XR Stories and Screen Industries Growth Network (SIGN)

Potential of Creative and Digital Economies

Workstream 1 (WS1)

April 2021

BOP Consulting

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Executive Summary

Objective: Building on the foundations of work initiated by XR Stories staff, to understand the potential of the creative, digital and cultural economy in our region, the place of the screen and immersive industries within this regional economy, and the connection to the wider creative economy of the UK, including cultural heritage sectors, music and media led tourism. In so doing, to develop a picture of the kind of creative-cultural companies that have been growing well and what factors have spurred this growth: What would XR Stories+/SIGN+ look like?

XR Stories and SIGN both support a sector, the Screen Industries, that is growing in York, North Yorkshire, and Yorkshire and Humber.

XR Stories is a partnership between the University of York, Screen Yorkshire, and the British Film Institute to support research and development on immersive and interactive storytelling across Yorkshire and Humber. SIGN, the Screen Industries Growth Network, is a sister project to XR Stories in which eight partner universities across Yorkshire work with the core partners of the University of York and Screen Yorkshire to provide business support, skills development and research for the screen sector, with a particular focus on diversity and inclusion.

Office of National Statistics (ONS) data demonstrates that the Screen Industries have been growing fast in all the geographies that XR Stories and SIGN have an interest. Between 2015 and 2019, screen industries employment increased in York by 228%, in North Yorkshire by 831%, and in Yorkshire and Humber by 66%. These rates of growth outpace those experienced in comparator geographies to York (Brighton and Hove, Norwich), to North Yorkshire (Lincolnshire, Devon), and to Yorkshire and Humber (West Midlands, Wales).

While growth has been dramatic, the size and concentration of the sector in York still remains less than in comparator geographies. Brighton and Hove is a celebrated centre of creative activity and York's growth indicates that it has potential to be a similarly significant centre.

Looking at the labour market in more detail via analysis of LinkedIn data, to identify people working to some extent with immersive and interactive digital technologies, validates XR Stories' approach of working across the whole of the Yorkshire and Humber region. The data indicates that York and North Yorkshire lag their comparators in Screen Industries employment, but the Yorkshire and Humber region sustains broadly similar levels of employment to its comparator, the West Midlands.

LinkedIn analysis reveals fast-growing companies across these geographies:

— Viridian FX is visual effects house, specialised in film and in-house experimental creative storytelling projects, that employs eight people in York – 50% of whom were hired in the past five years

— Radical Forge, a games developer, employs 28 people in North Yorkshire – 86% of whom were hired in the past five years

— XR Games, a games developer, employs 19 people in Yorkshire and Humber – 126% of whom were hired in the past five years

The work of XR Stories within this high growth sector is supported by Screen Yorkshire, which aims to make the region one of the most sought-after destinations for production in the UK. It is keen for research and development, enabled by XR Stories, to support this ambition.

There is potential for the close relationship that XR Stories has enjoyed with Screen Yorkshire and the Screen Industries to be paralleled by similar relationships in other sectors with potential for immersive technology platforms (Virtual Reality, Augmented Reality, Mixed Reality etc - generally all labelled as 'XR') to design experiences and narratives for their own audiences. The visitor economy is one such sector.

Yorkshire and Humber was the only region in the UK to have seen an increase in the number of visits and the spend of international visitors in 2018. As the UK seeks to move beyond Covid-19 and benefit from a recovery of international visitors, XR can showcase Yorkshire and Humber and improve the quality of visitor experiences in the region.

XR Stories should be woven into the growth strategies of all sectors with potential to bring jobs and growth to Yorkshire and Humber through research and development with XR.

1. Growth Analysis

This section analyses the presence and growth of employment and businesses relevant to XR Stories at a series of different geographical units (York; North Yorkshire; Yorkshire and Humber) and compares this performance against a series of comparators:

- City: York versus comparators (Norwich, Brighton)
- County: North Yorkshire[1] versus comparators (Lincolnshire, Devon)
- Region: Yorkshire and Humber[2] versus comparators (West Midlands, Wales)

These comparators were selected in partnership with XR Stories based on comparability to York in terms of scale and positioning relative to larger conurbations, as well as the perceived success of these localities within sectors of relevance to XR Stories.

This section begins by defining these sectors, both within relevant data maintained by the Office of National Statistics (ONS) and LinkedIn,[3] and then analyses growth within these sectors at city, county, and regional levels.

1.1 Definitions and Methodology

The Creative Industries were defined in the UK government's 2001 *Creative Industries Mapping Document* as "those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property".

To allow the Creative Industries to be measured the Department of Digital, Culture, Media and Sport (DCMS) worked with others to develop a statistical definition of the Creative Industries that reflects this definition. DCMS uses "creative intensity" to determine which industries (defined by 4 digit Standard Industrial Codes - SICs) are creative. The creative intensity is the proportion of occupations in an industry that are creative[4] and industries with more than 30 per cent of workers in creative roles form the Creative Industries.

We gathered and analysed Office of National Statistics (ONS) data[5] on the creative industries, as well as two component parts of the Creative Industries that are most relevant to the activities of XR Stories:

- IT, Software and Computer Services
- Screen Industries[6]

In addition to ONS data, we gathered and analysed LinkedIn data. We used LinkedIn API[7] data to analyse the same geographies as those assessed within the ONS data. We did this for two reasons:

- LinkedIn data allows an analysis that, unlike ONS data, is not constrained by SIC codes but rather relies on the self-descriptions provided by individuals and companies themselves and it is also real-time information (as opposed to ONS data)
- Using a combination of LinkedIn industry codes and the skills descriptions used by individuals, we can identify the size and locations of the specific part of the screen industries and creative industries' workforce that XR Stories activity is targeting, namely immersive and interactive digital storytelling.

[1] North Yorkshire is the county council that is composed of 7 district councils (Selby, Borough of Harrogate, Craven, Richmondshire, Hambleton, Ryedale, and Borough of Scarborough) and, therefore, does not include the city of York.

[2] Yorkshire and Humber includes York and North Yorkshire and the rest of the region.

[3] The platform used mainly for professional networking, allowing job seekers to post their CVs and employers to post jobs

[4] The analysis that informs the DCMS classification is based upon a review of the extent of creative activity involved with Standard Occupation Codes (SOCs)

[5] UK Business Register and Employment Services (BRES)

[6] This is a shorthand for the DCMS category of Film, TV, Video, Radio and Photography

[7] Application Programming Interface

Figure 1 below presents the detailed list of key terms that were used to define the ‘core’ screen immersive sector and the wider creative immersive sector.

Figure 1 LinkedIn data: how we identified workers engaged in digital immersive and interactive technologies, across the core screen and wider creative industries

Focus	Key terms used in the search
Core sector	Film&TV, Broadcast, Computer Games, Mobile Games, animation, Motion Pictures and Film, Entertainment, online media + skills: VR, Virtual Environments, Unreal Engine, Virtual worlds, Unity, 3D modelling
Wider sector	Music, Performing Arts, Museums Galleries, Publishing, Photography, Arts and Crafts, Fine Art, Apparel & Fashion, Marketing and Advertising, Architecture & Planning, Graphic Design, Design + skills: VR, Virtual Environments, Unreal Engine, Virtual worlds, Unity, 3D modelling

Source: BOP Consulting and City Curator, 2021

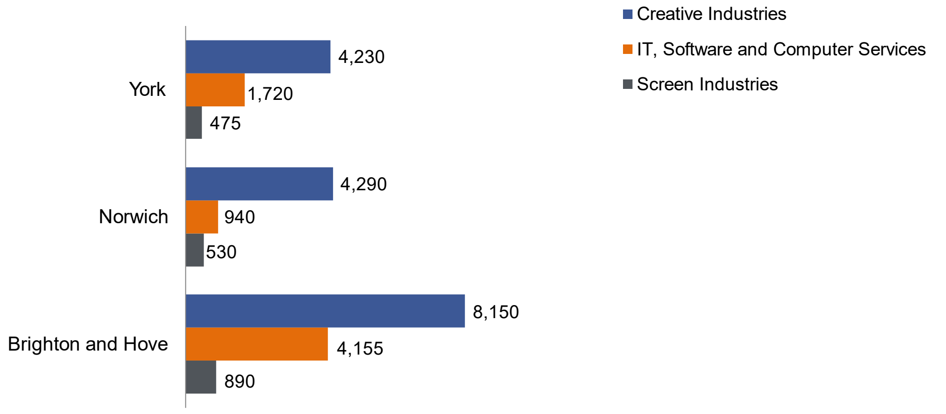
1.2 York versus Comparators

1.2.1 York workforce

In 2019, there were over 4,200 people working in the creative industries in York, almost 500 of which worked in the screen industries.

As illustrated in the figure below, York has scope for catch-up with Brighton and Hove across all three sectors / sub-sectors (“sectors” from herein). York employs similar numbers of people to Norwich in the Creative Industries, while lagging somewhat on the Screen Industries. York holds an advantage over Norwich in employment within IT, Software and Computer Services.

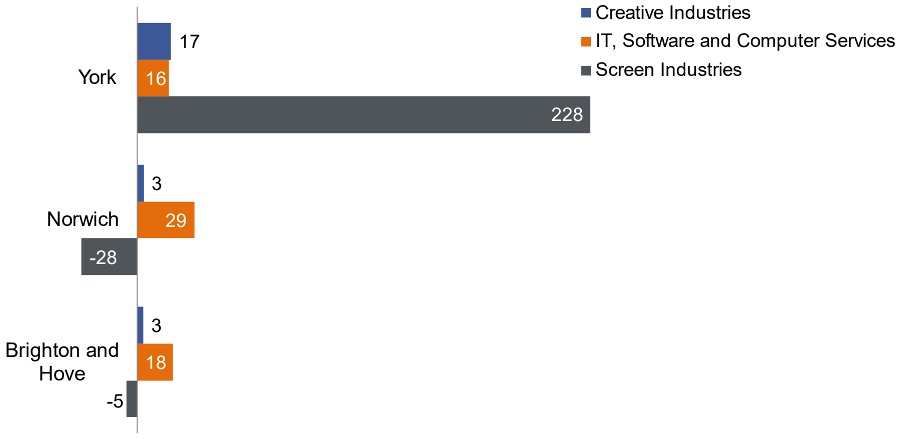
Figure 2 Number of workers in York and comparators, and by sector, 2019



Source: BRES (ONS)

York benefitted from a spectacular increase in the number of people working in the Screen Industries between 2015 and 2019 (228% increase), as shown in the figure below. This contrasts with a fall in employment in this sector over this period in both Norwich and Brighton and Hove. York also secured increases in employment within the Creative Industries and IT, Software and Computer Services over the same period.

Figure 3 Percentage change in number of workers by creative category in York and comparators, 2015-2019



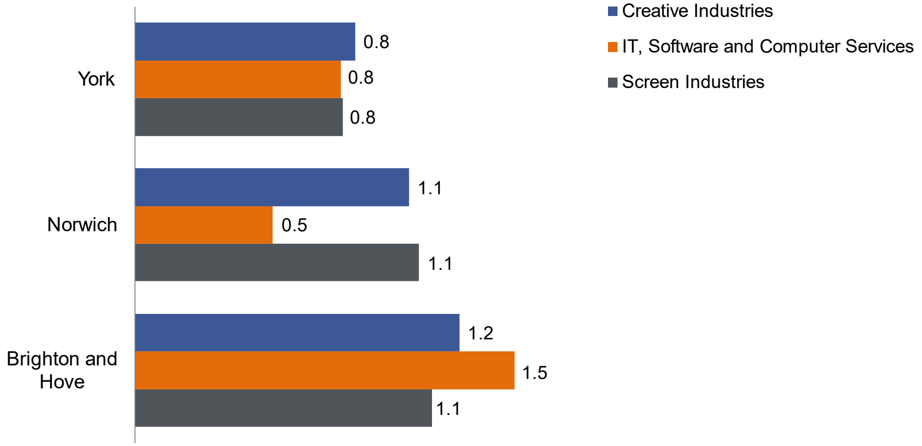
Source: BRES (ONS)

To examine whether these industries are more or less concentrated than would be expected given the size of the local economy in the geography in question and the size of the creative, screen and IT sectors nationally, we use a measure of concentration called Location Quotient (LQ) analysis. Any LQ above 1 indicates that the economic activity being analysed in a particular place is more concentrated than would be expected, with the reverse true of an LQ of less than 1.

In none of the three sectors does York benefit from an LQ above 1, as illustrated below. However, due to the dominance of London in the screen and creative industries in particular, having an LQ in these industries of 1 or above represents quite a high bar as a measure o concentration.

Notwithstanding this, Brighton and Hove has an LQ above 1 in all three sectors and Norwich has an LQ above 1 in two of the three sectors. This suggests that there is potential for York to increase its employment clustering within these sectors.

Figure 4 Location Quotients (LQs) for employment by creative category in York and comparator cities, 2019



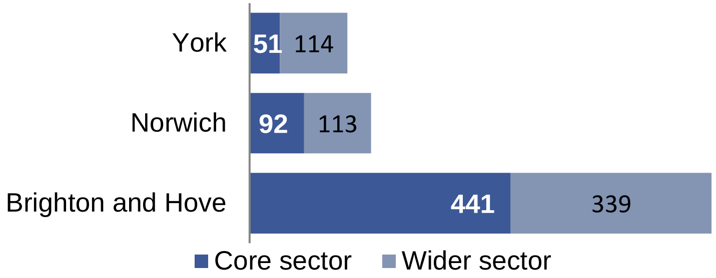
Source: BRES (ONS)

Analysis of LinkedIn data shows that the number of people currently engaged in cutting edge digital immersive and interactive technologies is still small. In York, this figure numbers only a little over 150 people, out of a total creative industries workforce of approximately 4,200.

The comparative LinkedIn data also supports the conclusion emerging from analysis of ONS data that Brighton and Hove sustains the strongest creative employment cluster among the three cities. The figure below shows that Brighton and Hove benefits from the highest number of immersive workers in both the core screen industries and the wider creative industries. The proportion of workers active in the core screen sector is 57% in Brighton, 45% in Norwich and 31% in York.

To summarise, while in Brighton the majority of workers with skills in digital immersive and interactive storytelling are operating in the screen industries, in York this is less than one third, with two thirds of workers with these skills operating in creative activities outside of the screen industries.

Figure 5 Number of workers engaged in digital immersive and interactive technologies in the core screen industries and wider creative industries in York and comparator locations, 2021

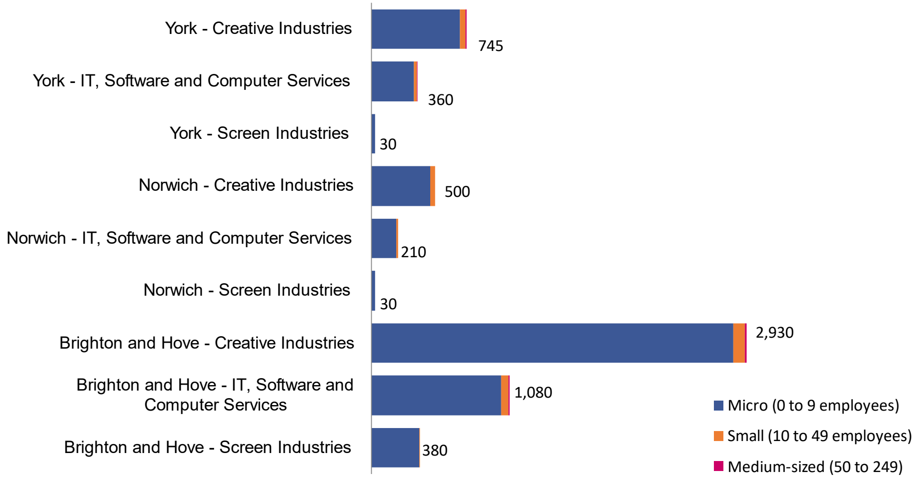


Source: BOP Consulting and Curator Technologies, using LinkedIn data, 2021

York businesses

In all three cities, most of the businesses in relevant sectors are micro enterprises (9 or fewer workers), as illustrated below. Across these three sectors, Brighton and Hove has more businesses than the other cities in every sector, while York has a larger business base than Norwich in terms of the Creative Industries and IT, Software and Computer Services.

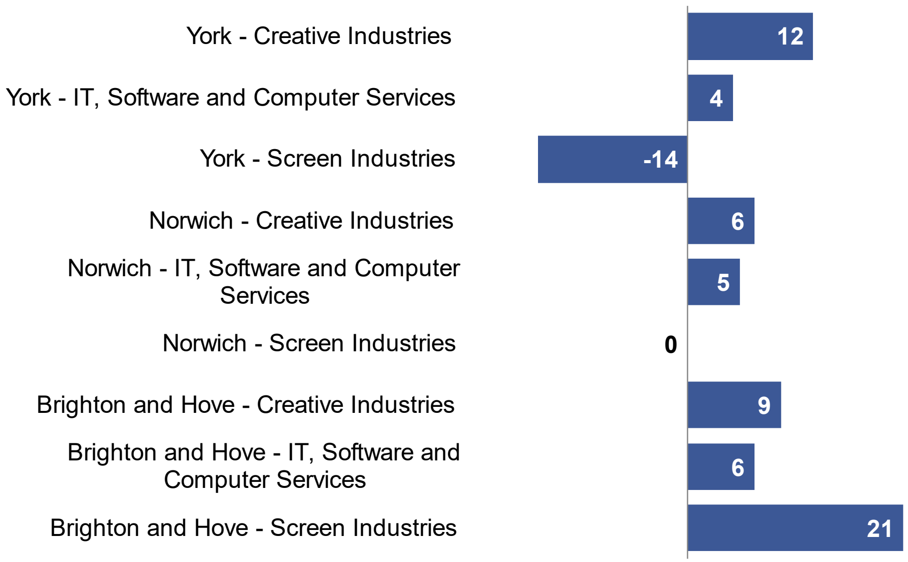
Figure 6 Number and size of businesses by city, and by sector, 2019



Source: UK Business Counts (ONS)

York experienced a contraction within its number of Screen Industries businesses between 2015 and 2020, while at the same time increasing the number of workers in this sector, perhaps indicating some consolidation of the local business base over this period.

Figure 7 Percentage change in number of businesses by city, and by sector, 2015-2019



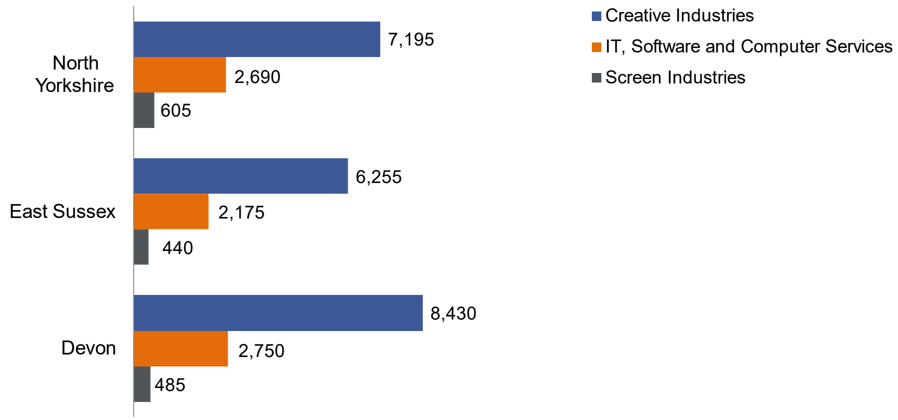
Source: UK Business Counts (ONS)

1.3 North Yorkshire versus Comparators

1.3.1 North Yorkshire workforce

North Yorkshire employs more people in the Screen Industries than either East Sussex or Devon. North Yorkshire also employs more people than East Sussex in both the Creative Industries and IT, Software and Computer Services, while lagging Devon within both these sectors.

Figure 8 Number of workers by creative category, in North Yorkshire and comparators, 2019



Source: BRES (ONS)

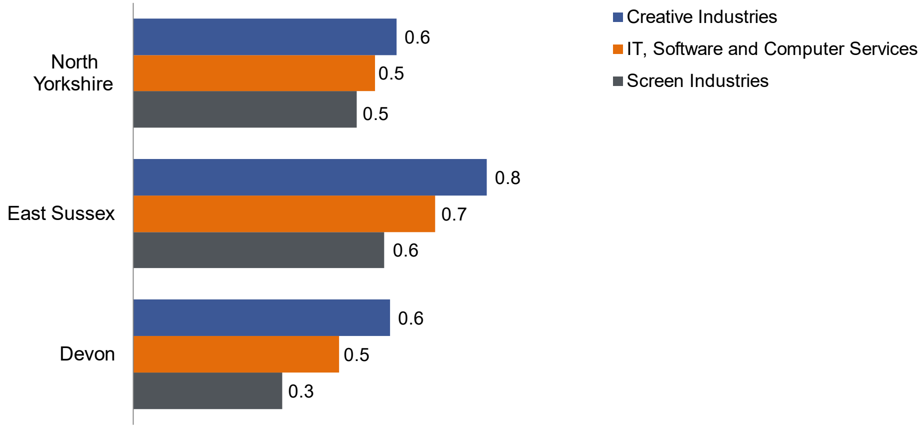
North Yorkshire benefitted from a spectacular increase in the number of people working in the Screen Industries between 2015 and 2019 (831% increase) – a much larger increase than those experienced in other sectors and geographies. North Yorkshire also secured increases in employment within the Creative Industries and IT, Software and Computer Services over this period.

Figure 9 Percentage change in number of workers by creative category in North Yorkshire and comparators, 2015-2019

Source: BRES (ONS)

Clusters of employment are often more identifiable within relatively smaller geographies (e.g. cities) than larger geographies (e.g. counties). While counties in the figure below have smaller employment clusters compared with the comparator cities, there is scope for North Yorkshire to catch-up on East Sussex in each of the sectors. North Yorkshire, however, outperforms Devon on one of the three sectors and matches it on the other two.

Figure 10 Location Quotients (LQs) for employment by creative category in North Yorkshire and comparator cities, 2019

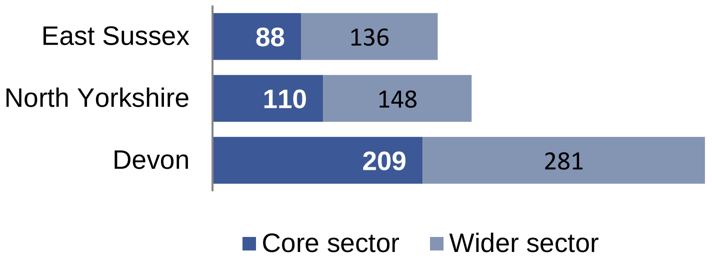


Source: BRES (ONS)

Data from LinkedIn again shows that the numbers of people working to some extent with digital immersive and interactive technologies is small. North Yorkshire, with a little over 250 workers, is positioned between East Sussex and Devon. This comparator is the opposite of the city comparator: York's hinterland of North Yorkshire performs better than Brighton's hinterland of East Sussex, despite Brighton having many more immersive workers than York.

The percentage of immersive workers in the core screen industries is reasonably consistent across the three geographical areas (43% in North Yorkshire and Devon, 39% in East Sussex).

Figure 11 Number of workers engaged in digital immersive and interactive technologies in the core screen industries and wider creative industries in North Yorkshire and comparators, 2021

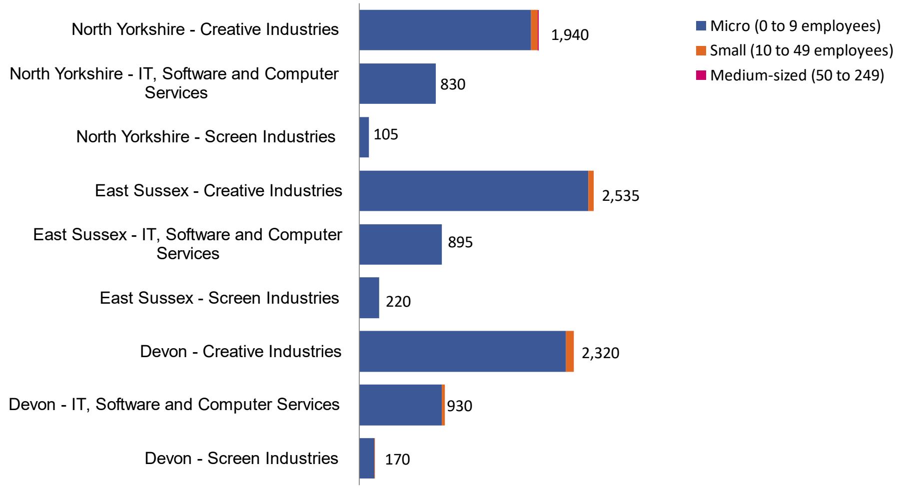


Source: BOP Consulting and Curator Technologies, using LinkedIn data, 2021

1.3.2 North Yorkshire businesses

North Yorkshire has scope for catch-up with both East Sussex and Devon in terms of the number of businesses in each of the three sectors.

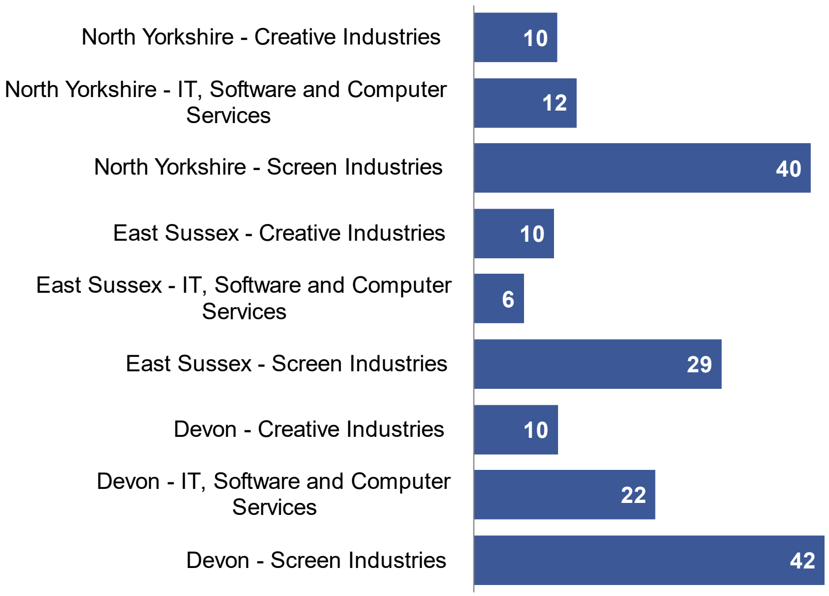
Figure 12 Number and size of businesses by county and sector, 2019



Source: UK Business Counts (ONS)

Across all three counties, as illustrated below, the change in the number of businesses between 2015 and 2020 was largest in the Screen Industries. The change in the number of Creative Industries businesses was the same (at 10%) across all three counties. North Yorkshire lags Devon and outperforms East Sussex on the change in the number of businesses in IT, Software and Computer Services.

Figure 13 Percentage change in number of businesses, by county and sector, 2015-2019



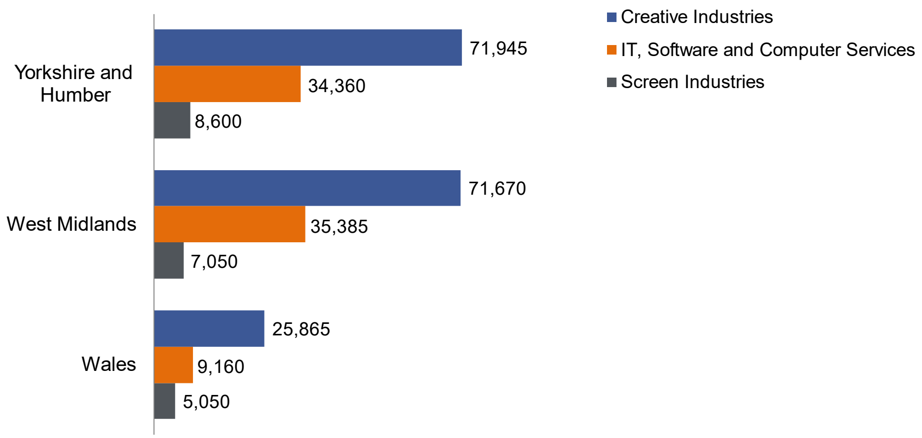
Source: UK Business Counts (ONS)

1.4 Yorkshire and Humber versus Comparators

1.4.1 Yorkshire and Humber workforce

The employment footprint of Yorkshire and Humber closely approximates the West Midlands across all three sectors. Wales is closest to matching the performance of the other geographies within the Screen Industries.

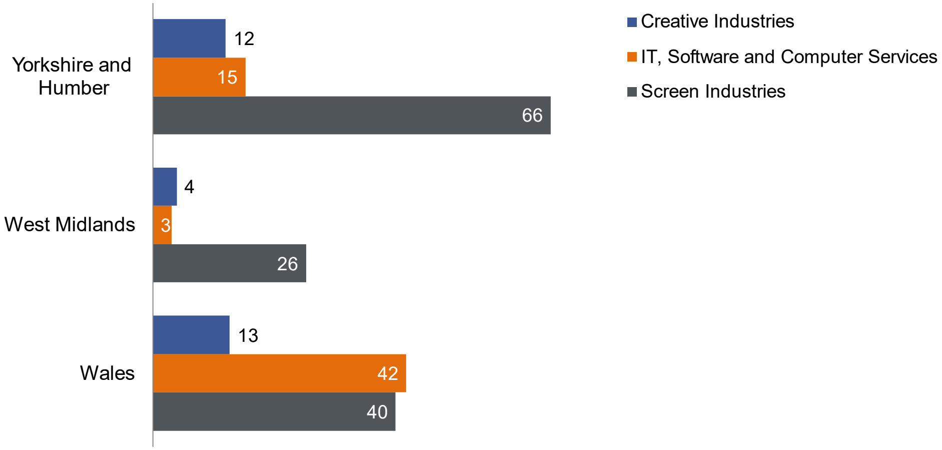
Figure 14 Number of workers by creative category in Yorkshire and Humber and comparators, 2019



Source: BRES (ONS)

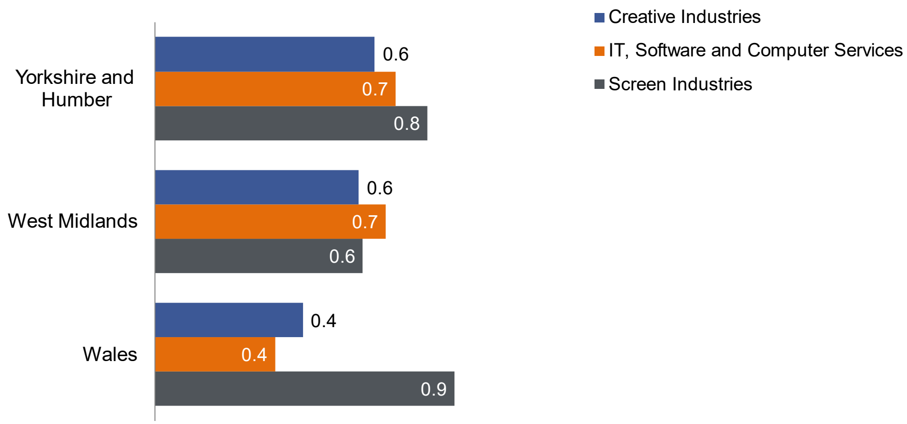
Yorkshire and Humber benefitted from increases in employment across all three sectors between 2015 and 2019 – with the Screen Industries enjoying the largest increase, larger than the increases secured by any of the other geographies here in any of the sectors.

Figure 15 Percentage change in the number of workers, by creative category in Yorkshire and Humber and comparators, 2015-2019



Source: BRES (ONS)

Figure 16 Location Quotients (LQs) for employment, by creative category in Yorkshire and Humber and comparator cities, 2019

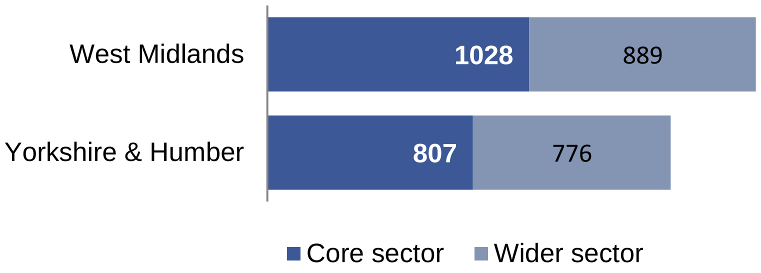


Source: BRES (ONS)

Of these larger geographies, Wales is closest to achieving an LQ of 1 in the Screen Industries – due to the cluster of TV and film activities in and around Cardiff. The screen sector also supports the strongest cluster in Yorkshire and Humber. An advantage that Yorkshire and Humber holds over Wales is stronger clustering in the Creative Industries and in IT, Software and Computer Services – where the performance matches the West Midlands.

As illustrated below, LinkedIn data shows that the number of workers engaged with digital immersive and interactive technologies in Yorkshire and Humber and the West Midlands is broadly similar (approximately 1,600 vs 1,900). The proportion of immersive workers active in the core screen sector is similar too (49% in Yorkshire and Humber, and 46% in West Midlands).

Figure 17 Number of workers engaged in digital immersive and interactive technologies in the core screen industries and wider creative industries in Yorkshire and the Humber and the West Midlands, 2021

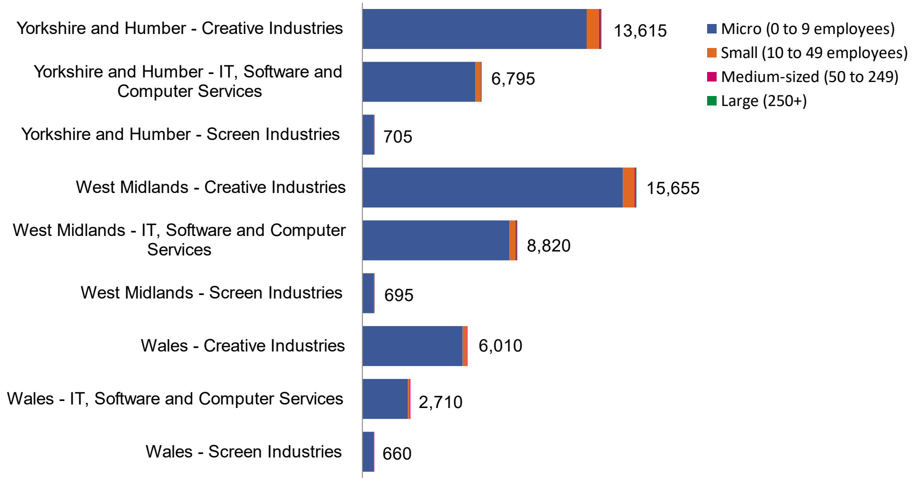


Source: : BOP Consulting and Curator Technologies, using LinkedIn data, 2021

1.4.2 Yorkshire and Humber businesses

As shown below, there are more businesses in the Screen Industries in Yorkshire and Humber than either the West Midlands or Wales. The West Midlands outperforms Yorkshire and Humber on the Creative Industries and IT, Software and Computer Services.

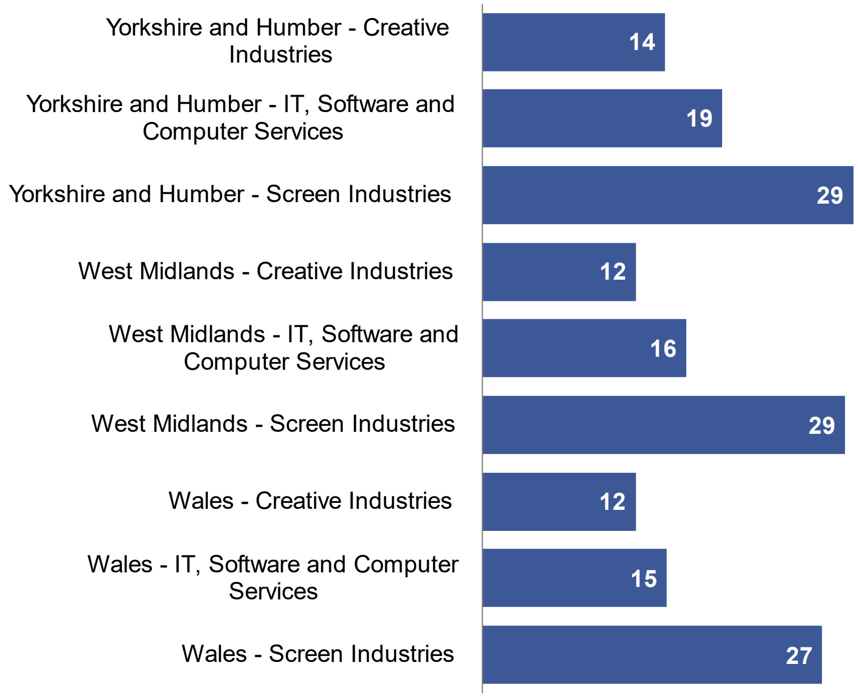
Figure 18 Number and size of businesses, by region and sector, 2019



Source: UK Business Counts (ONS)

We see the same pattern across all three geographies: the largest increases in numbers of businesses being in the Screen Industries, the next largest being in IT, Software and Computer Services, and the least in the Creative Industries.

Figure 19 Percentage change in number of businesses, by region and sector, 2015-2019



Source: UK Business Counts (ONS)

2. Understanding Business Growth in York, North Yorkshire, and Yorkshire and the Humber

This section analyses LinkedIn data to identify the fastest growing companies, as measured by the number of people recruited over the past five years, within the Screen Industries in York, North Yorkshire, and Yorkshire and Humber.

To give a flavour of these companies, we provide short profiles of some of these fast-growing companies. We conclude this section by looking at the relationship between XR Stories and the Screen Industries and other sectors – both in terms of the current character of these relationships and how they might further develop to benefit the economic development of York, North Yorkshire, and Yorkshire and Humber.

2.1 Fastest growing companies

2.1.1 York

Figure 20 presents the top five companies that have hired the largest number of employees over the last three years as a percentage of their total workforce. The top two fastest growing companies in York are small and active in the development of creative products.

Figure 20 Top 5 companies in York, as measured by employment growth over the past five years, in selected creative industries sectors, 2021

Name	Description	Employees in area	% hired in the past 5 years
Viridian FX	Visual effects house, specialised in Film and in-house experimental creative storytelling projects	8	50%
Inkblot Films	Video producers, animators and VR and AR creators	4	50%
RaceTech	Technical and broadcast services to the horse racing industry	25	48%
SPARQ	Event production service	51	43%
Phoenix Software	IT infrastructure solutions for companies	243	42%

Source: BOP Consulting and Curator Technologies, using LinkedIn data, 2021

2.1.2 North Yorkshire

As presented above for York, the figure below presents the top five companies that have hired the largest number of employees over the last three years as a percentage of their total workforce. While Games development does not feature in the company descriptions of any of the five fastest growing companies in York, it features in three of the five company descriptions of those growing fastest in North Yorkshire.

Figure 21 Top 5 companies based in North Yorkshire, as measured by employment growth over the past five years, in selected creative industries sectors, 2021

Name	Description	Employees in area	% hired in the past 5 years
Radical Forge	Games development	28	86%
Sockmonkey Studios	Games development	24	83%
Wander Films	Video production for social media	12	75%
Tanglewood Games	Games development	11	73%
Spearhead Interactive	Data visualisation company	5	60%

Source: BOP Consulting and Curator Technologies, using LinkedIn data, 2021

2.1.3 Yorkshire and Humber

Finally, the figure below provides the same data for Yorkshire and the Humber region. Here the list of companies includes a higher number of companies that have hired their entire workforce in the past five years. All these companies are based in Leeds.

Figure 22 Top 5 companies based elsewhere in Yorkshire and Humber region, as measured by employment growth over the past five years, in selected creative industries sectors, 2021

Name	Description	Employees in area	% hired in the past 5 years
XR Games	Games development	19	126%
Daisybeck Studios	Media production	26	100%
Cooperative Innovations	Immersive technologies studio	10	100%
Just Add Water	Games development	12	92%
Red Kite Games	Games development	40	88%

Source: BOP Consulting and Curator Technologies, using LinkedIn data, 2021

2.2 Company profiles

In partnership with XR Stories, we selected eight companies among those that have experienced fast growth over the past five years and created brief company profiles to describe their characteristics and activities.

These company profiles are below and give a flavour of the kinds of innovative companies and workers based in Yorkshire and Humber. They also indicate how employment patterns, business ownership and supply chains in the creative industries link York, North Yorkshire and the region as a whole to the rest of the UK and many other international countries. This is because a substantial number of creative workers are based in the region, while working for companies headquartered elsewhere and / or with many other sites.

Rockstar Games

Rockstar Games is a large games development and publishing company based in New York City with subsidiaries in London (Rockstar London and Rockstar International), Leeds, Lincoln, Edinburgh, Dundee (Australia), Bangalore (India), San Diego (USA), and Toronto (Canada). They have 3,799 employees listed on LinkedIn, with 274 of them being in the Yorkshire region (Leeds). Analysis of LinkedIn indicates that it has recruited 101 people in the last 5 years and 22 people in the last 2 years.

Rockstar Leeds is responsible for several popular offshoots of the company's main game series, *Grand Theft Auto*, as well as porting titles to different platforms and for collaborations with other Rockstar subsidiaries, namely Rockstar North (in Edinburgh) and Rockstar Toronto.

Rockstar Leeds is one of the sponsors of the Game Republic Student Showcase Award Show, which is run by Game Republic Ltd, an organisation that runs the two largest games industry networks in the North of England. Rockstar Leeds (among others) is consulted on the Games Art programme at Leeds Beckett University.

Coatsink Software

Coatsink Software is an independent games development company based in Sunderland. They have 91 employees listed on LinkedIn, with 34 being in the Yorkshire and Humber Region. It has recruited 21 people in the past five years and eight people in the past two years.

It is a leader in immersive experiences. While remaining operationally independent, it was recently acquired by Thunderful Group AB, a Swedish video game holding company based in Gothenburg, Sweden. Coatsink Software is a Gold Sponsor of Game Dev North, which is a bi-monthly game industry networking event for developers, publishers and freelancers.

Slanted Theory

Slanted Theory is a company that works in data visualization in Virtual, Augmented and Mixed Reality based in Sheffield and founded in 2016. They are a small company, with seven employees listed on LinkedIn and six of them based in Yorkshire and Humber. Analysis of LinkedIn indicates that it has recruited five people in the past five years and two people in the past two years.

Slanted Theory created ALAIRA, a visualisation and analytics platform that, in conjunction with their proprietary Organizational Network in Virtual Reality (ONVR) tool, works with VR headsets and allows users to immerse themselves in complex business data, represented as physical objects. Slanted Theory used this tool to assist the Institute for the Future, a California-based research and educational organisation.

Slanted Theory was listed as one of the 50 companies to watch in 2020 by *Yorkshire Business Insider*. It was also named as one of the seven top stars of the future in ‘Yorkshire at the Top Tech Awards’ organised by Mills and Reeve. It participates in Immerse Sheffield events - a networking organisation for people who are working or interested in the immersive technologies sector in the Sheffield City Region.

Limehouse Films

Limehouse Films is a small film, design and animation company founded in 2007 and based in Leeds with an office in London. It has 29 employees listed on LinkedIn, with 26 being in the Yorkshire and Humber region. LinkedIn analysis indicates that it has recruited eight people in the past five years and five people in the past two years.

The company has worked on projects with Nescafé, Asda, and Nestlé, in addition to collaborations with Durham University, the University of Leeds, and the University of Huddersfield. With the University of Leeds, for example, it created a series of films to showcase the courses offered by the Faculty of Mathematics and Physical Sciences.

Bluezoo Animation Studio

Bluezoo Animation Studio is a large, independent animation studio that is headquartered in London and was founded in 2000. It has 400 employees listed on LinkedIn in the North Yorkshire region. Analysis of LinkedIn indicates that it recruited 56 people in the past five years and 24 people in the past two years.

Covid-19 has accelerated the pattern of dispersed working used by the company. While being headquartered in London, most staff are based elsewhere – with Yorkshire and Humber being the base for many of these staff.

Successful projects include work for *Q Pootle 5* (in collaboration with Dell), *Go Jetters*, *Digby Dragon*, *Tree Fu Tom*, *Olive the Ostrich*, Playmobil, and a

Paddington animated series for Nick Jr. It has been nominated for and won several BAFTAs and British Animation Awards.

Blue Sky Studios

Blue Sky Studios is a feature animation studio based in Greenwich, Connecticut, USA and founded in 1987. It is a substantial company, with 936 employees listed on LinkedIn, and 35 of them being in North Yorkshire. Analysis of LinkedIn indicates that it has recruited 21 people in the past five years, and 11 people in the past two years.

It has worked on big budget films such as the *Ice Age* and *Rio* franchises, as well as more recent films such as *Ferdinand*, *Robots*, *Horton Hears a Who* and *Spies in Disguise*.

Tanglewood Games

Tanglewood Games is a games development company based in Hartlepool and incorporated in 2017. They are a small company, with 15 employees listed on LinkedIn and 11 of them being in North Yorkshire. Analysis of LinkedIn indicates that it has recruited eight people in the past 5 years and six people in the past two years.

Tanglewood Games are specialists in the Unreal game development engine. It has worked on various high-profile projects, such as the *Fortnite*, *Zomboid*, *Paragon*, and *Sea of Thieves* games, as well as the AT&T AdWorks Space Dive VR Experience.

MacKinnon and Saunders

MacKinnon and Saunders are a puppet making and animation production company based in Manchester. It has 39 employees listed on LinkedIn, and 14 of them being in North Yorkshire. Analysis of LinkedIn indicates that it has recruited eight people in the past five years and five in the past two years.

MacKinnon and Saunders have worked on several TV series such as *Bob the Builder* and *Pingu*, as well as films such as *Tim Burton's Corpse Bride*, *Mars Attacks!*, *Frankenweenie* and *Fantastic Mr. Fox*. The company has also worked on stop motion and 2D digital projects, both for external studios and in-house projects.

In 2018, it organised studio visits for Leeds Arts University students in animation. Professionals from the company also visit animation courses at the university. Hayley Mckinney, a Model Maker for the company is also a guest speaker at Hebei University in Baoding, China.

Pollen Studio

Pollen studio is a multimedia production facility based in York and founded in 1973. They are a small company, with one employee listed on LinkedIn.

It is a full-service multimedia production facility. It provides spaces for audio production, soundproof rooms for video production, green and blue screen space, lighting rigs, video editing and post-production services, grading and CGI, and e-learning opportunities.

2.3 Role of XR Stories

XR Stories works across film, TV, games, media, arts, heritage, advertising, digital and creative technology to champion a new future for immersive and interactive storytelling.

The screen industries have a history of contributing to economic growth in Yorkshire and Humber. The character of these industries is also changing. The development of easily obtainable immersive technology, modern computing platforms, mobile technology and fast networking have acted as a disruptor to more established media forms (film, TV, and games).

In this context of technological evolution, this section reviews how XR Stories contributes to the continued growth of the Screen Industries in Yorkshire and Humber – and the potential of XR Stories to enjoy similar relationships with other sectors of economic importance to Yorkshire and Humber: tourism, festivals, museums.

2.3.1 Screen industries

Yorkshire and Humber: Screen Industries Strength

Yorkshire and Humber is an emerging centre for the Screen Industries outside of London and the south east of England.

This strength has been recognised and supported by the British Film Institute (BFI - the UK's national body for film). In 2015, the BFI challenged cities, regions, and 'clusters' to demonstrate that they could become future national engine-rooms for screen industries production. Yorkshire and Humber alone, among numerous candidates from across the UK, was judged strong enough to draw strategic, targeted investment from the BFI.

The subsequent success of the University of York (XR Stories) in the AHRC Creative Industry Cluster Partnerships call in 2017 further confirmed the creative potential of this region, especially combined with relevant expertise at the University of York.

With the BFI investment, matched with funding from regional partners, the Yorkshire and Humber Consortium was established and proposed three growth pillars to build upon the BFI's backing for Yorkshire and Humber:

- Production/content fund incentive
- Major studio complex
- Industry-embedded skills/talent programme

A fourth growth pillar – to strength creative R&D in Yorkshire and Humber – required an academic partner. The University of York's longstanding engagement with the Creative Industries made it well-placed to fulfil this role, through the development of XR Stories.

University of York: Track Record of Screen Industries Engagement

The University of York has a successful record of multi-disciplinary, cross-departmental research in the Creative Industries. It helped to establish UK research and teaching in Music Technology between the Departments of Music and Electronic Engineering in the 1980s. This was followed by the establishment of the Department of Theatre, Film, Television and Interactive Media, with the University investing in £30 million in state-of-the-art studios, cinema and theatre spaces as part of its Heslington East Campus.

This helped the University of York to strengthen its activities in digital creativity and related R&D. Successes include:

- The £18m Digital Creativity Labs (DC Labs) an EPSRC/AHRC/InnovateUK digital economy impact hub for innovative research in the convergent area of digital and creative technologies. Based at the University's Ron Cooke Hub on Campus East, DC Labs has become an established centre of excellence for research that harnesses the potential of digital games and interactive media for economic, social and cultural impact.
- Successful ventures to emerge from DC Labs include:

- Gaming Grammar: a game development for second language teaching that resulted in a further £2m+ grant from the Department of Education for foreign language pedagogy in schools
- VikingVR: an award-winning VR experience exploring aspects of storytelling for a major exhibition delivered between York Museums Trust and the British Museum
- Cutting Room: tools for developing interactive televisual narratives in partnership with the BBC.

— £12m fund to support The EPSRC Centre for Doctoral Training in Intelligent Games and Game Intelligence (IGGI) – bringing together world-leading academics from across a range of disciplines, with 60 industrial games partners to develop the next generation of interdisciplinary researchers, designers, developers, and entrepreneurs for the games industry.

These and other projects have built a community of researchers and academics at the University of York whose output sits at the convergence of digital and creative methods, practice and technologies.

XR Stories: Building Screen Industries in Yorkshire and Humber

Building on its track record of R&D excellence, the University of York with its strategic partners Screen Yorkshire and the BFI, together with an impressive range of regional and national industry and regional university partners, were successful in their AHRC Creative Industry Cluster Partnerships bid. The XR Stories project was the result.

XR Stories has added a fourth growth pillar to the three initially identified by the Yorkshire and Humber Consortium (Production/content fund incentive; Major studio complex; Industry-embedded skills/talent programme).

This fourth pillar involves XR Stories as a regional hub through which to invest strategically in R&D, with the aim of making Yorkshire and Humber the leading UK centre of excellence for immersive and interactive storytelling.

To this end, XR Stories deliver a series of flexible funds to support different types of R&D activity. These enable the development of both small and large projects, working with companies on specific R&D challenges.

In this way, XR Stories enhances the capacity for Yorkshire and Humber to benefit from business R&D, the development of new Intellectual Property (IP) and, ultimately, economic growth.

2.3.2 Visitor economy

The relationships between XR Stories, BFI and Screen Yorkshire mean that XR Stories has benefitted from a close and strategic relationship with the Screen Industries in Yorkshire and Humber from its inception.

At the same time, the services of XR Stories are relevant to other industries of strategic significance to Yorkshire and Humber. These industries include the visitor economy – which encompasses a wide range of activities, including festivals and other kinds of cultural destinations, such as museums.

Figures published by Welcome to Yorkshire indicate the economic significance to Yorkshire and Humber of the visitor economy:

— Yorkshire and Humber attracted 129.8 million day visits and 10.5 million overnight visits in 2018

— The inbound tourism figures show a record-breaking 1.39 million international visitors were welcomed to Yorkshire and Humber in 2018, an increase of almost 4% on the previous year. The annual overseas visitor spend topped £600 million for the first time in that year

— Yorkshire and Humber was the only region in the UK to have seen an increase in the number of visits and the spend of international visitors in 2018.

Sadly, however, Covid-19 has dramatically curtailed tourist activity, especially inbound tourist activity.

There is potential for immersive technologies to assist Yorkshire and Humber in rebuilding its visitor economy in a variety of ways:

— **Immersion as a promotion tool:** For example, various agencies (e.g. Club Med, New Caledonia Tourism) enable potential customers to discover their destinations using a combination of VR headsets and YouTube 360° and Facebook 360°

— **Making travel more enjoyable:** The French start-up Skylights, for example, prepares headsets for airlines. These allow the traveller to make the most of the journey by immersing themselves in a movie theatre with a panoramic screen.

— **Improving holiday experiences:** VR and AR can improve holiday activities. The Tourist Agency of Bordeaux, for example, offers an iPad to enable VR experiences to complement trips to the city. Such technologies can be particularly relevant to festivals and museums:

- Coachella Music Festival in the United States has made use of AR/VR in a range of ways: VR features in the festival app; delivery of Google Cardboard headsets, which enable VR experiences, to festivalgoers alongside tickets; and the "Antarctic Dome" – the largest VR-based geodesic projection dome in the world. The dome created *Chrysalis*, an advanced eight-minute audiovisual programme that was projected in full-end 360° to create an impactful immersive experience for the audience.
- The National Museum of Singapore, for example, has run an immersive installation called *Story of the Forest*. The exhibition focuses on 69 images from the William Farquhar Collection of Natural History Drawings. These have been turned into three-dimensional animations that visitors can interact with by downloading an app to the phone or tablet.

— **Recording the travel experience:** The YouTube 360° and Facebook 360° technologies allow travellers to share their 360° experience utilising cameras embedded in drones, which are now being made available to rent by tourist destinations.

— **Travel from home:** AR/VR can bring tourist destinations to life for people from their own homes, which may be relevant to people with mobility challenges or seeking to reduce their carbon footprint or to experience habitats closed off for conservation reasons.

Given the rich natural and cultural assets of Yorkshire and Humber, the potential of AR/VR to strengthen its visitor experiences and, thus, grow its visitor economy is considerable.

Looking ahead

The benefit that XR Stories is bringing to the Screen Industries of Yorkshire and Humber has been assisted by its close relationships with the BFI and Screen Yorkshire. The intention to develop IP in Yorkshire and Humber, through XR Stories, is key to the growth strategy of Screen Yorkshire.

XR Stories has the potential to enjoy a similarly strategic and beneficial relationship with the tourism sector in Yorkshire and Humber. As Screen Yorkshire have helped XR Stories build relationships with the Screen Industries in Yorkshire and Humber, there may be potential for Welcome to Yorkshire to play a similar role in relation to the tourism sector in Yorkshire and Humber.

In any case, it will be necessary for XR Stories to understand the business ambitions and requirements of visitor and cultural destinations in Yorkshire and Humber and to tailor their services to these ambitions and requirements.

Immersive technologies and associated R&D have potential to accelerate the growth of important sectors within Yorkshire and Humber, including the Screen Industries and the tourist sector. With this acceleration underpinned by strategic relationships between XR Stories and key agencies (e.g., Screen Yorkshire, Welcome to Yorkshire) and the ability of XR Stories to understand and deliver to the ambitions and requirements of business with these sectors.

XR Stories should continue to strengthen these strategic relationships and to hone its ability to meet business ambitions and requirements. While XR Stories should continue to extend and deepen the many fruitful engagements that it has had with businesses in the Screen Industries in Yorkshire and Humber, interviews undertaken for this research indicate that agencies and businesses beyond this sector in Yorkshire and Humber could be more aware of XR Stories and how immersive technologies might help businesses to grow in the region. Building this awareness should, therefore, be an objective for XR Stories.

BOP Consulting is an international consultancy specialising in culture and the creative economy.

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