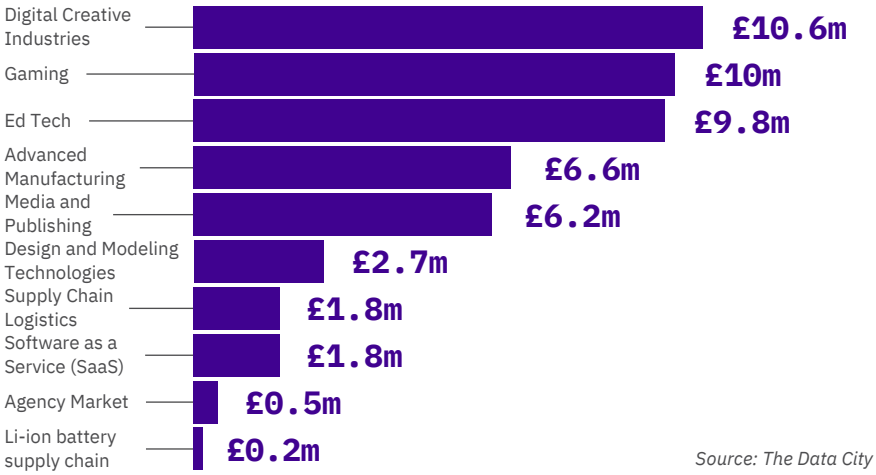
1,225
Full-time Employees

£135m Turnover

64%
Growth rate of the number of immersive businesses (past 5 years)

Yorkshire and the Humber

Turnover by immersive sector application



Source: The Data City

Steady, consistent growth has been the story of the immersive economy in Yorkshire and the Humber. One of its most successful immersive sectors is edtech, which is partially due to the presence of Immersive learning solutions company Niit. The Leeds-based outfit, employing over **90** people, offers programs as varied as VR health and safety training to AR and 360 video training interventions on ethics and compliance.

According to The Data City, **152** people in Yorkshire and the Humber are employed by immersive edtech companies. Other popular sectors include advanced manufacturing and digital creative industries. Overall, some of the leading cities in the region include Leeds (**42** immersive companies) and Sheffield (**29** companies).

XR Stories has formed an important part of driving innovation in Yorkshire's digital creative industries. Established as part of the Creative Industries Clusters Programme, a **£15** million investment has been made by the Arts and Humanities Research Council (AHRC), the University of York, BFI, and Screen Yorkshire. XR Stories is funding collaborative research and development projects which bring together SMEs with research partners. Local research centres such as Sheffield Hallam University's Cultural Communication and Computing Research Institute (C3RI), and the University of Bradford's Centre for Visual Computing collaborate with screen-based creative industry partners that work in animation, film, VFX and television in order to bring products to life.

Overview

121 Companies

609
Full-time Employees

£59m Turnover

47%
Growth rate of the number of immersive businesses (past 5 years)

Application Growth Areas

- Applications of immersive technologies vary across sectors, ranging from the innovative and emerging uses of VR to treat mental health conditions to the mature technologies used for safety-critical training for high-risk environments.
- Gaming (£142m), media and entertainment (£164m), and education and training (£156m) were the immersive application sectors with the highest turnover.
- A smaller but faster growing sector was healthcare, which saw 88% growth in immersive companies in the last five years, higher than any other application sector.

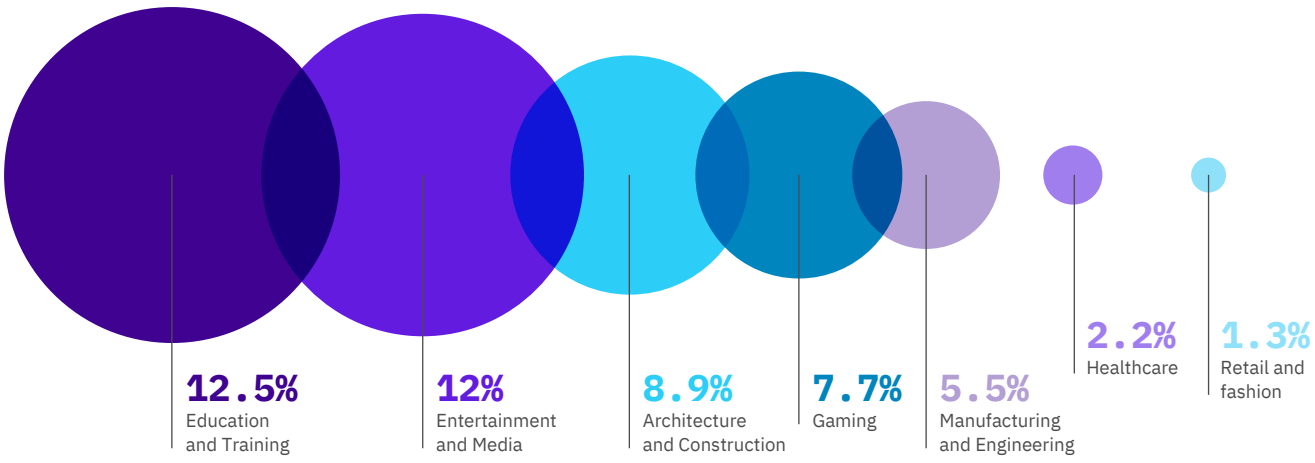
Contents

Immersive technologies have multi-sector applications, which the UK's immersive companies are finding and targeting as they grow. This was found amongst the companies surveyed, with **66%** of them saying that immersive technologies open up new markets and sectors to work with. The types of immersive technologies being used and how they are being used varies across sectors. This makes it important to explore the key growth areas in each sector independently in order to understand how the immersive economy is evolving.

This analysis of the immersive economy involved categorising the UK's immersive companies into the sectors in which they operate. Here, keywords were identified on websites that are associated with known growth areas for immersive technologies, such as 'Education and Training' and 'Retail and Fashion', and identified companies that are working in these sectors based on the text included on their websites. To do this, the analysis used The Data City's platform, which reads the websites of millions of UK businesses and analyses them using text-mining methods to understand what they do.

According to this analysis, the largest application areas by business count are 'Entertainment and Media' and 'Education and Training', with **12.0%** and **12.5%** of immersive companies operating in these sectors respectively.

Top 7 Sectors that Immersive Companies are Operating in

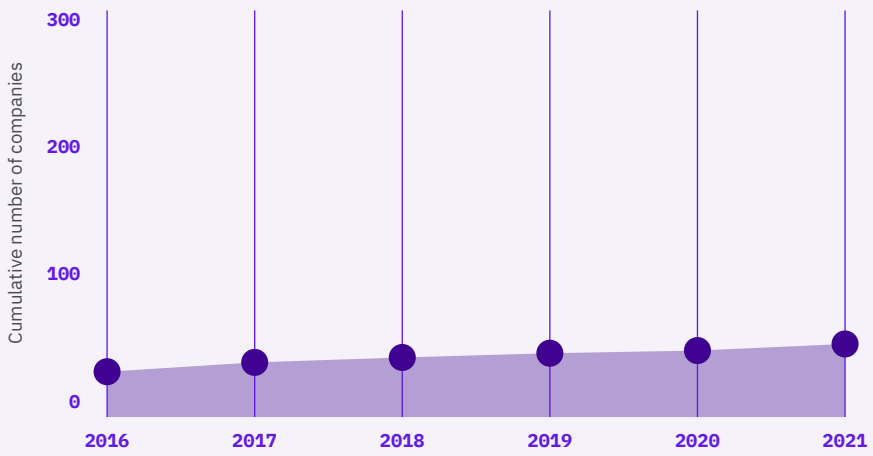


% of immersive companies that belong to each sector

Source: The data city

Healthcare

Cumulative growth of immersive companies in healthcare



Source: The Data City

Overview

46 Companies

204
Full-time Employees

£44.8M
Turnover

88%
Growth rate of the number of immersive businesses (past 5 years)

Additional pressures on healthcare systems created by the COVID-19 pandemic have increased demand for new approaches to increasing efficiency and performance via digitalisation. This was reflected in the **2021** Autumn Budget in the UK, which set aside **£2.1** billion for the use of digital technology in healthcare over the next three years.

Immersive technologies have the potential to play a role in solving these pressures. The main benefits the technologies bring to healthcare, identified in an upcoming NHS 'XR Discovery Report', include cost, time savings, and positive patient outcomes, which all align well in supporting service model efficiency.

There is an opportunity, therefore, for the healthcare sector to experiment with and adopt immersive technologies within their organisations. The rise in the number of immersive companies operating in the healthcare sector may reflect the beginning of this experimentation and adoption. Although the number of immersive companies in healthcare remains relatively low compared to other sectors, it has experienced the highest growth rate in the number of businesses over the past **5** years (**88%**) out of the sectors included in the report.

While the roots of immersive technologies in healthcare are in medical training, the companies collected in the text-mining process show that the technologies are now being used for

applications across the sector, ranging from pain management and rehabilitation to treatments for mental health conditions. Speaking to the diversity of applications, one of the UK's most prominent immersive companies in healthcare is London-based Random42, who works on medical animation, creating drug visualisations for pharmaceutical companies.

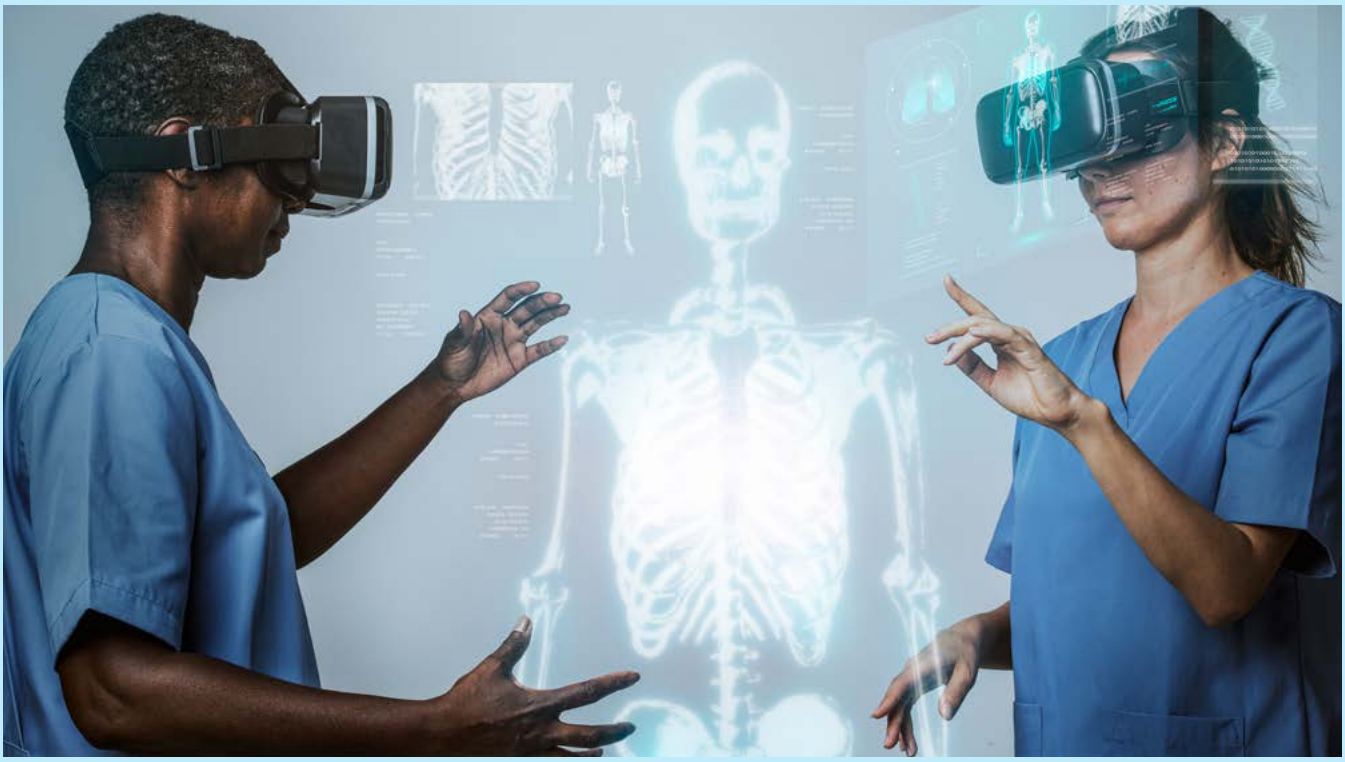
Mental health in particular became a priority issue for individuals and health service providers during the pandemic.
There is evidence of UK companies starting to emerge in the mental health space, such as Oxford VR, a company using virtual coaching and immersive simulations to treat serious mental illnesses including anxiety and psychosis.

The Institution of Engineering and Technology's report on immersive healthcare, developed in partnership with Immerse UK, raised important challenges associated with the regulatory backdrop for immersive companies working in healthcare. Companies looking to get their products licensed found they had to take part in a competitive, 18-month process to apply for a medical device licence from the Medicines and Healthcare products Regulatory Agency (MRHA). Similarly, the cost of clinical trials was considered a significant challenge by companies, with some companies having to fund several rounds of trials independently. Having support and guidance available to immersive companies navigating the heavily-regulated sector will be key for accessing the potential benefits of immersive technologies in healthcare going ahead.

The upcoming NHS 'XR Discovery Report' suggests that immersive companies operating in healthcare also often face an unclear route to market, created by a complex potential customer base, comprising organisations in both the public and private sectors. The NHS is a major customer for immersive companies and therefore its procurement practices will play a role in easing this challenge. Other barriers for immersive companies include the provision of hardware that is accessible for users with different health conditions and varying needs as well as the production of suitable content which is of a quality to supplement or replace existing treatments.

Mental health in particular became a priority issue for individuals and health service providers during the pandemic.

NHS Transformation Directorate



Discovering the Healthcare Potential of XR

NHS-led discovery work looking to understand the potential of extended reality (XR) across health and care has found that the top four uses in the NHS in England were training and education; mental health and wellbeing; rehabilitation and physiotherapy; and pain management. The 'XR Discovery Report', which is soon to be released, also identified a number of less mature uses of XR, such as data visualisation and image-guided surgery.

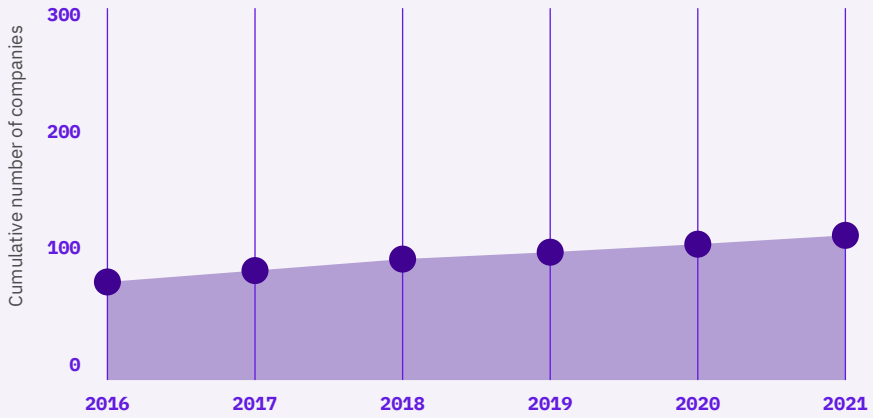
Several barriers to adoption were raised by NHS providers and suppliers. The most frequently mentioned was the lack of data on the effectiveness and return on investment from the use of XR, which made buy-in during the early stages of adoption more difficult. Suppliers also raised the lack of clarity on regulatory compliance for XR and the lengthy adoption times due to a lack of suitable procurement frameworks and differences in local approval processes.

12 recommendations were made in the report to address barriers, with three focused on supporting generation of evidence through dedicated funding in the short and medium term, and the development of a standardised cost-benefit framework. Other recommendations referred to the development of a governance framework for XR use in education and training, and clearer routes to market for XR products responding specifically to barriers raised by suppliers.

Neesa Mangalaparathy
— XR Programme Delivery Lead, NHS Transformation Directorate

Manufacturing and Engineering

Cumulative growth of immersive companies in Manufacturing and Engineering



Source: The Data City

Overview

115 Companies

823
Full-time Employees

£109m
Turnover

56%
Growth rate of the number of immersive businesses (past 5 years)

As the engineering and manufacturing sector look to digitise, immersive technologies are being adopted in the engineering and manufacturing processes of a range of industrial sectors, including aerospace, automotive, and oil and gas.

Interviewees distinguished between the use cases for VR and AR within manufacturing, pointing out that they are typically used at different points in the manufacturing process. VR is proving most useful at the very early stages, for instance in de-risking training or for virtual prototyping where the product does not yet exist. For example, virtual prototyping can drastically reduce the time prototyping takes. Professor Rab Scott, spoke to this with respect to his experience working with SMEs used to traditional manufacturing techniques in MDF.

AR, on the other hand, is more commonly used through life engineering services, including maintenance and repair. For instance, AR can be used as a real-time guide for a user carrying out a repair by mapping digital instructions onto physical equipment.

"We wanted to show the company how they could use emerging technologies to speed up the iteration process but also reduce their environmental impact. So we developed a configurator. This was developed in Unity, where they could actually get a customer in, put on the headset, and then the customer would actually do the layer themselves... what that did was it took down the iteration time from about six weeks to about 30 minutes."

Professor Rab Scott
— Director of Industrial Digitalisation at the Advanced Manufacturing Research Centre at the University of Sheffield

Digital twins are a key trend emerging within the engineering and manufacturing sector. Digital twins are virtual representations of objects or systems that are connected by the flow of real-time data between the virtual and physical object or system. For manufacturers, they offer promising new, smart manufacturing solutions such as remote operation. For immersive companies, they present an opportunity to build the VR and AR technologies that form a part of the foundational technologies needed to support the creation of digital twins. The likes of VR company, Virtalis, are already tapping into the capabilities of digital twins. Promisingly, the UK Government has given early and sustained support for the technologies, primarily via the National Digital Twin Programme and **£11.2** million with a further **£20** million of leveraged private investment in funding from the Engineering and Physical Sciences Research Council (EPSRC) for four prosperity partnerships.

Digitalnauts' HoloHub

Case Study

Glasgow-based Digitalnauts, a business supported by the Audience of The Future challenge, has developed the immersive virtual reality training platform Holohub.

Digitalnauts' HoloHub™ platform is a fully immersive, virtual reality (VR) training tool using the latest security and cloud-based technology to create immersive training that gives the learner a real sense of being there. Founded in 2016 by friends Mark Baxter and Charles Seguin. They initially focussed on creating bespoke training content, but soon identified an industry need for a much more sustainable VR training solution: the HoloHub™ platform.

In 2019, Digitalnauts won its first UK Research and Innovation (URKI) grant to develop its HoloHub™ training platform. The platform can help businesses train up anytime, anywhere, increasing productivity, cutting employee downtime, reducing travel costs and minimising their carbon footprint.

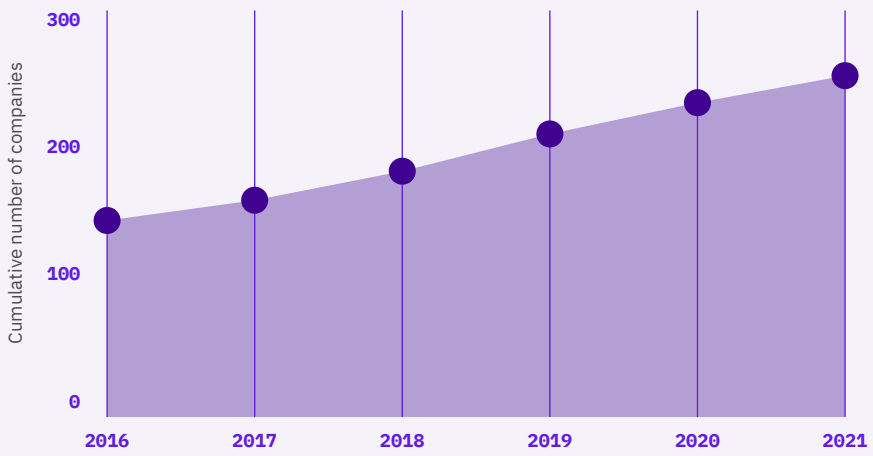
The Audience of the Future's Production Innovation in Immersive Content competition funding directly led to the company working for key global industry names, with ongoing impact. They include Takeda Pharmaceutical, Construction Industry Training Board, Construction Scotland Innovation Centre, Northern Marine Group (Stena) and Openreach.

Digitalnauts claimed that grant funding allowed them to create jobs and take more risks. This enabled them to go from two to seven staff, acquire a non-executive director, and use additional sub-contractors.

The plan for the company over the next two to three years is to expand further and launch more online VR training onto a marketplace, creating economies of scale. This will provide cost-effective, off-the-shelf training, allowing more global companies to access their immersive VR technology.

Education and Training

Cumulative growth of immersive companies in edtech



Source: The Data City

Overview

263 Companies

1,546
Full-time Employees

£156m
Turnover

80%
Growth rate of the number of immersive businesses (past 5 years)

According to our estimates, Education and Training is the most common sector for immersive companies to be operating in. Many of the top immersive companies in Education and Training identified in The Data City's analysis deliver enterprise training solutions, often using VR and AR technologies. Interviewees suggest this is down to a range of problems that VR and AR technologies solve for organisations dependent on high-quality training. They offer:

- **Safety** in high-risk environments, for example, the SimCentric VR system Saf-Tac being used by the British Military for training simulations and Digitalnaut's VR training solution for Openreach's high voltage pole work.
- **Standardisation** of training experiences. In domains such as archaeology, where weather can be highly variable, creating a virtual environment can give people a level playing field to work on.
- **Cost reduction** by removing the need for transport and the hiring of buildings.

Interviewees further suggested that the successes seen in enterprise training may have in part resulted from the cost of hardware coming down, making it easier to purchase VR headsets at scale. Moreover, with the huge demand for reskilling in the broader labour market, and the pandemic showing how virtual spaces have the potential to be highly accessible, demand for VR training is expected to continue to rise.

Bodyswaps
bodyswaps.co

Case Study

With the support of Audience of the Future's Investment Accelerator, Bodyswaps is building a soft skills training platform powered by real-time interactive VR and AI. The platform lets learners practise their soft skills in virtual workplace situations, including, communication, leadership and emotional intelligence. Learners are able to interact with virtual humans, using their own voice and body language, and playback the interaction from the virtual humans' perspective.

The impact of Covid-19

Originally, the training was going to be first rolled out with learners using VR headsets to access the platform. However, the pandemic disrupted these plans as headsets are typically shared between employees in the office. This presented risks for infection control and potential logistical issues with the delivery and return of hardware to and from learners' homes.

With the help of continuity grants that were available to existing Innovate UK funded projects to help with pandemic adjustments, Bodyswaps made their platform and immersive training content available on mobile devices and PC. As a result, learners who did not have access to a VR headset were able to access the training content from their own devices. This shift enabled Bodyswaps to complete the pilot despite the heavy restrictions in place at the moment of release (winter 2020-21).

Results from the project pilot

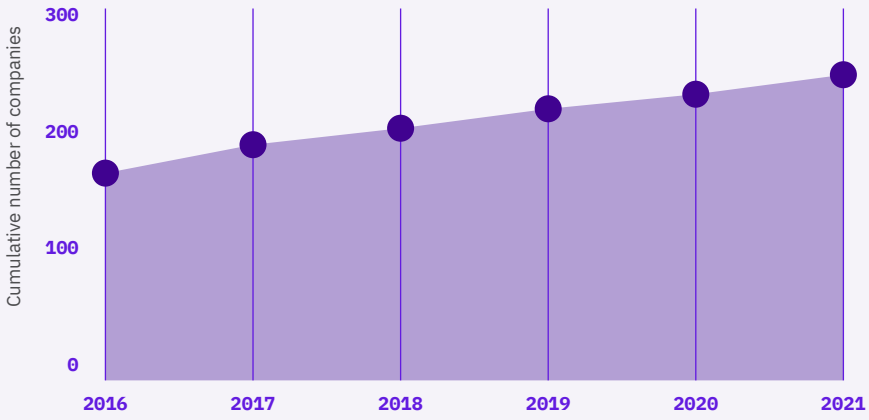
The pilot was first carried out with Grenoble Ecole de Management (FR) and Viability (US). Bodyswaps find that education institutions typically use the product as an employability training tool – enhancing students' soft skills, enabling them to get a job and progress faster in their career. Meanwhile, corporates use Bodyswaps to upskill their workers in skills such as Communication, Inclusive Leadership or Customer Service.

Feedback from learners suggests that those who have tried the VR version prefer the VR version. However, learners who have only tried the mobile version find it more engaging and immersive than traditional mobile apps.

By July 2021, Bodyswaps had over 20 paying customers from 8 countries and around 25% of them favoured a deployment on mobile devices, with a view to deploying in VR at a future date, when restrictions ease.

Media and Entertainment

Cumulative growth of immersive companies in Media and Entertainment



Source: The Data City

Overview

253 Companies

1,633
Full-time Employees

£164m
Turnover

50%
Growth rate of the number of immersive businesses (past 5 years)

As an inherently creative industry, immersive companies find an obvious home in the media and entertainment sector. The analysis found it was the second most common sector that immersive companies are operating in, following Education and Training. Within the sector, immersive companies are animators, storyline builders and world creators by using VR headsets, AR applications on smartphones and location-based experiences to deliver their creative content. For example, Alchemy Immersive is a content producer using a combination of these technologies to deliver immersive experiences in cinemas, theatres and museums.

Immersive companies in the UK stand to benefit from the country's competitive advantage in the creative sector. The UK's internationally renowned creative industries contributed **£115.9bn** in **2019** to the domestic economy in terms of Gross Value Added (GVA), making up **5.9%** of the total UK GVA. Already UK companies, such as The Mill, are expanding globally and showcasing their content production on the world stage.

Interviewees noted that the continued development of immersive technologies in the media sector requires a strong bridge between academia and industry. The Creative Industries Clusters Programme (see page 67 for details) has been fundamental to this development. Universities affiliated with the programme have demonstrated the benefits of linking their expertise and programme funding with local companies. The success of this work has led to increased industry buy-in, for example at Ulster

University when Epic Games named Ulster Screen Academy as one of its 'Unreal Academic Partners'.

The unique, creative and technical skillset needed by immersive companies working in media and entertainment have emerged as a barrier for the industry. Interviewees mentioned that, as a result, there is reskilling required for employees coming from the entertainment and creative sectors as well as those from traditional engineering backgrounds.

Responding to this skills shortage, various degree programs and industry training initiatives have emerged in recent years led by a number of different universities, private companies, and publicly-funded bodies. StoryFutures Academy (SFA) was developed through Audience of the Future Programme (see page 69) funding to be the National Centre for Immersive Storytelling run by the National Film and Television School and Royal Holloway, University of London.

SFA addresses the skills shortage from a number of different angles. They have offered opportunities for creative practitioners to understand the fundamentals of immersive storytelling, run bootcamps for academic researchers in fields such as Artificial Intelligence and Machine Learning to learn how to apply their technical background to immersive storytelling, and delivered a Train the Trainer (TTT) program to upskill educators and help them to design XR programs and courses for their educational institutions. Their diverse range of programs were tailored to meet industry needs and were adapted quickly to ever-changing developments in the industry. A great example of this was the development of the VP Futures programme in collaboration with Future Screens NI, to address the rapid rise of the use of virtual production film techniques during the pandemic and the subsequent skills shortage.

"We need to encourage researchers who work in traditional engineering and technology research, who don't see themselves as having a role in the creative industries, to potentially consider their focus in that area. Their work has an application because, ultimately, the creative industries in the future are going to be underpinned by data, AI, and communications technologies, and how they integrate in this unique and demanding field ".

Damian Murphy
— Professor of Sound and Music Computing, University of York and Director of XR Stories

Virtual Production

XPLOR and the Live Entertainment Industry

Virtual production (VP) is a rapidly expanding media production technique that combines the use of VR & AR with CGI through the use of real-time game-engine technology, and is becoming a significant part of the immersive economy. This method of production changes the traditional filmmaking pipeline from the linear process of previsualization, production, and postproduction, into an iterative process where these three phases overlap in real-time.

As the UKRI Deep Dive into the Creative Industries states, there has been an accelerated shift to Virtual Production technologies across the Film, TV, Games and Performance sectors (UKRI Deep Dive p. 12), which can in large part be attributed to the pandemic. This accelerated shift has produced a significant skills gap, which was explored in depth in the 2021 Story Futures Academy Immersive Skills Report.

As a creative industries leader, the UK is well placed to capitalise on this growing opportunity and develop a strong ecosystem of VP facilities and talent nationwide.

Significant work is already taking place on West Yorkshire's Production Park, the UK's premier live events, film, and TV campus. Production Park's Backstage Academy, a higher education institution specialising in the live events and creative industries, has launched XPLOR, the world's first research and innovation centre for entertainment technology and production.

As one of only a handful of open-access facilities in the UK, the Centre for Virtual Production is helping to bridge the development gap by enabling TV and video production companies to take advantage of the latest virtual production technologies.

The multi-million-pound research and innovation centre houses pre-visualisation suites as well as design and prototype spaces, which can be used to test, model and build product design, machine automation, hardware prototypes, and immersive VR/XR experiences, modelling, rendering, as well as virtual production.

Specialising in collective problem solving and pioneering research and development, XPLOR also offers a range of bespoke services for clients including technical consultancy, project management and networking, with core capabilities in concept and product design, software controls and automation, prototyping, testing and virtual production.

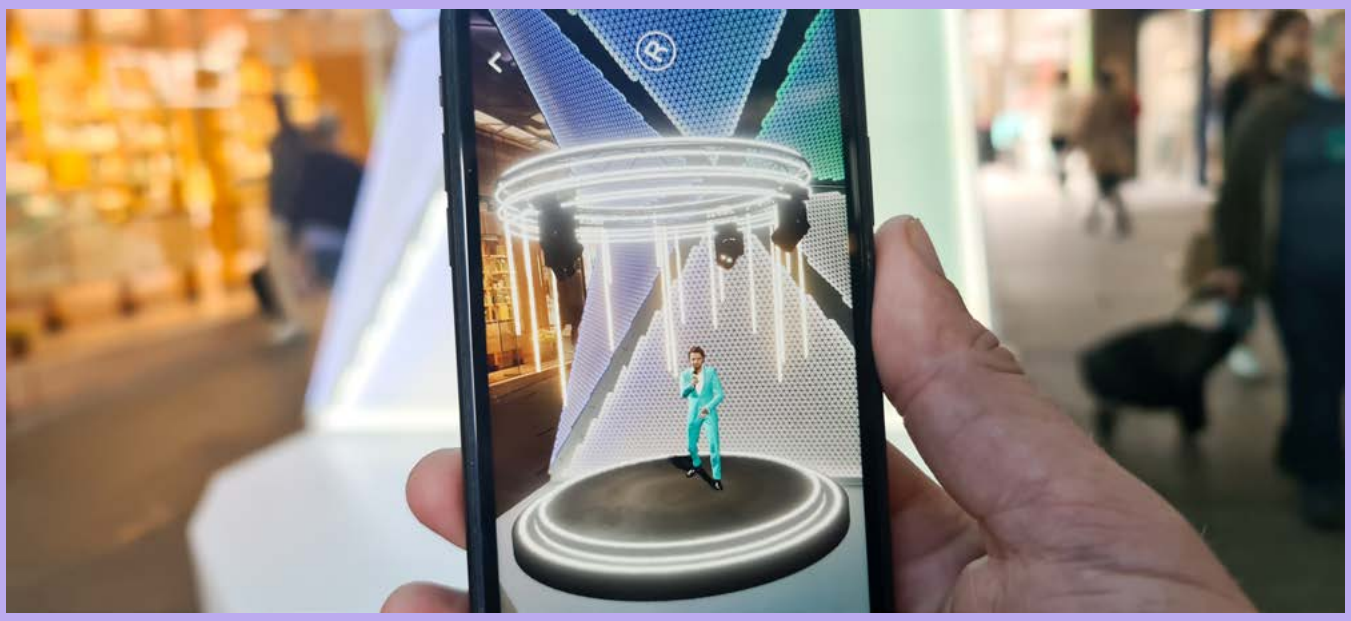
Backstage Academy students, at the heart of XPLOR's innovation cycle, are also gaining skills and industry experience. The technical team regularly collaborates with students to produce mixed-reality content in the Centre for Virtual Production.

The project is supported by the European Regional Development Fund (ERDF) and Department for Digital, Culture, Media & Sport (DCMS).

Jim Farmery
— Development Director, XPLOR

The Round
theround.live

Case Study



In April 2020 InnovateUK announced their first round of expedited COVID response grants, directly supporting innovations that would help industries worst impacted by the pandemic. At the time, The Round co-founders, Thomas Winsor & Pip Brignall, were already working for several years at the intersection of XR & live arts and understood the obstacles that prevented the live arts industry from adopting the technology more widely. Seeing the opportunity to use the funding to help one of the industries most severely affected by COVID, they applied for funding to build a prototype of The Round.

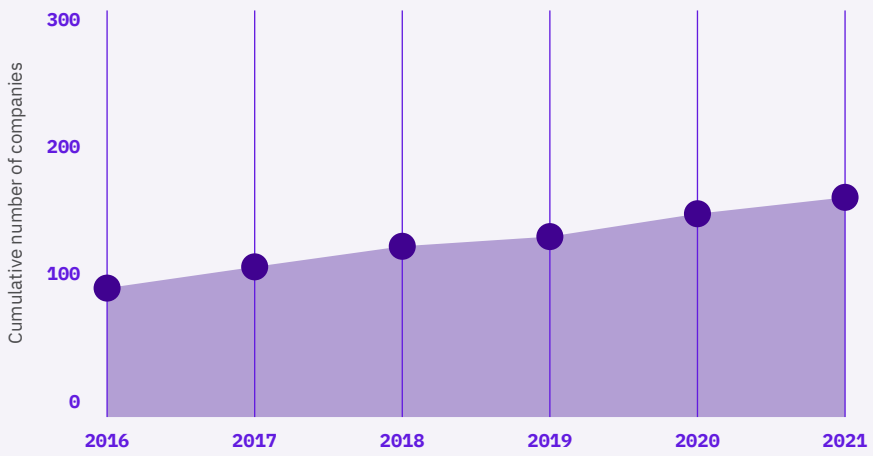
Two years later, The Round is now a Web3 platform for live entertainment in mobile Augmented Reality. In 2021, they delivered the world's first live concert in mobile AR, featuring One Direction's Liam Payne in collaboration with EE for the BAFTA ceremony. That was just nine months after receiving the first COVID response grant, and six months after receiving a second, larger, collaborative grant to further develop the technology alongside a drama school, a lighting designer, and Bristol-based Volumetric Capture company Condense.

With the support from InnovateUK and the revenue generated from the BAFTA project, The Round bootstrapped the company through its first 18 months of development, to a point where they could begin scaling their real-time streaming technology and building a SaaS platform around the creation of tools to make the process of creating immersive tech projects more accessible to the industry.

In January 2022, The Round accepted investment from Outlier Ventures to join their Basecamp Accelerator Program. They worked with Web3 experts over the course of three months to build a business model that leverages the incredible potential of blockchain technology to ticket access to experiences on The Round, and enable companies to monetise their content in new ways through a Web3 marketplace. The development of this marketplace is currently being supported by a grant from the Near Blockchain Protocol as both sides of the platform are near market readiness, they have begun raising further investment to take the product to market.

Gaming

Cumulative growth of immersive companies in gaming



Source: The Data City

Overview

163 Companies

1,227
Full-time Employees

£142m
Turnover

80%
Growth rate of the number of immersive businesses (past 5 years)

Currently, the gaming sector stands as one of the most mature adopters of immersive technologies. Mobile gaming made up **60%** of global gaming industry revenues in **2021**. Immersive companies are breaking into this market using AR technologies for mobile-based applications and looking ahead, interviewees note that AR mobile applications have significant potential for growth because of their scalability.

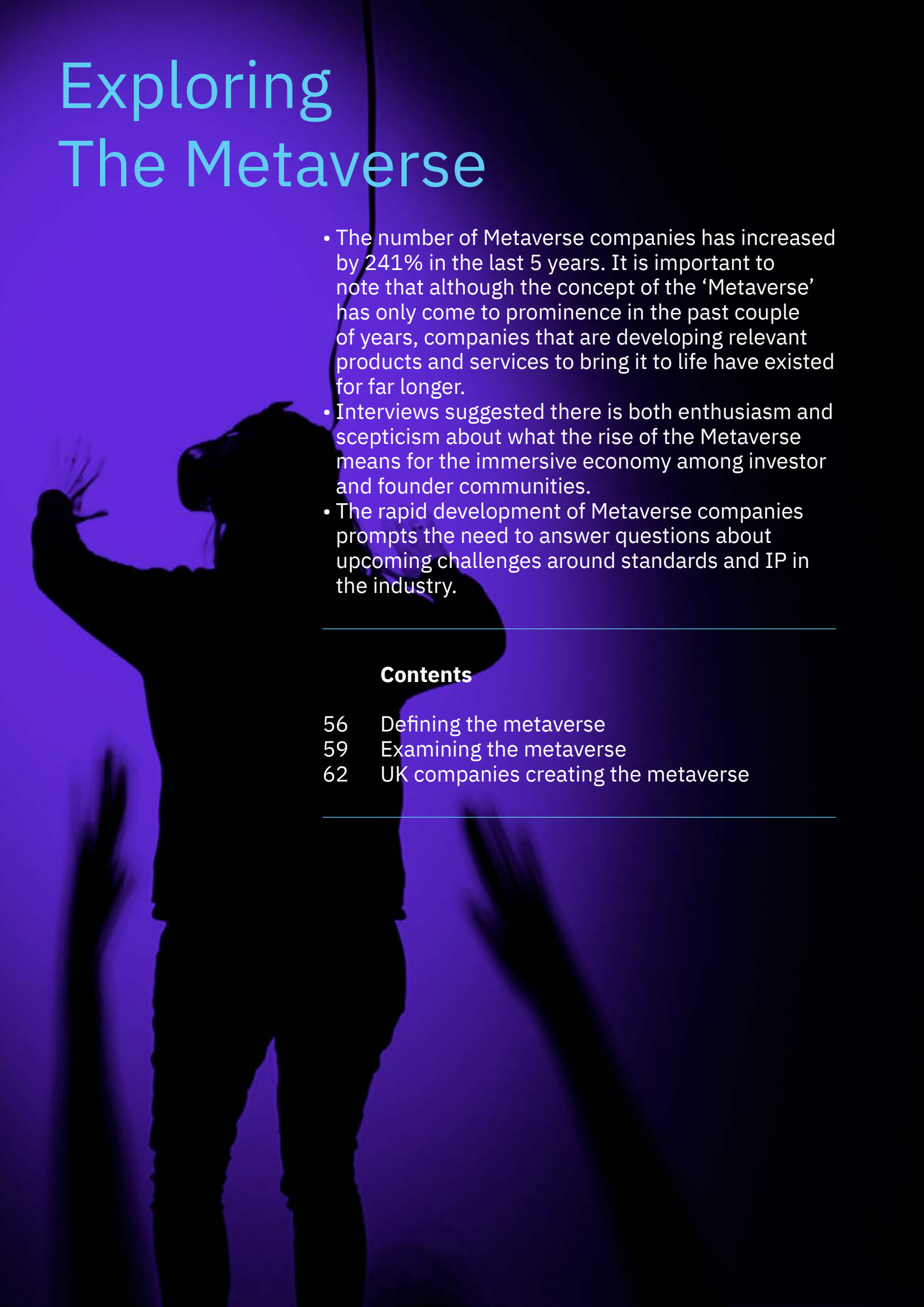
The evolution of multi-player, cross-platform games that can be played across VR headsets, PC, and mobile are combating previous concerns about the isolating nature of VR games. In the UK, the likes of Preloaded are exploring 'See-thru gameplay', 'hybrid play' and 'digital companions' that use AR and VR to change how children play.

VR gaming is also a part of the sector that has shown particular strength, interviewees noted. VR hardware sales in the UK reached a new high of **£183m** in **2021**, an increase of **41.9%** compared to **2020**, according to Ukie's market valuation. This trend is likely to have been supported by the decreasing cost of VR headsets, making them more accessible to consumers. While the hardware market remains dominated by international companies, with Meta's Quest 2 holding **90%** of the market share of VR headsets, UK companies such as nDreams and XR Games are developing VR games that consumers can use across a range of devices.

Interviewees suggested that the lack of investment felt by some other sectors of the immersive economy is slightly less of a problem in gaming. This is partially explained by large industry players such as Epic Games and Oracle having been more ambitious with the amount of funding they provide.

However, funding can still form a barrier, with some interviewees pointing out that many immersive gaming companies need updated language for video game tax relief eligibility. Currently, some companies are finding their projects do not qualify for this form of funding. As immersive is a new industry, it is to be expected that existing funding opportunities may need updating in order to encompass the new technologies and models that immersive companies are creating within the gaming sector. (See the Petaverse gaming case study on page 64)

Exploring The Metaverse



- The number of Metaverse companies has increased by 241% in the last 5 years. It is important to note that although the concept of the 'Metaverse' has only come to prominence in the past couple of years, companies that are developing relevant products and services to bring it to life have existed for far longer.
- Interviews suggested there is both enthusiasm and scepticism about what the rise of the Metaverse means for the immersive economy among investor and founder communities.
- The rapid development of Metaverse companies prompts the need to answer questions about upcoming challenges around standards and IP in the industry.

Contents

Defining the Metaverse

“For us, the Metaverse is not one continuum but rather an interplay between digital platforms/ products in Web2 and Web3 and how they are consumed. The evolution of devices like VR headsets, digital glasses, smartphones, and other devices act as enablers and will allow users to access 3D virtual or augmented reality environments where they can work, connect with friends, conduct business, visit remote locations, and access educational opportunities, all in an environment mediated by technology in new and immersive ways.”

Isabelle O’Keefe
— Sure Valley Ventures

“There are many definitions of the Metaverse. For us the Metaverse represents a major expansion of today’s Internet which primarily exists through 2D screens, websites and mobile. We think this new spatial web, or Metaverse, is more immersive and built with new tools such as real-time 3D game engines. It also spans an increasingly blurred line between the digital and physical and taken in its broadest sense it represents a multi-trillion dollar opportunity.”

Dave Haynes
—FOV Ventures

“I would describe the Metaverse as being many persistent, interconnected, virtual 3D worlds that expand upon what’s possible in the physical realm and enable us to exist and participate in digital experiences as ourselves.”

Gina King
—Supernode Global

While there is not a settled definition of the Metaverse, definitions broadly have in common that:

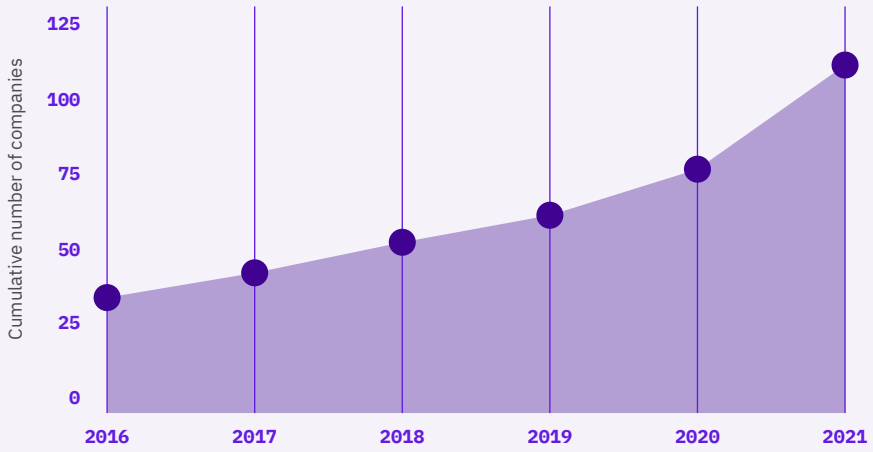
- The Metaverse will be made up of interconnected **3D virtual environments** or worlds, and is often described as the next iteration of the internet.
- These interconnected virtual environments should be accessible **persistently and synchronously** to an unlimited number of users.
- Users should have a **real-time rendered, interactive** experience when they participate in these interconnected virtual environments.

Some definitions add that for the Metaverse to exist it must be within a Web3 environment, where it has been created in an open, decentralised way, supported by blockchain technologies. Others do not set this technological requirement on the Metaverse and consider the role of centralisation still to be determined.

It is clear, however, that the interactive, virtual experience of the Metaverse will be underpinned by immersive technologies in whatever form it takes, and therefore offers new growth opportunities for UK immersive companies. The experience is also likely to be supported by other advanced technologies, including Artificial Intelligence, the Internet of Things, and blockchain technologies.

Examining the Metaverse

Cumulative number of metaverse companies



Source: The Data City

Overview

134 Companies

980
Full-time Employees

£40.1m
Turnover

241%
Growth rate of the number of immersive businesses (past 5 years)

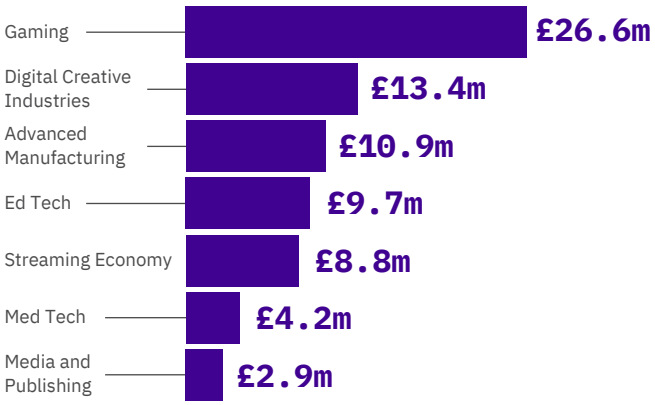
The Metaverse has emerged as a key trend for the global immersive economy in the past two years. Bloomberg has predicted that the global Metaverse market would be worth **$800bn** by **2025**. Other analysts have gone further than this, citing figures in multiples of trillions. Much of the attention on the Metaverse has been driven by the entrance of large global tech companies into the space. Companies such as Meta and Apple have brought significant investment into the industry, with Meta reportedly investing **$10bn** into its own Metaverse division.

In the UK, the trend is also clear. According to the analysis of The Data City's data, over the past **5** years, there has been a **241%** growth in the number of Metaverse companies. This growth includes many new Metaverse companies being created, but also existing companies which have pivoted to describing themselves as Metaverse companies. The growth also points to a shift in the way immersive technologies are being spoken about. The vision of the Metaverse overlaps with many innovations that were already taking place in the immersive economy but is now starting to shape the focus of the industry going ahead.

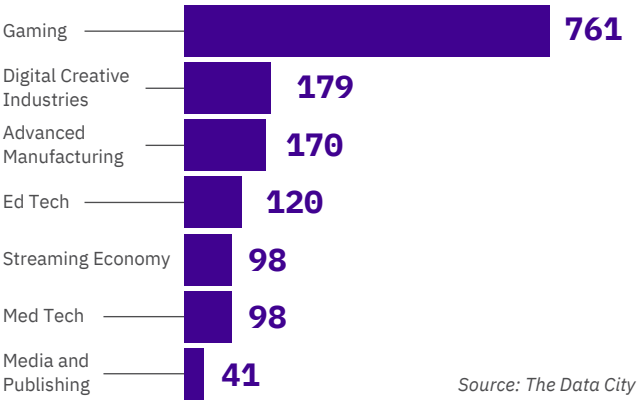
It has been suggested that the full range of human activities will become available within the interconnected virtual environments that make up the Metaverse, from socialising, shopping, and gaming to learning, working and exercising. Therefore, there are opportunities for immersive companies operating across many sectors. So far, gaming companies have been some of the most

prominent proponents of the Metaverse. According to the data analysis, gaming is the largest sector in terms of turnover and number of employees, which the UK's Metaverse companies are operating in. Similarly, the UK's largest Metaverse company both in turnover and number of employees is Improbable, a company most well-known for its game development.

Turnover of Metaverse companies by immersive sector application



Number of employees in Metaverse companies by immersive sector application



Source: The Data City

Interviews suggested that, for some investors, this breadth of applications being discussed for the Metaverse is a reason for caution. Some investors believe there is still not a clear use case in mind for the Metaverse and are wary of the risk that it may be just hype rather than substance.

Other investors believe the hype around the Metaverse has been positive for the companies involved. The hype has helped to spark interest from both existing and potential new customers for immersive tech companies, both in the UK and globally. Many are keen to understand how the Metaverse applies to their business and have established new budgets to explore opportunities in the space. The Metaverse hype has also renewed VC and investor interest in the immersive tech sector. Where VR or AR may have been perceived too niche, they now represent an important subset of a much broader Metaverse opportunity that is attracting a larger amount of investment.

Overall, there is an expectation that there will be a cooling down of the hype in the short term, potentially catalysed by an uncertain macroeconomic environment.

One barrier that is emerging as virtual worlds begin to be built and explored, is the need for standards to ensure interoperability. As companies start to build their own components of these virtual environments independently, there is a risk that the environments they build prevent users from being able to seamlessly move between them, one of the main promises of the Metaverse.

Interviewees note that there is a desire from all parts of the ecosystem to ensure interconnectivity across virtual environments in the Metaverse and to develop open standards for the Metaverse to ensure interoperability. The Metaverse Standards Forum recently released a statement calling for such measures. Despite this, there are still fears that the Metaverse could be turned into a 'walled garden', where large, siloed platforms host information on centrally-owned private servers.

The Metaverse hype has also renewed VC and investor interest in the immersive tech sector. Where VR or AR may have been perceived too niche, they now represent an important subset of a much broader Metaverse opportunity that is attracting a larger amount of investment.

Condense
condense.live

Location: Bristol, UK | **Category:** Tools, AR
Team Size: 20 | **Raised:** £4.5m (incl. Grant funding)
Investors: LocalGlobe, 7pc, RLC Ventures, SFC Capital, Deep Tech Labs

Condense brings the world live events in the Metaverse.

Condense allows artists to stream live performances as 3D volumetric videos into virtual worlds and environments. These performances could be anything from music to live theatre or keynote presentations. These can then be integrated by creators and developers into any VR, AR or 3D experience built-in game engines such as Unity or Unreal. The company has built the infrastructure and tooling for partners including musicians, creators and large organisations such as BT Sports to use.

The company started full-time in November 2019. Founder and CEO Nick Fellingham recalls that it was hard raising their first round of external funding as investors either didn't understand the space or felt it was too early. However, he is optimistic about the future and adds that he has had an easier funding experience since then. Due to the more positive investor sentiment throughout 2021, the company was able to pull in a recently announced funding round of £3.45m. As Nick points out, "the hype around the 'Metaverse' has been a net positive because it has accelerated trends that were already happening". However, he adds that "there have been some downsides too. One negative to all the hype has led to a lot of misunderstanding about what exactly the Metaverse is."

When asked for his definition of the Metaverse, Nick describes the Metaverse as "the 3D internet. And within this there will be many virtual worlds that will be shared, persistent and social environments just like there are many web pages on the Internet". As for VR and AR, Nick sees them as key technologies for the Metaverse but believes that "ultimately they are just tools to view virtual 3D worlds and 3D content with more immersion compared to a mobile phone or a laptop."

In terms of building in the UK, Nick does see potential competitors finding it easier to raise larger amounts in the US. However, he adds that the company has also been able to benefit from several grants and government support (including InnovateUK and DCMS for their 5G Create program). More importantly, Nick believes there's a lot more creativity in the UK, especially in hot spots like Bristol which has a number of tech companies but also organisations like the BBC. This has made hiring talent easier, especially with the technical and computer vision talent coming out of Bristol University.

nDreams
ndreams.com

Location: Farnborough, England
Category: Gaming, VR | **Team Size:** 180
Raised: £38.5m **Investors:** Aonic, Mercia, Upscale

nDreams is a leading VR games publishing and development company.

Having raised their first investment in 2014, the same year that Meta's acquisition of Oculus kickstarted the first consumer VR cycle, the studio is one of the original champions of gaming inside virtual reality. Early titles included VR classic Shooty Fruity and the early Quest release Phantom Covert Ops.

Founder Patrick O'Luanaigh acknowledges that they 'went in very early and it has taken quite a while for the market to really establish itself.' But he sees a very positive future, adding that 'VR has got to the point now where a studio can be really commercially successful. This past Christmas felt like a tipping point with the Oculus app topping the iTunes app store."

The resurgence of the VR gaming market has certainly been a key factor in the company's recent $35m fundraise, which will allow nDreams to take advantage of the continued expansion of the market. Meta continues to invest in VR gaming, there are predictions that Apple may also enter the market and newer consumer players such as Bytedance-owned Pico and Playstation are committing to the sector.

The latest funding round will allow nDreams to continue its expansion.

Ndreams now produces a mix of original IP and licensed titles. The company has 7 games currently in development, including the upcoming Ghostbusters VR, and has expanded with two other in-house studios, Elevation and Orbital. Patrick describes a healthy funding environment for immersive tech and found the process a positive one overall. He's excited for the future, stating, "we're at the beginning of the hockey stick now. For us, it's the right time to invest heavily and really scale up what we're doing".

Tiny Rebel Games
tinyrebelgames.com

Location: Newport, South Wales
Category: Metaverse, AR | **Team Size:** 24
Raised: $7m | **Investors:** Fabric, Animoca, CMT Digital, Sfermion, Sky Vision, Feb bushy, Spinmaster

Tiny Rebel Games is developing the Petaverse Network, an interoperable open standard for pets in the Metaverse.

The Welsh-based company is re-imagining virtual pets for the Metaverse, building at the intersection of XR, gaming and Web3. The first pets released this summer as NFTs, let players take ownership of their uniquely authenticated digital goods and interact with them in augmented reality. The behavioural traits of each pet is baked into the metadata of each NFT and the company builds everything with interoperability in mind. Tiny Rebel's ultimate vision is for digital pets to live persistently in the real world as well as in apps, experiences and games built by other creators and developers. It's a modern and immersive take on original hits such as Tamagotchi and Nintendogs.

Tiny Rebel was established a number of years ago and the startup's founder Susan Cummings has been making video games for 24 years and has been in AR since 2018. Susan cites various grants from InnovateUK as being foundational to their journey into augmented reality. The company led an Audience of The Future demonstrator bid, which had collaborators including the University of Wales and Aardman Animations in the consortium. This funding proved crucial at a time when many were still exploring how to commercialise new immersive technologies and allowed Tiny Rebel to connect directly with the bigger tech companies such as Microsoft, Apple and Unity.

The startup's progress accelerated last year when they raised a $7m seed round to develop the Petaverse concept. Starting the fundraise in September 2021 they had secured a term sheet several months later, which was quicker than their previous attempts at raising venture capital. "Despite being a tough time, the pandemic was definitely a net positive for the gaming industry, everything just exploded" Susan reflects, "and between that, the explosion of the Metaverse, increased investor appetite for XR and the boom in Web3/crypto, there are now so many funds that touch at least one part of our business".

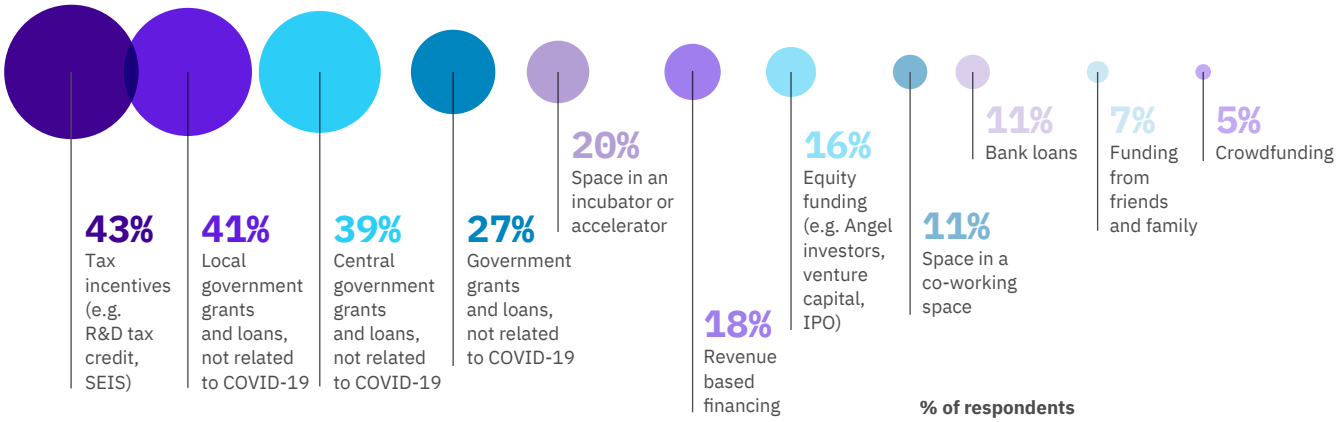
Research and Development

- Government grants and loans are a key part of the funding landscape for immersive companies, with two-fifths of survey respondents receiving at least one in the past year.
- The Audience of the Future and Creative Industries Clusters Programme have been influential contributors to the immersive economy, having funded 906 R&D projects or businesses and secured an additional £247m in co-investment, from both public and private funders.
- In the past 5 years AHRC, EPSRC, and Innovate UK have also collectively invested £147.2M into 674 creative industries projects, including many significant immersive technology focused projects.
- The pipeline for immersive public funding includes significant infrastructure investment and new support for companies working in mental health.
- Challenges associated with the length of the grant-funding process and the scale of grants available were identified in interview and survey responses.

Contents

When asked about the types of financial support companies have received in the past year, our surveys revealed that government grants were among the most common forms of funding received by organisations, with local and central government grants and loans (not related to COVID-19) being received by roughly two-fifths of respondents.

Has your organisation received any of the following types of financial support in the past twelve months?



Source: Oxford Insights/Immerse UK Survey

The immersive economy has been a key beneficiary of the UK Industrial Strategy Challenge Fund (ISCF), announced in the UK Government's former **2017** Industrial Strategy and featured in its **2018** Creative Industries Sector Deal. This was cited by the Industrial Strategy Council in October **2020** as an example of an effective sector-based approach to industrial intervention[10]. Within the **£2.6bn** Challenge fund, the Creative Industries Clusters Programme (CICP) and the Audience of the Future (AotF) Challenge have brought the most opportunities for immersive projects.

The CICP is made up of nine 'clusters', distributed across the Nations and regions of the UK, and six of which directly target the development of immersive technologies within those region's creative industries. Meanwhile, the Audience of the Future Challenge was set up solely to support immersive projects in the UK's creative industries. Together, the two have funded 906 R&D projects or businesses, reaching a predicted total investment of **£92.7m** and have secured an additional **£247m** in co-investment, from both public and private funders.

10 Industrial Strategy Council Paper: Effective Approaches to Sectoral Issues, Oct 2020 https://industrialstrategycouncil.org/effective-policy-approaches-sectoral-issues

Creative Industries Clusters

Running since November **2018**, The CIC Programme was developed in recognition of geographic clustering of creative businesses across different parts of the UK and of a lack of access to research expertise and facilities among these businesses. Through investing in applied research and innovation and facilitating partnerships between universities, large companies and SMEs local to each cluster, the programme aims at better harnessing the economic potential of these place-based creative economies.

Across all nine clusters, the programme has:

- Distributed **£56m** of ISCF investment through the Arts & Humanities Research Council
- Secured **£213m** in co-investment from a mix of private and public partners.
- Trained more than **3,000** individuals
- Organised secondments or placements for **174** creative industries entrepreneurs
- Provided **202** researchers or post-graduate students with industrial placements

Immersive technologies are a particular target for the Clusters programme. The independent Bazalgette Review of the UK's Creative Industries in **2017** highlighted the opportunity that the technologies present for the UK's screen industries but also to expect 'fierce international competition'. This has been one motivation for having six Creative Clusters that focus on the screen sector and immersive applications within it.

Immersive-focused Creative Research and Development Partnerships:

XR Stories

Location: Yorkshire
Collaborators: University of York, the British Film Institute, Screen Yorkshire
Immersive Focus: Provides R&D funding, support and networking to facilitate innovation within immersive technologies in relation to digital storytelling. XRStories funded **18** projects in its first year, spanning opera, ballet and cinema and involving over **100** organisations

InGame

Location: Dundee
Collaborators: Abertay University, University of Dundee, University of St Andrews
Immersive Focus: InGame is the only dedicated R&D centre for game and immersive technology innovation in the UK. It has launched **12** collaborative R&D projects, ranging from applications of GameTech in animal welfare, to using AR to experience 1938 Dundee.

Clwstwr

Location: Cardiff
Collaborators: Cardiff University, Cardiff Metropolitan University, University of South Wales
Immersive Focus: The programme focuses on creating new products, services and experiences in the screen sectors and in news broadcasting. Clwstwr's first open call selected **23** R&D projects and naturally, many of these have centred around immersive technologies, often exploring new, interactive or gamified storytelling.

StoryFutures

Location: M3/M4/M40 corridor (area to the West of London)
Collaborators: Royal Holloway University, Brunel University, National Film and Television School, University for the Creative Arts
Immersive Focus: StoryFutures have linked over **100** SMEs to university expertise. For a large part, this has been through its two main offerings to local SMEs: StoryLab Commissions, which funds prototype productions in immersive and next-generation storytelling, and R&D On Demand, which gives SMEs access to university researchers, including those with immersive technology expertise.

Future Screens Northern Ireland

Location: Belfast
Collaborators: Ulster University, Queen's University Belfast
Immersive Focus: Future Screens has funded **218** research and development projects, these cut across immersive technologies, gaming, film, broadcast and animation. Future Screens NI is also delivering Studio Ulster, a **£72m** investment in the world's largest Virtual Production studio.

Bristol & Bath Creative R&D

Location: Bristol and Bath
Collaborators: Watershed, University of Bristol, University of Bath, UWE Bristol, Bath Spa University
Immersive Focus: The programme has funded R&D projects and brought together industry and academic collaborators through its thematic 'pathfinders' that range from 'Creative Ecologies' to 'Digital Placemaking', many of which have immersive technologies at their centre. 'Digital Placemaking', for example, commissioned a prototype of a place-enhancing, AR-tour of local art.

The Audience of the Future Challenge

The Audience of the Future Challenge was created in recognition of the new kinds of experiences that immersive technologies could offer audiences and the challenge of facilitating the collaboration between technologists, researchers and creative companies needed to bring these experiences closer to viable commercial reality.

The Audience of the Future closed its final challenge in March **2022** and since its first wave of challenges in **2018**, has invested a total of **£39.3m** in immersive projects. The **5** challenge strands, explored below, function together to support the different stages in a company's growth journey from 'pre-start', being supported by initiatives like targeted training programmes, to the 'scale-up' stage, being supported by facilitating co-investment with private capital providers, for example.

Future Demonstrators Programme

The Future Demonstrators Programme was the largest challenge in terms of the amount of funding allocated per project. The challenge funded **4** projects, who received an average of **£5,417,000**. The programme has supported immersive experience builders across e-sports and gaming, performance, moving image, and visitor experience.

One of these projects, led by The Royal Shakespeare Company (RSC) and in collaboration with multiple higher education institutions and global technology companies, was the performance demonstrator Dream. The project involved the creation of novel techniques and technologies that allowed for immersive performance experiences, which could be participated in live and remotely by audiences while theatres remained closed during the pandemic. The performances attracted **68,000** live participants and allowed the RSC to experiment with the future of live performance as audience behaviours change.

Production Innovation for Immersive Content Competition (PIIC)

The PIIC aims to facilitate and accelerate the creation of immersive content, one of the key drivers of growth and oft-neglected areas of the immersive experience identified in this report.

The competition has funded **52** projects with investment totalling at **£12m**. Gravity Sketch was one company who received funding for their idea to develop a platform for immersive 3D collaborative review and presentation, which facilitates early-stage design of immersive content. The company held proof-of-concept trials of the platform with companies from diverse sectors, ranging from the motor industry's Ford to concept artists in the film industry. Gravity Sketch has managed to grow its user base by **5x** and revenue by **4x** in the past **12** months as well as attracting further funding from Boeing and Horizon Europe.

Design Foundations Competition

The Design Foundations Competition was held in two rounds, providing comparatively small grants of between **£30,000** and **£60,000** to **28** companies. The competition was directed at early-stage, human-centred design projects in creative or immersive experiences. Of the companies receiving grants, 54% of their projects reached the demonstration stage and **39%** reached commercialisation.

The Astonishing Visit is an organisation who is working on providing immersive film experiences for patients to share in real-time with remote family and friends. The grant allowed the company to carry out user research and analyse the potential benefits of immersive film for those in long-term care.

Industry Centre of Excellence

StoryFutures Academy was set up as an Industry Centre of Excellence to provide the UK's National Centre for Immersive Storytelling run by the National Film and Television School and Royal Holloway, University of London. The Academy is focused on providing creative training and development finance for Immersive Story-Forms to traditional screen industry talent as well as taking part in co-productions.

The Academy has now trained over **2000** unique beneficiaries, including over **700** screen industry professionals. These actions are important for allowing the UK's immersive sector to benefit from the skills that already exist in the UK's successful creative industries and upskilling trainees in the new forms of storytelling facilitated by immersive technologies.

Immersive Technology Investment Accelerator

The AOTF investment accelerator was a co-investment fund for early-stage businesses. The public grants provided through the Accelerator summed to just over **£2m** and private investors committed a similar amount, with funding having either a **70/30** or **60/40** split between public and private. Private investors involved included GC Angels, Techstart and HTC. The co-investment model allows SMEs to establish an equity relationship with a VC firm, helping to tackle the apparent funding gap present for early-stage immersive companies in the UK by de-risking initial investment for private investors.

Maze Theory used their grant to create new multi-player gaming technology for their upcoming Peaky Blinders game and have subsequently licensed new IP on the basis of this work. The company was also able to establish a partnership with Goldsmiths University of London. According to the upcoming Audience of the Future Evaluation Report, the company credits this partnership to the Accelerator programme as working with academia is something they otherwise would not be able to afford as a small developer.

The future of public funding in immersive

As the Audience of the Future Challenge comes to a close, there are new publicly-funded opportunities and investments in the UK's immersive economy to highlight:

The UKRI Mindset Programme

UKRI's Mindset Programme will run from **2022-2025**, aiming to catalyse a post-COVID transformation of UK Mental Health provision through collaboration between healthcare and creative technology sectors to develop a new industrial sector with global potential. Mental health problems of some kind will be experienced by **1 in 4** people each year in England, while only **1 in 8** adults with a mental health problem are currently getting any kind of treatment. Over the first two years of COVID-19, the percentage of people reporting at least one severe problem has doubled.

Mindset will consist of a number of opportunities over the next **3** years, and will invest in Extended Reality (XR) and other immersive technology companies, collaborative R&D projects and support an ecosystem to help companies bring their innovations to market.

CoSTAR

Continuing the commitment of AHRC to the immersive economy and building on AotF and CICP, the Arts and Humanities Research Council (AHRC) has secured a major investment to build an R&D infrastructure for the screen and performance sectors of the immersive economy, COnvergent Screen Technologies And performance in Real-time (CoSTAR) An initial **£24.2m** investment announced in June **2022** will build to **£69m** of UKRI funding, with industry co-investment and further UKRI funding a **£150m** programme over the next decade.

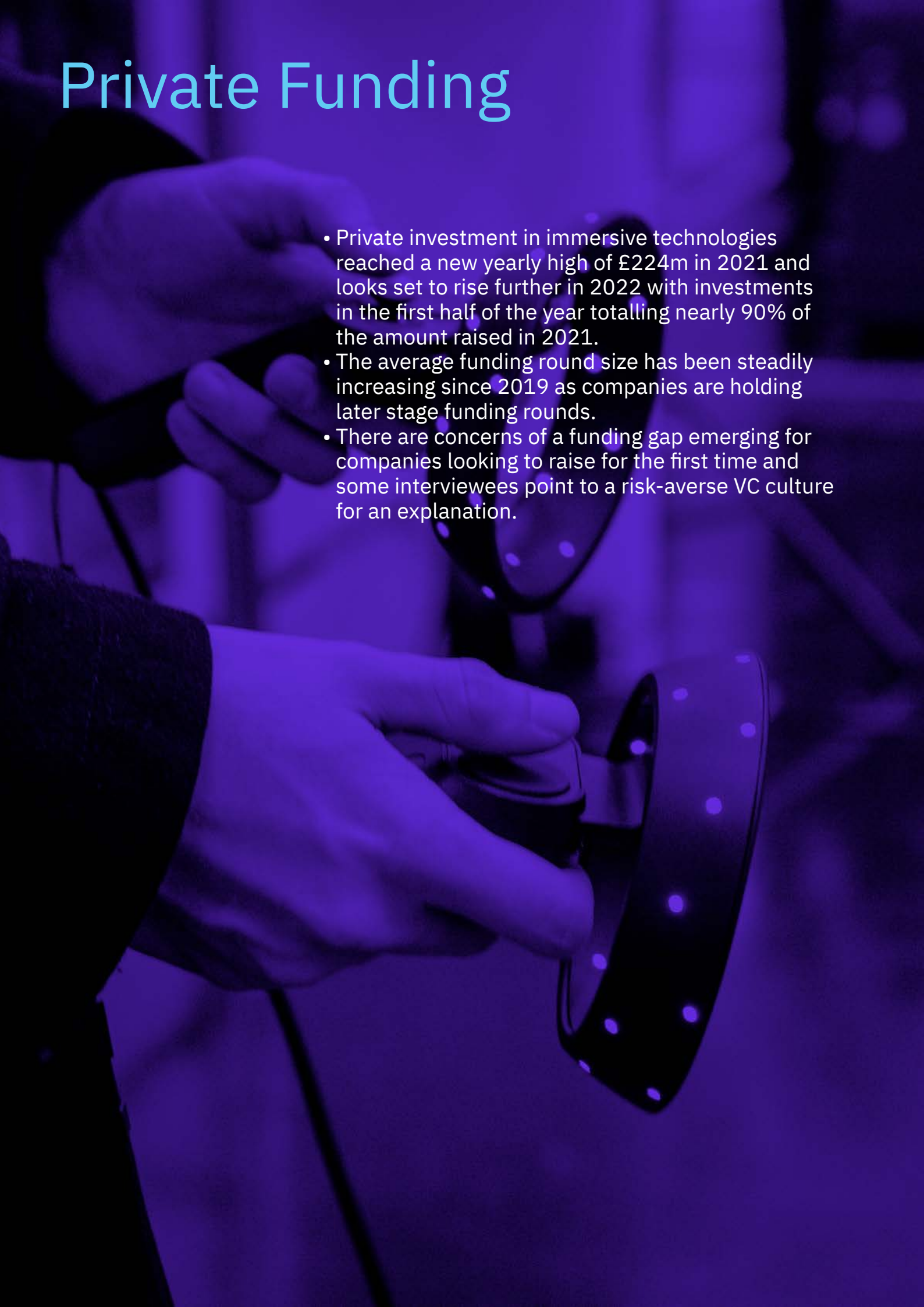
Core to the programme will be a new National Lab and three smaller, network labs, building a hub and spoke network supporting the transformation of screen and performance sectors through immersive and real time technologies. Each new lab will have research capability, and provide facilities and studios for industry innovation.

Challenges for Public Funding

While public funding is considered a crucial part of the funding landscape, some key issues with grant funding were raised in both interviews and survey responses. These were:

- **The funding is small in scale.** It was described as 'helping to keep the lights on', rather than helping to develop entirely brand new products and services.
- **The grant application processes and admin associated with delivering the funded project are too time-consuming**, whereby the paperwork and admin required for grants reduce the value of the funding eventually received.
- **A lack of grants that immersive companies are eligible for,** with companies commenting that the assessment criteria do not always match the industry's needs.

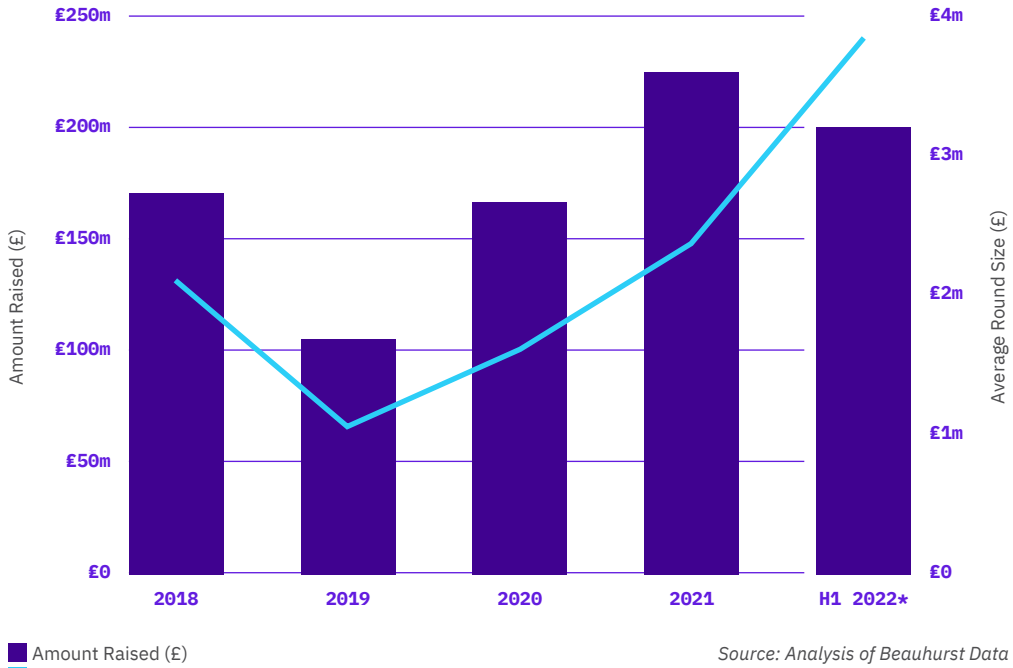
Private Funding



- Private investment in immersive technologies reached a new yearly high of £224m in 2021 and looks set to rise further in 2022 with investments in the first half of the year totalling nearly 90% of the amount raised in 2021.
- The average funding round size has been steadily increasing since 2019 as companies are holding later stage funding rounds.
- There are concerns of a funding gap emerging for companies looking to raise for the first time and some interviewees point to a risk-averse VC culture for an explanation.

Private Investment in Immersive Technologies

Investment into UK Immersive Tech Startups (2018-22)



Source: Analysis of Beauhurst Data
*This refers to data only for the first half of 2022, when the report was written

Equity investment in immersive technologies has recently accelerated. Investment into the sector kickstarted in **2014/15** and was marked by the Facebook acquisition of Oculus for **$2bn** in July **2014**. The initial hype cycle for VR/AR pushed overall UK investment up to a high in **2018** of **£170m** across **81** individual financings. This was followed by a significant cooling in the market, reflected in the **40%** reduction in investment in **2019**.

By the end of **2021**, investment appetite had picked up again and **2021** saw a new yearly high of **£224m**. This could be attributed to a number of different factors. Firstly, the pandemic ultimately triggered a new surge of VC investment, with VR/AR being just one of the sectors to benefit. Secondly, a new wave of enthusiasm around the sector occurred due to the Metaverse hype that peaked with Facebook renaming their company to Meta in **Q3 2021**. Lastly, the sector itself was maturing.

There are signs that the new appetite from investors has continued into **2022**, with investments in the first half of the year totalling nearly **90%** of the amount raised in **2021**. If investment continued at the same pace, the total figure for **2022** would reach nearly **£400m**. However, a more general cool down in the overall VC market, especially in the later investment stages, is likely to lower investment levels in the second half of **2022**.

When looking at the average amounts of individual investments each year, there is a similar pattern. An average round size of **£2m** in **2018** decreases slightly in **2019** before continuing to increase to nearly double that at **£3.8m** in **2022**. This can partly be explained by an overall growth of average round sizes in the UK over the same period, but also points to a maturing of the sector, with the successful companies from the first cycle going on to raise larger rounds in **2020/21**.

Some notable examples of companies raising significant rounds include:

Company	Amount Raised	Investment Date	Overall Raised	Description
Proximie	£66.6m	Q2 2022	£104m	Proximie develops remote surgery technology featuring augmented reality, aiming to provide worldwide surgeons with access to remote training and assistance.
Ultraleap	£60m	Q4 2021	£144m	Ultraleap develops technology that tracks the movements of the user in 3D space allowing them to interact with digital content effortlessly and intuitively.
Gravity Sketch	£25m	Q1 2022	£33m	Gravity Sketch is an intuitive 3D design platform for cross-disciplinary teams to create, collaborate, and review in an entirely new way
nDreams	£20.1m	Q1 2022	£31.5m	nDreams is a world-leading VR game developer and publisher across all leading VR headsets
XYZ Reality	£20m	Q2 2021	£26.4m	XYZ Reality develops augmented reality and virtual reality technology that enables its clients to view digital 3D models of their construction projects.
Admix	£18.2m	Q4 2021	£26.8m	LandVault merged with Admix and focuses on delivering end-to-end metaverse solutions for partners and brands
FundamentalVR	£13.5m	Q1 2022	£20.7m	FundamentalVR is a deep IP company working at the intersection of immersive technology (XR), haptics and machine learning
VividQ	£11m	Q3 2021	£16.4m	VividQ's Software and Hardware Development Kits provide all the tools manufacturers need to build, run and integrate holographic displays
FitXR	£8.54m	Q1 2022	£15.4m	FitXR develops VR/AR fitness apps to make fitness more fun and accessible for everyone. Their virtual fitness club includes workouts designed by fitness experts
Virti	£7.21m	Q2 2021	£8.84m	Virti is an immersive, enterprise learning solution for healthcare and beyond. Virti allows the creation and cross-platform distribution of immersive educational content
XR Games	£5.9m	Q3 2022	£11.3m	XR Games is an award-winning game development studio specialising in immersive AR and VR games

Source: Beahurst

Interviewees raised concerns that there is a funding gap for early stage immersive companies looking to raise for the first time. In part, this was put down to a risk aversion among VC firms. In interviews, some founders recounted challenging expectations from funders who demanded a sizable annual recurring revenue and a proven sales record before any initial investment.

This risk aversion is seen as a UK-specific problem. A number of interviewees and organisations surveyed considered the UK investment scene less supportive and dynamic than in the US. Generic Robotics noted that the "UK scene in particular, but even more broadly investors are quite phobic of hardware. UK Investment seems quite short-term focused, compared to US investment which seems more likely to look further down the line".

One consequence of the lack of private funding opportunities, especially for early-stage companies, may be that existing, larger technology firms end up shaping the kinds of immersive technologies developed. The likes of Meta are already seen to be attracting all of the talents and this poses a risk to the skills gap.

One consequence of the lack of private funding opportunities, especially for early-stage companies, may be that existing, larger technology firms end up shaping the kinds of immersive technologies developed.

Future Shaping

- An emerging challenge involves addressing the real-time 3D skills gap (especially developers in Unity and Unreal Engine).
- Interviews suggested that more needed to be done to create immersive experiences for communities with visible and invisible disabilities.
- As the immersive economy begins to become more widespread and commercialisable, new standards and IP regimes will need to be considered to reflect the more unique aspects of the industry.
- Early years education programmes present new ways to educate the population about immersive applications.

Skills gap - real-time 3D skills

The skills gap that was identified in the **2019** Immersive Economy Report, citing in-depth research by StoryFutures Academy continues to be a significant industry issue. A shortage of skills was frequently cited in both interviews and our survey as a barrier to the development of the industry. Whilst programmers and developers proficient in languages such as C++ & C# were in high demand, there are other skills that are also becoming especially important. The 3D component of this skills shortage is something that makes immersive unique compared to other emerging sectors such as AI and quantum.

Real-time 3D (RT3D), or real-time rendering, is the sub-field of computer graphics focused on producing and analysing images in real-time. The term can refer to anything from rendering an application's graphical user interface (GUI) to real-time image analysis, but it is commonly used in computer graphics. Be it 3D animation, modelling, graphics, or rendering, these skills are in somewhat short supply. As a result, this shortage will continue to place pressure on the development of the global immersive economy.

The shortage of real-time 3D skills came up frequently in both interviews and surveys as a key gap that needs to be filled. According to Burning Glass, the UK is witnessing higher demand for these skills than their international competitors. Developing these skills could therefore create an international competitive advantage for the UK.

"There is a talent drought in the initial race for the good people that exist. Every piece of software and every digital tool interactive on every platform will have to go to 3D and have to go to spatial in the next five to 10 years. Everything is going to be run through a 3D interface because everything is going to have an AR component. The glasses I wear will allow this conversation to be on a digital screen or the software platform or zoom - everything is going to get disrupted by mixed reality and AR glasses".

Solomon Rogers
— Global Director of Innovation, Magnopus

Equality, diversity and inclusion (ED&I)

As well as race and gender, both visible and invisible disabilities are characteristics that need greater consideration when developing immersive technologies.

Interviews found that immersive sensory rooms for people with disabilities can be incredibly valuable, but greater research is needed into spatialised and 4D audio.

This presents a distinct characteristic of immersive technologies compared with many other emerging industries, in that the experiential nature of the industry can provide a unique experience for those with previous difficulties interacting with and understanding the world.

Whilst Arts Council England funds some of these accessible projects, there is still limited funding available. Yet there is a significant proportion of the population who are neurodivergent or experience anxiety; a large market, therefore, exists for investment to prosper from a commercial lens.

Another challenge is making sure that immersive experience creators consist of and have access to a community of people with lived experiences of disability in order to be able to come up with ideas, and test concepts out. Throughout **2021** & **2022** Birmingham City University attempted to address this by running a series of Inclusive AR/VR sandpits to explore potential solutions and research opportunities in relation to different AR/VR barriers for people with disabilities.

A growing body of organisations are working on inclusive design for immersive experiences. For example, InGAME and StoryFutures Academy hosted an accelerator challenge programme in partnership with Open Inclusion and XR Access, which helps companies learn how to embed inclusive design practices into their experiences. Work of this kind will help to shift the needle towards a more inclusive landscape, but much more still needs to be done.

"Within invisible disabilities, we're tapping into research about the ways that spatialised audio can help to calm and de-stress neurodivergent people. We would like to use that as a springboard into thinking about how we could push spatialised audio and combine it with the digital therapeutic work that is out there to create something that's really useful to neurodivergent people. This would help people with hidden disabilities be able to navigate space, make journeys and actually engage with society by getting to work, college or school".

Karen Newman
— Founder & Director,
Birmingham Open Media (BOM)

The Metaverse and AI

The previous section on the Metaverse detailed the challenges of ensuring interoperability for the Metaverse, and using appropriate standards to facilitate innovation. A similar process is underway in the AI landscape, with the new AI Standards Hub aiming to make the UK a world leader in the nascent field of AI standards.

Yet the fusion of these two industries complicates these matters further. Interviewees pointed out how the merging of Metaverse products with AI poses an enormous challenge for how to design and govern virtual worlds.

AI could be used in the Metaverse for accurate avatar creation, digital humans (3D versions of chatbots), creating multilingual accessibility, turning 2D pictures into 3D objects and even creating virtual worlds—something that Nvidia is already doing.

This is also where funding is heading. Facebook AI Research (FAIR) recently announced their movement to Meta's Reality Labs, showing how the company formerly known as Facebook are prioritising their Metaverse strategy further.

These developments present a broad suite of challenges, including the ownership of copyright produced by AI in the Metaverse; accountability for AI bias displayed in the Metaverse; and how to address the levels of inequality that may develop from an AI-powered Metaverse.

Intellectual property

Many interviewees pointed to the difficulty of securing Intellectual Property for immersive technologies. For example, some interviewees referenced how their unique innovation will be their storyline, which can be difficult to capture in an IP regime, compared to a traditional scientific invention or innovation.

Furthermore, the IP negotiating process for prospective university spinouts is often difficult, with UK Technology Transfer Office (TTO)'s demanding fairly high equity, disincentivising academic founders from taking the gamble of spinning out their own company.

In addition to this, challenges around IP occur with brands or places appearing in virtual worlds. For example, the Angel of the North, outside Newcastle, is the subject of a registered shape trademark. Including these monuments in virtual worlds and other immersive experiences would therefore present legal challenges to content creators.

Munch Museum
munchmuseet.no

School Education Programme with Munch Museum, Denmark

The Munch Museum houses artist Edvard Munch's biggest collection of works, including 'The Scream' (1893).

The Norwegian museum, with support from Digital Catapult and Arcade, created an AR project that enabled school children to place, edit, and share their Munch-inspired works in locations of their choosing across the physical world.

The project, called MunchMunch, aims to reach over 200,000 Norwegian school children. The long term goal of the project is to evolve MunchMunch into a fully-fledged public creativity tool for the Norwegian education system.

Not only do programmes like these offer an exciting application of the creative sector to the immersive landscape, it can showcase the industry itself to an upcoming generation of pupils, inspiring them to want to engage further.

Concluding Remarks

With **83%** growth in the number of companies in the last five years, the immersive economy appears to be experiencing a sustained period of economic activity. This is a trend that shows continuity from the previous **2019** Immersive Economy Report.

Immersive companies appear to be offering a broader range of services, with an increase in the number of companies offering product-based, consultancy-based, and service-based solutions, compared with the previous report. This suggests that companies are growing, being able to operate multiple streams within their business model.

Since the last report was released in **2019**, the pandemic rewired much of the economy, and this was certainly the case for the immersive economy. The increased demand for online experiences and shift in cultural mindset towards remote operations meant that **43%** of survey respondents said COVID-19 had an overall positive impact on the growth of the organisation, compared to **23%** who found it had an overall negative impact.

80% of immersive companies are micro-SMEs, occupying small but valuable niches in the UK economy. Gaming, media and entertainment, and education and training were the immersive application sectors with the highest turnover (**£142m**, **£164m** and **£156m** respectively). A smaller but faster growing sector was healthcare, which saw **88%** growth in immersive companies in the last five years, higher than any other application sector.

Yet it isn't just applications that matter - geography does too. Whilst London still proved to dominate the industry, the fastest growing areas of the UK in the last five years were Wales (**124%**) and Scotland (**95%**). Interviews and data also suggest that the Creative Industries Clusters Programme shows a successful case study for collaborative R&D targeted at regional innovation.

The funding landscape has been transformed by the emergence of the Metaverse. With Meta reportedly investing **$10bn** into its own Metaverse division, this investment dwarfs spending from other companies and governments, and will likely have a material impact on the trajectory of the industry. Whilst the development could usher in with it the investment the industry needs, there is still little consensus on what a Metaverse should look like, or how it should be governed.

Challenges of regional immersive inequality are heightened by the explosion of Metaverse activity. The overwhelming majority of Metaverse companies (**73%**) are based in the capital, meaning that if the Metaverse takes up an increasing portion of immersive activity, London's relative strength in immersive compared to the rest of the UK will continue to escalate.

As suggested by the Creative Industries Clusters Programme, part of the story of funding is the story of R&D. Together, the CICP and Audience of the Future Challenge have funded **906** R&D projects or businesses, reaching a total investment of **£92.7m** and securing an additional **£247m** in co-investment, from both public and private funders.

The industry faces many similar public funding challenges to other industries, such as grant applications taking a lot of resources for small companies to complete, difficulty for small companies to raise match funding and the support itself being small in nature. Yet there are increasingly coordinated efforts to try and address this issue in the immersive environment.

Zooming out, some of the strengths of the UK's immersive industry include the relative availability of public funding compared with other international competitors; and the global reputation of the UK's creative industry. Below are the following key challenges that the immersive economy is either currently facing, or set to face in the near future:

Funding

Funding, in both public and private models, is seen as low in quantity.

Interviewees frequently mentioned that applying for grant support requires an excessive amount of time for companies & researchers.

Talent

Real-time & 3D skills are viewed as the most important skills for immersive that are in short supply.

There is sparse education for young people about immersive technologies & future opportunities to work in the industry.

Interviews suggest that immersive innovation often ignores many communities that could benefit from it, such as the neurodivergent community.

Developing new coordinated policy, standards and IP regimes are an important upcoming challenge

Interviewees spoke to the challenge of scaling their business when they couldn't obtain Intellectual Property in many areas of the immersive economy.

Whilst the Metaverse is not yet a true 'industry', a clear set of rules around how to achieve interoperability between platforms, as well as how to protect new ideas will be fundamental.

These represent some of the key challenges that policy-makers must rise to meet in the coming years for the immersive economy to reach its true potential.

Appendix - Methodology

Our research combined three approaches; machine learning-powered sector mapping, stakeholder interviews and an industry survey.

ML-Powered Sector Mapping

Sector mapping, using The Data City's 'The Data Explorer' tool, was used to provide an accurate, up-to-date overview of the companies operating in the UK's immersive economy. It involved identifying the companies within the UK economy that should be counted as an 'immersive technology' company and collecting data including the size, financials, sector association, and location of these companies.

To identify the UK's immersive technology companies, the first stage of work involved creating a taxonomy of the immersive technology economy. The taxonomy breaks down the overall immersive economy into 'sector verticals', according to relevant technology functions, such as Virtual Reality, as well as applications such as 'Gaming' or 'Education and Training'. The verticals were then defined using keywords associated with them that are found on company websites. For example, the Virtual Reality verticals included keywords such as "virtual reality", "vr", "vr headset" etc. Examples of companies in each sector vertical were also included in the taxonomy.

Together, the keywords and list of example companies provided a training set for The Data City's web scraping and machine learning algorithms to capture UK companies (those with a registered Companies House number) that use similar language to those in the training set based on the text on their websites. The output is a list of immersive technology companies within each sector vertical.

The financial data and data on the size of companies, such as the number of employees, comes from Companies House & CreditSafe and are matched with the companies identified using the taxonomy.

Industry Survey

A survey of industry participants collected their perspectives on and experience of operating within the UK's immersive economy. The surveys were sent out to Innovate UK KTN's mailing list of stakeholders and other immersive newsletters, and 56 responses were returned.

Stakeholder Interviews

Interviews were held with immersive stakeholders, industry leaders, and ecosystem builders. These provided expert opinions on the opportunities, barriers, and prospects for immersive technology, their personal experience of how the industry has progressed in recent years and in-depth discussion of their own involvement in the immersive technology economy.

Immerse UK is the UK's leading membership organisation for immersive technologies. We bring together industry, research organisations, the public sector and innovators to help fast track innovation, R&D, scalability and company growth.

Our aim is to support UK businesses in the immersive tech sector to be the most successful and innovative they can be.

We do this by connecting people to explore future collaborations; pointing to the latest funding and finance opportunities from across all industries in the UK economy; addressing the pressing issues that slow down R&D and barriers to innovation; and identifying the opportunities for growth in the emerging marketplace.

For more info please visit: immerseuk.org

Oxford Insights helps public sector organisations understand how to harness the potential of technology. We help by assessing the landscape, building an implementation team, and evaluating impact.

For more info please visit: oxfordinsights.com

The Data City contributes to the definition of the emerging economy in the UK by analysing how companies define themselves on their websites. Their proprietary machine learning technology makes it possible to group companies according to common language patterns. The result is a series of original datasets (Real-Time Industrial Classifications) that shed light on newer industrial developments and inform decision-making.

For more info please visit: thedatacity.com

UK Research and Innovation brings together the UK Research Councils (including The Arts and Humanities Research Council (AHRC)), Innovate UK and Research England into a single organisation to create the best environment for research and innovation to flourish. The vision is to ensure the UK maintains its world-leading position in research and innovation.

For more info please visit: ukri.org

Funded by UK Research and Innovation (UKRI), Audience of the Future focuses on the development of new immersive technologies such as virtual, augmented and mixed reality including a world-leading demonstrator programme, with collaborations including the Royal Shakespeare Company and Aardman. This coordinated programme of research and development ensures the UK can become a world leader in creative technology.

Find out more: Audience of the Future - UKRI

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