The immersive economy in the UK 2019

The growth of the virtual, augmented and mixed reality technologies ecosystem

CATAPULT Digital | **IMMERSE UK.ORG**

This report, co-authored by Immerse UK and Digital Catapult, provides evidence of the growth of the sector and its key drivers and barriers. It explores the geographical and industrial spread of companies working with immersive technologies.

The Knowledge Transfer Network is a network partner of Innovate UK and helps businesses to get the best out of creativity, ideas and the latest discoveries and strengthen the UK economy.

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Report contents

Foreword from Immerse UK

Welcome to the 2019 Immersive Economy report

This is our second study of the UK's immersive technology ecosystem. It has been a hectic year for the UK immersive sector and headline trends are positive.

The UK is currently Europe's largest market for virtual and augmented reality (VR/AR), tapping into what is predicted to become a US$160 billion immersive technologies market. Major advances in head-mounted displays have opened up new opportunities for our content and services sectors, location-based experiences are attracting new audiences and consumer uptake is on the rise. At the same time, the key enabling technologies of artificial intelligence, machine learning and 5G are expected to make immersive experiences richer and more accessible, opening up new possibilities for content and application producers.

While much of the market is still consumer-led, our research indicates that immersive technologies in enterprise and industry will be a dominant driver for future global growth.

Despite economic uncertainty, over the last year we have seen more realistic projections on market value and penetration, more accurately reflecting this evolving space. Over the past four years, a growing number of exceptional UK businesses – creators, visionaries, innovators, researchers and experimenters – have continued to lead the international market, partly fuelled by a strong publicly-funded agenda that is rarely seen in other countries.

This support has been a game-changer for research and development in shaping immersive experiences for global audiences and businesses, and the UK is universally acknowledged as a power base for great ideas.

We continue to see creative energy, technical innovation and business expertise grow across the sectors covered by this report. The UK's VR industry is set to grow faster in entertainment than in any other media sector; and across construction, planning, transport and engineering, immersive technologies are improving efficiency, streamlining collaboration and boosting project confidence. Organisations continue to transform the virtual training space, and we have also seen an accelerated pace of interest and innovation in immersive healthcare.

The UK is in an excellent position to reap the rewards of this growth in momentum, particularly as 5G begins to roll out. However, the technology and global markets are fast-moving and highly competitive. The key players featured in this report are central to continued acceleration and growth, productivity, and innovation in all areas of the immersive tech ecosystem.

The insights and evidence provided in this report will help to identify new opportunities and remove barriers to growth, ultimately realising the full potential of the sector and positioning our UK immersive tech businesses front and centre on an international stage.

Fiona Kilkelly
Immerse UK

Foreword from Digital Catapult

The immersive ecosystem in the UK continues to be a source of cultural creativity and technological ingenuity

Thanks in part to the boost from publicly-funded stimuli such as Audience of the Future and CreativeXR, the creative output of immersive companies in the UK continues to inspire the world. And as this report points out, the opportunities for industrial applications of the technology are diverse.

Innovative businesses in traditional industries are starting to adopt VR and AR for a wide variety of applications such as product design in component manufacture, health and safety training in hazardous manufacturing environments, and engaging with hyper-real digital humans that allow surgeons to practice virtually before working on live patients. These approaches are increasingly helping UK businesses to improve processes, drive down costs and create new efficiencies. Industry appetite is steadily growing, and with support from a range of publicly-funded programmes, the potential for even more widespread industrial adoption of immersive technologies is vast.

The last two years has produced challenges to running immersive businesses, not just in the UK but globally. Low levels of device consumer penetration, incompatibility between competing hardware platforms, lack of concerted venture investment, and immaturity of markets makes it an ongoing challenge to achieve resilience and sustainability in immersive companies. But the UK is seeing some encouraging green shoots. A small but growing number of companies is looking to scale up, drive recurring revenues and open up export markets. Almost a quarter of the immersive companies interviewed for this report identify themselves as growing startups, while 12% identify themselves as scaleups.

Given the relative immaturity of the markets around the world, a surprisingly large proportion of UK immersive companies are exporting products, applications and experiences around the globe. The UK is certainly beginning to look like a powerhouse of immersive innovation both in cultural content as well as in technology application.

Immersive technologies have the potential to transform how we work and play, and the combination of innovators, researchers and unique public funding available makes the UK well-positioned to become the best place in the world to create immersive content and applications.

Dr Jeremy Silver
Chief Executive Officer, Digital Catapult

Executive summary

The immersive ecosystem in the UK has the power to transport audiences and entertain, but also to increase efficiencies and improve productivity.

01

Immersive technology companies are scaling up

As the sector matures, there is a positive trend towards immersive startups beginning to scale up.

Of the almost 200 companies surveyed for this report, 24.5% were identified as a growing startup, 12% identified themselves as a scaleup and 20.8% as an established small and medium enterprises (SME).

02

Immersive technology companies are creating industry solutions in a number of application growth areas

The creative output of the immersive economy remains strong, and immersive technology companies are now building solutions for a truly diverse range of sectors such as training, architecture, manufacturing and healthcare.

03

Immersive technology activity thrives across the UK

53% of the UK companies identified are based outside London. There are strong hubs of immersive technology activity in areas such as Bristol, North East and Tees Valley, Manchester, Brighton and Northern Ireland.

Increased technical infrastructure and support has helped these ecosystems grow, as has the support of local universities, accelerators, incubators and local government.

Executive summary

04

Immersive technology companies are exporting

62.3% of the companies surveyed for this report export products, services or content related to immersive technologies, including 63.5% of exporting companies selling to Europe, and 45.3% to the USA (24% of which export to both).

05

Access to finance and the skills gap continue to be challenging for immersive technology companies in the UK

45% of respondents found that difficulty in recruiting talented individuals with the right skills was a blocker to success. 52% of respondents found limited access to finance a significant barrier to growth. While investment numbers have fallen, trends suggest investors see immersive as a hot sector, with an increase in seed stage investment and investment into AR focused companies.

06

Public support for research and development continues to be strong

From the UK Research and Innovation (UKRI) database, over 500 immersive technology projects have been identified since 2018 (either ongoing, open or completed), worth over £220 million. £33 million is being invested in immersive technologies as part of the Creative Industries Sector Deal, including the Audience of the Future programme.

Introduction

78.3% **Five-year growth rate for spend in UK AR/VR[1]**

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 from industry, higher education institutions, incubators, accelerators and supporting facilities.

The immersive economy comprises immersive (virtual, augmented and mixed reality) specialists and participants who contribute to growing the technology's economic potential, including businesses, researchers and research organisations, practitioners and developers.

Definitions used in this report

Immersive technologies
An umbrella term for virtual, augmented and mixed reality.

Virtual reality (VR)
Closed and fully immersive three-dimensional environments.

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.

Haptic communications
Technology creating the experience of touch.

The market intelligence company IDC forecasts that worldwide spending on AR and VR will reach US$160 billion (about £130 billion) in 2023, up significantly from the US$16.8 billion (about £13.7 billion) forecast for 2019. The five-year compound annual growth rate (CAGR) for AR/VR spend is estimated at 78.3%[1]. PwC's Future Forecast report also reveals that £1.39 trillion will be added to the global economy through VR and AR, and that £62.5 billion will be added to the UK economy by 2030. Over 400,000 UK jobs are predicted to be impacted by VR and AR by this time[2].

[1] www.idc.com/getdoc.jsp?containerId=prUS45123819

[2] PwC report "Seeing is Believing: How will virtual and augmented reality transform your business and the economy?" Published November 2019

Introduction

<h1>62.5bn</h1> **Added to the UK economy by 2030 (£)**

Purpose of this report

This report enables businesses, policymakers, investors and educators to make more informed decisions by tracking the progression of the immersive technologies economy, and by examining how barriers and opportunities are shifting over time. It also looks at the growing numbers of innovative products, services, applications and hubs in the UK.

Almost 200 organisations were surveyed for the report, including distributors, technology developers, manufacturers, R&D organisations, service providers, trade bodies, associations, industry networks and public funders.

Many of the methodologies and objectives remain unchanged from last year's Immersive Economy report[3].

To accommodate the significant growth in the immersive technology landscape, this year's report includes three new sections:

– Notable application growth areas where immersive technologies are being used to transform industry

– The regional hubs that are showing significant promise, and from which high numbers of immersive businesses are emerging

– The opportunities for research and development for UK immersive businesses, and the impacts they have had so far

Methodology

A list of the immersive specialists and non-specialists that form the immersive economy in the UK was compiled, with invaluable support from glass.ai.

Glass.ai[4] is a startup that combines machine learning and computational linguistics with semantic analysis and resource crawling at scale. For this report, the team facilitated the compilation of a comprehensive UK-wide list on a scale that would not have been achievable by other methods.

Alongside this analysis a detailed survey was sent to organisations and key stakeholders within Digital Catapult and Immerse UK's networks. As well as collecting baseline information, the survey asked questions about immersive challenges, opportunities, growth and interactions within the wider ecosystem. 78% of the companies surveyed were immersive specialist companies (for example over 50% of their turnover is related to immersive activities).

A clear and up to date picture of the current immersive technology landscape in the UK has been formed from the survey results and the glass.ai data. 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.

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[3] www.immerseuk.org/wp-content/uploads/2018/05/Immersive_Technologies_PDF_lowres.pdf

[4] www.glass.ai

Contents

State of the nation

This section summarises the survey findings relating to the sector landscape, economic value and growth.

Overall, the findings confirm the impression of a fast-growing and confident industry, and that immersive technologies are becoming increasingly important in the development of new products and services.

However, well-established concerns (such as skills shortages and access to finance) still remain as growth barriers, holding the sector back from fulfilling its full economic potential.

State of the nation

The landscape

There are currently around 1,250 active immersive specialist companies in the UK – those who generate over 50% of their revenue from the creation, development or production of immersive content, software or hardware, as well as consultancies that focus mainly on immersive technologies.

In addition to these organisations, there are approximately 4,500 participant companies active within the immersive economy, generating up to 50% of their turnover from immersive products and services, but where immersive is not a core component of their overall business.

The business models of the surveyed companies were:

– 59% product-based

– 51% consultancy-based

– 70% service-based

This also indicates that many of those surveyed have combined business models across these three areas.

The results of the research show a trend towards growth and the scaling of immersive technology companies:

24.5%

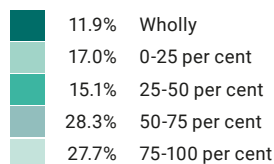Identified themselves as growing startups
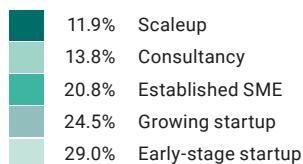
12.0%

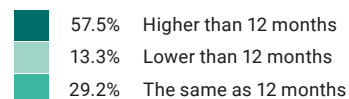Identified themselves as scaleups

20.8%

Identified as being an established SME

State of the nation

What proportion of your business is enabled by immersive technology?
(Figure 1)

	11.9%	Wholly
	17.0%	0-25 per cent
	15.1%	25-50 per cent
	28.3%	50-75 per cent
	27.7%	75-100 per cent

How would you classify yourself?
(Figure 2)

	11.9%	Scaleup
	13.8%	Consultancy
	20.8%	Established SME
	24.5%	Growing startup
	29.0%	Early-stage startup

Is revenue lower than, the same as or higher than it was 12 months ago?
(Figure 3)

	57.5%	Higher than 12 months
	13.3%	Lower than 12 months
	29.2%	The same as 12 months

There has been growth in the immersive economy, with 57.5% of those surveyed seeing revenues higher than they were 12 months ago. However, the industry is still young, and growth is not across the board, with 29.2% seeing the same revenues, and 13.3% seeing lower revenues.

This growth is reflected by how the companies surveyed classified themselves, with 11.9% now identifying as a scaleup, and 24.5% as a growing startup.

State of the nation

Economic value
Of the businesses surveyed, 27.7% were broadly (over 75%) enabled by immersive technologies (Figure 1), while 46.8% said that 100% of turnover is related to the application of immersive technologies (Figure 4).

Growth
Of the surveyed companies, the revenues of almost 60% were greater than 12 months ago, and only 13% had seen decreases in revenue (Figure 3).

Company turnover
Companies in the immersive sector are generating income. While 29% of companies surveyed identified as early-stage startups (Figure 2), only 14.4% were pre-revenue (Figure 5).

44.4% companies (excluding pre-revenue, and those companies that elected not to give details) have revenue of less than £500,000 per year.

Export
62.3% of the survey respondents export products, services or content related to immersive technologies.

63.5%
Export to Europe*

45.3%
Export to the USA*

13.2%
Export to the Middle East region*

11.9%
Export to the People's Republic of China*

6.9%
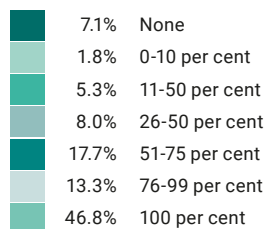Export to the Republic of India, South East Asia and other parts of the world*
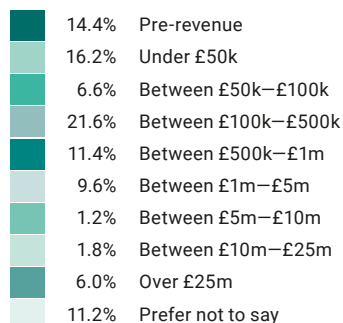
5.0%
Export to Japan*

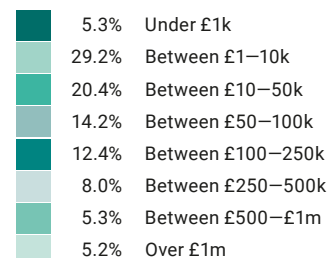*Refers to 62.3% of the survey respondents

How much of your turnover is related to immersive technology?
(Figure 4)

	7.1%	None
	1.8%	0-10 per cent
	5.3%	11-50 per cent
	8.0%	26-50 per cent
	17.7%	51-75 per cent
	13.3%	76-99 per cent
	46.8%	100 per cent

Company turnover
(Figure 5)

	14.4%	Pre-revenue
	16.2%	Under £50k
	6.6%	Between £50k—£100k
	21.6%	Between £100k—£500k
	11.4%	Between £500k—£1m
	9.6%	Between £1m—£5m
	1.2%	Between £5m—£10m
	1.8%	Between £10m—£25m
	6.0%	Over £25m
	11.2%	Prefer not to say

Please estimate your organisation's spend on immersive technology in the past 12 months (Figure 6)

	5.3%	Under £1k
	29.2%	Between £1—10k
	20.4%	Between £10—50k
	14.2%	Between £50—100k
	12.4%	Between £100—250k
	8.0%	Between £250—500k
	5.3%	Between £500—£1m
	5.2%	Over £1m

The immersive economy is split between a few large multinational companies where immersive is one part of a broader offering of services, and a larger number of small, agile startups specialising in the technology.

14.4% of companies surveyed were pre-revenue and 16.2% had a turnover of under £50,000, with 6% reporting over £25 million in revenues.

Opportunities

87%

Respondents said that immersive technologies have helped to improve their organisation either as an end user of the technology or as a developer of solutions

Opportunities

29%

29% said that immersive technologies have changed the way their organisation is seen by its peers

21%

21% of respondents have used immersive technologies to help prototype more quickly

37%

37% said that immersive helps to create new networks of organisations to collaborate with

70%

It is seen as a business opportunity for 70% of respondents, helping to offer new or improved products and services

47%

47% said that it has enabled widening of their current client base

16%

16% said that it has enabled them to change the culture of their organisation

92%

92% of respondents expect their spend on immersive technologies to grow in the next twelve months (most having spent between £1,000 and £10,000 over the last twelve months)

27%

27% of respondents said that it has led to a new way of marketing their organisation

65%

65% said that it has opened up new markets and sectors

Challenges

Many of the challenges faced by companies in the immersive ecosystem are those already being seen across the wider spectrum of advanced digital technologies.

23%

23% of respondents said that not having enough highly skilled workers from local universities or other educational institutes is a significant issue for them

54%

54% of respondents said that low device adoption among consumers is a key barrier to growth for their organisation

48%

48% of respondents said that untested business models and investment returns are barriers to growth for their organisation

34%

34% of respondents said that poor quality applications in the market are a barrier to growth for their organisation

39%

39% of respondents said that under-developed industry standards and definitions are a barrier to growth for their organisation

43%

43% of respondents found the fragmented device ecosystem to be a barrier – although 84% do not struggle with poor technical infrastructure

44%

44% of respondents said that the current economic climate is a key barrier

52%

52% of respondents said that limited access to finance is a key barrier

45%

45% of respondents found that difficulty in recruiting talented individuals with the right skills was a blocker to success

Mind the skills gap

97%

The immersive economy is lacking appropriate skills

Mind the skills gap: barriers to growth in the UK's Immersive Economy

Amanda Murphy and James Bennett, StoryFutures Academy: National Centre for Immersive Storytelling

As part of StoryFutures Academy's ambition to ensure the UK creative workforce is the most skilled in the world in immersive storytelling, a comprehensive skills report will reveal the major skills challenges facing this nascent industry.

Working with partners across the screen industries, including Immerse UK, Pact, Ukie, the UK Screen Alliance and BIMA, this research includes a survey of over 100 companies creating audience-facing immersive experiences, interviews with 15 experienced content makers, and a focus group of leading industry figures.

The skills gap is a significant barrier to growth

- 97% of survey respondents indicated that the immersive economy was lacking appropriate skills

- 77% of companies identified lack of technical skills within their own company and wider talent pool as a barrier to growth

- Creative roles were highlighted by 28% of respondents, with a lack of experienced creative writers, directors, and interactive designers being cited

- 23% focused on the need for more senior leaders, particularly those who understand both technical and creative elements

- Over 68% of survey respondents characterised sourcing the right skills to build a production team as 'difficult' or 'mostly difficult', with many citing the pace of change of the sector as a challenge in predicting and scoping the skills required to build successful teams

> **"The medium is so young that there aren't any experts yet."**

Mohen Leo — Director of Immersive Content, ILMxLab

WWW.STORYFUTURES.COM/ACADEMY

Mind the skills gap

17%

Respondents identified games as their main recruitment ground

Key skill: real time game engines

– 52% of respondents identified a lack of Unity (28%) or Unreal (24%) technical artists as being a key skills shortage

– 17% of survey respondents identified games as their main recruitment ground – the most significant sector for recruitment beyond the immersive sector itself

The shock of the new

– The survey found that 48% of respondents had employed people with roles and job titles that had not existed before, such as 'VR level designer' in games companies. Senior figures emphasised that a mix of skills and hybrid roles were pivotal to success

– A series of 'slash roles' were identified, such as 'developer/artist' and 'producer/artist', enabling companies to employ people with a combination of skills who can respond flexibly to production demands

– This is further underscored by the way that emergent team structures are taking a wide variety of forms, as production teams understanding their own needs and flex accordingly

With 44% of respondents worried about the lack of graduates with relevant skills able to keep up with demand, it was felt that new courses that address the creative application of immersive technologies were desperately needed, along with a drive to rapidly develop immersive literacy within our world-leading creative industries.
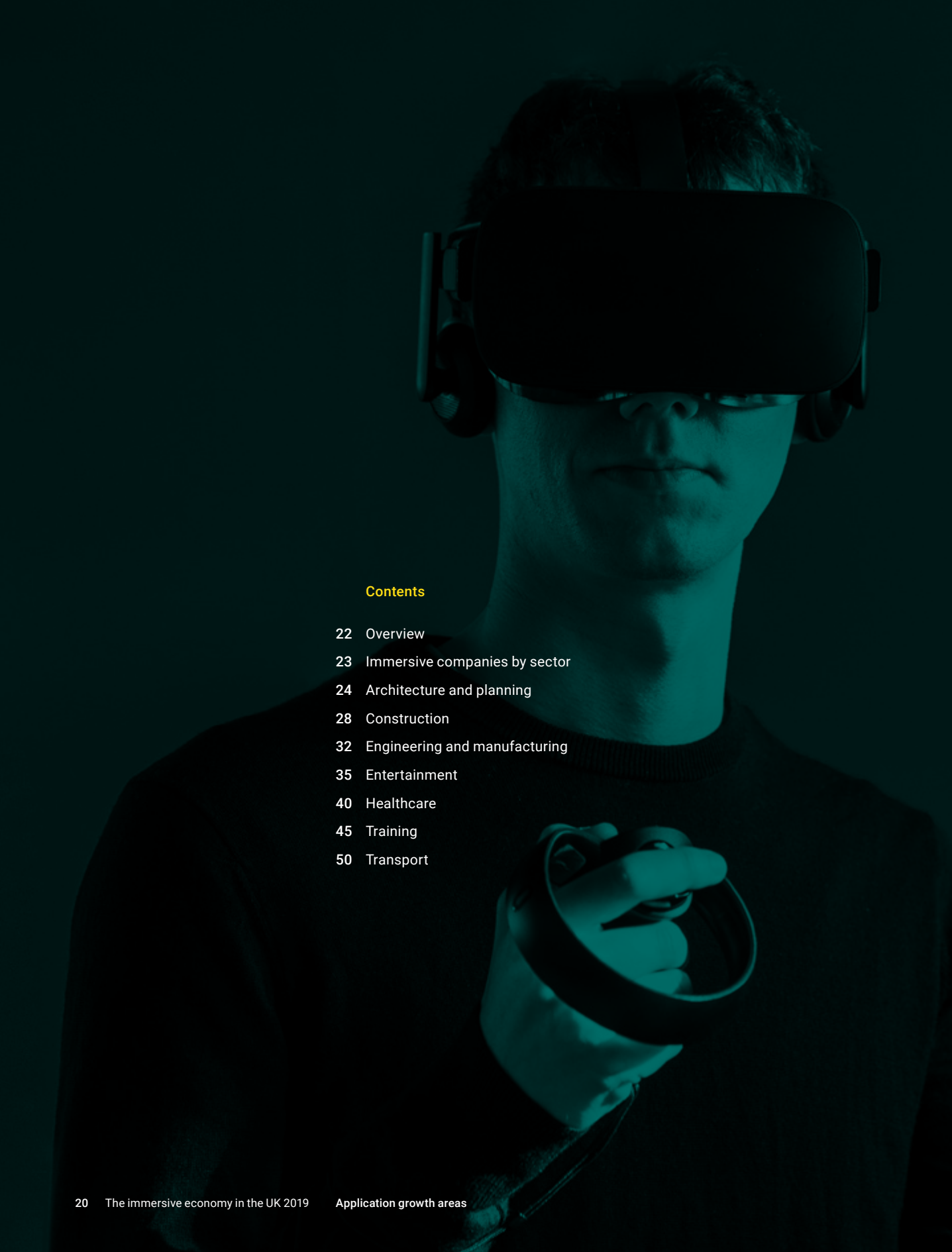
StoryFutures Academy's final report will provide further detail around these skills gaps and the barriers they represent to growth, as well as how the resulting challenges may be addressed.

"The games sector has not only become a leader in immersive content production, but also a hunting ground for recruiting talent."

Stephen Brown – REWIND

StoryFutures /ACADEMY/
National Centre for Immersive Storytelling

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Contents

Application growth areas

The 2018 Immersive Economy in the UK report highlighted how immersive companies are driving innovation in a diverse range of sectors.

Although 80% of the companies surveyed operate in creative and digital markets, two-thirds mentioned other markets, ranging from education and training to architecture, advanced manufacturing and energy.

Overview

Having emerged from the digital media and entertainment sectors, industrial application of immersive technologies remains the fastest growing part of this emerging market, with an increase in the development and application of immersive technologies for use in business and in the delivery of public services.

As the sector profiles and use cases demonstrate, companies can now use immersive technologies to resolve long-standing challenges and increase productivity, reduce costs and ensure staff safety. As the uptake of 5G becomes widespread, so the power and sophistication of these services will increase, particularly with high capacity and low latency mobile data. This market growth and increasing commercial use is creating opportunities for a new generation of specialist immersive technology and production companies.

65% of the companies surveyed found that immersive technologies have opened up new markets and sectors for them to work with. The strongest spending growth over the 2019–2023 forecast period, it is predicted that investment will come from the financial sector (133.9% CAGR) and infrastructure organisations (122.8% CAGR), while manufacturing and the public sector will follow closely behind. In comparison, consumer spending on AR/VR is expected to deliver a five-year CAGR of 52.2%[5].

This section will explore the growing immersive ecosystem across a number of sectors in the UK, highlighting example companies and use cases as well as insights into the dynamics of immersive technology adoption by end users.

[5] www.idc.com/getdoc.jsp?containerId=prUS45123819
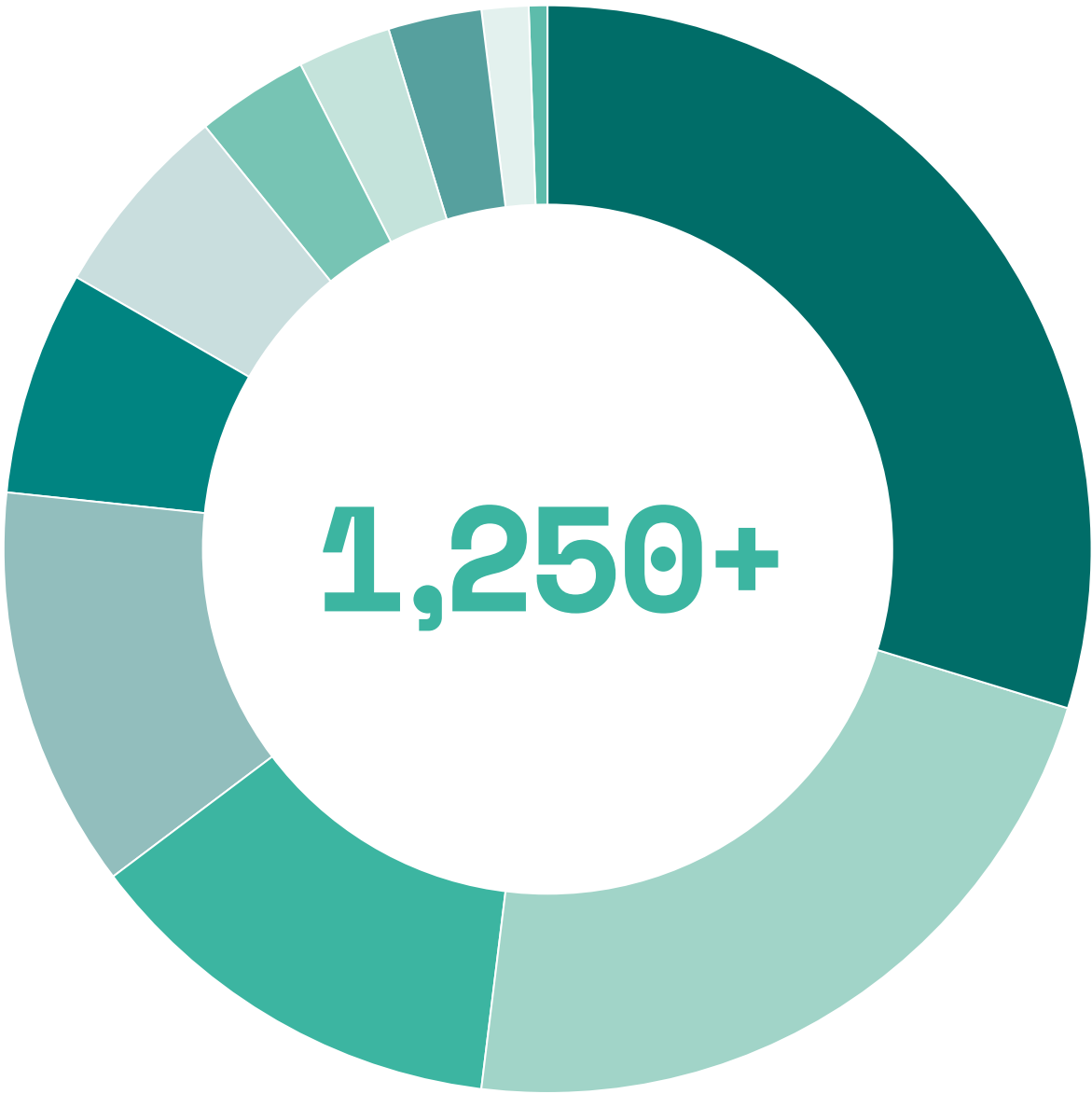
133.9%
2023 forecast for the financial sector (CAGR)

122.8%
2023 forecast for infrastructure organisations (CAGR)

52.2%
Consumer spending on AR/VR is expected to deliver a five-year (CAGR)[5]

Immersive companies by sector

1,250+

29.9%	Technology	
22.3%	Media and arts	
12.8%	Professional services	
11.7%	Leisure and hospitality	
6.7%	Real estate and construction	
5.9%	Non-profit education	
3.3%	Consumer goods and service	
2.8%	Heathcare and scientific	
2.7%	Industrial and agriculture	
1.5%	Miscellaneous	
0.4%	Energy and environmental	

Architecture and planning

35% **UK architects now use at least one form of immersive technology**

The International Data Corporation (IDC) recently demonstrated that 35% of UK architects now use at least one form of mixed, augmented or virtual reality immersive technology, with that figure expected to grow to 64% within the next four years.

This is encouraging in a sector that, along with construction and urban planning, has faced barriers and slower uptake of new and emerging technologies in the past. According to the Digital Transformation in Architecture report, 73% of architects agree that adopting digital technologies leads to improved project efficiencies with the potential for immersive tools to enable architects and clients to better visualise and assess proposed constructions.[6]

While digitalisation through technologies such as immersive can transform the sector, planning systems have remained relatively unchanged with today's planners using "19th century governance and 20th century tools to tackle 21st century problems", according to the Connected Places Catapult. Its Future of Planning programme explores how planning could evolve through the application of new practices and digital tools, such as immersive simulations of new developments, that are responsive to change, provide a richer experience and are more centred around the future needs of citizens.

Cost is cited as the main barrier to adoption in terms of software, time and training, while other challenges are fear of change and lack of company-wide commitments to innovation – immersive production tools are relatively unknown to most architects. Benefits, say the adopters, include improved productivity and efficiency, better buildings and places, enhanced client experience and more effective collaborations.

"The first thing to do is to inspire the industry so they understand the technology's potential," says Euan Mills, Head of Digital Planning at the Connected Places Catapult. Though he explains there is also an issue with creating the right technology for the sector's needs, a market he describes as currently untapped. "There is education to be done, both on the demand side and also on the supply side. The tech providers need to see the opportunities that exist in the planning world. Once we can show people that it works, I think it will spread like wildfire."

Immersive technologies could play a substantial part in overcoming one of the industry's biggest barriers to building new homes – local community's distrust of local planners and developers. Using augmented and virtual reality to put a new development in context, on its site, in scale, and allow people to walk around it, could significantly improve the communication and approval process.

[6] www.architecture.com/-/media/gathercontent/digital-transformation-in-architecture/additional-documents/ribamicrosoftdigitaltransformation2018pdf.pdf

Architecture and planning

With clients including Peabody Housing, Thames Tideway, Zaha Hadid and Moss Architecture, Hobs works with top planners and construction companies in the UK. Their projects include building data visualisation, providing interactive training and reimagining digital systems in VR.

For a recent programme for Peabody, one of the oldest social housing providers in the country, they applied gaming technology to engage local communities, giving them the chance to virtually design and build a park in the Thamesmead housing development. This is one of the biggest planning projects in Europe, where 20,000 new homes are set to be built over the next 15 years.

Using immersive technologies to engage, inspire and work with young people in these communities is also enabling the Hobs team to encourage the next generation to see the possibilities of immersive storytelling, grow the industry and develop a talent pool of young people who are tech-ready with relevant skills.

"We're seeing virtual reality and digital tools being used to have conversations with communities about their neighbourhoods and there is real social impact in that, getting people to think about the places they live in and becoming more invested in their local areas. We have witnessed communities really being inspired by that."

Kadine James
— Technology Lead

HOBS3D.COM

Architecture and planning

Fracture Reality

Working as a Microsoft partner for the past three years, Fracture Reality is currently building a real-time urban planning collaboration platform for the government in Singapore. Here they are aiming to address the challenges associated with housing dense populations on a small land mass, ongoing large-scale planning projects being constantly in the pipeline, and up to 90% of residents currently living in social housing.

Fracture Reality uses HoloLens to create a 3D interactive model of the city, enabling planners to try out different ideas and quickly make changes, while avoiding the need for multiple decision-making feedback sessions and reducing sign-off time from months down to weeks, or even less.

Chief Executive Officer Mark Knowles-Lee identifies the four key benefits for immersive technologies in this sector as training, rapid visualisation, collaborative workflows and new perspectives on complex data sets.

"When we started in 2016, we decided to side-step VR and go for MR, where we've seen a slower burn. We had to go out and educate companies, and while the excitement about VR has now peaked a bit, the anticipation and potential for MR is still growing."

Mark Knowles-Lee
— Chief Executive Officer

FRACTUREREALITY.IO

Architecture and planning
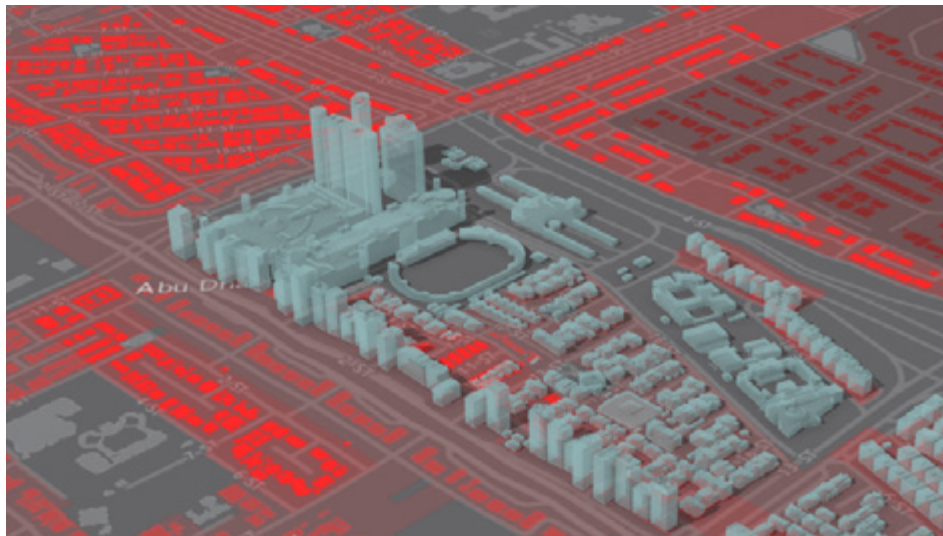
Garsdale Design

A small family practice in the north of England has identified a niche market in providing immersive technology training for major organisations in the architecture and urban planning sectors. With clients across the UK, US and Middle East, Garsdale Design originally began by using the gaming tool City Engine for urban master planning projects. Now recognised as an expert in the technology for the sector, MD Elliot Hartley provides a consultancy service for other companies working with this tool.

"What we're seeing is the larger practices joining up visualisation elements with the underlying data and existing mapping, so they can output it to any medium the client wants. And increasingly clients want augmented reality and hologram tables," he explains.

"Big architecture companies say to me, is this worth our time, should we be doing it? And I say I'm part of a small family firm in northern England and I'm doing it. And in half a day I can create an urban environment of 10,000 units and put on a VR headset and walk around it. So even if you're not doing it, I definitely am."

Elliot Hartley
— Managing Director

WWW.GARSDALEDESIGN.CO.UK

CASE STUDY IER0003-ARP

Construction

£72m **Awarded to the Transforming Construction Alliance to deliver the Core Innovation Hub**

Despite fears of a weakening market, private housing output is forecast to grow 2% in 2019, with a 1.3% annual growth in overall construction output between 2019 and 2023 when an anticipated 168,500 construction jobs will be generated. This is an increase from the 2018–2022 estimate of 158,000.

Construction is often regarded as one of the least digitised of major industries, but things are set to change with the recent award of £72 million to the Transforming Construction Alliance to deliver the Core Innovation Hub. This is predicted to lead to a ramping up of private sector efforts to digitise the construction process.

Experts agree that digital technology has the potential to transform construction, as long as the sector is equipped with the right skills and knowledge. Immersive technologies have the potential to improve processes, communication, training and safety, providing entirely new ways of working. Slow adoption is due to a lack of consensus and understanding within the industry, and current use is largely limited to pilots or trials, such as Crossrail's Tunnel Boring Machine technology and VR hazard training at Hinckley. "The issue is that the construction industry isn't fully up to speed on the art of the possible," says Chris Bagley, Head of Infrastructure Systems at KTN.

Many of the problems inherent in the industry, such as under-performing projects and late delivery, directly correlate with the inability of site workers, designers, architects and engineers to fully visualise a project before it is built. With VR and AR technology enabling stakeholders to step inside a finished development from the outset, potential conflicts or necessary changes can be identified at the design stage. By providing real-time information, immersive technologies will increase efficiency, improve safety, streamline collaboration, manage costs and boost investor confidence.

At present, there is still a reluctance within the sector to change established systems and processes. Costs and hardware requirements are also a concern, particularly as the technology would need to be used in harsh environments. There is also the issue of communication, as observed by Richard Johnston, Director of Geve. He says that their formal processes reach only a limited market. "We spend billions of pounds on big construction projects, but we don't communicate with the public very well." Immersive technologies could significantly transform the way the sector communicates.

Construction

The Soluis Group is one of the global leaders in the creation of 3D environments for the design, construction and property industries. The group is currently launching two key projects: a portal for creating traffic data collaboration for the UAE Road Traffic Authority, and an immersive sales and marketing space for a Montreal real estate company.

Founder Martin McDonnell is also the Chief Executive Officer and Co-Founder of Sublime, which pioneers immersive technology and content solutions for property marketing and brand activation. He is confident of seeing industry spend grow. "Hopefully we'll see a great delivery for the buyers, though it's important not to over-promise. The industry is often guilty of over-promising what VR can do."
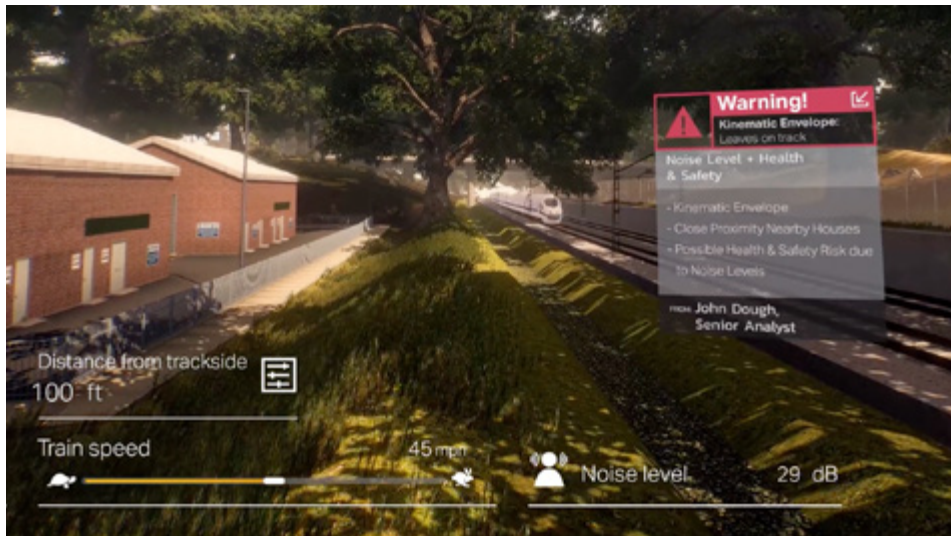
Martin predicts that "we are soon likely to see a robust safety glass design launched from China or Taiwan."

> "Within two years, we'll have a decent US$200 device with an 8-hour battery life, robust enough for construction sites and manufacturing plants, and that's where we're targeting our own R&D."

Martin McDonnell
— Founder and Chief Executive Officer

WWW.SOLUIS.COM

Geve

Engineer Richard Johnston and Data Manager Mark Beckett realised if they wanted to accelerate the pace at which new technology was being adopted in their industry, they needed to do it themselves. This led to the foundation of Geve. With a background working on projects for London 2012, HS2 and Transport for London (TfL), Richard and Mark now develop immersive products to support the construction industry and the way in which it engages with the public. Geve is currently running a trial with a government agency.

Richard believes that change will be driven by client organisations "because middle management sees change as a threat and the marketplace and contractual organisations are not empowered to make change themselves. They will only do so if pressured by senior management or government".

"Cost barriers will break down once immersive technologies are seen to make projects more efficient and quicker to complete, and initial investment is proven to reduce overall project costs."

Richard Johnston
— Co-Founder and Director

GEVE.CO.UK

Mace

Mace is a £1.97 billion international consultancy and construction company, with major UK projects including The Shard and the development of Battersea Power Station. Current immersive projects include VR training on mobile elevated working platforms at Battersea and design immersion for clients at the company's London HQ.

The Mace design team also uses the Unity game engine to turn building information into virtual environments, enabling clients to experience their projects 'live', check operational requirements and plan crucial details, such as vehicle movements within and around the development site. This makes it a valuable stakeholder engagement and communications tool.

The technology is also useful, says Innovation Manager George Holder, for providing interactive environments by creating immersive caves for collaboration on multidisciplinary projects. The benefits of immersive technologies are being used more and more in the construction industry.

"Our project team collaborated with the hiring company to train the operatives off-site to work at great heights in enclosed areas."

George Holder
— Innovation Manager

WWW.MACEGROUP.COM

Engineering and manufacturing

$160bn
Immersive technology market within the next three years

Immersive technologies are predicted to become a US$160 billion (about £130 billion) market within the next three years and while much of this demand will be consumer-led, current trends indicate that business applications, particularly in engineering and manufacturing, will be a major driver for global growth.

The High Value Manufacturing Catapult (HVMC) 2018 report, 'Immersive Technologies in Manufacturing', explores how such technologies are being deployed across several industrial sectors, including the aerospace, oil and gas industries. The study found that there has been a major uptake of immersive technologies with 84% of survey respondents adopting AR/VR technologies within the last three years, coinciding with the increasing availability of low cost head-mounted displays (HMDs) and mobile devices.

The potential benefits of these technologies are well understood. By integrating AR/VR into the design and prototyping processes, engineers and industrial designers are able to more easily identify faults, and make amendments, additions and improvements without having to do physical modelling and/or make adjustments to the manufacturing processes.

Adopters cite benefits such as improved production quality, with reduced risk and costs.

Alongside these, immersive technologies provide scope for more effective training and remote maintenance with reduced inspection time. According to the HVMC report, increased productivity, reduced risk and improved quality were all cited by respondents as more significant factors, rather than 'saving money', suggesting that immersive technologies are helping UK manufacturers transition into more productive, higher-value activities.

Publicly funded institutions and support systems are enabling further growth in the industry. The Advanced Manufacturing Research Centre (AMRC) is helping companies of all sizes use immersive technologies, from global businesses to a van conversion service that has reduced its turnaround time from six weeks to half an hour by working virtually.

Barriers to the adoption of immersive technologies were reported as principally being lack of skills and knowledge, time constraints and security issues. However, the single biggest perceived barrier was justification of the investment to start with.

The Augmented Reality Enterprise Alliance (AREA) promotes the acceleration of AR adoption in enterprise, and has recently completed a research project on overcoming barriers to adoption in manufacturing.

"We talk to businesses about the best practices involved in delivering pilot schemes, encouraging them to think about what the end goal is," says Executive Director Mark Sage.

"There are lots of interesting supporting technologies coming out of AR at the moment; things such as gesture control and content development are bringing a whole new set of skills and knowledge to the industry."

Technology Manager at the Manufacturing Technology Centre (MTC) David Varela says that demand will increase as businesses begin to realise the benefits. "When people hear about it, they're not sure, but when they see immersive technology in action and what it can do, they want to invest in it."

VISR

Co-Founder and Director Louis Deane describes VISR as "combining digital twin technology with immersive headsets, data-modelling large installations and presenting that model through mixed reality technology". With Centrica as a major client, VISR's ultimate aim is to put 20,000 headsets onto the heads of engineers in the oil and gas industry.

Louis sees mixed reality as having a measurable effect on industrial productivity and profitability, largely due to the efficiencies and cost savings that it can deliver – up to 30% in some cases.

He cites VISR's partnership with Microsoft HoloLens as being a significant factor in success. He values the power of Microsoft's XR strategy and its industrial focus, which he sees as having a measurable impact on the UK engineering economy. Microsoft helped VISR to broker a deal with Centrica.

"Combining digital twin technology with immersive headsets, data-modelling large installations and presenting that model through mixed reality technology."

Louis Deane
— Co-Founder and Director

VISR-VR.COM

Luminous
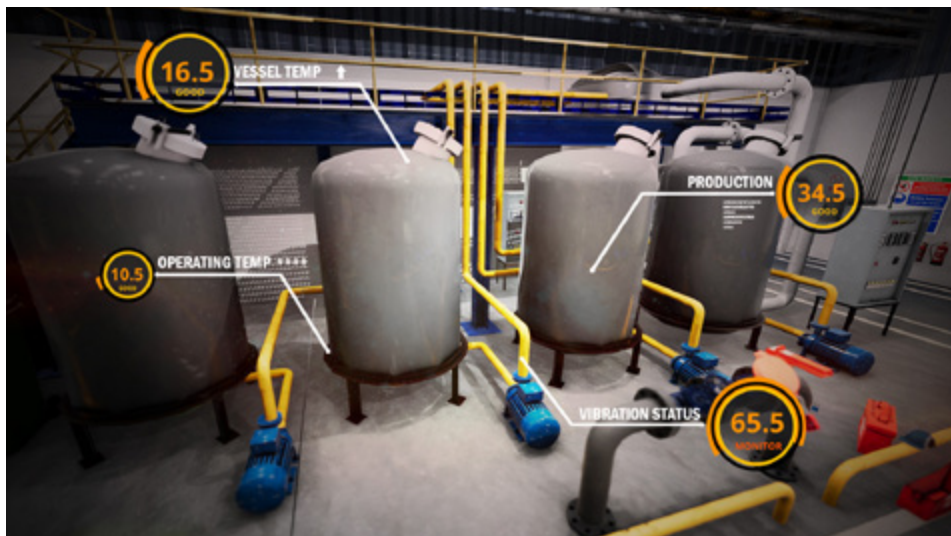
Originally known as Digital Surveys, Luminous was founded as a 3D imaging company digitising built real world environments. In 2016, they transformed into an immersive technologies company under their new identity. Using real world data to create user models in the AR/VR space for clients in the industrial sector, they developed new products: Rivo, an asset mapping tool for industry, and Traxr, a mixed reality app built for a client and now being adapted for launch to the wider market.

Luminous now plan to help move the industry from being reactive to proactive, using technologies such as AI to predict and address problems before they arise.

"We used to work a lot in the architecture sector, but the products weren't mission-critical in that space. Now we focus on industrial sectors, heavy engineering and manufacturing, where the cost implications are huge if factories experience downtime."

Ben Bennett
— Managing Director

WWW.LUMINOUSGROUP.CO.UK

Entertainment

£294m **UK VR industry will grow to £294 million by 2023**

In a consumer-led market, immersive technologies are often seen as a medium for next generation media and entertainment. VR and AR content has the potential to move audiences beyond the two-dimensional screen and generate powerful new experiences. Whether live gaming with competitors from across the globe, watching holographic performances from resurrected music icons or being immersed in a location-based experience, these technologies can transform the way we engage with arts, sports and leisure experiences – and with each other.

We are emerging from a period of low levels of device penetration, awareness and buy-in from the consumer market. Multiple new products and devices have appeared in the market over the last few years. The UK's VR entertainment market is likely to grow faster than any other entertainment and media sector, from £118 million in 2018 to £294 million in 2023. Sales of standalone VR headsets such as Oculus GO and HTC Vive, are projected to grow from 2 million in 2018 to 3.5 million in 2023[7], with continued growth supported by the roll-out of 5G, all of which is leading to a stronger market.

Considerable investment in immersive experiences has been made by the government and industry, and should ensure that more VR-specific content can be developed and delivered across a range of entertainment sectors.

For example, The Audience of the Future programme, launched in 2018 by UK Research and Innovation (UKRI), will bring more than £30 million of public funding into the sector. This is a huge opportunity for a new generation of storytellers who already enjoy an international reputation, with a strong UK presence at SXSW and Venice Biennale VR showing award-winning work.

"The hard bit is always funding, of course," says CreativeXR Executive Producer and Venice Biennale VR Curator Liz Rosenthal. "But having a network is really important and that's why Immerse UK is great. Also, content producers, who I think are key, need more business training, as a lot of them have come from the design world – producer business skills are very important."

Sports and esport entertainment

In the UK, gaming is the primary driver of VR revenue representing 53% of all VR spending in 2018. The fastest growing area of the gaming market is esports, where competitive video games are played in front of an audience, in an arena or streamed live. In 2018, UK esports revenue was £24 million, and is expected to reach £48 million by 2022. This comes from the sale of individual games and revenues from events such as ESL One Birmingham, which hosted more than 24,000 spectators with a further 300,000 watching online.

With global revenues from esports expected to pass the US$1 billion (around £800,000,000) mark in 2020, there is an opportunity to reach broader audiences than ever before, particularly as 5G starts to enable data networks at the capacity and speed that advanced gamers demand.

[7] PwC – Global Entertainment & Media (E&M) Outlook 2017-2021

Entertainment

Technology is lowering barriers to entry for new creators

Sol Rogers is the founder and Chief Executive Officer of REWIND, which partnered with York University and ESL UK to deliver the Birmingham event in 2019. Despite advances in hardware, software and new opportunities, he cautions that, "the easy money is gone. So, companies really need to have a measurable and clear vision about what they want to create."

Performance
Entertainment is about finding audiences, and immersive technologies make performance-based media much more inclusive and accessible. Applications in theatre, concerts, music videos and cinema have already started to transform the ways in which these experiences are produced and enjoyed.

New developments in motion-capture, projection mapping and virtual prototyping shorten production times and costs for the biggest producers, while the technology to process 360° imagery already exists and has lowered barriers to entry for new creators. Increasingly unbound by their location and further enabled by 5G, more audiences can now enjoy live performances that feature stories told using content written specifically for holographic and volumetric technologies.

Support has been slower to develop, according to Robin McNicholas, Founder and Creative Director of Marshmallow Laser Feast. "It's unfortunate that the costs involved in our kind of work are quite gargantuan and they frighten lots of arts organisations off. Sometimes it's a whole year's worth of budget guzzled up in one production. This is decreasing as time goes by, but it's still a challenge."

Location-based experience
Immersive visitor experiences are gaining popularity and investment across a wide range of activities. Many high-end VR units are still above the average consumer's price point, contributing to the popularity of VR centres and arcades across the UK. Government and industry funding has also helped to bring gallery and museum exhibits to life through new digital experiences. In 2018, over 50 locations and 40 operators were identified across the UK, while smaller independent locations are reported to be flourishing and establishing themselves.

John Cassy, Chief Executive Officer of Factory 42, which produced 'Hold the World', a behind-the-scenes tour of the Natural History Museum guided by Sir David Attenborough, says: "By combining world class storytelling with cutting edge immersive tech, we will take people into worlds of enhanced reality that engage their emotions and senses in ways never before possible and that other media simply cannot match. It's an exciting future and the UK, with the incredible pedigree of its creative industries and the right policy and practical support, has every opportunity to lead the world in this space."

As well as creating the esports cross-reality platform for ESL One Birmingham, the team at REWIND has also been busy creating a series of world firsts for clients, including The O2 and the BBC. Their innovations enable anyone to enjoy immersive experiences using only a smartphone, tablet or computer. Using experimental volumetric capture technology, fans at home were able to enjoy a Michael Bublé performance at The O2, while would-be motor racers could take three petrol-fuelled vehicles airborne over a music festival, a petrol filling station, and a supermarket car park on the Top Gear website – thanks to being immersed in 360° film.

An acclaimed interactive VR experience that reimagined the Sky drama 'Curfew' was created for Oculus Rift, and at the start of this year REWIND joined forces with Three Mobile to create a mixed reality fashion show, powered by the 5G network and starring Lennon Gallagher.

Sol Rogers, Founder and Chief Executive Officer of REWIND, now has his eye on commercial applications for immersive technologies.

"We're definitely taking the plunge away from purely entertainment and are releasing our own software to solve big problems or create big opportunities within enterprise. We're seeing a huge amount of energy and uptake from new clients wanting to use virtual reality and other immersive technologies to help change their businesses for the better."

Sol Rogers
— Founder and Chief Executive Officer

REWIND.CO

Marshmallow Laser Feast

VR experience 'We Live in an Ocean of Air' was showcased by London-based multimedia design studio Marshmallow Laser Feast at Tribeca Storyscapes, before transferring to the Saatchi Gallery in London in 2018, where its run was extended several times.

Based on the data collected from that experience, the Marshmallow Laser Feast team is now developing a project called 'Sweet Dreams', which was shown at the Sundance New Frontier programme this year and uses similar backpack PC technology.

"A big focus of ours is to increase audience numbers," says Founder and Creative Director Robin McNicholas.

"It's good to allow people to explore and have a level of freedom that untethered backpack PCs essentially enables. And there's a big shift in the technical abilities and production values as a result of that, because they're more filmic, based on the improvement of graphics cards and sonic production."

"Just two years ago people were tethered in these experiences. So that meant that they were unable to walk around in a space and it was very difficult to get multiple people through."

Robin McNicholas
— Founder and Creative Director

WWW.MARSHMALLOWLASERFEAST.COM

Anagram

Pushing the boundaries of immersive technology, storytelling and physicality, Anagram's Collider VR experience 'collides' people in an effort to understand how bonds are formed and destroyed. Described by Director and Anagram Co-Founder May Abdalla as 'a two-person experience about relationships and power dynamics in a multi-room immersive set', it has travelled the world from New York to China, where it won the Best Immersive Art Award at the Sandbox Festival and moved participants to tears.

Balancing the needs of enthusiastic art creators with building a sustainable business, Anagram is currently developing a VR software tool to collaboratively make functional VR prototypes in just a few hours.

"I think we're good at playing at the edge of what the technology can do," says May.

"Immersive tools often come with a lot of assumptions about how they should be used, and what we like to do is take them apart and reimagine other kinds of playfulness. We don't want people to feel that this is not for them, that they can't play computer games. This has been quite an obsession with us."

May Abdalla
— Co-Founder and Director

WEAREANAGRAM.CO.UK

Healthcare

30% **Growth globally in digital health services by 2025**

According to Invest in Great Britain, there are approximately 3,700 companies in the UK's medical technology sector, generating a turnover of £21 billion with a total market worth of £7.6 billion. Globally, digital health services are predicted to grow by 30% to reach US$25 billion (about £20 billion), with the immersive healthcare market worth US$5.1 billion by 2025, says Forbes.

Growth will be fuelled by aging and growing populations, a rise in chronic diseases and an increasing requirement for improved patient outcomes. At the same time, technologies such as 5G and artificial intelligence hold out the promise of more accessible and sophisticated immersive applications.

This growth comes at a cost. NHS figures show that total health spending in England was around £129 billion in 2018/19 and is expected to rise to nearly £134 billion by 2019/20. This figure accounts for almost 10% of GDP. An additional £20 billion will be available for NHS England by 2024, however there are still significant cost constraints.

With healthcare stakeholders under pressure to provide more cost-effective, efficient operations and results-based care, the opportunities for the immersive technology sector are immense. While there has been a proliferation of VR healthcare technologies in the past two decades, the pace of both interest and innovation has accelerated in the last two years, according to medical professionals.

Healthcare benefits of immersive technologies include enhancements to medical training and practices while reducing costs, improved patient education and engagement, non-location-based access to care and more effective rehabilitation and mental health support.

A recent Immerse UK Technologies for Healthcare event brought together healthcare practitioners, academics, public body representatives and immersive technology experts to explore the barriers and opportunities in the sector, across collaborative research and development, distribution and infrastructure, data and security, regulation and ethics. Sarah Ticho, founder of Hatsumi VR, working in health, art and immersive technology, said that it was moving to hear patient case studies at the event, which had demonstrated how powerful immersive solutions can be.

Healthcare

Issues raised for immersive adoption into the healthcare sector include:

– The facilitation of collaboration between industry and academia to create commercialised products
– The skills shortage, and how games developers familiar with the required technology are not entering the health sector
– Complex regulatory and procurement procedures
– Caution around sharing research

Opportunities are being presented by the growing market size and multiple routes to market through centralised NHS and government bodies, private health care companies, educators or direct to patient.

Nick Peres, Head of Technologies at Torbay and South Devon NHS Foundation Trust, set up one of the first patient VR labs in the NHS. He says that even two years ago VR was a relatively new technology in healthcare. "There are now more examples of [immersive] equipment being accessible and there are more [NHS] Trusts using VR equipment as part of their programmes."

Chris Scattergood is Co-Founder and CRO of FundamentalVR, which builds VR simulations for surgical training, also stated that "the technology is not only transferring surgical knowledge and surgical skills to trainees, it's also capturing the data, which means the training directors can see who is ready to move to live surgery." Counting the Mayo Clinic among their clients, FundamentalVR's technology is in use in the UK, US, Korea and several countries across mainland Europe.

"There are now more examples of [immersive] equipment being accessible and there are more [NHS] Trusts using VR equipment as part of their programmes."

Nick Peres — Head of Technologies, Torbay and South Devon NHS Foundation Trust

"Immersive technology is not only transferring surgical knowledge and surgical skills to trainees, it's also capturing the data, which means the training directors can see who is ready to move to live surgery."

Chris Scattergood — Co-Founder and CRO, FundamentalVR

Alder Hey Innovation Centre

Rafael Guerrero is a Consultant Heart Surgeon at Alder Hey Children's NHS Foundation Trust in Liverpool. Five years ago, he co-founded its innovation centre – based on a model at Boston Children's Hospital – at a time, he says, when the US was 15 years ahead of the UK in innovation and the HoloLens had not yet been invented.

Working with Liverpool University's Virtual Engineering Centre, where components for companies including Bentley Motors and BAE Systems are designed, the team at the innovation centre used CT scan data to build a virtual baby's heart that he could enter and examine in detail before surgery took place.

"VR will fundamentally change the way we deliver healthcare," he explains, giving as examples the ability to perform surgery and diagnose patients remotely using holograms, provide no-frontiers training, enable telemedicine consultations and allow patients to step inside their own bodies to better understand problem areas. Next, he wants to establish the UK's first immersive healthcare conference, hackathon-style, that will bring together patients, practitioners and technologists.

WWW.ALDERHEYINNOVATION.COM

"VR will fundamentally change the way we deliver healthcare."

Rafael Guerrero
— Consultant Heart Surgeon

Rescape Innovation

Based in Wales, Rescape Innovation recently launched an out-of-the-box VR distraction therapy to help manage patient pain, and reduce anxiety and stress. It is currently developing 30 other healthcare products, from fully immersive spaces for patient group therapy sessions to 360° filmed VR pathway experiences for hospital familiarisation. The team is also involved in two pain-reduction clinical trials.

"The pace of growth in the sector is huge," says Rescape Innovation's Co-Founder, Glenn Hapgood. "And there are not many players in this space. Many businesses don't want to work within healthcare and that's often down to procurement processes. But that's improving now."

"Growth is being driven by funding and substantial buy-in from healthcare providers," he says, "with innovation now being driven from the top. As people live increasingly digital lives, the health system is waking up to the fact it needs to move into this space."

"It's non-stop for us at the moment and we're getting at least three or four enquiries a week. We're actually getting to the point where we can't manage the workload and are outsourcing."

Glenn Hapgood
— Co-Founder

WWW.RESCAPE.ME

The Fred Company

BILLETTO EDITORIAL

The Fred Company has effectively demonstrated the benefit of immersive technologies for client engagement in its recent Grenfell Tower project. Working with Ross O'Brien, Deputy Director of the Grenfell Health and Wellbeing Service, the team used outdoor VR experiences to engage the community and provide awareness of the local support services that were available after the fire.

Fred's Founder Rosie Collins explains that they went on to develop a series of immersive film projects to get people talking about mental health and wellbeing. Planned future collaborations include a VR art therapy immersive experience.

One of the main issues in the sector, she believes, is that while many people are doing interesting things, efforts are not joined up – there is no central facility for sharing, or for funding technological innovations. "If one NHS Trust is funding an innovation, that should be freely available to the others. But that's not how it works at the moment."

THEFRED.COMPANY

"VR engaged people, it brought out their endorphins, they trusted the person they engaged with to the point they talked about something that was really difficult and traumatic."

Ross O'Brien
— Deputy Director

Training

70% **Improvement in employee performance with VR-based training programmes**

Particularly useful for replicating dangerous and complex scenarios, such as an underground building site or operating theatre, immersive technologies can be used to increase participants' engagement and retention, reducing errors and tracking actions to provide feedback. When complemented by machine learning and artificial intelligence, the scope to improve effectiveness becomes even greater.

Recent research shows that 45% of businesses in high-consequence industries, such as aerospace, manufacturing and healthcare, see immersive technologies as critical to their business goals over the next two years. And with evidence that VR-based training programmes can reduce training time by 40% and improve employee performance by 70%, according to REWIND Chief Executive Officer Sol Rogers, it's no surprise as one of the most common uses of extended reality in enterprise.

Use of immersive technologies by high profile companies in this sector is now attracting attention. At Boeing, test subjects who used AR to assemble wing parts achieved a 90% improvement in first-time quality compared to colleagues using PDF files. BAE used a Google Glass pilot to decrease assembly time by 25% in aviation manufacture. Airbus and Japan Airlines are using Microsoft HoloLens to train engineers and cabin crews.

Meanwhile, UK companies are developing innovative applications for their clients, such as Clicks and Links' virtual shop floor app for Co-op trainees, Hobs' pop-up virtual reality training system for Tideway's Tunnel Boring Machine, the Smart DS hologram platform for Bureau Veritas and the first 5G-ready immersive content delivery platform built by Mativision.

According to Smart DS director Steve Picken, off-the-shelf tools are not adequate for training. "The tools that do exist are all basically oriented towards gaming and game development, which, when you're trying to simulate real world assets and real-world environments, just don't come up to scratch."

Outside the corporate environment, adult learning skills in the UK are falling behind those in Europe. With improvements in this area estimated to provide an annual economic boost of £20 billion there is a great deal of opportunity for immersive technology companies to explore in the training sector.

Ministry of Defence

©PA

A £500,000 immersive technology solution, developed by Pennant Training Systems and VR specialists Maelstrom, is currently helping to train members of the armed forces at the Parachute Training School at RAF Brize Norton in Oxfordshire.

The VR parachute trainer allows students to virtually experience a parachute jump within a controlled environment. Controlled from an instructor's console, the eight student stations enable trainees to practise realistic parachute drills, including emergency malfunction situations.

The training school runs eight to ten courses a year with up to 32 students on each course, and trainees cannot take part in a live drop until they have passed their virtual training. "The system is as close to doing a real parachute jump as you can get," say the trainers.

"The VR parachute trainer allows students to virtually experience a parachute jump within a controlled environment that is as close to doing a real parachute jump as you can get."

Trainers
— RAF Brize Norton

WWW.GOV.UK/GOVERNMENT/ORGANISATIONS/MINISTRY-OF-DEFENCE

Clicks and Links

Clicks and Links specialises in immersive technology training and marketing for the construction, infrastructure and services sectors. The company has carried out virtual inspection work on rail projects for Network Rail and nuclear decommissioning for Sellafield, and has developed a range of immersive training experiences for clients including EDF, J. Murphy & Sons and the Co-op.

As early pioneers, the Clicks and Links team was one of the first collaborators on the Second Life platform in 2006, later moving into more traditional gaming platforms, working with Unreal and Unity, and obtaining extensive experience in 3D building.

The challenge today, explains Founder and Chief Executive Officer Vin Sumner, is taking these platforms into an industrial space.

"Some industries think this stuff is all from the games industry and say 'We're serious people, we don't do games'. There is a need to convey the message that in the same way that the computer can be used for a game, it can also be used for an industrial application. So, too, can gaming platforms."

Vin Sumner
— Founder and Chief Executive Officer

CLICKSANDLINKS.COM

Smart DS

Smart DS has developed hologram-based training for one of its largest clients, Bureau Veritas, building a software platform to make it easier to create, build and share 3D experiences. It is also currently working on 3D scanning prototypes for three different dental organisations and has previously created training and visualisation tools for companies across engineering, health, education and leisure.

"Interest in the sector is rising," confirms Business Development Manager Lynne Jones. "But we need to see that materialising into more client paid work or easier-to-access funding pools, as we are working with very new technologies."

"Most people who deliver training actually want simple tools, and those simple tools aren't Unity – they are solutions similar to PowerPoint," explains Director Steve Picken.

"We've been developing a programme for the last two years called Scenario, which is like a 3D version of PowerPoint that is used within the HoloLens, enabling the trainer to put simple 3D scenes together to explore with a classroom of users."

Steve Picken
— Director

WWW.SMARTDS.CO.UK

Mativision

Mativision is a world leader in VR live streaming, with clients including Facebook, Google and Samsung. Leveraging 5G's low latency to cut lag time, while using its increased capacity to enable live-streamed 360° video, interactive experiences and video-on-demand extended reality content gives them the competitive advantage of developing 5G-tech-ready products and services before competitors.

Mativision created the Medical Realities' platform for award-winning Surgeon Dr Shafi Ahmed to deliver VR surgical training, and developed the first 5G-ready immersive content delivery platform.

With a keen interest in understanding user requirements, Founder and Chief Executive Officer Anthony Karydis explains that a recent feasibility study, run in partnership with the Manchester University NHS Foundation Trust, revealed that many companies in the sector produce features that may look progressive and modern, but are not necessarily what the audience is ready to accept.

"There's a lot of talk about how people will interact and communicate with each other in immersive applications, but we found users are not too keen on this engagement."

Anthony Karydis
— Founder and Chief Executive Officer

WWW.MATIVISION.COM

CASE STUDY IER0018-TRN

Transport

$78bn **Global automotive aftersales revenues will grow to US$78 billion by 2025**

Digital technologies and vastly improved connectivity are reshaping the entire experience relating to the movement of people and goods, and immersive technologies are an increasingly important element of this.

Advancements in immersive technologies are creating new revenue streams for businesses and breaking down traditional barriers to entry in the motor sector. Autonomous cars will be not simply vehicles, but rather future marketplaces, providing in-car services that enable the purchase of fuel, parking, food, beverages and entertainment, with global aftersales revenues predicted to grow from US$29 billion to US$78 billion by 2025.

Audi and Toyota have already experimented with using consumer-based VR applications. The standard car dealership with its limited range of makes and models will be enhanced by VR environments in which models can be adapted and customised for consumer preferences and trials. At the same time, the integration of AR/VR tools are already transforming transport design and production processes. According to Forbes, BAE Systems have seen a strong return on investment from immersive technologies that are driving efficiencies, such as mixed reality tools that enable them to train new employees up to 40% more effectively.

Connected Places Catapult's visualisation lab is developing immersive technologies to support transport planning, design and customer service experience, as well as facilitating collaborations that reduce the need for travel. Advancements in immersive training and integrated technology are greatly improving health and safety in the transportation sector across the automotive, rail and aerospace industries.

The new holoride is a UK/US/German collaboration that promises to take everyday journeys and transform them into hyper-immersive experiences by combining navigational and car data with extended reality (XR) technologies. With 60% of automotive companies' revenue predicted to come from software in the future, and the ride-hailing market predicted to grow to a trillion-dollar industry, the transport market is opening up to apps and services providers working alongside OEMs, breaking down the traditional barriers to entry.

The transport sector faces many challenges: reducing congestion, costs and emissions, improving efficiency and combating climate change – all against a backdrop of strict regulation. If these are to be addressed, a long-term action plan is vital for integrating new technologies, such as AR/VR, within an interconnected transport ecosystem.

The GB railway and UK rail industry transports 1.7 billion passengers and 110 million tonnes of freight each year, with the demand for rail transport projected to increase by 58% over the next 10 years.

Working with key clients HS2 and National Skills Academy Rail (NSAR), PAULEY is pioneering the use of mixed reality technologies across the rail industry, demonstrating the future of learning through immersive technologies. NSAR estimates this market to be worth up to £600 million over the coming years.

PAULEY's enhanced software is being used to create online, augmented and mixed reality spaces to improve learning and assessment capabilities, as well as reduce costs. Award-winning immersive training technology for the sector has been trialled at the National Training Academy for Rail (NTAR) and PAULEY has also launched HoloSkills, in line with the government's Rail Sector Deal (RSD), to drive innovation and investment. Using Microsoft's HoloLens, HoloSkills will convert training material into next-generation augmented reality for use across the industry.

WWW.PAULEY.CO.UK

"HoloSkills will convert training material into next-generation augmented reality for use across the industry."

PAULEY

Razor

Founded to help businesses stay relevant in a fast-paced world of digital technologies, Razor offers innovative insights and delivers transformational products and services to companies across several sectors.

A recent immersive technology project for a UK FTSE 100 aerospace manufacturer has introduced significant productivity gains. Developed from an initial piece of research into component inspection carried out by the Advanced Manufacturing Research Centre (AMRC), Razor scaled up the original concept, converting a highly complex human interpreted task into a digitised one, improving efficiency by making it ten times faster.

Currently in the testing phase, the innovation will be transformational for the manufacturer once it is rolled out, and could also be applied in other industries, especially where non-destructive testing, additive manufacturing and 3D printing are required.

"There's a lot of reticence to adopt digital technologies because people are still unsure of their impact, both positive and negative. So I think it's great to see a big aerospace company like this embracing it, because if they get it right it's hugely beneficial to them."

Jamie Hinton
— Chief Executive Officer

WWW.RAZOR.CO.UK

MXTreality

Working in partnership with Highways England (HE) for the past two years, MXTreality is helping to shape the future of UK travel and transport by providing training simulators, immersive laboratories, multi-user bespoke environments, haptic experiences and prototype solutions. Key projects include condensing two-day training sessions into 25-minute high impact training simulations for mission-critical workers, and building a four-lane motorway using immersive technologies in a bespoke innovation centre. MXTreality is also creating a virtual environment to showcase HE's archaeological finds.

Co-Founder Tony Pettinger explains that while the company's US business works largely in immersive entertainment, its London operations are focused mainly on enterprise.

While skills shortages in the industry are a hurdle, he is happy to be working with computer science students, as he has found that these people tend to be the real enthusiasts.

"There are tangible use cases for the technology, and I think there's often too much emphasis put on its 'wow' factor, while we need to tell the practical story. There's a huge market in enterprise, but people have got to get it right and start talking about the customers' needs rather than the technology's capabilities or impressiveness."

Tony Pettinger
— Co-Founder

Contents

Understanding regional hubs

The audio-visual and digital media industries tend to be more generally associated with London, and immersive content production is no different. However, as immersive technologies have risen in prominence, hubs of activity have emerged in areas across the UK.

This chapter will focus on hubs of activity outside of London. These hubs are regions with high densities of activity within the immersive economy, including higher education institutions, the investment community and industry, and small and growing innovative companies.

Regional hubs overview

This section explores the UK's diverse and growing regional hubs of immersive technology activity. In-depth interviews were conducted with key stakeholders from local councils, universities and commercial organisations.

The semi-structured interviews followed the same script for each regional hub, to enable comparison of the challenges and opportunities faced by each area.

Qualitative findings were then combined with the quantitative analysis already derived from the collaboration with glass.ai.

The regional hubs identified in this section have been selected to represent the variety of activities happening around the country and the different levels of development of regional ecosystems, and they do not represent the full extent of immersive activity around the UK.

The interviews covered the following subjects:

– Geographical spread of the hub
– Maturity of the ecosystem
– The nature of driving forces and interventions available
– Main challenges and opportunities faced by VR, AR and MR businesses

The regional hubs: (234 companies)

– Manchester and the North West (52)
– Edinburgh (13)
– Leeds City Region (18)
– The North East and Tees Valley (26)
– Nottingham and the East Midlands (18)
– Bristol and the South West (49)
– Brighton and East Sussex (27)
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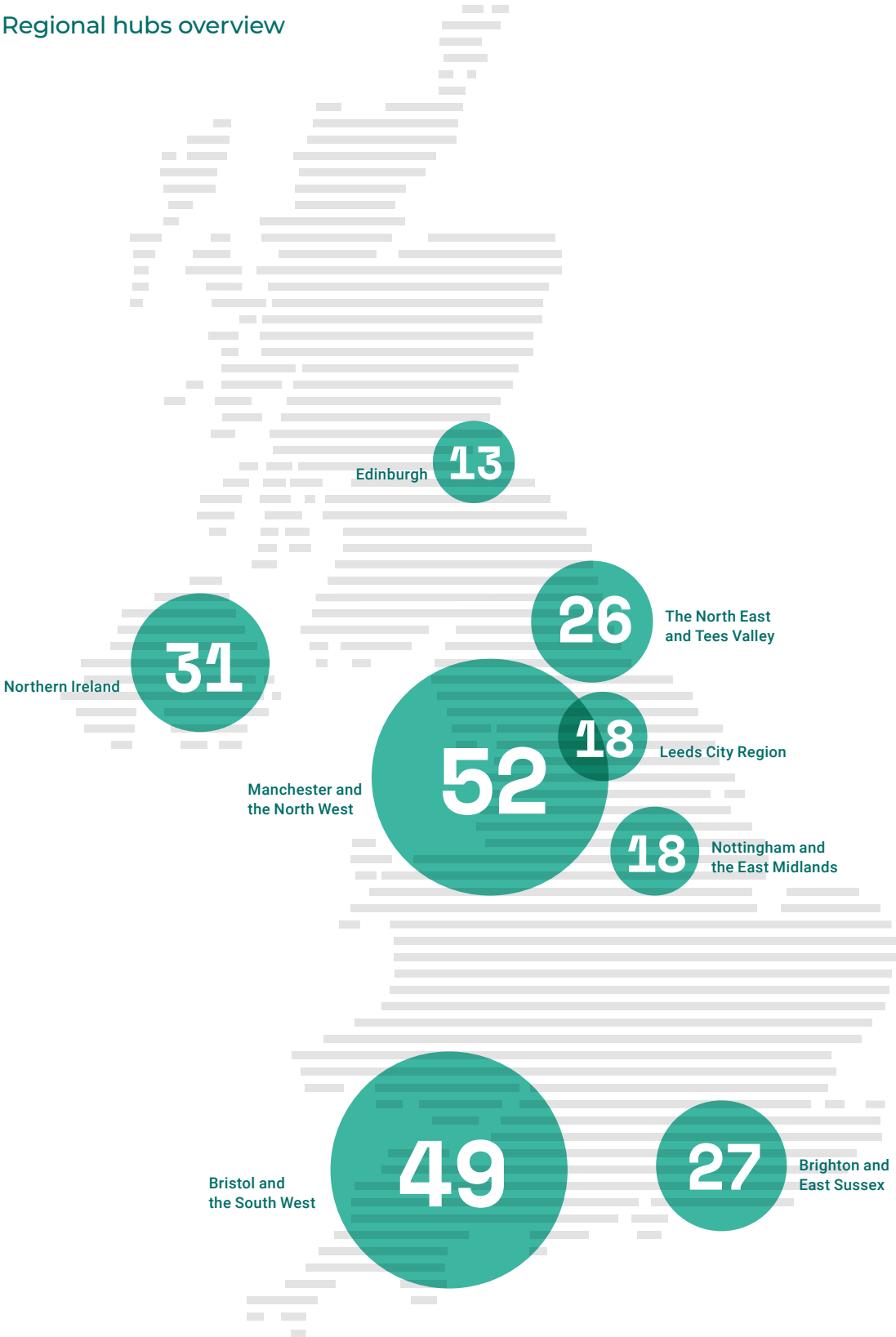
Manchester and the North West

1,471 **VR Manchester members**

Hub overview

Manchester and the surrounding area offers a variety of production and post-production facilities. Thanks to MediaCityUK, Sharp and Space Project, barriers to experimentation with VR, AR and MR are relatively low compared to other areas.

The advent of 5G and the local presence of ITV, the BBC, Channel 4 and Dock10 have led to significant opportunities for the creation and distribution of immersive content. Greater Manchester boasts up to forty production companies, while esports is also growing in prominence.

Hub participants

This hub is split down the middle between business-to-business (B2B) and business-to-consumer (B2C) activity. Having BBC's R&D and Dock10 in the area is an incentive to experiment with consumer-facing immersive prototypes, whereas The Landing primarily serves industrial applications of immersive technologies.

Alongside the manufacturing and creative influence in the region there is increasing exploration of immersive tech for healthcare. Salford Royal NHS Foundation Trust, in particular, strives to maintain a connection with emerging startups and scaleups. There is a growing ecosystem of universities and agencies to support medical training, devices, clinical care, trials and commissioning.

Within Manchester and Greater Manchester, four key meetups take place around once a month as well as larger get-togethers across meetup groups. VR Manchester is a public group with over 1,471 members, and the MetaLab: Immersive Technology Conference hosted by The Landing in November is an annual event that brings together industry speakers, panellists, startups and businesses from across the region.

There is also the Hartree Centre in Warrington. It is a high performance computing, data analytics and artificial intelligence research facility that focuses on industry-led challenges, and is part of the Science and Technology Facilities Council. Though the centre has a national reach, it is embedded in several regionally-based programmes across the North West (primarily Liverpool and Manchester). The centre fosters collaboration between small to medium-sized businesses, while larger multinationals are also drawn to the centre's facilities and also offers a range of activities to support immersive startups and scaleups (further details included in this section).

Manchester and the North West

52

Specialist immersive companies in the region (52)

	2.2%	Consumer goods and services
	4.3%	Healthcare and scientific
	2.2%	Industrial and agriculture
	4.3%	Leisure and hospitality
	23.9%	Media and arts
	6.5%	Non profit and education
	10.9%	Professional services
	4.3%	Real estate and construction
	41.4%	Technology

INFLUENCING FACTORS

Funding

The investor community in this area has grown in recent years. Apadmi Ventures has significant presence there as a strategic technology partner and investor in highly scalable startups. GP Bullhound is primarily interested in the convergence of digital and creative, while Amadeus Capital, Petora, Maven and Axion have all invested in VR, AR and MR businesses in the region. MIDAS is also a driving force for inward investment, as its aim is to secure significant levels of new investment and employment for Greater Manchester.

Government-backed organisations have also been growing in prominence, with Innovate UK, Digital Catapult and Creative England all developing strongholds in this region and collaborating with local partners. The Landing often serves as a signpost to the support functions in this area by providing a collaborative environment through the development of the Business Growth Hub. The Hartree Centre also provides funding through its involvement as a partner with the Bridging for Innovators Funding Programme and Analysis for Innovators (A4I).

Facilities and resources

There are extensive state-of-the art facilities within the hub. In May 2019, The Landing launched a Digital Catapult Immersive Lab to support the growing immersive community in the region. The lab is equipped with a range of the latest AR and VR equipment and can be hired by businesses of all sizes, academics and researchers.

The presence of content commissioners and suppliers, such as the BBC, Sony, Warner Bros and Cubic Motion, alongside the production and post-production facilities at MediaCityUK and Sharp has made it less daunting to experiment with VR, AR and MR on a large scale.

Manchester and the North West

Retaining talent is a pressing challenge for this hub

The Hartree Centre can be used for small meetings or large events with hundreds of attendees. As an embedded facility within the Sci-Tech Daresbury science and innovation campus in Cheshire it offers the high performance computing, data analytics and immersive components essential to the analysis or review of data by industry. The centre also supports research and development by providing a dedicated space offering the speed of supercomputers and state-of-the art analysis and visualisation facilities. This takes research away from conventional R&D workflows and enables it to be carried out more cheaply and quickly in-silico. Through these facilities, there will be significant opportunity to explore how immersive experiences can be used for scientific and industrial applications.

Opportunities

Vodafone launched 5G for Salford and Greater Manchester in 2019, offering companies in the area the opportunity to experiment with this new infrastructure before the service becomes available UK-wide. The combination of higher bandwidth and lower latency will facilitate an increase in the ability to deliver rich immersive experiences.

However, the most significant potential for the growth of immersive technologies is likely to be in the increasing convergence between content production, post-production, CGI, games, film and TV supply chains. This convergence is leading to scalable opportunities for research, development and distribution of immersive content.

There is also further potential for the Hartree Centre's capabilities, in particular the UK's largest supercomputer, to be fully exploited.

Challenges

Retaining talent is a pressing challenge for this hub. There is a need for a concerted effort to create a pipeline from immersive researchers and facilities at the main universities in this region to the startups, scaleups and more established small and medium-sized businesses that are taking root in this area. Many immersive tech firms are experiencing gaps and shortages in skilled staff, a problem that is limiting their ability to grow. Effort is needed to encourage 'mid-career' developers and producers to relocate to the area.

Despite the potential for commissioning content via the BBC, ITV and Channel 4, there is, as of yet, no clear way of being able to do so. Distributing experimental or independent content to consumers remains a challenge, even in areas such as Manchester that are well-served by commissioning bodies.

Edinburgh

300+ **Mixed Reality Scotland meetup members**

Hub overview

Edinburgh is regarded as one of Europe's leading tech hubs and is one of the fastest growing digital economies in the UK. It is also a growing hub for immersive and gaming technologies, with thriving local industry, a focus on art, culture and heritage, and well-connected universities, including the University of Edinburgh, Heriot-Watt University and Edinburgh Napier University.

Hub participants

There is a broad spectrum of companies in the region, from small startups to multinational organisations such as Rockstar North. There is also a sizable community of students and academic researchers from the range of universities in the region.

The principle focus for immersive technology companies in the area is on industrial applications (oil and gas, infrastructure and engineering), looking at solutions for training and health and safety. There is also a strong gaming community and exploratory work going on in the esports industry.

There are many consumer-facing VR experiences in Edinburgh, including The Realm VR, which offers immersive gaming experiences. The Bannockburn Centre's immersive storytelling of the famous battle is highly regarded, and it is clear that more high-quality content will further stimulate demand, as these existing attractions are highly rated by the public.

Funding

Edinburgh was named the UK's fastest-growing tech hub in 2017[8], and the ecosystem in the region continues to flourish. It is second only to London for inward investment and is an attractive place for establishing and growing technology companies. There are a number of accelerators and incubators in the city, such as Seed Haus, and CodeBase – the UK's largest startup incubator – and it is also home to a Barclay's Eagle Lab. Conferences such as Start-Up Summit and EIE (Engage, Invest, Exploit) are held there each year. There are ample investment opportunities for companies in the region, with a fairly big angel group, a strong venture capital community and support from the Scottish Investment Bank, which offers financing and co-investment for small to mid-sized businesses.

Facilities and resources

Universities in the region have plenty of immersive technology expertise and equipment. For instance, GRID at Heriot-Watt, a £19 million investment for Global Research, Innovation and Discovery, combines the university's expertise in engineering, maths and computer science with immersive technologies, looking at new ways of creating enterprises and partnering with large corporations. Heriot-Watt has also formed an Immersive Technology Workgroup to build on the existing network of practitioners and evangelists, in order to increase new immersive and gamification use-cases with industry partners.

There are also easy links to InGAME: Innovation for Games and Media Enterprise, an £11.5 million pound R&D Centre based in the heart of the Dundee videogames cluster. Led by Abertay University, in partnership with the University of Dundee, the University of St Andrews and local and international industry partners.

[8] technation.io/insights/report-2018/edinburgh/

Edinburgh

InGAME delivers innovative research and offers R&D support and services to games companies in the city and beyond. InGAME is part of the Creative Industries Cluster Programme, funded by the Arts & Humanities Research Council and part of the Industrial Strategy. It has also received significant funding from the Scottish Funding Council.

INFLUENCING FACTORS

A number of academic infrastructure projects are planned for the next three to five years. A joint venture between Heriot-Watt and the University of Edinburgh will operate the UK's first National Robotarium for robotics and autonomous systems, as part of a Data-Driven Innovation (DDI) initiative from the Edinburgh and South-East City Deal.

Opportunities

Scotland's capital attracts and retains a talent pool of software developers and entrepreneurs, largely due to the diverse range of industry opportunities available and the high standard of living. Startups can accelerate growth by collaborating with universities in the region: STEM universities have made significant investment in artificial intelligence and immersive technologies, and this is underpinned by world-renowned capabilities in engineering and expertise in data science.

The Converge is a challenge programme open to all Scottish Universities that helps academics realise the commercial value of their creative ideas. It provides competitions for cash prizes, coaching, training and support that can turn fledgling businesses into investor-ready opportunities.

There is a regular Mixed Reality Scotland Meetup in Edinburgh with 300 members.

Challenges

With such a strong tech ecosystem in the area, recruitment can be difficult when the salaries offered by immersive businesses are lower than those being paid by large software companies.

Specialist immersive companies in the region (13)

	10.0%	Financial services
	20.0%	Healthcare and scientific
	10.0%	Leisure and hospitality
	30.0%	Media and arts
	10.0%	Professional services
	20.0%	Technology

Leeds City Region

Universities and local councils are key drivers of immersive technology growth and development

Hub overview

Much of the innovation within the immersive landscape in this area is the result of a concerted effort by a large Russell Group university to support the development of the emerging VR, AR and MR sector.

The Leeds City Region hosts world-leading simulation and visualisation capabilities that cannot be found anywhere else.
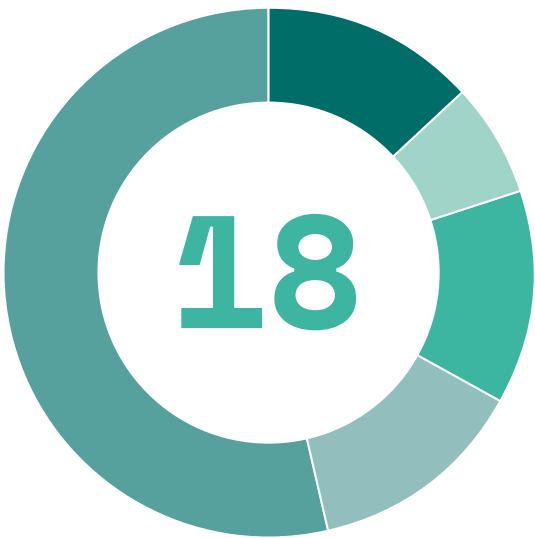
Hub participants

Early-stage startups and well-established small to medium-sized businesses are delivering innovations to address a plethora of sector challenges. Notable companies include XRGames, WEAVR and Dubit, one of the world's leading creators of content for children's VR. Dubit launched in 1999 and has created content for Disney, Netflix, the BBC, Viacom, Sky, SONY Pictures and Cartoon Network.

Leeds is also home to leading companies such as ReflexArc and Co-operative Innovations, which create VR and AR experiences for enterprises and consumers. They are committed to establishing best practice in VR/AR development through extensive research and development, the creation of industry-leading tools and technology, and through training and knowledge-sharing.

Facilities and resources

The main drivers of immersive technology growth and development in this region are the universities and local councils, which are working together to ensure that it forms part of a broader effort to enhance societal good and drive innovation in all areas of life, including health, education and business.

In June 2019 the University of Leeds launched the Centre for Immersive Technologies (CFIT) to connect internationally renowned researchers with partners from the public and private sector. Its mission is to accelerate innovation and place people at the heart of the immersive technology revolution. The Centre works collaboratively across a range of disciplines to help companies and organisations use immersive technologies for maximum benefit and competitive edge. Its academic experts take a critical, inclusive and interdisciplinary approach towards addressing challenges, and have already established a reputation, nationally and internationally, for helping companies and organisations in developing evidence-based immersive technology solutions.

Leeds City Region

Specialist immersive companies in the region (18)

	13.3%	Leisure and hospitality
	6.7%	Media and arts
	13.3%	Professional services
	13.3%	Real estate and construction
	53.4%	Technology

INFLUENCING FACTORS

CFIT research covers five main areas

Human-centred design using immersive technologies to create solutions that meet the needs of end users, such as modelling driver and pedestrian behaviour to help local authorities and urban planners design efficient and sustainable cities.

Improving health and wellbeing by pioneering advances in robotic surgery, surgical training, virtual 'walk-in' medical departments and using VR to support rehabilitation after an accident or stroke.

Accelerating education by engaging with small businesses and multinational partners to enrich the knowledge of the learner, enabling them to practise key skills and processes.

Cultural engagement working with schools, museums, artists and businesses to develop new ways of engaging audiences and learners with culture, and ensuring collections remain interesting and relevant.

Augmenting decisions and enhancing productivity using immersive technologies to facilitate better business decisions and bring huge benefits in terms of cost, time and safety.

Leeds City Region

This area is a crucible for immersive technology research and businesses

The University of Leeds also launched Nexus in 2019. Nexus is a state-of-the-art innovation and enterprise centre designed to create a community of innovators within Leeds University, and to enable businesses from all sectors to connect with the expertise, talent and facilities at the University of Leeds. Nexus is bringing together key stakeholders from higher education, industry and innovators to work together to accelerate and de-risk innovation and maximise commercial returns.

Opportunities

This area is a crucible for immersive technology research and businesses.

Firstly, the region has a strong and collaborative approach to tackling large-scale societal challenges through a thriving digital ecosystem. An example of this co-ordinated regional working comes from a unique partnership between the Universities of Leeds, Bradford and the Bradford Institute for Health Research. This has seen the establishment of the Wolfson Centre for Applied Health Research to house the world's largest education-focused virtual reality research programme. This work builds on the Born in Bradford project, one of the world's largest birth cohort studies, which tracks research studies and routinely collected medical and educational data of 13,500 births to aid in the identification of genetic illnesses and allergies.

Immersive technologies, in combination with big data and AI will be used to generate insights from the children as they start secondary school, informing the development of evidence-based methods to support students in maximising their education potential.

Born in Bradford is an exciting study that could have a significant impact on innovation in healthcare and education. This is an excellent example of synergy between academia and the public sector that will generate a large-scale population dataset, which could have far-reaching effects on many sectors, including the immersive economy.

Secondly, Leeds University's investments in CFIT and Nexus have already generated significant interest in Silicon Valley, and will have a positive impact on the number of immersive businesses set up in the region, as well as their ability to scale and grow.

Challenges

The immersive community within this region is rapidly growing, but a clear forum for companies to convene, showcase and share ideas is not mature. The Centre for Immersive Technologies and the Nexus Innovation Centre will take this role on.

Future challenges include enabling new immersive companies in this region to access funding, and equipping young people with the skills they will need to take advantage of the opportunities being presented. High profile investments focused on fundamental research into new applications, acceleration programmes and training for young people could be important steps in garnering inbound investment to make the Leeds City Region a powerhouse for immersive technologies.

The North East and Tees Valley

28,000 **Employees in the IT and digital sector**

Hub overview

The North East and Tees Valley is a hotbed for training quality talent and boasts a large talent pool of graduates, with five universities all offering bespoke courses aimed at immersive technologies and the gaming industry.

With a heritage that includes AAA studios and a history of industrial innovation, the region has a strong – and growing – immersive technology community.

As well as being a stronghold for gaming and content creation, the region benefits from heavy manufacturing industry, primarily automotive, process and energy sector businesses, which serve as a potential customer base for immersive technology companies.

There is strong support from Gateshead Council, local universities, Digital Catapult North East Tees Valley (NETV) and DigitalCity, all underpinned by state-of-the art facilities and internationally recognised events.

Hub participants

The North East has over 28,000 employees working in the IT and digital sector and has the highest proportion of students studying STEM subjects in the UK[9]. The region's five universities offer over 90 courses related to immersive technologies between them.

The creative industries and manufacturing sectors are highly active, and are two of the dominant vertical markets for immersive technology businesses. There are over 2,600 creative businesses in the region, and over 120,000 people engaged in the manufacturing industry. Immersive businesses catering to industry clients have already enjoyed success in creating training content for this market.

There are over 50 specialised gaming companies in the North East and Tees Valley[10], in addition to the industry-focused immersive businesses. Immersive businesses span from early-stage startups all the way to the more established, such as Coatsink, Wolf and Wood, and HammerheadVR on the creative side, and companies like Annimersion on the industrial side.

[9, 10] Invest North East England

The North East and Tees Valley

Specialist immersive companies in the region (26)

	5.6%	Healthcare and scientific
	5.6%	Leisure and hospitality
	11.1%	Media and arts
	16.7%	Non profit and education
	5.6%	Professional services
	5.6%	Real estate and construction
	49.8%	Technology

Companies in this region are well-supported by academia and government-backed organisations.

– Digital Catapult NETV operates throughout the region, focusing on bringing commercial opportunities to the businesses in this hub and educating traditionally non-digital businesses on the potential of emerging technologies like immersive.

– DigitalCity is a partnership between Teesside University and Tees Valley Combined Authority that provides growth and innovation support to SMEs, from startup (through its growth accelerator Fellowship programme) through to scaleup (the DigitalCity SCALE programme). Since its launch, DigitalCity has supported over 350 startup businesses and 700 businesses in total.

– Highly specialised equipment is available through PROTO: The Emerging Technology Centre in Gateshead, managed by Gateshead Council. PROTO is also home to the Digital Catapult NETV Immersive Lab, one of four regional labs across the UK run by Digital Catapult. The lab provides a dedicated facility for developing, testing and demonstrating new immersive content.

The region also enjoys a range of business support interventions tailored specifically for the digital and technology sector, such as the business support offered by Sunderland Software City, and high-spec office space such as the facilities at Sunderland Software Centre, managed by Sunderland City Council.

Additionally there are several key industry events hosted in the region. Animex, a five-day international festival of games and animation, is highly regarded internationally and brings together some of the games and animation industries' brightest lights.

The North East and Tees Valley

Previous events have seen top global companies such as Pixar, Dreamworks, Sony, Ubisoft, Insomniac Games (Spiderman) and Third Floor (Game of Thrones) come together to share their knowledge with the next generation.

XRTGO Conference (formerly known as VRTGO), run by Secret Sauce, has also been successful in bringing together key stakeholders across the intersection of entertainment and VR. This conference and exhibition has been running since 2014 and is marketed as an event for specialists across VR and AR, catering to decision makers, developers, innovation managers, press and potential consumers.

There are also high profile employers that support the region's immersive ecosystem directly and indirectly. Ubisoft, the world's third largest producer of video games, has a major presence in Newcastle upon Tyne and employs 220 people at its Newcastle studio, and 150 staff at its EMEA customer relationship centre, recruiting its highly talented employees from over 27 countries. Nissan UK also has a large presence in the region, employing almost 7,000 people and supporting 27,000 jobs in its supply chain. This OEM has a track record of embracing new technologies and working with local digital SMEs.

Opportunities

The region's existing links between business and academia provide an opportunity to grow the talent pool for immersive companies, ultimately facilitating future sustainable growth of the North East and Tees Valley hub.

This can be seen through Ubisoft's sponsorship of the North East Futures UTC in Newcastle, and in Northumbria University's engagement with the Northern Design Centre. Teesside University's School of Computing and Digital Technology has engaged with over 1,500 businesses in a number of ways, including access to graduate and student talent, consultancy, knowledge transfer and contract/collaborative research.

There are a number of high-spec, high-grade office spaces available across the North East and Tees Valley hub, providing immersive companies with access to the digital infrastructure and flexible accommodation that they need to grow. Middlesbrough Council and Middlesbrough Digital have collaborated to create Boho Next Gen, which will see investment of more than £20 million in new business

accommodation over the next five years and will provide additional space for immersive companies already housed in the Boho area. Sunderland Software Centre was designed following consultation with immersive (and wider digital) businesses and, as a result, is completely flexible, allowing companies to expand their office footprint as their needs demand.

Finally, there are clear opportunities for immersive businesses to engage with other sectors in the North East and Tees Valley hub area. In addition to the creative and manufacturing industries, there are examples of sectors embracing immersive technology in the region, including health and life sciences, culture and heritage, retail and professional services. These opportunities are supported by Digital Catapult NETV and the NETV Immersive Lab. Digital Catapult NETV works to connect corporate clients with local small to medium-sized businesses, while the Immersive Lab provides a prototyping facility and space for companies to demonstrate their content and services.

Together, these opportunities mean that the barriers to starting and growing an immersive business are relatively low in the North East and Tees Valley hub, especially when compared to other parts of the UK.

Challenges

There is limited startup capital and investment available to immersive technology companies looking to grow. While regional venture capital is provided through the Northern Powerhouse Investment Fund (Tees Valley area) and North East Funds (North East area), there is little private venture capital funding available, and the hub does not benefit from a mature angel network. Pre-seed stage funding can be accessed (on a competitive basis) through accelerator programmes such as Ignite, which also launched an immersive-focused programme in partnership with Gateshead Council for 2019.

Grant funding is limited and is typically available on a matched-basis or for specific R&D-based projects (for example, grants provided by GX Programme, North East Business Innovation Centre or NBSL).

Nottingham and the East Midlands

1,000+
Growing digital meetup group members

Hub overview

Home to the University of Nottingham (UoN) and Nottingham Trent University (NTU), Nottingham is an up-and-coming immersive technologies hotspot.

Hub participants

Nottingham's technology sector has been growing at a faster rate than the UK average, yet much of the immersive ecosystem is still in its infancy.

Funding

There are local investment opportunities in the region, such as the Nottingham Growth Fund, a local venture capital organisation, the Nottinghamshire Country Pension Investment Fund and the Foresite Group. There is also a healthy digital meetup group with over 1,000 members.

Facilities and resources

There are good equipment resources in the region, with a mixed reality lab at the University of Nottingham, and event capacity at Nottingham Trent and the Broadway Theatre.

Nottingham City Council proposes to add a building dedicated to supporting immersive technologies to Nottingham Science Park. This hub will become part of a network of facilities that already includes UoN's Mixed Reality Lab and the Horizon Digital Economy Research Institute, and works with a number of local creative and cultural partners on their immersive projects.

The building will be equipped with a lab for immersive technology companies, and those looking to set up or grow their business in the region will be able to access equipment, business support and accelerator programmes, as well as hot desk space.

There is also a dynamic business support environment, including the Nottingham Growth Hub, the UoN Ingenuity Network and Nottingham Trent University's Hive.

Nottingham and the East Midlands

Specialist immersive companies in the region (18)

	6.7%	Industrial and agriculture
	13.3%	Leisure and hospitality
	40.0%	Media and arts
	6.7%	Non profit and education
	6.7%	Professional services
	6.7%	Real estate and construction
	19.9%	Technology
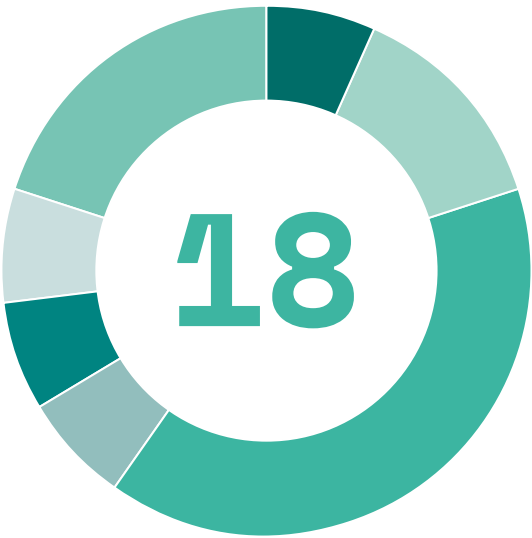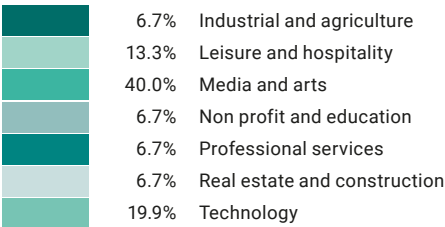
Opportunities

The local presence of healthcare companies, such as Boots, and a flourishing creative sector provide plenty of opportunity for immersive organisations in the region.

There is also strong interest based on the existing immersive experiences already being used to highlight the area's heritage and landscape, such as local company Hot Knife's project to scan 90 of Nottingham city centre's network of 700 caves using LiDAR (light detection and ranging), and then convert the data into a VR experience. There are also immersive installations at the newly refurbished Nottingham Castle, and last year Zero Latency launched a multiplayer free-to-roam VR experience in the city centre.

Challenges

The ecosystem of immersive companies in the region is still being established, and some business opportunities are yet to be defined, especially those targeting the multinationals in the area.

Now that there is a developing support system being offered through the wider partnerships available to immersive companies in the East Midlands, the main challenge facing the region will be finding opportunities to engage with local industry, in order to demonstrate how immersive technologies can drive productivity and generate value.

Bristol and the South West

Hub overview

This region has easy links to London and the coast, a strong incubation network and an established immersive ecosystem, including the Opposable Group, four major universities, and several cultural and arts venues, such as the Watershed, Bristol.

Hub participants

The immersive ecosystem in the region is well-established, with many immersive technology companies now starting to scale up and generate revenue. Some, such as Ultrahaptics (which creates haptic feedback using ultrasound), are exporting internationally, and there is a trend for established immersive companies to move into the region.

There is good consumer-facing activity in the region, such as the work of Limina Immersive, who tour cultural VR and founded the UK's first arts venue dedicated to virtual reality, located on Bristol's Harbourside. There is also a history of creative content production in Bristol

Aardman Animations is based in the region, and the BBC and Channel 4 have offices that have engaged in 360° experimentation. The Bristol Games Hub, a centre for games development, has stimulated an emerging games industry in the area, but although there are around 50 games developers, there are no large games employers in the region.

Specialist immersive companies in the region (49)

%	Category
2.5%	Energy and environment
2.5%	Financial services
7.5%	Healthcare and scientific
2.5%	Industrial and agriculture
17.5%	Leisure and hospitality
25.0%	Media and arts
2.5%	Non profit and education
15.0%	Professional services
2.5%	Real estate and construction
22.5%	Technology

Bristol and the South West

INFLUENCING FACTORS

The area boasts a strong cultural heritage and high tourist numbers: tourism in the region is valued at £1.75 billion. This hub also has a strong 5G infrastructure and expertise from local universities.

Funding

Funding opportunities are available through the West of England Combined Authority (WECA). For example, the recent 5G Smart Tourism testbed showcased five unique immersive use-cases including Watershed, the Roman Baths, Millenium Square, M Shed and We the Curious.

Historically, Bristol and the South West area hasn't had a strong investor landscape. Most immersive companies in the region seek investment from London, and a network of local angel investors is becoming increasingly strong.

Facilities and resources

Since July 2018, the Department for Digital, Culture, Media & Sport, in collaboration with the West of England Combined Authority, launched their 5G testbed to focus on delivering enhanced experiences for tourists visiting major attractions in Bath and Bristol. Technologies used included AR and VR, 3D motion tracking, and 4K 360° content streaming.

The Bristol VR Lab – founded by the University of Bristol, the University of the West of England (UWE Bristol), Watershed and VR developers Opposable Group – is a space for research, development, product design, teaching, company incubation and investment. It offers a co-working space with high-end VR, AR, MR and 360° equipment, experts on hand to offer advice and engaging industry talks and events on a number of subjects related to the field.

These and other universities in the region, including the University of Bath and Bath Spa University, have ample resources and expertise in immersive technology. Bath University is home to Bath CAMERA, the Centre for the Analysis of Motion, Entertainment Research and Applications.

Opportunities

The cultural heritage of the region is a significant content driver, with a busy calendar of tourism events including the Harbour Festival, Bristol Pride and the Bristol Balloon Fiesta.

With thriving aerospace, health and architecture industries, there is also a strong focus on the development of solutions for industrial applications. Both AirBus and Rolls Royce operate in the region, and the University of Bristol specialises in nuclear science. These have led to opportunities for immersive technology developers to create bespoke training applications, with a particular focus on health and safety.

Challenges

Property rental costs in Bristol are high. There is also a skills gap, as established and successful tech companies (such as Graphcore) are often able to offer more competitive salaries than those that can be afforded by technology startups and innovators.

Brighton and East Sussex

Hub overview

Brighton is a well-known creative hotspot. Considered a hub for both tech and creative, it has long been a popular place to start up new businesses.

Hub participants

There is a high density of startups and small to medium-sized businesses in the region. Immersive technology companies are predominantly early stage startups, although there are instances of companies starting to scale up, such as Fracture Reality, which creates augmented and mixed reality HoloLens solutions for businesses.

There is a strong focus on B2B solutions, such as those created by Gorilla in the Room, an award-winning developer of immersive products for the market research industry. There are, however, ample consumer-facing opportunities being exploited by companies such as Curiscope, which creates augmented reality products to inspire children's love of science by exploring the world around them.

27

Specialist immersive companies in the region (27)

	9.5%	Industrial and agriculture
	19.0%	Leisure and hospitality
	19.0%	Media and arts
	4.8%	Non profit and education
	9.5%	Professional services
	38.1%	Technology

Brighton and East Sussex

There is a strong gaming cluster in the region

INFLUENCING FACTORS

There is a strong sense of community in the Brighton region, with a particularly vibrant events scene for the immersive ecosystem. Meetups are regularly held by organisations such as WiredSussex, and the VR Brighton Show & Tell offers local companies the opportunity to demonstrate their technology and network with other innovators.

This sense of community has resulted in a history of collaboration in the region, with companies working together in innovative ways (Gorilla in the Room was a merger between two startups).

The University of Sussex hosts two incubators, dubbed the Sussex Innovation Centres. There is an Eagle Lab and a Natwest Accelerator, as well as the FuseBox, a collaborative research and development R&D hub created and managed by WiredSussex. The University of Brighton has also invested in immersive technologies, with a particular interest in diversity and inclusion. Virtual Umbrella helps local businesses to find ways to connect with publishers and markets.

Opportunities

The Brighton 5G Testbed, a collaboration between Digital Catapult, WiredSussex and the local universities, launched in 2017 with funding from the Coast2Capital LEP. It facilitates deployment and usability of advanced 5G solutions, including immersive products. The programme has supported several local immersive product developers, including Make Real, Percept Imagery and VR Craftworks.

There is a strong gaming cluster in the region, and local immersive content creators have been seeing success in the e-learning space, with engagement from prominent e-learning centres such as City & Guilds and LEO learning.

There are also industrial opportunities, including high-end automotive brands like Rolls- Royce and Ricardo. However, these companies have tended to work with immersive companies on an experimental, ad hoc basis.

Challenges

As with other regions, there are still issues around industry engagement in the region. Corporate enterprises are not always recognising the value of investing in immersive technologies, but this is beginning to change as companies in the region begin to scale and receive support from local innovation centres and incubators.

Northern Ireland

100 **100 gigabyte per second link provides the highest download speeds in the UK**

Hub overview

Companies based in Northern Ireland are ideally situated between mainland Europe and the US, and there are communications links to match.

There is a 100 gigabyte per second telecoms link between Northern Ireland, Europe and North America and the region has the highest availability of superfast broadband and 4G download speeds in the UK. Almost 900 international companies have invested in Northern Ireland, benefiting from operating costs that average 20–30% less than the rest of the UK and Europe, and some of the lowest prime office rental costs in Europe.

Hub participants

The Northern Ireland immersive ecosystem is primarily made up of micro-businesses, startups and small to medium-sized businesses, with a backdrop of large corporations receiving foreign direct investment.

As well as dedicated immersive technology companies in the region, there is a rich vein of small and medium-sized businesses, passionate individuals and enterprises that are investing in this area, and who consider the exploitation of immersive technology to be an important part of their R&D, workflow or business model. These organisations include Kainos, RPS and The McAvoy Group.

Some of Northern Ireland's dedicated immersive companies continue to gain traction and benefit from funding and support mechanisms in the region, and from their ability to win new business independently as their portfolio of immersive content and customers expands, for example Boom Clap Play's success in the UK-wide CreativeXR programme, Sentireal's collaboration with the NHS and Yellow Design's expansion.

More success stories include RETìníZE's winning pitch in association with London-based INITION for the BBC 'When AI Met the Archive' challenge[11] and INCISIV, with their continually evolving tech platform that combines in-game VR experiences with a powerful action analytics engine to measure sports performance. These are just a few of the examples of the immersive technology companies that are establishing themselves and flourishing in Northern Ireland.

New entrants to the sector include David Henderson Design, which has evolved from a standard design and marketing business model into exploring immersive content production, and games studio Italic Pig, which has entered the immersive world with the Infinite Hotel experience pilot, which debuted at SXSW and GDC in 2019, with support from Invest NI and NI Screen.

[11] www.bbc.co.uk/programmes/b0bhwk3p

Northern Ireland

Specialist immersive companies in the region (31)

	15.4%	Leisure and hospitality
	15.4%	Media and arts
	7.7%	Non profit and education
	15.4%	Professional services
	15.4%	Real estate and construction
	30.7%	Technology
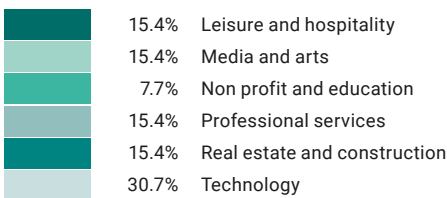
INFLUENCING FACTORS

Funding

The region receives continuing support from government agencies to drive growth in this sector: Invest NI, NI Screen, Digital Catapult and Innovate UK are all extremely active.

A collaboration between higher education institutions and multiple industry partners has been successful in obtaining funding for a five-year project: 'Future Screens NI'. The £13 million for this regional project has come from the Industrial Strategy Challenge Fund, backed by the UK government and the Arts and Humanities Research Council.

This Creative Industries Cluster brings together academic strengths in research and teaching with complementary expertise from key industrial players in creative and digital. Importantly, the strategic priorities of Future Screens NI are to be driven by the needs of industry, as articulated by the industrial partners, and support is targeted at growth at all levels, from micro businesses to larger enterprises.

Northern Ireland has also been awarded a valuable City Deal. This co-investment from the UK government, local government, universities and the private sector is designed to deliver a step change in the region's economic fortunes, helping to achieve a 15-year programme of inclusive growth and an increase of £470 million Gross Value Added. The aim is to create up to 20,000 new and better jobs and deliver 22 ambitious large-scale projects across six Northern Ireland councils, extending innovation and technology potential beyond traditional strongholds such as Belfast, and Derry and Strabane.

Medtech, advanced manufacturing and data science are among the sectors that will have centres of excellence. Immersive technology is a common theme throughout and this includes a Screen and Media Innovation Lab, which aims to be at the convergence of creativity, content development, technology and digital delivery, with immersive technologies playing a key role in this cutting edge R&D facility.

Northern Ireland

- **Tourism NI**, in partnership with Digital Catapult Northern Ireland ran a £200,000 AR challenge to local and UK companies that provided a fantastic opportunity for immersive technology companies to connect with – and deliver a number of high quality AR projects for – the Northern Ireland tourism ecosystem.

- **BBC Northern Ireland** recently partnered with Digital Catapult to work on a range of opportunities that connect knowledge, technology and content for companies and stakeholders in NI and beyond. To date, the partnership has delivered a BBC Archive AI challenge that provides the BBC audience with a fresh way to experience their archive content. This also connected local businesses with funding, and resulted in a unique collaboration between NI company RETìníZE and London-based INITION.

Facilities and resources

The Northern Ireland Digital Catapult Immersive Lab is based in the Ormeau Baths, a co-working space and tech community based in a historic former Victorian bath house in the heart of Belfast. The entrepreneurial campus helps the brightest and best indigenous tech startups gain access to new networks, funding and expertise and gives them the tools to flourish in global markets.

The Immersive Lab has become a hub of activity, growth and shared learning where collaboration with others leads to progression in the understanding and implementation of immersive and emerging technologies.

So far, it has engaged with over 100 organisations and provides an extensive range of equipment to showcase the potential of immersive including AR and VR headsets, a green screen studio, motion capture devices and associated immersive content experiences to use as case studies.

Northern Ireland has a number of globally recognised, technology-related university research centres, including the Intelligent Systems Research Centre (ISRC) at Ulster University, and The Institute of Electronics, Communications and Information Technology (ECIT) at Queen's University Belfast.

Opportunities

Northern Ireland has a diverse and vibrant advanced manufacturing and engineering sector, with companies spanning aerospace and defence, automotive, construction, materials handling, electronics and consumer products. Manufacturing in Northern Ireland has grown almost three times faster than in the rest of the UK, and accounts for 11% of employment in the region. Many companies are now reaching out to discover how they can implement emerging technology, including immersive, into their production and design functions.

There is also a burgeoning creative sector in the region, employing over five per cent of the entire workforce in Northern Ireland and contributing nearly £1 billion GVA. NI Screen's success in attracting world-leading TV and film productions such as Game of Thrones, Krypton and Line of Duty has greatly enhanced the local talent pool across a range of creative technology roles.

Challenges

There are still some scaling challenges facing the immersive sector in Northern Ireland, with many companies still in the early stages of investigating the potential of immersive content. Finding the right balance between investing in resources – skills and technology – while finding fresh and continuing revenue streams can be difficult.

Contents

Research and development in the UK

The economic potential of immersive technologies can be evidenced by the sheer number of research and development opportunities for immersive technology businesses in the UK.

This section provides an overview of the Audience of the Future programme, which is one of the largest investments made in creative industries to date, and seeks to enhance the UK's storytelling prowess through immersive technologies.

It also provides an overview of grant opportunities that are relevant for the immersive ecosystem in the UK – including other competitions within the Industrial Strategy Challenge Fund, such as Made Smarter and the Creative Industries Clusters Programme.

Audience of the Future
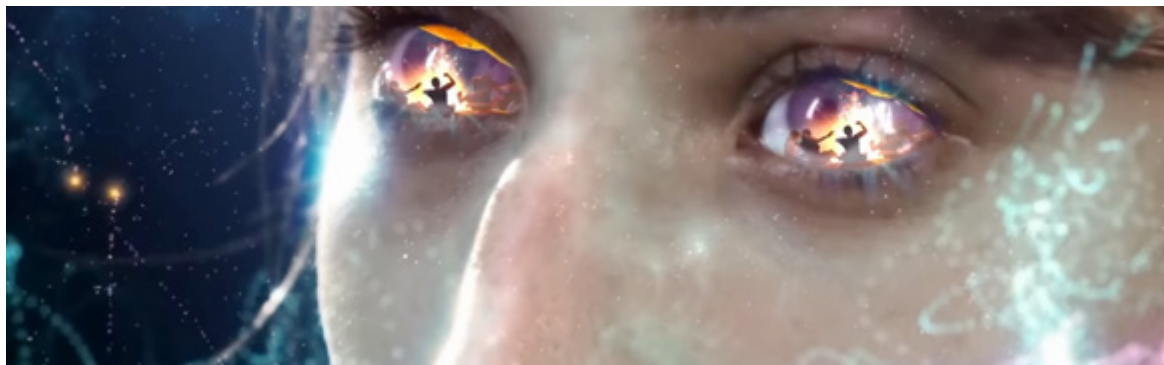
Audience of the Future is a £33 million programme that forms part of the Industrial Strategy Challenge Fund overseen by UKRI and is a key element of the government's Creative Industries Sector Deal.

It is a strategic programme of investment for UK businesses and researchers to develop new products, content, services and experiences that exploit immersive technologies, and foster new kinds of creative and cultural engagement for audiences.

The Challenge has established five interlocking initiatives, each of which focuses on business-led R&D.

01. Demonstrator programme

02. Production innovation for immersive content

03. National centre for excellence in immersive storytelling

04. Immersive technology Investment Accelerator

05. Design Foundations

Together, these five initiatives constitute one of the largest-ever dedicated public investments in creative industries innovation.

Audience of the Future

01
Demonstrator programme

The demonstrator programme represents £15 million of investment across four industry-led consortia in the creative industries, based on sport entertainment, performance, moving image and visitor experience.

The objective is to create ambitious new immersive experiences and test them with large-scale audiences, where there is potential for creating commercial value in the future through the adoption of immersive technologies.

The programme seeks to address the key challenge for immersive businesses in developing clearly defined business models across VR, AR and MR.

02
Production innovation for immersive content

Twenty projects have received a share of £7.5 million to support R&D projects which aim to create faster, more efficient immersive content. This is an exploration into funding businesses that have innovative pre-commercial projects, by focussing on tools and products that could contribute to making immersive content, increasing the efficiency of the production pipeline.

03
National centre for excellence in immersive storytelling

£10 million has been invested into the StoryFutures £5 million has been invested into the StoryFutures Academy, a national centre for the development of cutting-edge creative training and research programmes for immersive storytelling. The partnership between Royal Holloway and the National Film and Television School works to cross-skill experienced professionals who are already in the industry so that they can understand how to leverage their skills and apply them to immersive technologies.

04
Immersive technology Investor Accelerator

The Investment Accelerator aims to encourage and support investment in innovative immersive technologies in the UK, including content, products, services, software and hardware. The accelerator providing simultaneous grant funding and venture capital investment in early-stage projects led by UK companies. Around 10 projects will be supported through this programme.

05
Design foundations

£1.2 million in funding has been awarded to 31 projects to use human-centred design (design focused on user requirements) to create new immersive experiences, products and services. Off the back of its success, several projects have gone on to join the Immersive technology investor accelerator

Creative Industries Clusters

The Creative Industries Clusters Programme is another programme within the Industrial Strategy Challenge Fund, and another core element of the Creative Industries Sector Deal. £55 million of funding has been used to establish nine creative R&D partnerships and a new Creative Industries Policy and Evidence Centre. Three of the Clusters have a strong immersive focus, working within existing creative clusters across the UK.

In response to the lack of investment in research and development for creative industries, the programme is highlighting the potential of creative industry collaboration with universities, companies and industry.

OTHER INDUSTRIAL STRATEGY CHALLENGE FUND RELATED OPPORTUNITIES

Made Smarter Challenge

Made Smarter is the UK's government-backed national initiative to drive the adoption of industrial digital technologies by manufacturing companies.

Officially launched in November 2018 and backed by some of the world's biggest industrial businesses, the Made Smarter programme has recently launched and closed its first round of funding through its Fast Start competition.

The initiative has also set up a North West Pilot that is set to boost productivity for 3,000 small to medium-sized manufacturers in Cheshire, Warrington, Cumbria, Lancashire, Greater Manchester and the Liverpool City Region. Companies that get involved in the project will have the chance to access match-funded support and advice on how Industrial Digitalising Technologies (IDTs), including immersive, could revolutionise their manufacturing processes, enabling them to benefit from more efficient production.

3,000 Small to medium sized manufacturers productivity boost

Creative Industries Clusters

£559bn
Aviation market worth to 2050

Future of Flight Challenge

The Future of Flight ISCF challenge aims to revolutionise the way people, goods and services fly and position the UK as a world leader in aviation products and markets worth over US$675 billion (£559bn) to 2050. The challenge will develop the supporting ground infrastructure, regulation and control systems required to use these new aircraft practically and safely. These new modes of travel will increase mobility, reduce road congestion, improve connectivity, increase UK manufacturing opportunities and help aviation to reduce its environmental impact around the world. The Future Flight programme is funded by £125 million from the Industrial Strategy Challenge Fund, which is expected to be matched by up to £175 million from industry.

The challenge will cover four areas of activity:

− Control and regulations including air traffic management
− New operating models
− Ground infrastructure
− Integrating new aircraft with a new aviation system

New forms of immersive interfaces and haptics could be relevant applications and use cases to test through the R&D projects.

Healthy Ageing Challenge

Over the coming years there will be a series of opportunities for UK-based businesses and researchers. The opportunities range from Trailblazers, which will focus on supporting the development of near to market propositions with potential to be adopted at scale; Investment Accelerator and early stage support for businesses looking to develop early-stage innovations; and research to further our understanding of healthy ageing.

The Centre for Ageing Better charity has developed a Healthy Ageing Challenge Framework, to stimulate thinking about the ISCF Healthy Ageing Challenge. It focuses on seven themes to stimulate innovation in pursuit of longer, healthier lives for all:

− Sustaining physical activity
− Maintaining health at work
− Design for age-friendly homes
− Creating healthy, active places
− Supporting social connections
− Living well with cognitive impairment
− Managing common complaints of ageing

All funded projects will need to show how they tackle one or more of these challenges of older life. The bids can again explore how immersive technologies may be used to tackle some of these challenges.

Creative Industries Clusters

£650bn Worth of projects by 2025

Transforming Construction Challenge

The Transforming Construction ISCF challenge aims to transform the construction sector – enabling it to produce safe, healthy, efficient building using the latest digital manufacturing techniques. This will enable the UK to meet its national infrastructure programme target of £650 billion worth of projects by 2025. The challenge will support industry in adopting technologies and help buildings to be constructed 50% faster, 33% cheaper and with half the lifetime carbon emissions. The UK Government is looking to industry and researchers to innovate in construction, increase productivity across the UK and open up significant global markets for efficient buildings.

They will invest up to £170 million, matched by £250 million from industry, to create new construction processes and techniques, such as the development of standardised modular components from which buildings can be manufactured. This includes immersive technologies and grants will be awarded to support academic groups in undertaking creative user research and development, as well as business-led projects that streamline processes, create cost efficiencies and improve productivity, quality and performance.

ADDITIONAL IMMERSIVE PROGRAMMES AND FUNDING OPPORTUNITIES

Augmentor

Augmentor is a 12-week programme that provides technical and business mentorship, access to state-of-the-art immersive facilities and regular check-ins with investors. It is aimed at the next generation of companies developing innovative, commercially-focused applications for augmented and virtual reality. Bringing together investors, commercial partners and early-stage companies, it aims to accelerate UK investment in immersive technologies, their development and adoption by industry.

Up to ten companies are selected to participate in each cohort of the programme, and receive 12 weeks of support from Digital Catapult and partners, helping them to fine-tune their technology and business proposition before pitching to investors at a showcase event.

Propositions can be relevant to any sector, but the ideas must be commercially viable.
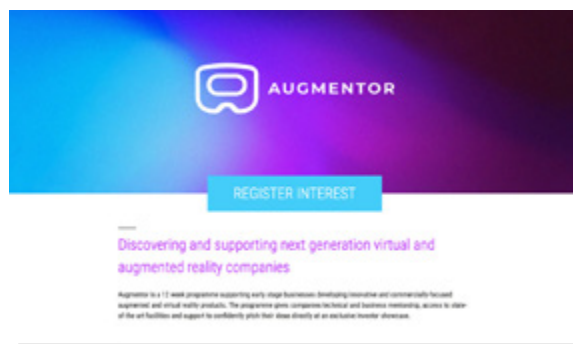
Creative Industries Clusters

CreativeXR

CreativeXR is an innovation programme, developed by Digital Catapult and Arts Council England, that enables small businesses, creative innovators, and arts and culture organisations to develop immersive content concepts and prototypes. CreativeXR offers:

– **Prototype funding:** Up to £20,000 to develop immersive prototype
– **Expertise:** Access to a network of industry experts, high calibre peers and commissioning bodies
– **Facilities:** Access to Digital Catapult's Immersive Labs in Belfast, Brighton, London, Manchester and North East and Tees Valley
– **Workshops:** Focused workshops to help develop concepts and pitches
– **Pitch:** Opportunity to pitch at final commissioner Showcase and Market
– **Development funding:** Chance to secure funding for further development
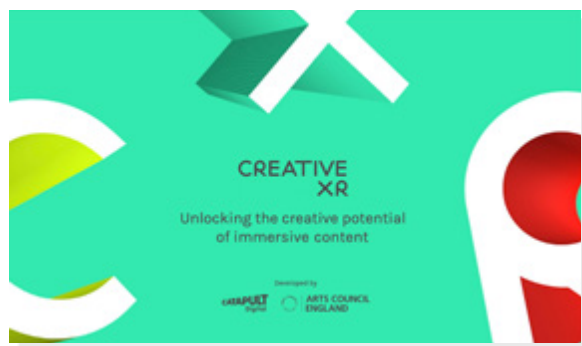
2,000+
Registrations of interest to date

500+
Applications to join the programme

40
Successful teams through the programme

2
Two years of CreativeXR

Investor landscape

The Accelerator Network researched investment activity into immersive technologies in the UK, comparing 2017 and 2018.

After a record year in 2017, VR investment fell 37%, from £181.17 million to £113.25 million. This drop of almost £70 million in VR investment is consistent with wider investment trends with an increasing focus on later stage funding at the expense of seed stage investment.

However, while the overall investment amount has dropped, the number of individual deals has actually increased.

Investor landscape

37% **Immersive specialist companies surveyed received some form of equity investment**

The picture is more promising in the AR landscape, although the base was lower, increasing 40% from £50.41 million in 2017 to £70.69 million in 2018. Deal numbers were up here as well, from 13 to 16.

For companies using combined AR/VR solutions, there was also a decrease in venture capital investment, from £227 million to £181 million. However, there was an increase in seed stage investment, with £13 million being invested at the earlier stage.

This increase is markedly different from the rest of the UK's investment trends, which may hint at this being seen as a hot sector (with more interest growing at the early stage, and increased familiarity as an emerging sector).

37% of the immersive specialist companies surveyed for this report have received some form of equity investment. The largest percentage of these had received seed investment, with angel and pre-seed closely behind. 13% were mature businesses with no funding needs.

How have your interactions been with the investment community? (93 responses)

Value	Category
46	Neither positive or negative
24	Quite positive
9	Quite negative
9	Very positive
5	Very negative
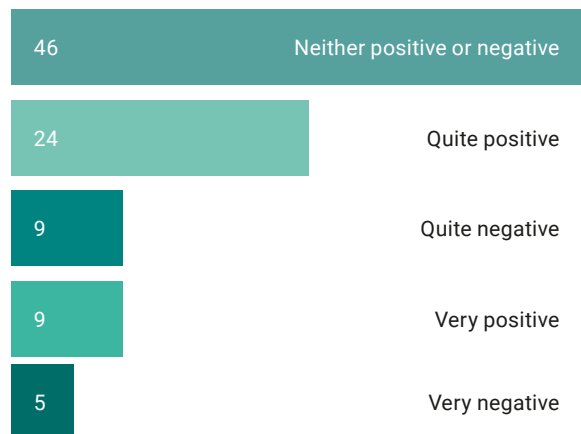
Funding stage of surveyed immersive companies

£183m+

19.5%	Angel	
14.6%	Pre-seed	
23.6%	Seed	
7.3%	Series A	

0.8%	Series B	
1.6%	Series C	
13.0%	Mature business	
19.6%	Other	
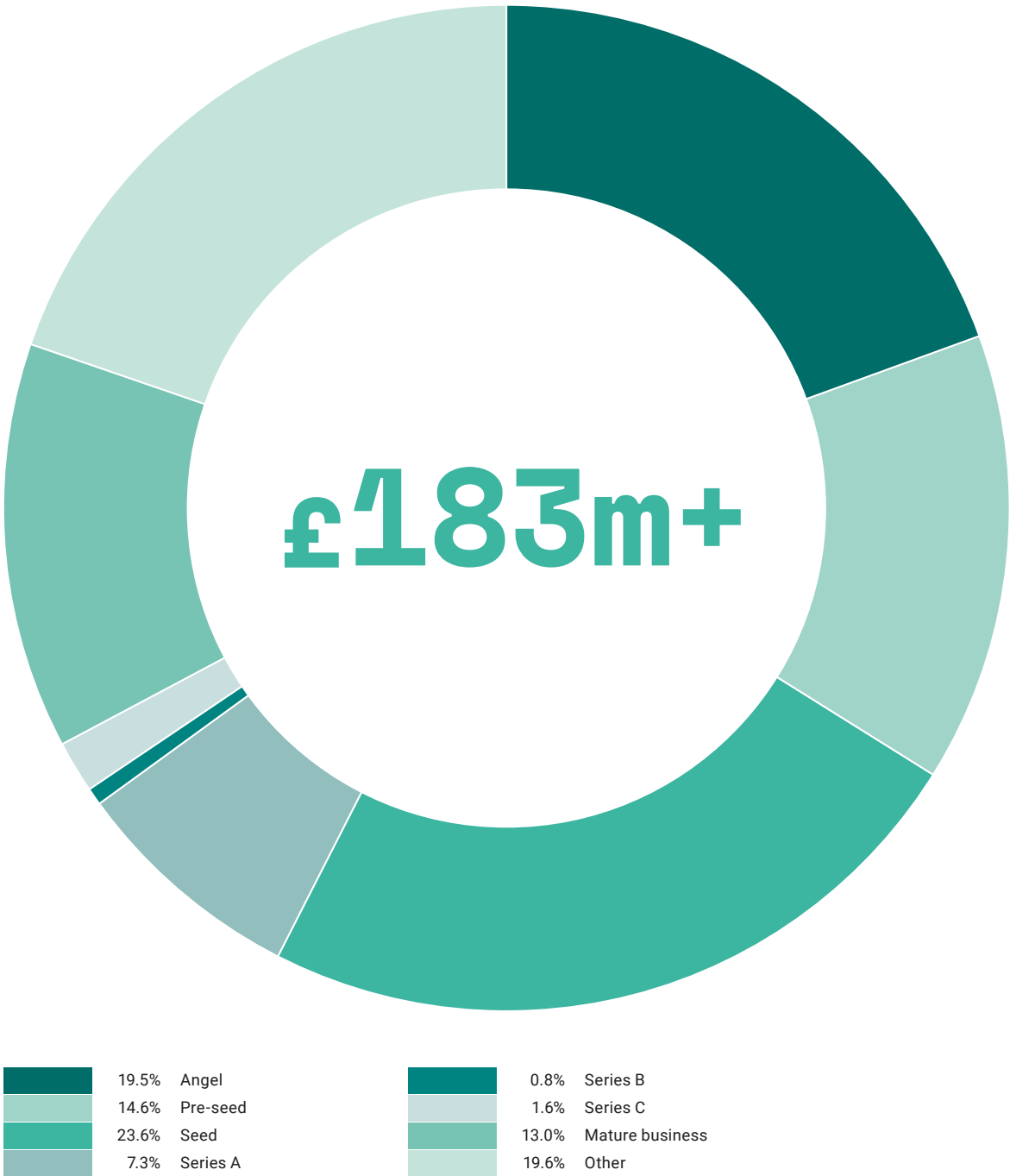
Success story

Ultraleap

Ultraleap, the new single brand that joins together Leap Motion and Ultrahaptics, is a scaling UK tech success story. Through its team and carefully chosen investment partners, the company is growing a global business. It is proud to be British, but it will develop, generate IP, operate, compete and be commercially successful on a global scale.

Ultrahaptics was officially founded in 2013 following CTO Tom Carter's final year MSc project and PhD studies at the University of Bristol. The company has developed a technology that creates the sensation of touch ('haptics') in mid-air, without the need to wear or touch anything. By using ultrasound, the company can project tactile sensations directly onto the hands.

The company has grown quickly since it secured seed funding in 2014. Investment in Ultrahaptics has grown with each subsequent funding round – the company raised one of the UK's largest technology A rounds of £10.1 million in 2015, followed by a B round that brought in £17.9 million.

ULTRALEAP.COM

£10.1m
A round investment

£17.9m
B round investment

£35.0m
C round investment
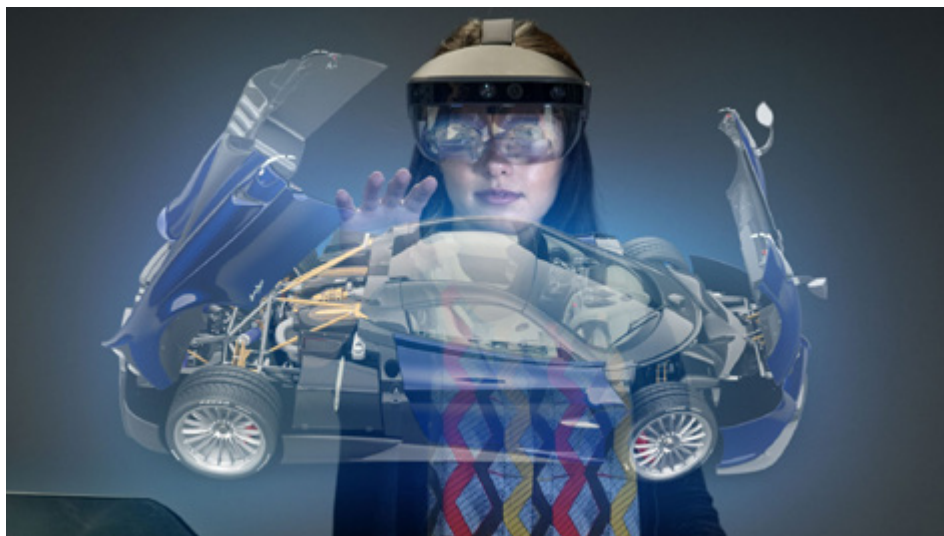
UltraLeap

In December 2018, a £35 million C round of funding brought the total raised from investors to £64 million. The latest successful funding round was oversubscribed and showcases the vast potential of the technology and the company's commitment to further commercialise and develop its technology for different industry sectors and markets around the world. Ultrahaptics' investors now include IP Group, Hostplus, Mayfair Equity Partners, Dolby Family Ventures and Cornes.

Whilst Ultrahaptics continues to showcase its commercial viability in various public installations, it has also made moves into the wider spatial interaction world, completing a deal with leading hand tracking company, Leap Motion, in May 2019. The joining of forces adds value to Ultrahaptics' already impressive IP, but also means that the company is now a complete spatial interaction solution, and in a strong position to change the face of human machine interaction.

The company has developed a technology that creates the sensation of touch – haptics – in mid-air, without the need to wear or touch anything. By using ultrasound, the company can project tactile sensations directly onto the hands.

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Conclusion

The immersive technologies economy in the
UK continues to grow, and the optimism shown
by companies, investors and public agencies
over the last two years remains well-founded.

Conclusion

It is clear that current opportunities in immersive technologies have never been greater

The immersive technologies economy in the UK continues to grow, and the optimism shown by companies, investors and public agencies over the last two years remains well-founded.

This is demonstrated by the growth of AR/VR in established digital media and entertainment markets, and by a scaling up across the wider economy.

In a range of diverse sectors, from architecture and construction through to health and education, there has been a flourishing of entrepreneurial activity, with specialist immersive businesses – many of whom began as creative content producers – developing services and solutions to address long-standing problems and generate new revenue streams.

This innovation has been supported by considerable public funding. The Industrial Strategy Challenge Fund, and in particular the Audience of the Future programme, represents an unprecedented level of investment in immersive R&D, with a focus not just on technological innovation but also more broadly on design, storytelling, business models and audience testing.

The full impact of this investment will not be felt for another two to three years, but it is clear that current opportunities for research, innovation and content creation in immersive technologies have never been greater.

Conclusion

The role of government, industry bodies and public agencies will remain critical

Yet there is no room for complacency, as the UK's immersive economy is grappling with many of the issues and barriers associated with an immature and rapidly evolving sector.

Not surprisingly, the skills gap remains a considerable obstacle to growth, with companies, training providers and higher education organisations struggling to supply the relevant and up-to-date creative and technical skills required for production teams.

On the demand side, the speed of device adoption and the take-up of standards will be critical in building up the UK market over the next few years and, in turn, attracting greater levels of private finance.

Given these challenges, the role of government, industry bodies and public agencies will remain critical.

There is a rich ecosystem of support and innovation underpinning the sector, from organisations such as Immerse UK, Innovate UK, Digital Catapult and the country's leading universities and research institutes.

The extent to which these organisations are able to collaborate, respond to industry needs, champion the sector and provide strategic leadership will be crucial to the success of the UK's immersive technologies economy in the years ahead.

About the co-authors

CATAPULT Digital

Digital Catapult is the UK's leading advanced digital technology innovation centre, driving early adoption of technologies to make UK businesses more competitive and productive to grow the country's economy.

We connect large established companies, startup and scaleup businesses and researchers to discover new ways to address big challenges in the manufacturing and creative industries. Through this collaboration businesses are supported to develop the right technologies to solve problems, increase productivity and open up new markets faster.

Digital Catapult provides physical and digital facilities for experimentation and testing that would otherwise not be accessible for smaller companies.

As well as breaking down barriers to technology adoption for startups and scaleups, our work de-risks innovation for large enterprises and uncovers new commercial applications in immersive, future networks, and artificial intelligence technologies.

For more info please visit www.digicatapult.org.uk

IMMERSE UK.ORG

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 www.immerseuk.org