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A Deep Dive into the Creative Industries

Mapping UKRI's engagement with the UKs fastest growing knowledge sector

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Introduction

Why deep dive into the Creative Industries?

1.1 The Creative Industries are important — and an area of opportunity for UKRI

The UK Government's recent Plan for Growth identified the Creative Industries as one of the UK's areas of true competitive advantage in research and innovation. As this report will show, UKRI has made a substantial contribution to this competitive advantage, and has the potential to retain a central and innovative influence in future developments, thereby enhancing job prospects, changing people's lives, and driving up prosperity across the United Kingdom.

The Creative Industries are an economic powerhouse for the UK. The sector makes a greater contribution to the UK economy than to any comparable nation. With annual GVA of £115bn, providing 2.1m jobs and growing at three times the rate of the economy overall since 2008, the size and economic weight of the Creative Industries is still surprising to many. But any level of surprise that the sector is larger (in terms of GVA) than the Life Sciences, Automotive, Aerospace and Oil and Gas sectors combined is understandable, because the idea of the Creative Industries as an industrial rather than a cultural sector is relatively 'new', being only conceptualised and defined in the last 25 years.

Nobody gets up in the morning thrilled that they work 'in the Creative Industries'. Instead they are excited to work for architectural practices like Foster + Partners, creating iconic buildings across the globe that fuse creative practice with cutting edge construction and engineering technologies, or to build and grow new fashion design studios like Doppelhaus, developing new looks, fusing new materials and traditional skills and onshoring manufacturing to create shorter, sustainable supply chains. Our Creative Industries include the User Experience Designers creating digital services for green energy suppliers and the software developers of Red Dead Redemption and Hopin. This is the work force of writers, actors, designers, composers, publishers, technicians and producers behind Harry Potter in print, on stage, and on screen (not forgetting the GFX wizards who have won eight of the last ten Visual Effects Oscars for UK companies including one for the most 'realistic' black hole). The advertisers and marketers at WPP that shape our current desire and behaviours, and the museums and galleries that anchor our scientific, cultural and collective memories are part of the Creative Industries too. As we will show in this deep dive UKRI has deep links with, and funds research questions relevant to many (but not quite all) sectors of the Creative Industries.

1.2 The Creative Industries now identify as a Research and Innovation driven sector and look to UKRI as a partner

It is only over the last half decade that policymakers, universities and industry have slowly begun to re-frame the Creative industries as a sector powered by research and innovation – not least through engagement and interventions from UKRI and its Councils.

As we will show in this deep dive, almost all UKRI's constituent councils fund research of relevance to this dynamic and fast-growing sector – from archaeology to virtual reality, psychology to AI, design to signal processing.

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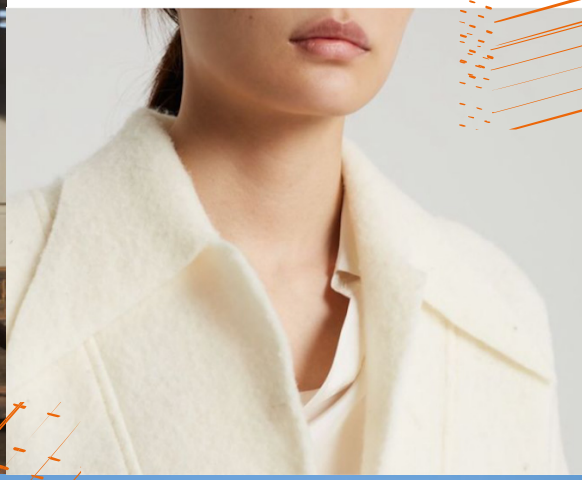
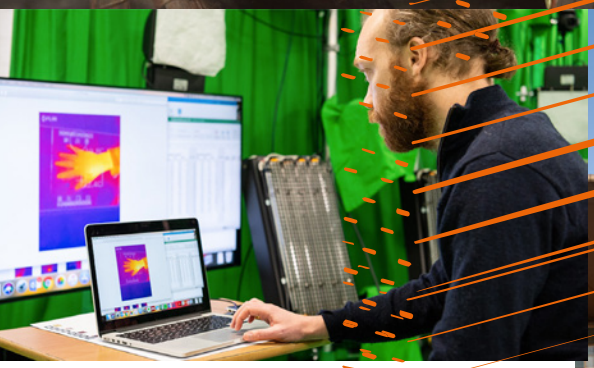
With growth in almost all creative industry sectors now influenced by advanced digital technologies, the contribution of advances in STEM to their future growth and employment has become more apparent and the need to combine this with innovation around business and revenue models and new creative processes more pressing. Some have gone so far as to advocate that a new high-growth 'CreaTech' space is emerging at the intersection of Creative Industries and digital technology analogous to the more familiar FinTech and EduTech sector (and UKRI is funding research in precisely this phenomenon).

Structural alignment and engagement between UKRI, the Creative Industries and government stakeholders have become much closer over the last four years driven by the Creative Industries Sector Deal and previous Industrial Strategy. The Executive Chair of the AHRC now sits on behalf of UKRI on the Creative Industries Council, co-chaired by Secretary of State BEIS, Secretary of State DCMS and Industry. The Creative Industries Council Covid Recovery plan was developed in close consultation with UKRI. And AHRC and DCMS co-sponsored a report on the post-Covid challenges for the creative sector, entitled Boundless Creativity.





Clockwise from left:
'Red Dead Redemption II' – Rockstar Games, Cloudwool by Doppelhaus, featured in Elle China, 'The House of Wisdom' library, UAE – Foster + Partners, Centre for the Analysis of Motion Entertainment Research & Applications

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1.3 The Creative Industries is both a dynamic application space and a resource for wider UKRI challenges and missions

The Creative Industries are a multidisciplinary application space for UKRI research ranging from practice-based arts and culture to emerging technologies. Some subsectors (Computer Games, Advertising, Film, TV and Photography) provide cutting edge use cases, industry 'pull' and translational opportunities for AI, machine vision and associated technologies. Software development itself, perhaps surprisingly to some, sits within the Creative Industries.

Other sectors address and impact major societal challenges: health and wellbeing; the preservation of cultural heritage and memory; and the changed social norms that we will need to realise a Net Zero society. There is compelling evidence that Design, a core creative discipline and a powerful sector in its own right, can act as a translational language between multiple disciplines, to negotiate between social, political, behavioural, and technological drivers.

The specialised approaches of product design, service design, human centred design, design engineering, design futures and policy design have evolved to address different contexts. Design is perhaps the vital component required to conceptualise and deliver any mission that encompasses multiple disciplines and seeks to deliver social change.

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Objectives of this Deep Dive

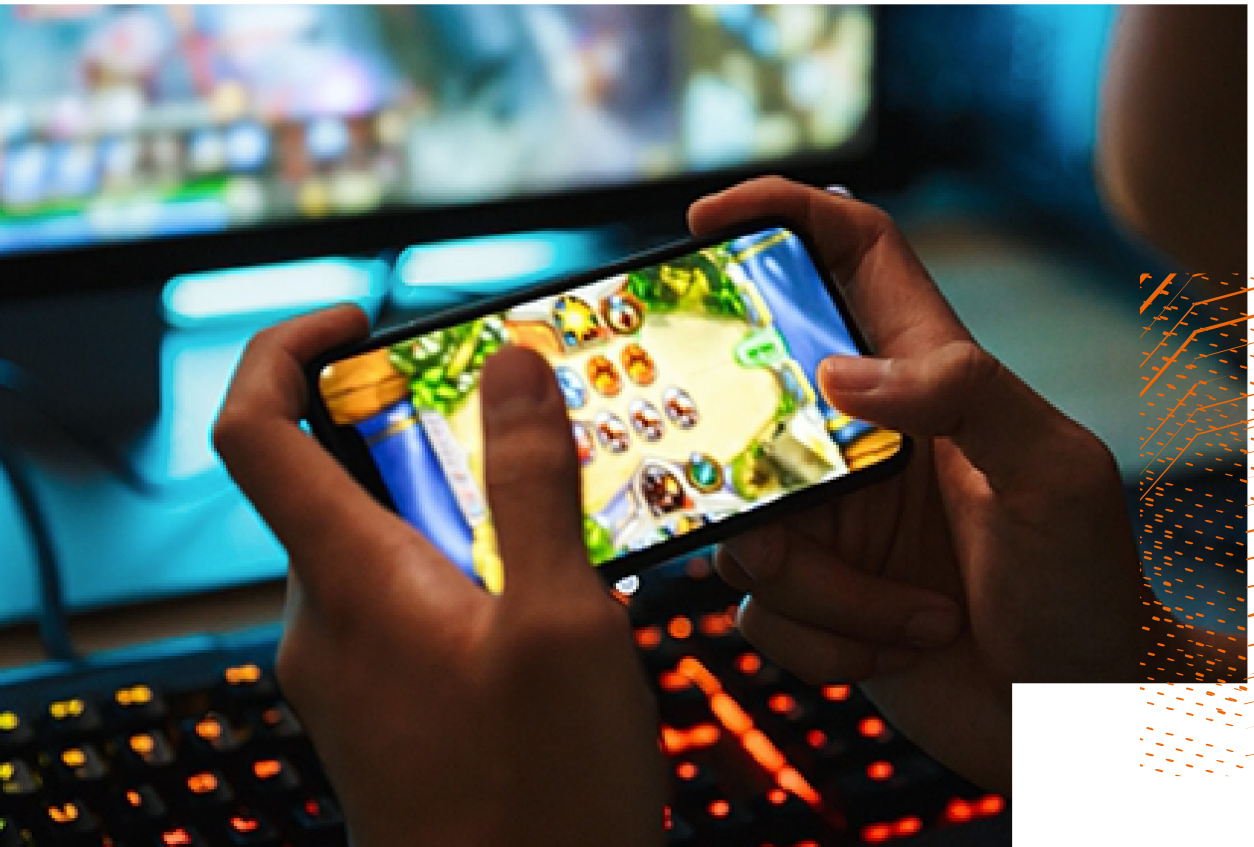
This paper takes a holistic view of UKRI's engagement with the Creative Industries for the first time. It identifies the breadth of engagement, and the multiple modes of intervention from enquiry-led to applied research, Centres of Excellence, Knowledge Exchange, business-led innovation programmes and talent and skills development initiatives.

It seeks to celebrate current success with case studies drawn from across the UKRI portfolio. These will hopefully also illuminate the Creative Industries for UKRI colleagues as an opportunity space for further cross-UKRI collaboration and societal and policy impact.

It also attempts to map UKRI's current portfolio of Creative Industries projects and to put a shape and, tentatively, a size on it for the first time. There are serious challenges here in comparing the apples of inquiry-led research with the oranges of innovation funding. Whilst companies and the innovation funds they receive can be ascribed to Creative Industries sectors with some degree of accuracy, there is no simple relationship between research disciplines and those same sectors.

To resolve this we have drawn on the expertise of UKRI colleagues who work most closely in the relevant areas and developed a simple Creative Industries Intensity Scale that we hope captures the relevance of the broadest range of disciplines.

This paper is not designed to advocate for particular actions with regard to further engagement between UKRI and the Creative Industries but rather to present for discussion the range, depth and impact of our current investments, the current policy landscape and thereby the opportunity for UKRI to further engage with a dynamic and growing sector which engages both policymakers and the public and one where the UK truly leads the world.



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Understanding and Measuring the Creative Industries

3.1 Mapping the Creative Industriesare important – and an area of opportunity for UKRI

The idea of a distinctive, identifiable and coherent Creative Industries sector within the economy arose more or less simultaneously in the UK and Australia towards the end of the 1990s. The UK produced its first document mapping the sector in 1998. This identified 13 subsectors which were characterised by their creativity: Advertising, Architecture, Art & Antiques, Crafts, Design, Designer Fashion, Film and Video, Interactive Leisure Software, Music, Performing Arts, Publishing, Software and Computer Services, Television & Radio.

The initial mapping exercise also proposed a definition. The Creative Industries are "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."

The sector mapping was revised in 2006 to become the 9 Creative Industries sub-sectors we have today (**Table 1.**). All economic data on the sector is collected by ONS against this simplified sectoral breakdown and its associated SIC codes, and reported on annually by DCMS as shown in Table 1.

	The Creative Industries Subsectors **(As recognised by ONS and collected in DCMS Creative Industries Economic Estimates)**
1.	Advertising & Marketing
2.	Architecture
3.	Crafts
4.	Design and Designer Fashion
5.	Film, TV, Video, Radio & Photography
6.	IT, Software & Computer Games
7.	Publishing
8.	Museums Galleries and Libraries
9.	Music, Performing and Visual Arts

Table 1.
The Creative Industries Subsectors
(As recognised by ONS and collected in DCMS Creative Industries Economic Estimates)

It can be seen from the Table that among these nine subsectors some are clearly "technological" subsectors (e.g. IT Software and Computer Games), whilst other economically prominent sectors are underpinned by STEM-driven innovation. But the products, services and experiences that generate their revenue are shaped primarily by creative processes (Advertising & Marketing, Architecture, Film, TV etc, Design, Publishing). From a distance some subsectors may appear primarily 'artistic' (Music Performing and Visual Arts, Crafts) or 'cultural' (Museums Galleries and Libraries) rather than innovation or technology intensive.

However, whilst there is some truth to the broad trends, the reality is more complex and the opportunities more exciting.

- Even apparently low-tech sectors such as crafts have pockets of experimental materials science (e.g. ceramics, jewellery), business model innovation (global digital distribution of craft textiles) and high levels of technology adoption (computer aided design, short run manufacture) existing within a culture of designer/makers and traditional craft processes.

- The Performing and Visual Arts, Music, Film and Animation sectors provide some of the most challenging use cases for AI and also some of the most enthusiastic adopters of AI and Machine Learning to emulate and enhance creative production processes.

This is one of the reasons why UKRI is such a powerful home for the Creative Industries R&D. The co-existence of arts, humanities, social sciences and physical and life sciences in a framework shot through with values of innovation, where research across the spectrum from practice-based to experimental is equally valued, is precisely the context in which the Creative Industries thrive.

3.2 Economic Performance

Perhaps the most surprising aspect of the Creative Industries, for those not directly engaged with the sector, is its sheer size and the scale of the contribution it makes to the economy. In 2018 the Creative Industries accounted for 5.8% of UK GVA. **Figure 1**. shows the latest data breaking down the overall £116bn GVA of the Creative Industries across the contributing subsectors.

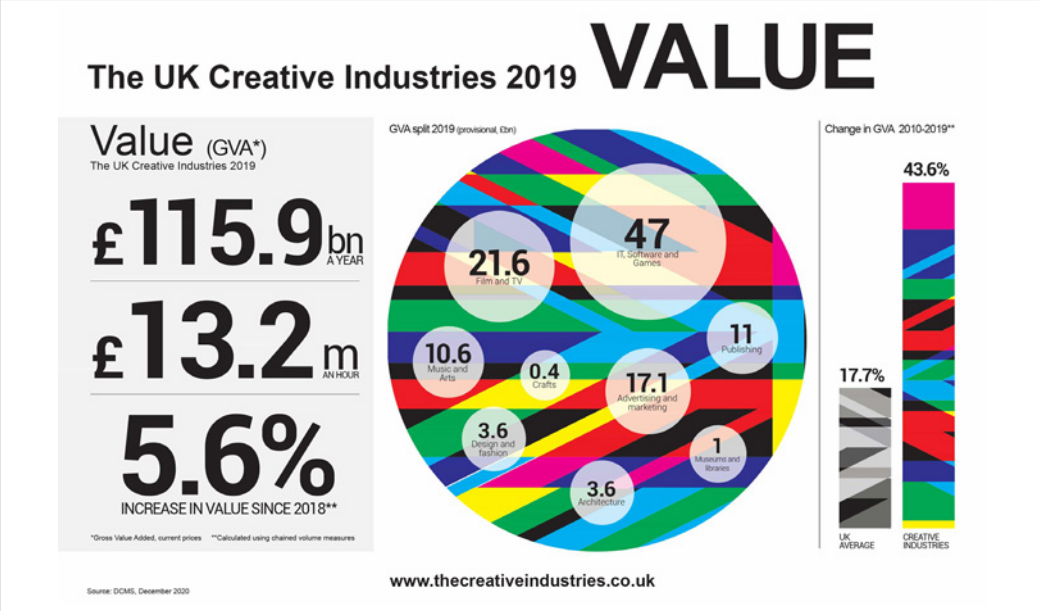

Figure 1.
Creative Industries GVA; DCMS Economic Estimates 2020

It's not just value but the historic rates of growth achieved by the sector that make it such an important contributor to the UK economy. In the 10 years to 2019, Creative Industries GVA grew at a rate 2.5 times that of the rest of the economy.

The Creative Industries is also a major growth sector in terms of employment. In 2019 the UK creative workers represented 6.5% of the total labour market **Figure 2**. shows that these 2.1m Creative Industries jobs are distributed across every nation and region of the UK but with a third of the sector working in London. A third of the workforce is also self-employed, a feature which together with the small number of large companies and very large number of SME's characterises the sector. Employment has grown by 34.5% between 2011-2019, a rate 2.7 times the average across all industry sectors (11.4%). Industry predictions prior to the pandemic were that the Creative Industries could create another 1 million jobs by 2035.

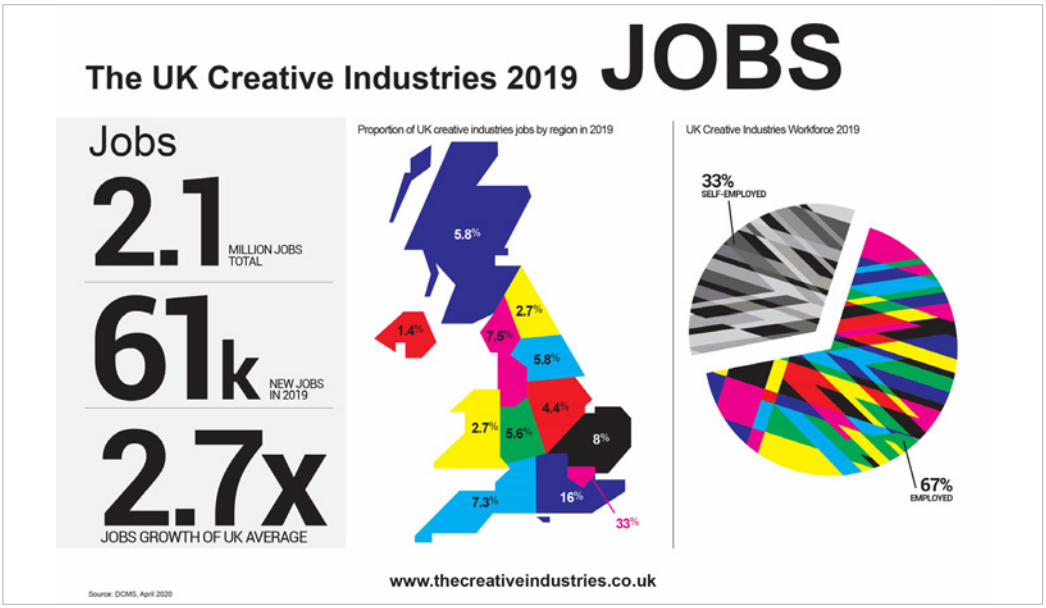

Figure 2.
Creative Industries Employment; DCMS Economic Estimates 2020

Though comparisons are sometimes misleading they can often provide useful context. Table 2. shows comparative data for the UK Creative Industries with the other innovation-intensive sectors against which the sector is increasingly trying to benchmark itself. Whilst the economic weight of the Creative Industries is clear the R&D figures for the sector appear relatively low. However, there are reasons to believe that R&D in the Creative Industries may be significantly undercounted.

	GVA (£bn)	Employment	Industry R&D (£bn)
Creative Industries	115.9	2,100,000	1.9
Life Sciences	30.7 (2017)	256,000	4.8
Automotive	15.3	1,044,000	3.4
Aerospace	8.0	111,000	1.7 (2015)
Oil & Gas	20.5	270,000	0.2

Table 2.
Sector Comparisons GVA, Employment, R&D Investment. Source ONS, all figures 2019 unless indicated.

Understanding of the processes that constitute R&D within the sector is limited. Recent DCMS research suggested that whilst 71% of creative firms surveyed used some kind of IP protection, only 14% conducted R&D as defined by the HMRC for the assessment of R&D Tax Credits. However, 55% of firms could identify R&D activities within their businesses under the wider Frascati (OECD) definition employed by our European competitors. This question of creative business access to tax credits is a significant sectoral issue with a current call for evidence from HMT, to which UKRI is responding.

The Creative Industries are significant export sectors as well. **Figure 3**. shows that the overall £35.6bn achieved in 2019 was concentrated in a few key sectors. Recent export growth has been significant particularly in Film & TV sectors but perhaps the most important aspect here is that these exports include significant service sectors (Advertising, Architecture, Design), and sectors driven by the creation and exploitation of IP (Software, Games, Film & TV) although for these IP based sectors there are often significant service elements as well as (often intangible) products.

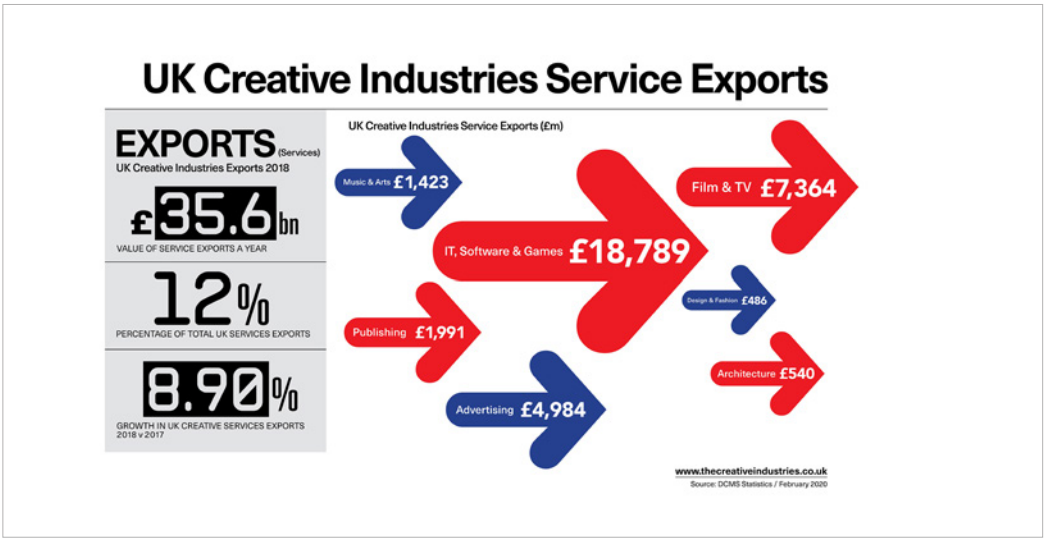

Figure 3.
Creative Industries Exports; DCMS economic estimates 2020

UK creative exports indicate the underlying competitiveness of our creative sectors and here the screen sector stands as an example. UK Film and TV production has been transformed over the last twenty years through access to investment, a supportive regulatory and economic framework and a growing technology infrastructure driven by a globally competitive Graphic and Special Effects sector and a growing network of studio facilities. The result has been larger, more resilient companies with access to global markets. Over 50% of all the TV formats, the reproducible IP of global entertainment, that are produced around the world originated in the UK, and 20% of global Film box office revenues in 2018 were for British-made films. As mentioned in the opening section, eight of the last ten Oscars for Special Visual effects, representing the cutting edge of creative technology, have been won by British companies.

The UK is a global leader in both the origination and production of Creative IP. To maintain that status when competitors (particularly China) are investing heavily in screen sector technology R&D will require an even stronger partnership between UKRI and industry than has been the case to date. In this regard, the inclusion of Creative Industries programmes within the UKRI Infrastructure Plan is of great significance. CoSTAR, a proposal for research and innovation infrastructure for the screen and performance sectors comprising facilities co-sited with private sector studios, university partnerships and new capabilities for R&D in AI and Virtual Production, will be a step change in the capabilities of the sector to conduct and absorb R&D and continue to attract global investment. But this also raises the issue of how to understand the development of the Creative Industries within a Trusted Research context.

3.3 Impact of Covid on the Creative Industries

The overall economic impact of successive lockdowns and ongoing social distancing measures on the Creative Industries has been severe, but this has fallen disproportionately on some sectors with others recovering after initial disruption, and highly digital sectors seeing improved revenues from changes in consumer behaviour.

Oxford Economics working with the Creative Industries Federation predicted an overall fall in turnover for 2020/21 of £77bn (-31%) and a GVA shortfall of £29bn (-26%) against 2019 figures, with over half of this impact being felt in London. But this is highly differentiated. Theatre revenues for 2020 were 90% down, advertising revenues only 17% down and recovering rapidly by end of year along with overall consumer confidence. Workforce predictions for the short term are dire. In the same report Oxford Economics projected the loss of 409,000 jobs from a total workforce of 2.1 million, with 70% of the impact falling on the sector's large self-employed workforce. The hardest hit sector being Music, Performing and Visual Arts where the loss of revenues from live music and touring and the closure of venues could see the loss of 30,000 employees and 160,000 self-employed workers, respectively 32% and 71% of the 2019 workforce. The rate of recovery of these jobs is as yet unclear.

Those sectors that are built on live experiences, venues and events (particularly Music and Performing Arts, Museums, Galleries and Libraries) effectively closed to their audiences. Current live test events under control of DCMS Chief Scientific Adviser Prof Tom Rodden (formerly Deputy Executive Chair of EPSRC and current AHRC Council member) will hopefully usher in a reopening of music venues, theatres, and performance spaces across the summer, but large crowd events, particularly music and arts festivals, may suffer a second fallow year. Museums and Galleries will reopen as planned from 17th May 2021.

The live performance and venue sector will need significant support to reopen and recover. This will include R&D support to enable venues to explore and adopt hybrid business models that will implement digital technology to serve both remote and live audiences. The DCMS/AHRC Boundless Creativity joint research project has explored these issues over the pandemic period and will publish its recommendations in the near future.

The *Boundless* project, the Audience of the Future Challenge and the Creative Industries Policy and Evidence Centre have all identified positive trends during Covid19 within the Creative Industries. The degree of 'digitisation' of sectors has been a major factor in this – those creative sectors with digital production and distribution were the least disrupted by the move to remote working and have subsequently thrived. The computer games sector and digital entertainment platforms have seen increased audiences and revenues. Film, TV and music streaming platforms have significantly increased their subscription revenues albeit in the case of TV platforms running down their stocks of new inventory. The insurance scheme underwritten by the UK government that has allowed film and television production to restart has as a consequence been one of the UKs most successful Covid19 interventions. One long lasting legacy of the pandemic is that the IP rights model of the film industry has been transformed more in the last 12 months than the previous 50 years.

[1] *The Projected Economic Impact of Covid-19 on the UK Creative Industries;* Oxford Economics 2020 available at http://bit.ly/Covid19OxfordEconomicsCIF

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The Covid19 pandemic has also stimulated a period of rapid innovation across the sector seeing:

- Rapid adaptation of existing digital platforms to create new audience channels during the pandemic, e.g. adoption of streaming platforms such as Twitch by the music industry and performers; ticketed and free streaming experiences from the National Theatre, Old Vic and museums;

- Creation of new forms of online, virtual and social user experiences that have accelerated the deployment and adoption of advanced digital technologies, e.g. new theatre and eSports experiences incorporating Augmented, Virtual and Mixed Reality, and the use of Realtime Game engines to create live performances accessible globally;

- An accelerated shift to Virtual Production technologies across the Film, TV, Games and Performance sectors and the increased usage of AI and Machine learning across the entire sector.

It is important to note that UKRI has supported research in and for the recovery of the Creative Industries sector, and that this research is likely to influence long term trends. Notable examples include InnovateUK's Fast Start and Sustainable Innovation Funds for which creative businesses have competed particularly successfully, research conducted by the Creative Industries Policy and Evidence Centre and the work of the Audience of the Future Challenge (supported by ISCF funds), including the successful immersive theatre experience with the Royal Shakespeare Company, Dream, and other examples showcased in a UKRI video, recently launched.

This is a really strong example of how emergency funding will have a long and profitable outcome.

'Dream' – Audience of the Future Demonstrator led by the RSC recently released UKRI video

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UKRI and the Creative Industries

4.1 Councils, Industry and impacts

The diversity of the Creative Industries means that an extremely wide range of research disciplines have impact and application in the sector and influence its growth. However, as the term "Creative Industries" is a description of an industrial sector there is no direct correlation with research disciplines or university structures. There are few 'creative industries' faculties in universities and those that exist are primarily concerned with research about the sector - its dynamics, policy, workforce and structure - rather than research for the direct benefit of creative businesses in developing new products, services, content, experiences, processes or business models. Recent UKRI investment, particularly the Creative Industries Clusters Programme (CICP, supported by ISCF) have encouraged the reconfiguration of universities engagement with the CI's but this is still at an early stage.

That said, there are underlying structural relationships between particular Creative Industries sectors and the research communities served by three UKRI councils:

- AHRC - with the Design, Museums, Libraries and Archives, Music, Visual and Performing Arts and Film, Television and Radio sectors intimately bound into the Arts and Humanities through both research, practice and education, AHRC has the broadest and longest standing range of interactions with the creative sector;

- EPSRC –investing in discovery research in digital, engineering and computer science research which underpin the transformational technologies driving growth in creative businesses, particularly Software Development (a CI subsector in its own right). Audio-visual technologies, smart materials, sensors for fashion, and co-creation between technologists and the creative community drive STEM impacts in the CIs;

- InnovateUK –as the UK's funder of business-led innovation, IUK's remit has long identified the Creative Industries as a high value and innovation driven sector, and the Digital Catapult represents a significant translational capability for the sector.

Though AHRC, EPSRC and IUK are 'core' councils from the perspective of the Creative Industries, other councils have significant engagement with the sector, particularly around new social challenges (e.g. NERC's growing engagement, alongside AHRC and InnovateUK with the Fashion and Textiles industry on issues of sustainability and circular economy), as a component of significant research programmes (e.g. ESRC's engagement with creative SMEs around productivity, workforce dynamics and IP), or as a new application space for enquiry led research (e.g. BBSRC funded research in Neuroscience with relevance to human perception and Virtual and Augmented Reality).

The impact of UKRI supported research and innovation on the Creative Industries can be either direct or indirect in nature. Direct impact from applied research and innovation programmes with industry are complemented by indirect impacts where the outputs of enquiry led research have relevance to the sector though industry is not involved. Impact can also be delivered through sector specific interventions that target the Creative Industries, or through broader initiatives that are sector and discipline agnostic.

Figure 4. illustrates this by plotting a range of current UKRI programmes against the axes of sector specific vs agnostic; direct vs indirect impact. It shows that, as would be expected, InnovateUK has a range of programmes with direct impacts on creative businesses. So too do AHRC and EPSRC and these Research Council schemes are sector specific whereas IUK's SMART and Covid programmes are accessible across industry. A range of generic UKRI investment models (particularly responsive mode) also deliver significant and valuable indirect benefits to the Creative Industries albeit probably over a longer period before they impact the market.

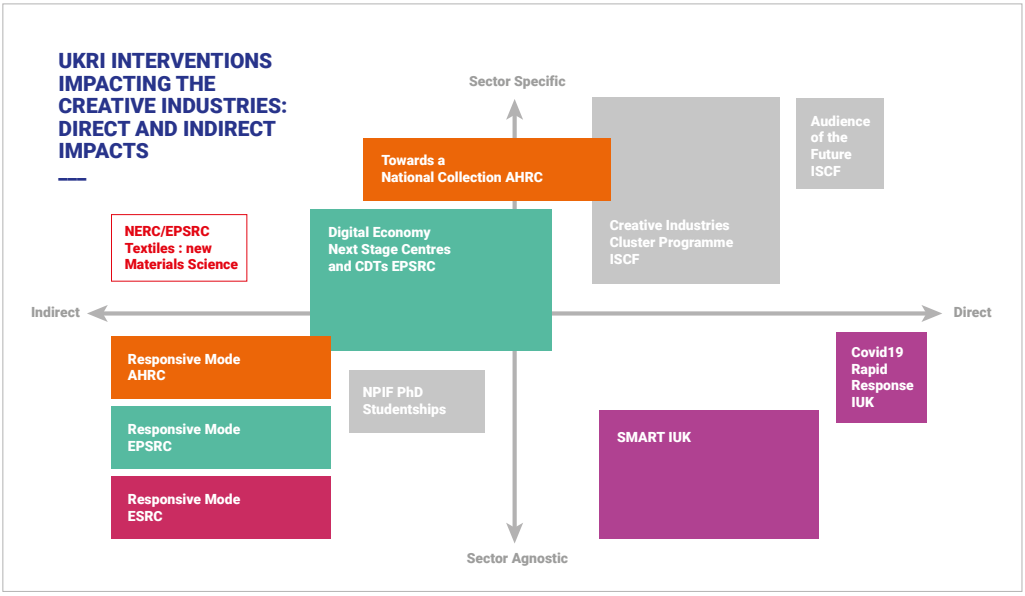


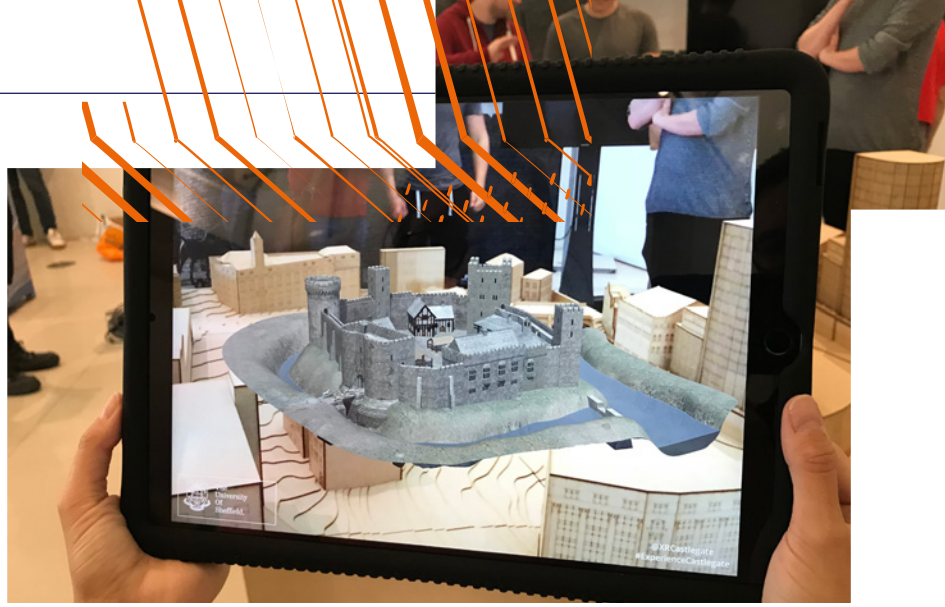
Figure 4. Current UKRI interventions relevant to the Creative Industries plotted against degree of sector specificity and direct or indirect impacts.

4.2 Foundations for the deep dive

We have focussed this deep dive on the current portfolio of projects across UKRI (from 2016 to the present) but this is built on an evolving relationship across the short (20 year) history of the Creative Industries. As the relationship has developed, so has the recognition on both sides of the innovation potential of the sector and its research and development needs. This is, in short, a UKRI success story.

Prior to 2016 three programmes have played a significant role in establishing the potential and credibility of research and innovation programmes with the Creative Industries. Each was initiated by one of the core councils (EPSRC, AHRC and InnovateUK), transformed the sector's understanding of research and innovation policy and funding, and laid the foundations for UKRIs current success:

- **The Digital Economy Theme (2009-present)** has worked across the Research Councils over the last decade to rapidly realise the transformational impact of digital technologies on aspects of community life, cultural experiences, future society, and the economy. It is delivered by EPSRC in partnership with AHRC, ESRC and IUK. Critical mass investments in research have had a profound impact on engagement between some sectors of the Creative Industries and the STEM sector, bringing together creative, technology and computing disciplines within universities to create multidisciplinary research centres with which creative business can engage. Two of the Digital Economy Theme key strands of activity have had a profound impact on engagement between some sectors of the Creative Industries and the STEM sector: the Next Generation (and subsequent Next Stage) Centres brought together creative, technology and computing disciplines within universities creating multidisciplinary research centres with which creative business could engage. The Content Consumption and Distribution strand supported ambitious multidisciplinary R&D projects that brought together technology and content. These two programmes created both a model and an initial capability for interaction between Creative Businesses and STE(A)M



'Memory, Place, Performance' research call response – Heritage-led Urban Regeneration

researchers, also laying the foundations for the place based regional centres of digital creative excellence that are visible today. These also act as the anchor points for Centres for Doctoral Training e.g. CAMERA in Bath working with games, health and content industries in the South West which has become one of the strongest regions in the UK for the creative industries, Digital Creativity Labs in York (computing, games, theatre, broadcast), QMUL, East London (Music), and Music/Audio in Surrey (networks and 5G).

- **The AHRC Knowledge Exchange Hubs for the Creative Economy (2012-2017)** was five multidisciplinary knowledge exchange partnerships based in HEIs (in Dundee, Bristol, London and Lancaster) that explored and developed academic research and KE programmes with Cultural organisations and creative businesses. The Hubs engaged Arts and Humanities researchers with business and with the dynamics of emerging regional creative clusters. The hubs each had a thematic as well as a place-based focus, from design to the creative economy and were critical for building the knowledge base for the ISCF investment in Creative Clusters this time on industry with the objective of economic impact through innovation in new products services and experiences, rather than research outputs.

- **InnovateUK's Cross Platform Production in Digital Media Competition (2014-2016)**. Initiated by the then Technology Strategy Board, this was Innovate UK's largest innovation programme in the Creative Industries prior to the ISCF *Audience of the Future Challenge*. It was specifically designed to position the UK as a leading territory for film post-production, supporting the UK's globally competitive VFX industry and securing Industrial Light and Magic (and with it the lucrative Star Wars productions) to move to the UK. The programme has directly created over 1000 high-skilled roles to date, and contributed an estimated $1bn to the UK economy. The programme was enabled by additional funding directly made available by HMT and demonstrated the opportunity for linking technology innovation and production infrastructure to FDI.

Since making these initial investments AHRC (Creative Industries), InnovateUK (Creative Economy) and EPSRC (Digital Economy) have retained specialist teams to engage the sector and AHRC and EPSRC have incorporated high level Advisory Groups with Creative Industries representatives within their governance structures building additional capability across UKRI.

Over the past 5 years, engagement between UKRI/Councils and the Creative Sector has accelerated significantly following the emphasis placed on research and development by Sir Peter Bazalgette's Independent Review of the Creative Industries in 2017. This prompted development of the Creative Industries Sector Deal between HMG and the sector (2018) and the initiation of the two ISCF funded UKRI programmes within it, the *Creative Industries Clusters Programme* (CICP) and *Audience of the Future* (AotF) which represented a step change in both the level of UKRI funding for Creative Industries R&D and in the ambition and expectations of the sector.

This history is important because it reminds us that Research Councils and then UKRI itself have been partners to the development of the Creative Industries from the very beginning; we are an integral part of their success.

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Mapping UKRI's Engagement with the Creative Industries

To map engagement with the Creative Industries across UKRI and to capture the diversity of the current portfolio, we have worked with all UKRI's councils to identify the projects and programmes which they believe engage, impact, or have applications or relevance to the Creative Industries. This engages a potentially enormous and disparate field. Just to think of the Film and TV sector, this might range from archaeological, historical, or environmental research that might form the core content for a global TV franchise on the one hand or collaborative R&D programmes for businesses to deliver the next generation of performance capture technologies for film on the other.

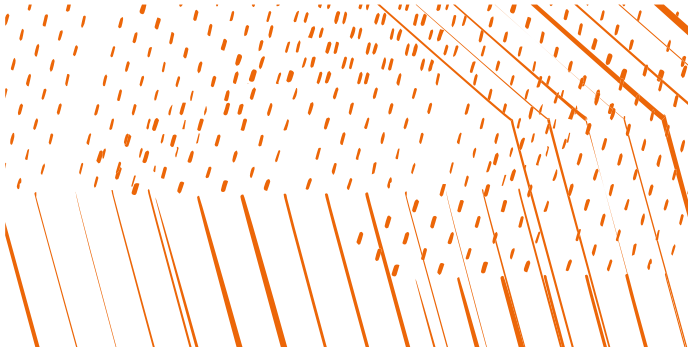
To allow us to compare the 'apples' of enquiry driven academic research with the 'oranges' of business innovation (and all points in between) we have developed a **Creative Industries Intensity Scale (CIS)**, to model, albeit in a simple way, the relevance and likely impact of a project on the Creative Industries as an economic sector. This is absolutely not a measure of value but rather a measure of where projects sit on the spectrum between being driven by pure research questions at one end (CIS=1) and industry needs and challenges at the other (CIS=4), the outputs of the former being research publications and new knowledge, and of the latter being new (or prototype) products, services or experiences or the data and/or insights to create them.

We have also been able to explore the economic geography of UKRI's engagement with the Creative Industries by mapping both programmes and investment by place, an increasingly important dimension of research and innovation policy.

5.1 UKRI's Creative Industries Portfolio

Thanks to the excellent support we have received from across UKRI, colleagues provided us with an initial 1,430 relevant projects to explore. From these we have confirmed 885 projects from 2016 to the present with identifiable application to the Creative Industries. These range from the ground-breaking research that underpinned a blockbuster Hokusai exhibition at the British Museum, to the computer science of object-based media platforms that may transform video and audio production; from post-doctoral researchers embedded in the development of digital rights platforms for the music industry to computer games developers and molecular biologists modelling DNA control switches in Virtual Reality.

More extensive consideration of the richness of each Council's portfolio, case studies that illustrate the unique contribution each council can make to the Creative Industries and the geography of their investments are attached in the Appendix. Here we will attempt to provide an overview of where UKRI is investing in the Creative Industries, how that investment is spread across the different industry sectors, and of the balance between enquiry and applied research to identify areas of current strengths, weakness, and opportunities for future strategic investment through individual council programmes, challenges, or missions across UKRI.



	Identified projects (number)	Qualified Investment (£)	1. Advertising and Marketing	2. Architecture	3. Crafts	4. Design and Designer Fashion	5. Film, TV, Video, Radio and Photography	6. IT Software and Computer Games	7. Publishing	8. Museums, Galleries, and Libraries	9. Music, Performing and Visual Arts
AHRC	365	£48,527,112	0.1%	1.8%	2.1%	6.0%	7.4%	3.8%	2%	56.6%	20.4%
EPSRC	59	£64,764,040	0.0%	0.0%	0.0%	3.7%	24.9%	45.5%	0%	3.5%	22.3%
IUK	250	£36,544,703	6.9%	0.4%	1.8%	13.6%	42.7%	16.6%	3.6%	1.8%	12.7%
ISCF Challenges	82	£92,741,690	0.7%	1.2%	0.7%	14.3%	26.3%	34.5%	1%	8.8%	12.0%
ESRC	51	£5,074,108	0.5%	12.6%	0.9%	14.9%	10.9%	18.0%	0%	2.6%	39.1%
NERC	78	£3,429,192	0.0%	15.9%	0.0%	22.2%	14.1%	25.3%	0%	9.3%	13.2%
TOTAL	**885**	£251,090,845	1.3%	1.3%	0.9%	10.0%	24.2%	28.4%	1.4%	15.6%	17.0%

Table 3.
UKRI Creative Industries portfolio 2016 - Project Number and qualified investment by council analysed by Creative Industries subsectors.

Table 3. summarises the numerical data we have collected for this deep dive and analysed for Creative Industries Intensity. It includes data from AHRC, EPSRC, InnovateUK, ESRC, NERC and the two Creative Industries programmes supported by the ISCF – *The Audience of the Future* Challenge (AotF) and the *Creative Industries Clusters Programme* (CICP) . The data we have collected from BBSRC, MRC and STFC has allowed us to identify case studies but with relevant projects being almost entirely research lead, sectoral and creative industry Intensity analysis is much less certain so does not contribute here. Research England is somewhat of a special case and is considered separately below. All Councils have exceptional projects within their portfolios, and we consider the remarkable range of case studies in the Appendix to illuminate the distinctive way that each Council contributes to outcomes in the Creative Industries and the particular sectors they impact upon.

Our Deep Dive shows that UKRI's current Creative Industries portfolio extends across all subsectors of the Creative Industries and also spans the range of Creative Intensity from pure research investigations to highly applied industry research and innovation programmes. That said, high Creative Intensity programmes currently predominate. Profiles of Creative Intensity at the level of the individual Councils differ from this overall picture quite markedly as one might expect. ESRC and NERC support relatively early-stage research; InnovateUK supports only highly applied business innovation with a corresponding high Creative Intensity; AHRC and EPSRC are active across the spectrum. The Challenge Programmes are, as might be expected, highly geared to industry innovation needs and thereby also score highly in terms of Creative Intensity.

[2] Though the programmes are largely delivered through AHRC and IUK mechanisms they are led and managed through the ISCF so we have treated these challenges separately for clarity as they represent a step change in both the scale and form of UKRIs engagement with the Creative Industries.

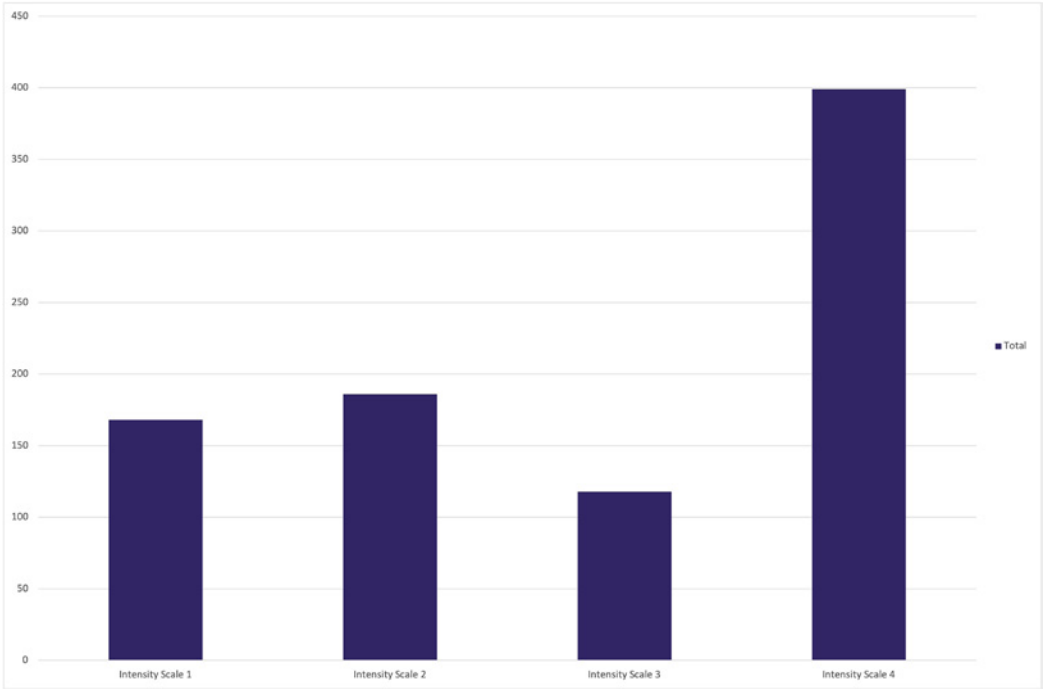


Figure 5.
UKRI Projects 2016-present Numbers of projects vs Creative Intensity. n=885

If numbers of projects can be taken as a proxy for reach into the sector, three councils predominate in their engagement with the CIs: AHRC, EPSRC and InnovateUK. The fourth largest contributor being the two Challenges supported by the ISCF, *Audience of the Future* (AotF) and the *Creative Industries Clusters Programme* (CICP). AHRC clearly has the broadest reach into the Creative Industries as reflected by the number of identified projects **(Figure 6**.), showing the structural linkages to the Creative Industries noted earlier. IUK has the next largest portfolio by number, followed by the ISCF Challenges, EPSRC and the other Research Councils. The contribution of the ISCF Challenges to portfolio engagement is substantially underestimated in this data as each of the nine partnerships in the *Creative Industries Clusters Programme* (CICP) are counted here as only a single investment, though they have to date deployed their grant funding on R&D projects to an average of 30 SMEs each.

Using scale of investment as an alternative metric paints a slightly different picture, perhaps one that is more closely related to impact on the sector than engagement with it. Qualifying project budgets by their Creative Intensity Scale allow us to compare investment across applied and enquiry-led research based on industry application. In this process the projects scoring 4 on our Creative Industries Intensity Scales (applied, business-led or collaborative R&D programmes involving industry partners) are assessed at 100% of budget whilst the lower CI scoring projects (scores 3,2,1) are assessed at 50%, 25% and 10% respectively. Applying this qualified budget process to all 885 projects gives a total UKRI portfolio of just under a quarter of a billion pounds (see **Table 3**.).

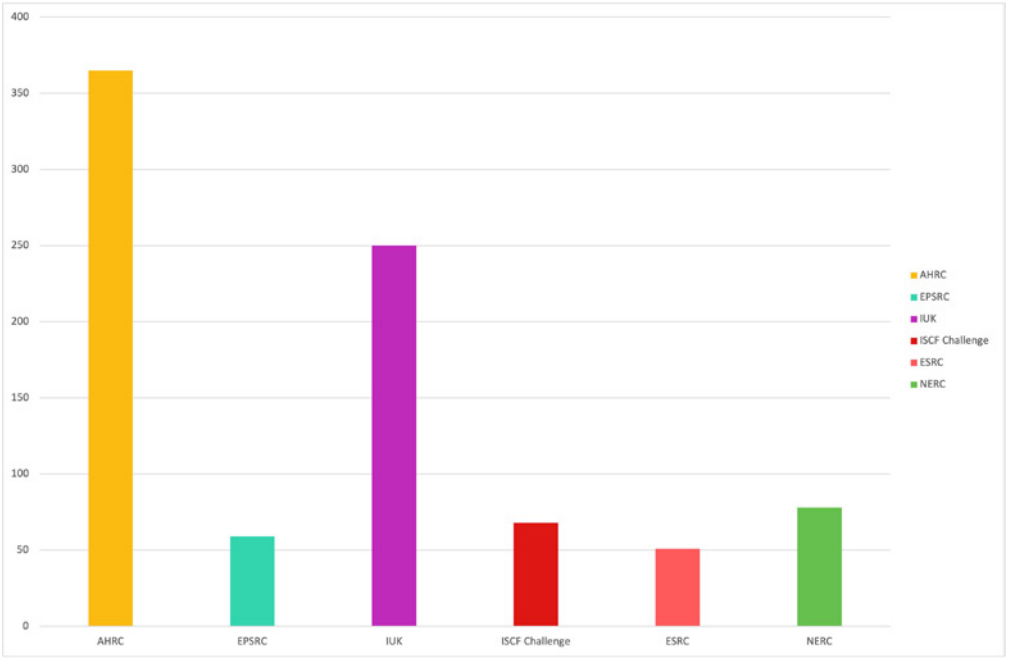


Figure 6.
UKRI Creative Industries total projects by Council and intervention n=885

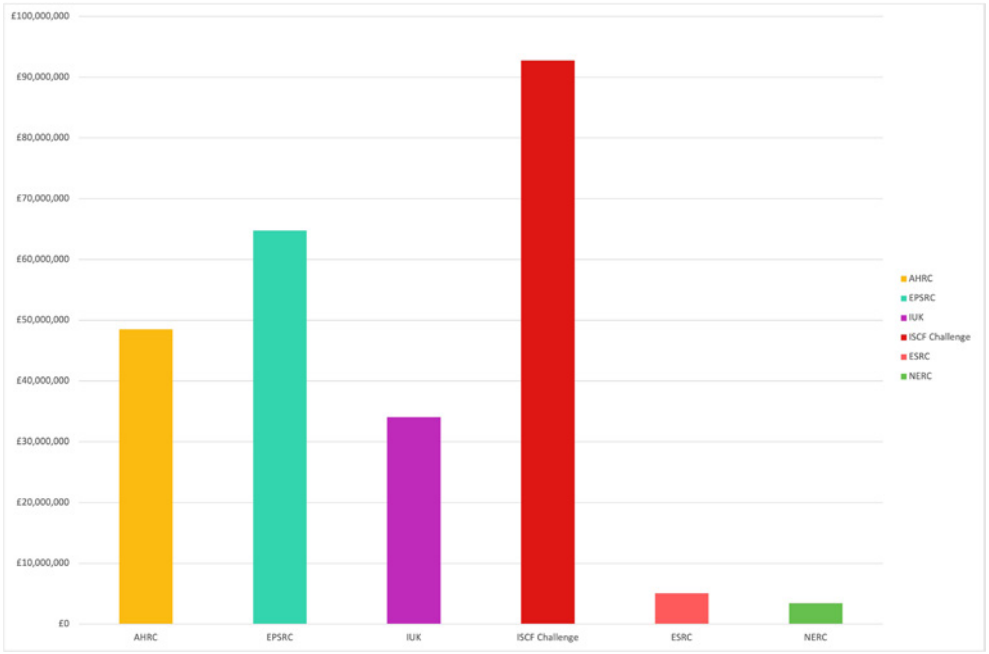


Figure 7.
Creative Intensity Qualified investment by UKRI Council and Intervention

Figure 7. shows how that investment maps to the different councils. AHRC is a significant investor, as to a lesser degree is InnovateUK, with ESRC and NERC investing at much lower levels. However, EPSRC invests more than any other Research Council. EPSRC's investments are on average larger in size, often through Centres with five-year commitments and a high score on our Creative Intensity Scale. But even EPSRC's investment is exceeded by that of the two Challenge Programmes. This new funding from ISCF has come on stream only in the last 3 years and has transformed UKRI's level of investment in Creative Industries R&D, significantly raising both profile and expectation in the sector.

However, from a research and innovation perspective, not all sectors of the Creative Industries are equal it would seem. There are distinct patterns to the distribution of grant funding across the nine creative subsectors at the UKRI level. **Figure 8.** maps the distribution of grants across the subsectors, showing that that UKRI engages with some areas of the Creative Industries much more deeply than others. Film & TV, Software and Computer Games, Museums, Galleries and Libraries, and Music, Visual and Performing Arts are very well represented but other economically significant and technologically driven sectors such as Advertising and Marketing, and Architecture have a low level of engagement, potentially offering new opportunities and unexplored needs for research and innovation.

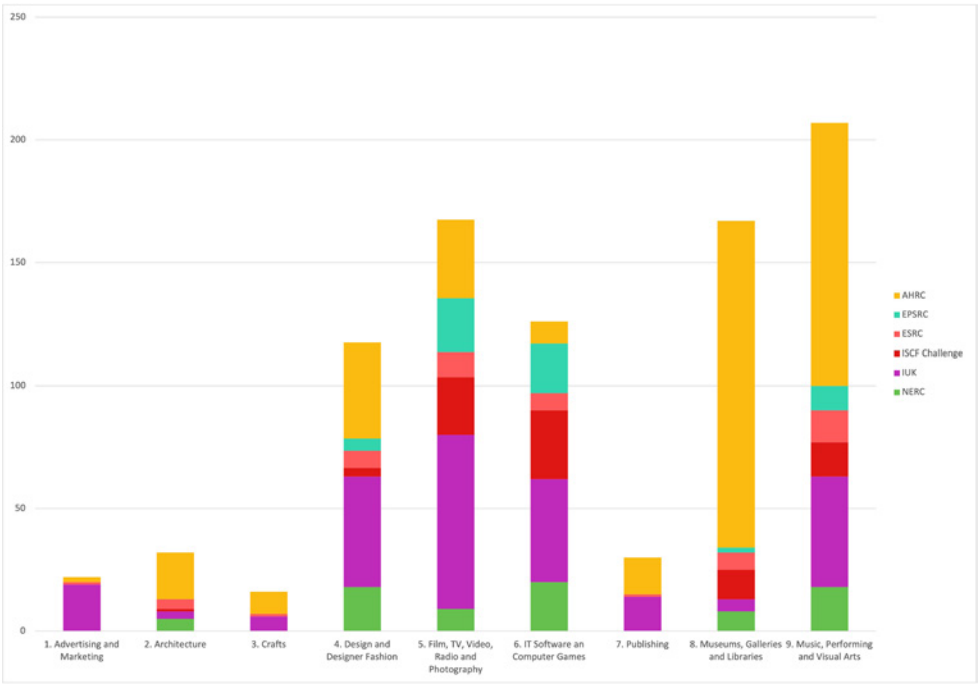


Figure 8.
UKRI Creative Industries Projects: Number of projects by creative industries subsector cumulative by Council n=885

Switching this to a plot of qualified investment against Creative Industries Subsectors and showing the contribution of each council the picture becomes clearer as shown in **Figure 9**. There is a significant concentration of investment in four of the subsectors:

- **Film, TV, Radio and Photography** – driven largely by EPSRC and the CICP Challenge programme there is a high level of investment in R&D for this globally successful sector. As can be seen from the case studies in the appendix, much of this is focussed on the innovation needs of the screen sector, from computer graphics and advanced visualisation to new Virtual Production technologies and the content forms they enable. Major investments include the four Creative Clusters partnerships that focus on the Screen Sector (StoryFutures based at Royal Holloway and the National Film & Television School, Clwstwr in Cardiff, Future Screens Northern Ireland and XRStories in Yorkshire), the EPSRC Next Stage centres that have underpinned STEM research in the sector (e.g. CAMERA in Bath, Digital Creativity Labs in York) and IUK's innovation funding to VFX companies including The Foundry and Framestore.

- **Museums, Galleries and Libraries** – is an area of great strength for AHRC with this GLAM sector both integral to the arts and humanities and constituting a Creative Industries sub-sector in its own right. Widespread research engagement is complemented by large-scale initiatives such as Towards a National Collection which looks to extend user access, enhance the experience and multiply the utility of our great collections within an interoperable data framework.

- **Music, Performing & Visual Arts** – is an area where the relatively high investment stems from contributions across all UKRI's councils. EPSRC contribute significantly to high-level skills through their CDT in AI and Music. AHRC have a large portfolio of practice-based research in the performing and visual arts, and EPSRC support important research on the workforce and sector microbusinesses. NERC and IUK have supported programmes in digital music and arts and technology. Perhaps the project that brings to life most successfully the way UKRI can contribute to this sector is the recent Dream Online, part of Audience of the Future performance Demonstrator. Bringing together the RSC, Philharmonia Orchestra, Manchester International Festival and creative SME's from the sector, researchers from Portsmouth, Goldsmiths and de Montfort Universities, Intel corporation and Epic Games it delivered a completely novel live performance using real-time motion capture and image rendering to 60,000 trialists under lockdown conditions.

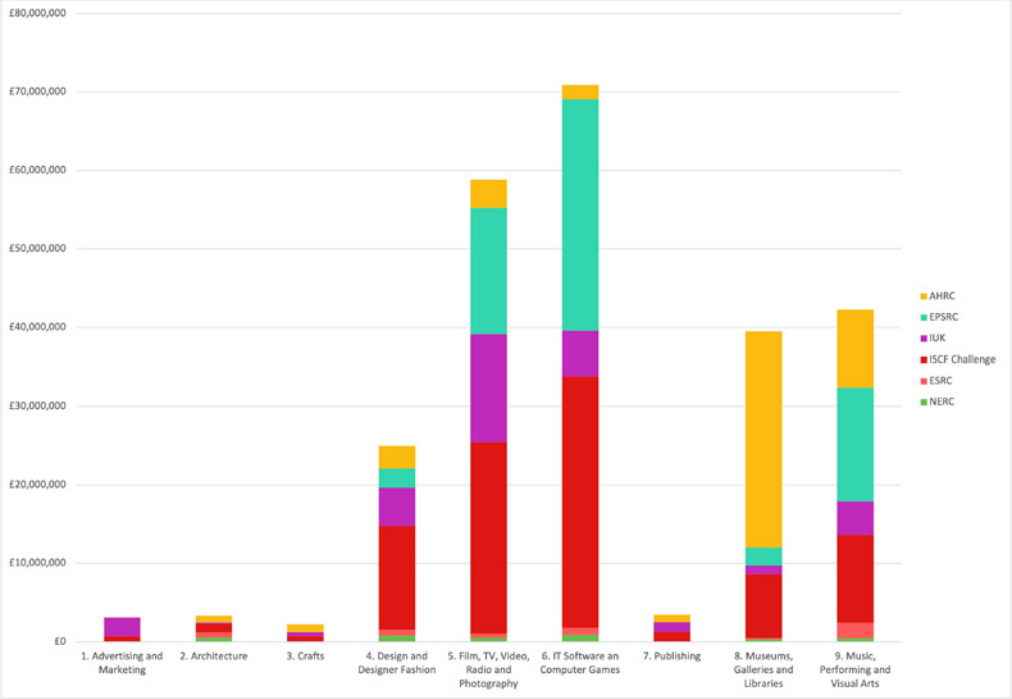


Figure 9. UKRI Investment in Creative Industries qualified by Creative Industries Intensity Scale mapped to Creative Industries subsectors, cumulative by Council or intervention.

This contrasts with four Creative Industries subsectors which receive comparatively little investment from UKRI:

- **Advertising & Marketing** is perhaps the most puzzling as a sector heavily enabled (and also disrupted) by digital technology and often thought of as an avid adopter of insights from the behavioural sciences. The UK advertising industry is the second largest in the world, globally competitive and advocates for new CreaTech business models but engagement with UKRI is very limited despite the technological, ethical and regulatory challenges the industry has itself identified (see 5.2 below).

- **Architecture** currently receives little investment from any of UKRI's councils or from the Challenge Fund programmes. Given the challenges of design and construction in relation to Net Zero, of the links to advanced visualisation, simulation and digital twinning this looks to be an area of opportunity in the innovation space, though academic research in architecture remains a relatively undeveloped discipline.

- **Crafts**. As the smallest of the Creative Industries subsectors by value it is perhaps unsurprising to see Crafts receive the smallest amount of research and innovation funding. However, there may exist place-based opportunities to support innovation in rural economies through Crafts which would offer significant return on limited levels of investment

- **Publishing** is an industry that faces significant challenges that one might think would be tractable to R&D. Academic publishing in particular faces a time of significant transition with new platforms, AI and distributed ledger technologies and a business model that almost defines a burning platform. The lack of connectivity between the publishing industry, whether trade, news, magazine or journal, and the research base seems anomalous, especially in a sector where the UK has a significant global market at risk.

Which leaves the ninth subsector, **Design and Designer Fashion** somewhere in the middle, engaged by multiple councils and with significant growth in UKRI funding over the last 3 years.

- **Design and Designer Fashion** - The Challenge programmes have invested significantly in Fashion R&D with the establishment of two fashion clusters committed to sustainability and funded by AHRC as part of the Clusters programme. Fashion companies have been successful in applications to InnovateUK's recent Sustainable Innovation Fund and there has been cross-council dialogue between AHRC, IUK and NERC to incorporate sustainability in fashion, textiles as a vital sector for the development of a circular economy. Design research and the wider design sector have also a potentially significant role to play in delivering the transformation needed to achieve Net Zero living, through the fields of human centred, service, and policy design and the field of design futures (world building). Design and its contribution to achieving a cleaner environment and sustainable growth looks like an area of opportunity for pan-UKRI challenges and missions.

This deep dive into UKRI's current portfolio is by no means a perfect, nor does it provide a definitive picture but this data does provide some reflection of the relative power of UKRI's current investment and contribution to different Creative Industries sub sectors. We hope it might also provide some insights and provocations in terms of new opportunities for UKRI. The sector of course has its own ideas about its future research and innovation needs.

5.2 UKRI's Creative Industries Portfolio: Geography

There has been significant attention paid to the economic geography of the Creative Industries over the last decade. The broad outlines are clear – The Creative Industries are present in all nations and regions of the UK and are significant contributors to the economies of many city regions but with a significant weighting in both employment and turnover to London, to a degree exacerbated by headquartering effects. Nesta's influential study, The Geography of Creativity (2016), identified 47 areas they termed 'creative clusters' across the UK that had significant potential for growth arising from the critical mass of creative businesses within their local economy.

With the increasing importance of place as a policy driver it is necessary to develop an understanding of the geography of UKRI's current engagements with the Creative Industries, the relationship between the distribution of the sector and of research excellence and any opportunities for future place-based interventions which might contribute to future policy imperatives around regional economic growth, levelling up or resilient regional or place-based economies.

Fig 10 maps the location of participants (research organisations, IROs, businesses) in the 885 Creative Industries projects that we have identified across UKRI. Encouragingly it demonstrates that UKRI investments are widespread across the UK Nations and regions with investments in all major city regions and the university network clearly identifiable as might be expected for the mapping of any large research

field. **Figure 11** maps the level of investment by geography and again shows a pan-UK distribution with a significant level of investment in Scotland (Tayside as well as the central belt) Northern Ireland (Belfast) and Wales (Cardiff city region), in Yorkshire, the Northwest, the Midlands, Bristol, Bath and the wider South West, Brighton, Oxford and the M4/M40 corridor to the West of London as well as in the capital itself.

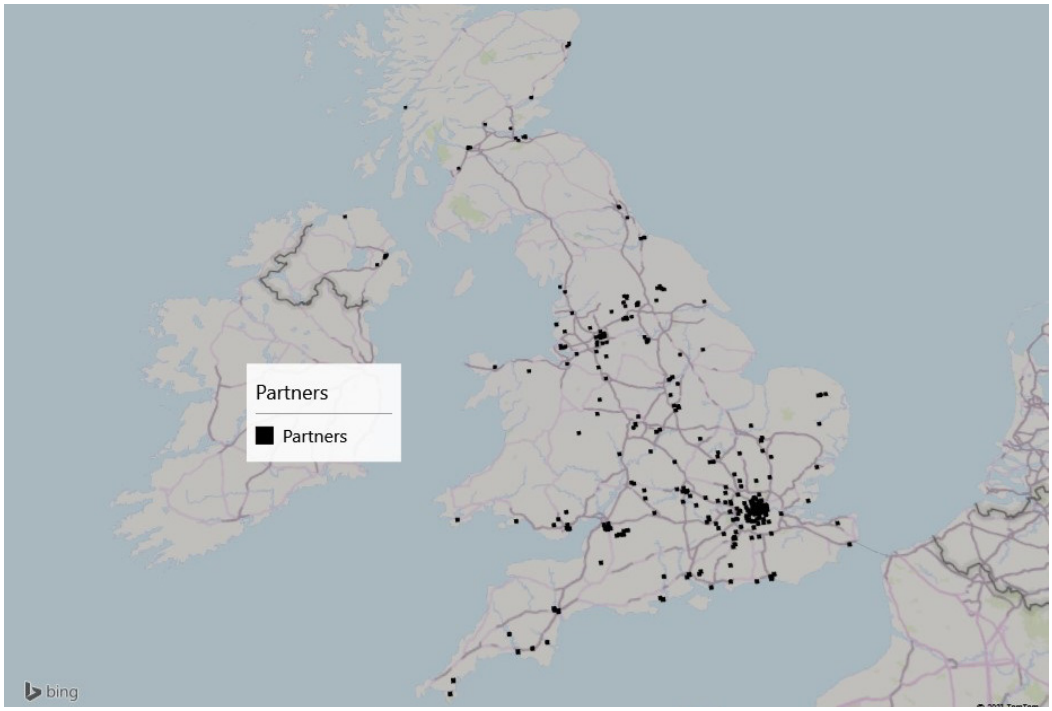


Figure 10. Geographical distribution of participants in UKRI Creative Industries projects across all Councils

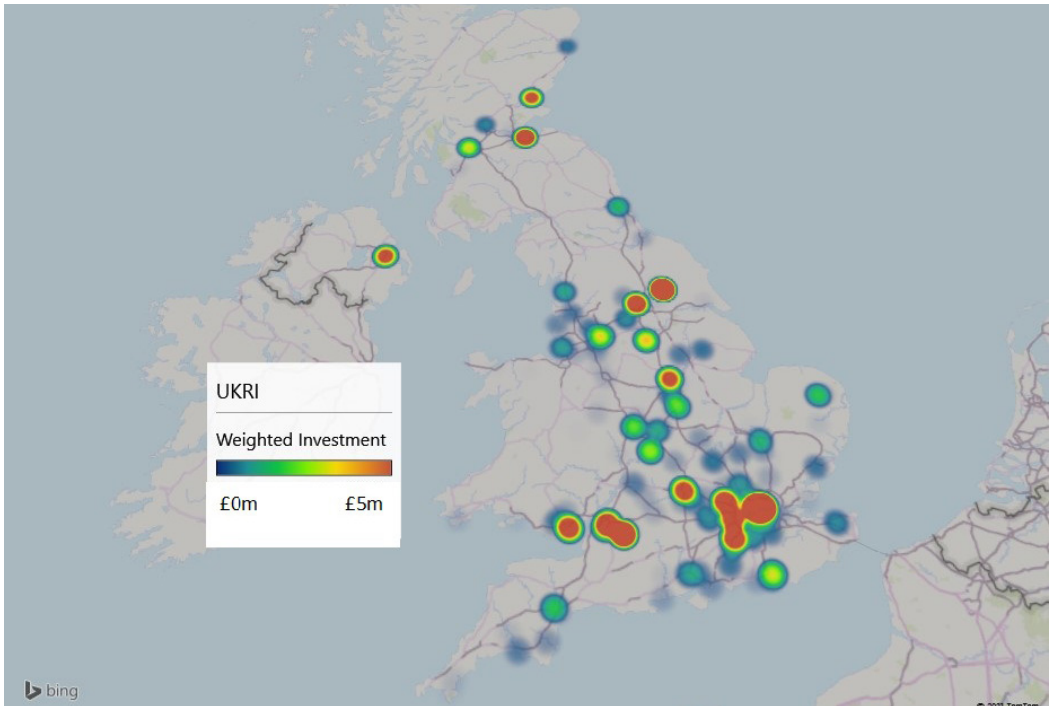


Figure 11. Heatmap of distributioin of weighted UKRI Creative Induystris investment across all councils by project by location of project participant

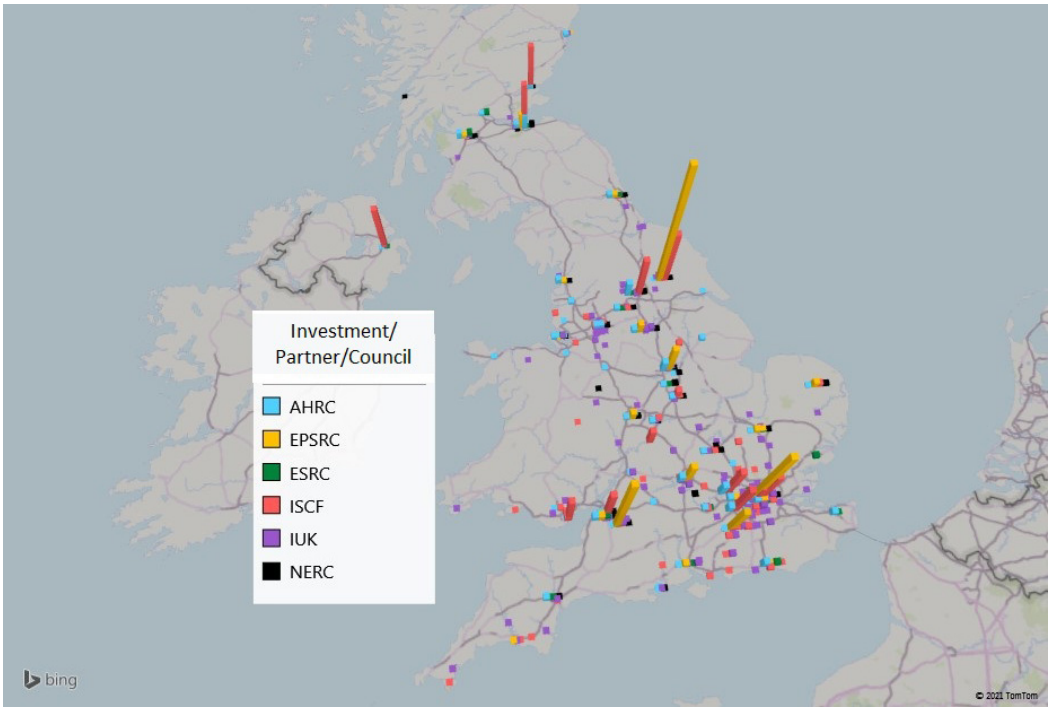


Figure 12. Geographical distribution weighted UKRI Creative Industries investment by location of participants by Council. Height of column representing size of individual investment. associated projects

The overall picture here is of a geography significantly different to that of the 'golden triangle' and its institutions and one where UKRI's Creative Industries portfolio has the potential to engage with and support place-based initiatives across the nations and regions of the UK. However, **Figure 12** shows that there is a degree of nuance underlying this UKRI-level geography with each council's interventions having their own particular geography. We consider this for each council in the Appendix but as Figure 12 shows whilst AHRC and IUK contribute the widest reach in terms of geography, the investment distribution is largely driven by significant centre- or cluster-based investments from EPSRC and the ISCF programmes with the latter being particularly influential in the Nations.

5.3 Matching UKRI's capabilities to future opportunities in the Creative Industries

In June 2020 the industry members of the Creative Industries Council presented a Transition and Recovery Plan to the government co-chairs of the Council SoS BEIS and SoS DCMS with Research and Innovation as a central plank of their proposals for Covid recovery and return to growth. A more detailed plan developed by the CIC's Research and Innovation Working Group identified a series of innovation challenges faced by industry each of which also represented an opportunity for economic recovery and job growth in the short-term and increased UK competitiveness in the medium and longer term.

- Access to excellence in research and innovation right cross the UK to support place-based, innovation-led growth;
- An advanced digital infrastructure for R&D to support innovation in the screen sector outside London (StudioUK);
- A talent pipeline for high level innovation skills for creative R&D;

- Significantly enhanced support for research, collaborative R&D and adoption of advanced technologies, particularly AI/Machine Learning but also data and distributed ledger technologies, 5G and virtual production across the Creative Industries;
- Investment in new R&D capabilities to connect the Creative Industries with healthcare, education, automotive and other high value sectors;
- A sustainable fashion programme to tackle the challenge of the impact of fashion on the planet, its people and communities;
- Support for R&D to decarbonise the sector from production to distribution.

The report acknowledged the significant contribution UKRI and its councils have made to the sector's increased awareness of, and engagement with, R&D. The CIC now recognise that innovation is key to the sector's future growth and competitiveness and UKRI is a key partner in that growth. It is a sign of how central UKRI is to the CIC's thinking that the capabilities we have invested in across our current portfolio, for all that they are relatively recent, match so well to the future needs of the sector.

AI-driven design by Away to Mars with BFTT Cluster (CICP)

UK Research and Innovation

6 UKRI and its International networks

UKRI has developed a strong international presence with regards to the creative industries sector and creative research and innovation, drawing on the UK's significant reputation in this area. Working closely with UKRI international teams and key partners such as DIT and the British Council, these international partnerships across a growing number of countries are helping to bolster the UK's global competitiveness in what is a huge national cultural and economic asset.

To develop these international creative partnerships UKRI has drawn on a range of interventions and investments across Councils. Innovate UK's Global Expert Missions (GEM) and Global Business Innovation Partnerships (GBIP) have been deployed to develop new networks, strategic partnerships, test markets and shape future bilateral collaboration programmes; the Newton, GCRF and Fund for International Collaboration (FIC) programmes have built powerful new research, and industry partnerships around the Creative Industries; a range of wider engagement and showcasing activities have been used to build the profile and highlight the success of UK creative R&I; and individual investments made through other programmes are working increasingly with global creative companies.

A number of priority territories and programmes have grown from these interventions:

- **China** – AHRC's long standing partnership with the Shanghai Theatre Academy, one of the hosts of its International Partnership Scheme, has helped to form the basis of a growing programme of R&I focused on the Creative Industries. The Newton-funded AHRC 'Development through the Creative Economy in China' programme has been followed by the major FIC-funded 'UK-China Creative Industries programme', a collaboration between AHRC, IUK, EPSRC and a range of Chinese partners. It seeks to develop research-industry partnerships between the UK and China across a range of subsectors and themes of mutual interest and has culminated in eight large-scale UK-China research-industry Creative Partnerships being established. These projects, co-funded by Chinese partners, focus on areas ranging from innovation in sustainable fashion to immersive experiences in museums and cinemas, and they are bringing together UK organisations, including Aardman Animations, Harris Tweed, and the Tate galleries, with Chinese bodies such as HTC, Shanghai Yue Opera House, and the Shanghai Science & Technology Museum. The programme as a whole has highlighted a clear example of the diverse benefits of UK-China research and innovation collaboration in this sector. This programme has run alongside a number of IUK missions to China, focused on developing links around immersive technologies.

- **US and Canada** – GBIPs around immersive technology have been funded by IUK to explore future potential partnerships and business opportunities, in 2020 being connected with a Global VR/AR Summit and the DIT immersive technology mission. UKRI has also had a significant presence at the past three SXSW Festivals, including 'Audience of the Future Live' at UK House, hosted as a 3-day programme of events showcasing the best of projects across CICP and AotF and significantly raising UKRI and the programmes' profile. The collaboration between NRC Canada and UKRI - a joint 'Research and Innovation Pilot Program', led by IUK - funded R&D projects and networking activities across five themes, one of which focused in part on immersive technologies.

- **South Korea** – a virtual GEM was funded by IUK in 2020 to develop links with the burgeoning immersive market in South Korea, with the wider mission covering immersive content, Gaming, Healthcare, Training/Education and Manufacturing/Engineering. Work has been ongoing with the British Chamber of Commerce in Korea and Brainpark teams in South Korea as well as the SIN in Seoul to deepen the partnership opportunity.

- **India** – IUK has led Creative Industries GEMs to India that have resulted in a Sustainable Fashion programme developed in collaboration with DIT and UKRI India commencing in 2021/2

- **Turkey** – through the Newton Fund AHRC jointly funded the UK-Turkey Creative Industries Research Networking call as part of a partnership with the Istanbul Development Agency. This opportunity is currently being built upon in part through a wider opportunity linked to the UN International Year of Creative Economy for Sustainable Development 2021, for which AHRC is developing a follow on funding call which seeks to enhance the impact of research on the sustainable future development of creative economies.

- **Japan** – whilst not focused explicitly on the Creative Industries, the ESRC/AHRC Japan SSH Connections grants call has demonstrated the clear interest in future programmes of activity, funding seven projects focused explicitly on the sector.

The Challenges show how the Creative Industries shares much with other parts of the UKRI portfolio, but is also distinctive. We have mentioned issues around Trusted Research with significant issues over IP protection and regulation. This itself offers interesting opportunities for research conducted for the Creative Industries. There are issues over definition, misaligned priorities and mismatched budgets and timescales. But the appetite for engagement is clear and growing.

And there is no question that one of the most important countries, where mutual capacity building and powerful economic interests converge across the Creative Industries and the current political landscape, is India.

Specific interventions have also been designed to attract global creative companies to collaborate and invest in R&D in the UK. The Global Partners Initiative aimed to make global creative, media and technology companies aware of the capabilities of the UK creative innovation ecosystem and to engage them with it and attract FDI. It drew on funding from Audience of the Future and utilised the expertise and networks of the Creative Industries Clusters Programme to deliver the collaborations. Run as a partnership between UKRI and selected Clusters partnerships, the programme has stimulated a broad and diverse set of R&I activity and aims to draw long-term and sustainable international investment into the UK creative economy. Discovery Communications and Warner Media were selected to participate in the pilot programme, and the pilot projects have delivered prototypes, developed strong partnerships with two global companies and established a model for similar activity in the future, with clear interest shown in the model by DIT.

Individual investments have also used their growing profile and success to develop strong international links. Future Fashion Factory, one of the Creative Clusters, has developed a strong relationship with Burberry as one of their core partners, leading to collaborations such as the 'Burberry Hackathon' which gave students the opportunity to redesign some of Burberry's iconic fashion items. The Creative Industries Policy and Evidence Centre (CIPEC) has also developed a strong international presence through the formation of its International Council, a network of leading policy and creative economy practitioners from across the world, convened by The British Council. This group gives the PEC critical international creative economy policy intelligence, and acts as an international sounding board on the PEC's activities and potential future collaborations.

UK Research and Innovation

Case Study: Shaping the Connected Museum

Funded through the UKRI Fund for International Collaboration as part of the AHRC/EPSRC/IUK Creative Industries in China programme, 'Shaping the Connected Museum' is exploring how to connect museums, their exhibitors and visitors between China and the UK. The project is a collaboration between research and industry bodies in the UK and China. Collectively, the interdisciplinary, international team is exploring how both exhibits and visitors can project their presence across remote sites to enable cross-cultural visiting experiences.

The project will enable Creative Industries in both countries to deliver interactive visiting experiences that connect museums across the UK and China, including through the development of 'Gift', a web app that enables visitors to create personalised museum tours as gifts for one another, and 'Visitor Box', a deck of ideation cards that support the design of digital museum experiences. These will help open up a potentially vast market for their work overseas while strengthening their position in their home markets. Industry partners are playing a crucial role, through business expansion and exporting, providing office space in Shanghai, and dissemination of project outputs at industry conferences such as Museum Next, Remix and BAFTA. The lead industry partner in the UK is Factory42, who are also leading the Dinosaurs and Robots Audience of the Future Demonstrator. We have included this example in part because it shows how Creative Industries can operate successfully in contexts where other research areas may not be so straightforward in the new context of Trusted Research, and thereby keep open important economic relationships.

'Dinosaurs & Robots – Factory 42 (AotF)

UK Research and Innovation

7 Public Engagement

The Creative Industries form an important part of the public engagement programme for all research activities, with many research teams utilising film and video to disseminate learning. The capture of research material in the form of archives also forms an important part of the research process. There are numerous examples across projects funded by all Research Councils of collaborations with museums and galleries – with those partners then exploiting the material to generate content for exhibition and, in some cases, further research.

Our Future Planet, the new gallery that will reopen the Science Museum after lockdown and which explores Carbon Capture and Storage technologies has received support from UKRI and demonstrates how the GLAM sector of the Creative Industries can provide spaces for public engagement that spans the range of UKRIs activities – climate science, archaeology, space science, humanities, AI and a host of other UKRI-supported research disciplines.

Creative businesses are often a natural ally for public engagement. UKRI plans for COP26 in Glasgow later this year, for example, include researchers supported by NERC and the British Geological Survey, working with ScanLab – an ISCF funded SME – exploring the role of human action in changing landscapes. Other projects being supported to promote awareness of UKRI research on climate change involve advertising agencies, as well as designers and film-makers.

The AHRC plays a particularly important role in promoting the value of research in creative business. Its Research in Film Awards, for example, celebrate the best in academic filmmaking. Since 2015 it has inspired researchers across the UK to think more deeply about how they share their work with the wider world. Previous RIFA winners have gone on to secure funding for new productions, have been screened at major film festivals, and even been nominated for – and won - BAFTAs.

Being Human is the UK's only national festival of the humanities. A celebration of humanities research through public engagement, it is led by the School of Advanced Study at the University of London, the UK's national centre for the pursuit, support and promotion of research in the humanities, in partnership with the AHRC and the British Academy. In November each year the festival features around 300 events across the country, working with an average of around 80 universities and research organisations in 50 towns and cities to make research in the humanities accessible to non-specialist audiences and demonstrate its relevance to our everyday lives.

AHRC is not the only Council to use exhibitions or festivals to promote its research. The MRC supported London Institute of Medical Science has a long history of developing and delivering public engagement with science projects from comic books and school workshops to arts collaborations, science festivals and 'Biomedical Picture of the Day'.

Research England also supports investments working with the sector through a range of open and targeted knowledge exchange schemes. Whilst also not hypothecated, HEIF currently supports around £16m of public engagement activities, many with the creative and cultural sectors, and the returns from KEF Clusters Arts Specialists highlighted a number of HEIF funded activities working directly with the creative industries sector.

UK Research and Innovation

Perhaps the best illustration of the importance of public engagement with and through the Creative Industries is the forthcoming 'Festival 2022'. Festival UK* 2022 features 10 ground-breaking commissions designed to reach millions, bring people together and showcase UK creativity globally. These highly ambitious creative projects are being developed by researchers and practitioners drawn from Creative and STEM subject areas, with UKRI-supported researchers and businesses involved in almost every team selected to lead the festival next year. **StoryFutures**, one of the ISCF funded Creative Clusters R&D partnerships is unique, however, in actually leading a Festival UK* 2022 project working with some of the UK's foremost Creative technology companies SMEs. *The People's Archive of Now* will use 5G and new developments in persistent Augmented Reality to bring the UK's national film and television archives to life in our present-day surroundings. Interactive showcase events across the country will celebrate and challenge our civic histories under the guidance of Creative Director David Olusoga.

'Virtual Veronese' launch at The National Gallery, StoryFutures (CICP)

UK Research and Innovation

8 The Current Policy Landscape

Significant regional and national investment in the Creative Industries over the last 20 years has tended to focus on regeneration and economic development. Creative industries are well spread across regions, and can make substantial differences where traditional industries have weakened. A very good example is Northern Ireland where the Creative Industries which include, and are to an extent spearheaded by the AHRC Cluster Future Screens Northern Ireland, far outweigh the traditional fishing industry in terms of GVA and are playing an increasing role in political decision making.

Increasingly the connection has been made between R&D investment and local growth. The Sector Deal was itself a response to Sir Peter Bazalgette's Independent Review of the Creative Industries 2017 which was among the first documents to properly appreciate the importance of investment into R&D as a core element of a strategy for sector growth.

The ISCF *Creative Industries Clusters Programme* and *Audience of the Future* together make up nearly £100m of investment into Creative Industries R&D – and form a central feature of the Government's Creative Industries Sector Deal. This was cited by the Industrial Strategy Council in October 2020 as an example of an effective sector-based approach to industrial intervention.

The *Creative Industries Clusters Programme*, the new *Creative Industries Policy and Evidence Centre* (PEC), and the four AotF Demonstrators were identified as a case study in the Government's R&D Roadmap in 2020 . Research and Innovation was a core theme in the Creative Industries Council Recovery Plan of 2020, with UKRI identified as the key partner in both shaping the plan and delivering it. This plan laid out the current R&I needs of the Creative Industries for an innovation-led recovery from Covid:

- Expansion of place-based access to multidisciplinary R&I;
- R&I support for sectors hit hard by Covid to develop products, services and audience channels;
- AI research and adoption across sectors;
- Advanced digital technologies in transformation of production to make UK a global destination for production and inward investment;
- R&I for key economic sectors not yet well served – music, advertising, publishing;
- Revision of operation of R&D tax credits to provide greater access to Creative Industries businesses.

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf

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Levelling-up has also been a consistent theme and priority for the Creative Industries Council, with the *Creative Industries Clusters Programme* celebrated as a model of good practice – allocating funding to nine hubs across the Nations and Regions, and empowering them to leverage and catalyse new investment in R&D. Many Clusters engage in mentoring and other best practice which means they are both leveraging income and influencing behaviour across the ecosystem. City Deals are increasingly identifying Creative Industries as a potential strength and investing in R&I facilities and activities; examples include Belfast, Edinburgh, Cardiff, and the combined authorities in Manchester and West Yorkshire

The Plan for Growth, the government's most recent statement of economic policy, mentions the Creative Industries no fewer than eight times, picking the sector out alongside AI, Life Sciences and Net zero as key growth areas driven by Research and Innovation. It is important therefore that in the forthcoming Innovation Strategy, particularly in the Global, Talent, Technology, Place and Finance Pathways, a clear case can be made for the Creative Industries. And given both the history and the potential explored in this Deep Dive, that case should be vigorously made by UKRI.

Digital Creativity Labs
at the University of York

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9 UKRI and the Emerging Creative Research & Innovation System: Conclusions and Recommendations

As can be seen from this Deep Dive, UKRI has been integrated from the beginning in the success of the Creative Industries, and this success is a pervasive part of what we do. In manifold and sometimes unexpected ways, the Creative Industries add to the richness of our research.

They represent moments of convening, catalysing, conducting and incentivising through major investments. They help build a rich ecosystem partly because of the intensely transdisciplinary nature of their work, and the broad distribution across the UK and across a landscape of SMEs. By no means all enquiry or experimental research happens in universities – arts and cultural organisations, SMEs and practitioners all develop new knowledge as well as applying it.

They are also contributing to a necessary transformation of arts and humanities, where creative industries are supporting jobs-focused education and taking the place of more traditional subjects in some post-1992 institutions. This is one reason why DfE's decisions regarding the teaching grant are troubling, but we believe that these subjects will continue to positively influence and refresh the sector.

This diverse research ecosystem is increasing connectivity across disciplines and borders to generate new ideas and approaches, and we have identified some of the areas where more can be done. It is our hope that this document can inspire more ideas and more cross cutting initiatives.

We also believe that the role of the Creative Industries offers extraordinary examples of improving social resilience, both through their own success in the pandemic, and through the indubitable role of culture of all kinds, delivered online, to sustain communities and individuals through long months of lockdown. The opportunities uncovered now offer opportunities for sustaining models of accessibility which will transform the lives of those who had for long been excluded from such events through disability or locality.

UKRI's research in, about and for the Creative Industries thus reaches into the very heart of our communities. This nexus of innovative thinking, rooted in design and imagination, delivered across multiple platforms and methods, is the backdrop to our 21st century experience, from advertising and architecture to the digital native Generation Z.

We believe that this strand of research also reflects what is best and most compelling about the transdisciplinary and cross cutting nature of UKRI's role in research and innovation.
Our three recommendations as we close this Deep Dive are as follows:

1. That UKRI works strategically alongside BEIS and DCMS to secure a clear and significant commitment in R&D investment in the Creative Industries, to sustain our pivotal role

2. That UKRI continues to support, recognise and strengthen the cross-cutting collaborative potential of the Creative Industries as it does other transformational technologies and themes.

3. That UKRI licenses the existing liaison bodies, including the Creative Industries Advisory Group, which currently reports to the ISCF Steering Board and the AHRC Council, to take a stronger and more prominent lead in convening and catalysing the potential for further growth and innovation, and keeping the deep dive under review.

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Appendix
UKRIs Creative Industries Portfolio

10.1 AHRC

CI Investment (2016-) £48.5m
Projects. 365

Overview

AHRC supports the core arts and humanities disciplines that drive the Creative Industries – from architecture and design, to the visual and performing arts. The breadth of AHRC's portfolio spans research and innovation about, with, and for the Creative Industries and is the widest of all UKRI's councils with 365 Creative Industries related projects in the last 5 years.

As the mapping data below demonstrates, AHRC's investments span all nine subsectors of the Creative Industries, but with a clear concentration within the Museums, Galleries and Libraries, and Music, Performing and Visual Arts subsectors and significant investments in Design and Film & TV. Types of interaction are spread across all subsectors, with AHRC-funded awards engaging through basic research, applied research and direct collaboration. In terms of budget, however, the AHRC's commitment to supporting the UK's Galleries Libraries and (particularly) museums sector is very clear with recent major investments in the sector. It might surprise some that those projects and schemes with the greatest Creative Intensity, i.e. those that work most directly with the sector, are the focus of the majority of AHRC's funding. In terms of geography AHRC's portfolio is well dispersed across Scotland and all the regions of England, underpinned by the research-intensive universities and its portfolio of IROs.

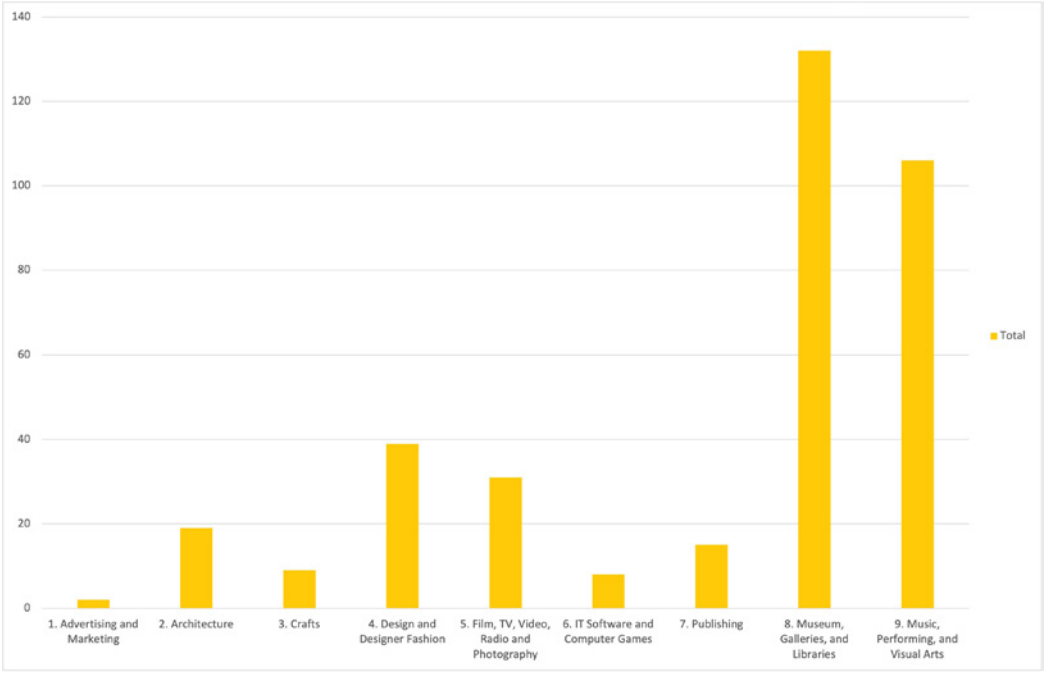

Figure 13.
AHRC Creative Industries projects by CI subsector. n=365

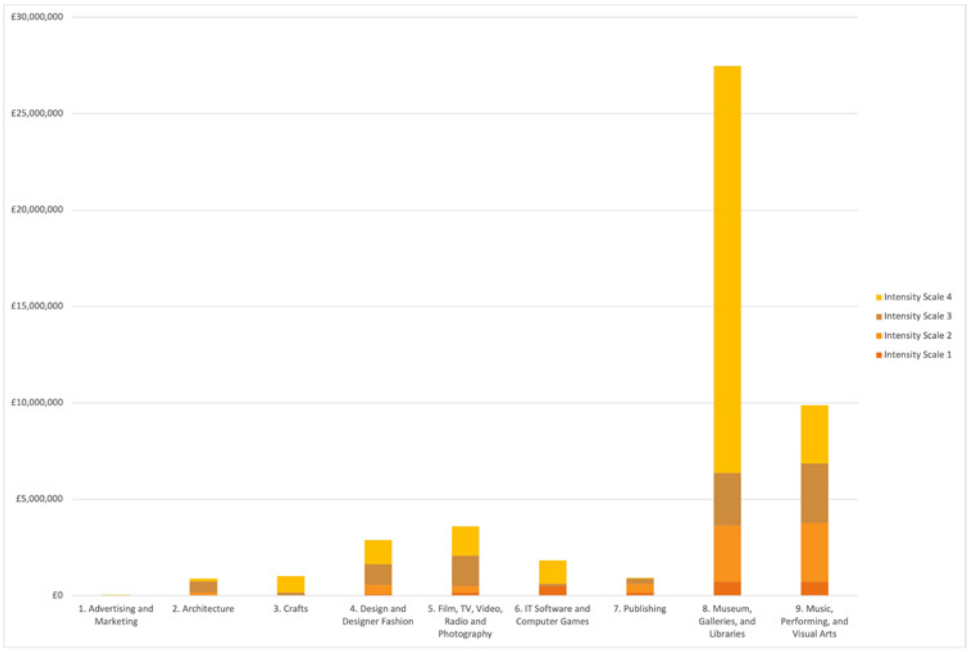

Figure 14.
AHRC Creative Industries investment by subsector and qualified by Creative Intensity Scale

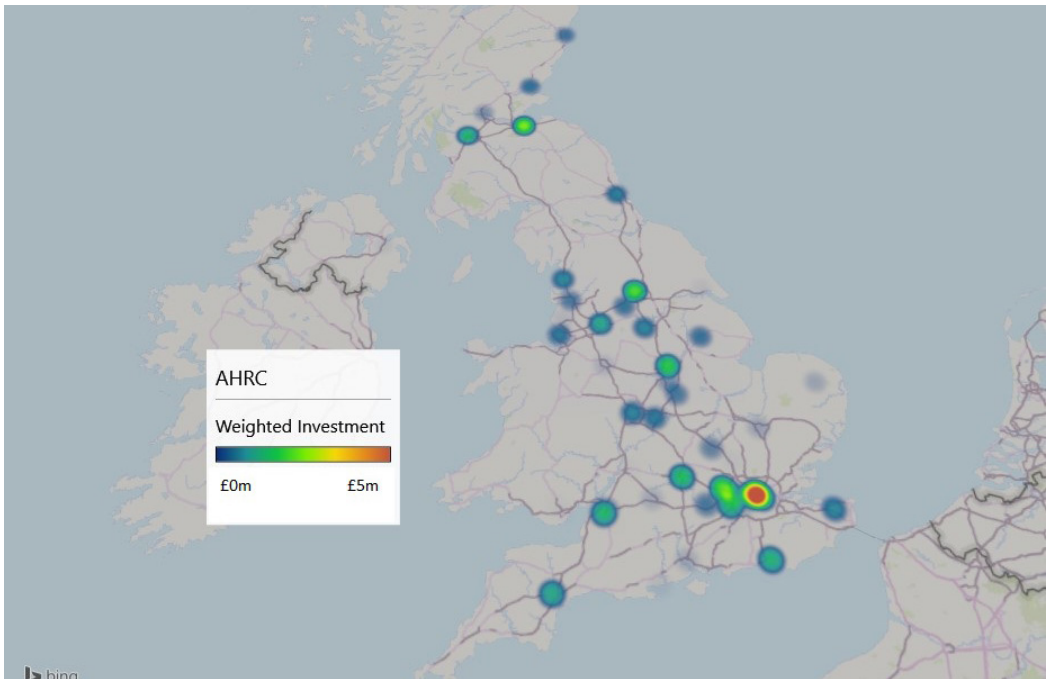

Figure 15.
Geographical distribution of AHRC Creative Industries investments across UK. Heatmap of level of investment by location of funded participants.

Interventions

AHRC has live responsive mode research grants in each Creative Industries subsector, which range from discovery research about the sector to highly applied research working with creative businesses and cultural organisations. Increased impact of AHRC funded research within the Creative Industries is supported by access to AHRC's Follow-on Fund, and open calls such as the current 'Where Next?' initiative, which includes a project focused on sustainable materials in the Creative Industries, are helping to develop the evidence for future potential programmes and partnerships.

Alongside a number of core skills interventions such as design-focused CDTs and Collaborative Doctoral Partnerships funded with major cultural institutions, AHRC has also funded a wide range of strategic skills initiatives to strengthen the Creative Industries research pipeline through engagement with the sector and development of relevant knowledge and skills. This includes both the Creative Economy Engagement Fellowships and AHRC's recent commitment to forward funding of StoryFutures Academy, the national centre for immersive skills originally established as part of the Audience of the Future Challenge.

AHRC also funds a wide range of targeted schemes aiming to directly address particular challenges, research themes or subsectors within the Creative Industries. From directly commissioned research and partnerships such as What's Up with Everyone and the British Fashion Council Circular Fashion Ecosystem Fellowships, to targeted schemes such as Next Generation of Immersive Experiences, funded in collaboration with EPSRC to support the development of research partnerships exploring the creation of new immersive experiences. The £18.9m Strategic Priorities Fund programme Towards a National Collection is deepening the Council's engagement with the GLAM sector, taking the first steps towards creating a unified virtual 'national collection'. AHRC also funds direct business engagement and collaborative R&D initiatives – the KE Hubs for the Creative Economy for example aimed to develop academic research and partnership programmes with creative businesses and acted as a key stepping-stone to the AHRC-led CICP that has followed.

Whilst many AHRC investments have policy-focused impact of relevance to the creative sector, AHRC has also funded initiatives that work directly with policy-makers. The Policy and Evidence Centre for the Creative Industries (PEC) provides independent research and evidence to support policy-making for the UK's Creative Industries, with outputs stretching across skills, IP, diversity and inclusion, geography of the sector, and international competitiveness. AHRC also works directly with DCMS, including on 'Boundless Creativity', the report for which identifies potential interventions across the cultural sector, detailing the impact of coronavirus, the innovative responses by the sector, the factors that limit that response over the short, medium and long-term, and the lessons for the future.

Excitingly, with support from across UKRI, the development of the UKRI Infrastructure Report has led to AHRC leading the development of three research and innovation infrastructure bids which relate directly to the Creative Industries. CoSTAR, as discussed earlier, is at business case stage, and plans for a National Institute for Digital innovation and Curation in the Arts and Humanities are in development as part of the UKRI Digital Research Infrastructure. It will establish a national distributed research infrastructure comprising a growing family of specialist data services and an Institute HQ to provide strategic oversight of access and to develop curatorial expertise and best practice. A bid is also being refined for a Research Institute for Conservation and Heritage Science Research – a distributed, UK-wide infrastructure, strategically connecting, integrating, co-ordinating and enhancing existing provision and expertise in institutions across the UK and ensuring that the UK remains world-leading in this field.

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Case Studies

AHTV and TVPhD
TV PhD is a scheme that gives AHRC-funded PhD students the opportunity to learn more about the TV industry delivered in partnership with the annual Edinburgh Television Festival. AHTV provides a programme of sessions and networking opportunities bringing together arts and humanities researchers and television professionals, creating a space for dialogue and knowledge sharing about all aspects of research and industry practice.

The partnership provides a high-profile platform at the Edinburgh TV Festival to showcase AHRC's work with researchers and provide unique access to a broad network of industry partners. It gives arts and humanities researchers the opportunity to learn about all aspects of the television industry, and for the industry to engage with the skills and knowledge of researchers.

The projects have delivered measurable and significant outputs, including:

- The Edinburgh Television Festival TV PhD Live Pitch received 1,994 live views, the most popular festival session in terms of live views;
- Three TV PhD calls in 2018, 2019 and 2020 have enabled 36 AHRC funded PhD students to embed themselves in the television industry;
- Engagement from producers including BBC, Lion TV, NatGeo and Amazon Studios;
- The third edition of AHTV, held during lockdown in 2021, had an extended digital offer of 11 sessions, 4 roundtables and 156 speed meetings and reached 766 registered delegates;
- 80% of 2020 participants strongly agreed that their awareness of the television industry had improved, and 93% agreed their professional networks had been enhanced.

Invisible Difference
Invisible Difference, funded as an AHRC grant and follow-on-fund project, brought together dance, law and disability to understand the economic realities for disabled dance practitioners, how we value dance made by and performed by disabled dancers, and how dance made by disabled artists find its rightful place in our cultural heritage. The project challenged perceptions of disability in society, a theme that continues to resonate across all the Creative Industries.

The key features of the project include investigating intellectual property and copyright, human rights and disability and choreographic processes – art form development/practice based research as well as developing a digital tool kit for educational purposes and activities and dissemination to drive attitudinal change both within the sector and wider audience.

The research provided evidence for policy reviews via Arts Council England and Creative Industries Scotland. This was further supported through Follow on Funding Resilience and Inclusion Dancers as Agents of Change enabling the creation of a digital toolkit with disabled dance artists to improve accessibility to physical spaces.

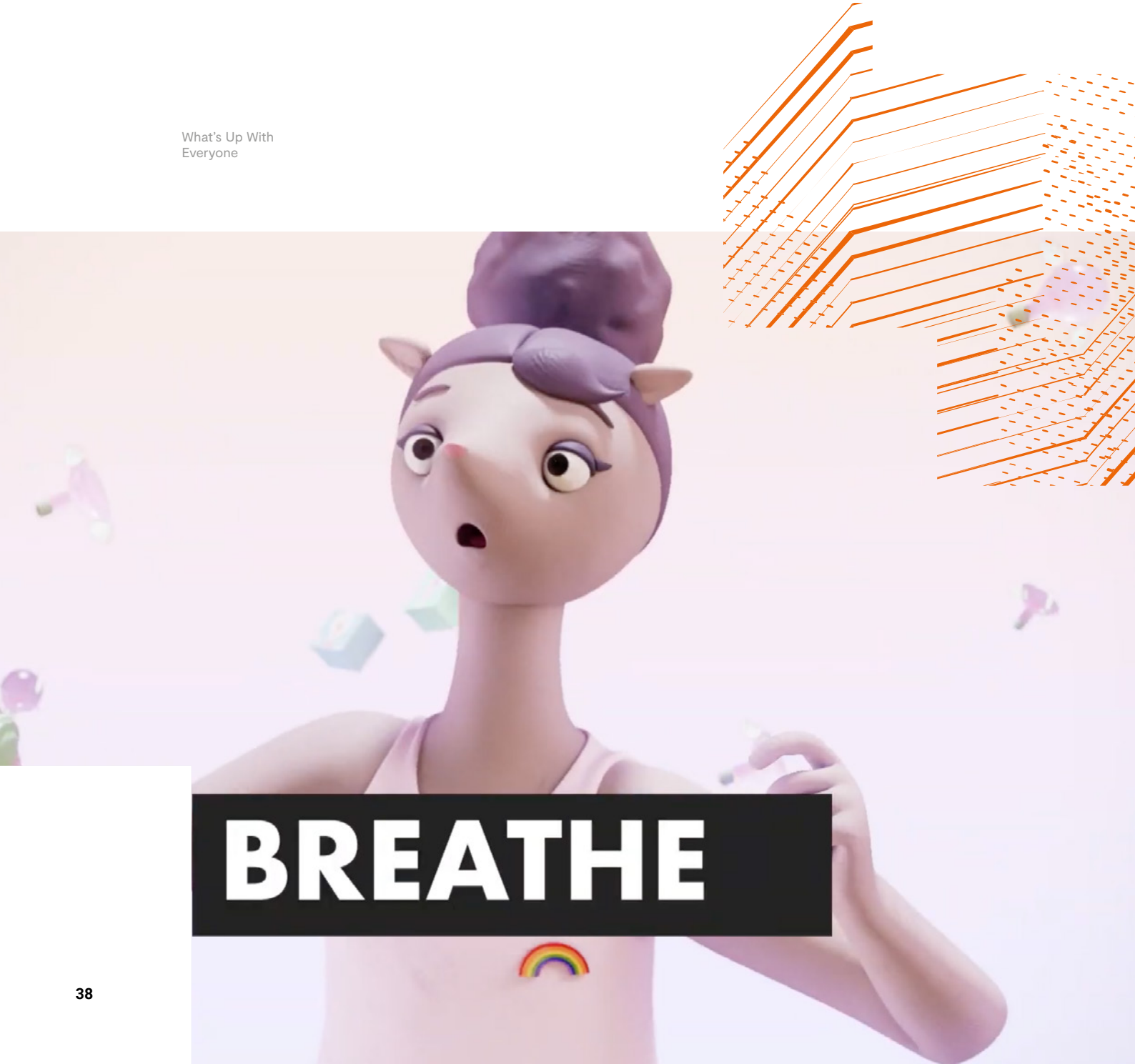
What's Up with Everyone
The What's up with Everyone project brings together leading academics with the multi-award-winning animation studio Aardman to tackle the mental health crisis in young people. Through the project, young people struggling with mental health issues arising from challenges such as loneliness, perfectionism and competitiveness, will be supported by a series of animated films and a companion website.

UK Research and Innovation

This project translates evidence-based mental health research into accessible animated films created by Aardman, and analyses the impact of the films on young people. It has also launched a mental health campaign to disseminate the films and website, with the aim of supporting young people's mental wellbeing and improving mental health literacy. That campaign achieved a combined reach of 6.9 million across social media channels and featured on BBC platforms over Mental Health Awareness week. Partnerships with organisations included the Mental Health Foundation, and Samaritans also supported the campaign.

As well as communicating mental health research to a wide audience, What's Up With Everyone? will help further our understanding of mental health through an evaluative study of audience responses. As such this project provides a great example of what can be achieved when the creative and academic sectors come together to maximise the impact of public health research.

What's Up With Everyone



UK Research and Innovation

10.2 EPSRC

CI Investment (2016-) £64.7m
Projects. 59

Overview

Advances in AI and machine learning, sensors and signal processing, machine vision, compression technologies and the whole range of Human Computer Interaction, graphics and visualisation have had a profound influence on the Creative Industries over the last decade. Technologies emerging from the physical sciences and engineering are providing aids and tools for creative processes from design to music, underpinning new production methods for film and TV, games and performance, driving streaming distribution across mobile and fixed networks and enabling new forms of interaction between the Creative Industries and their clients, users and audiences.

As a consequence, EPSRC's wide range of investments act as the STEM foundations for the UK's Creative Industries by ensuring a strong and diversified research base in advanced computing, signal processing, AI, machine vision, acoustics, audio and graphics that underpins the Creative Industries' adoption of these technologies. EPSRC also provides direct support to the Creative Industries with targeted programmes that take a co-creation approach to engage with the needs and opportunities of specific subsectors.

We have worked closely with EPSRC to identify 59 investments directly related to the Creative Industries and these are illustrated below. The majority of projects have a high level of Creative Industries intensity and, as one might expect, the investment is concentrated in particular sectors whose competitive advantage relies on the exploitation of science and technological advance– software and games, performance, computer graphics and post-production in films and TV and to a lesser, but noteworthy extent in music and performing arts (this latter very highly valued by industry). In terms of investment, qualified for intensity, EPSRC is - recent Challenge programme investments aside - UKRI's most significant investor in the Creative Industries by monetary value, and even this data does not capture all of EPSRCs underpinning investments in CI related technologies. An initial estimate has found over 150 projects with a total investment exceeding £160m where the CIs are mentioned as being impacted by research outputs, even if initially CI was not a focus of the work.

EPSRC's contribution is and will remain vital for the UK's Creative Industries with significant opportunities to develop research partnerships with global as well as British companies. Geographically EPSRCs investments are characterised by a smaller number of major investments in centres across England focussing on creative technology which make up an important network anchoring UKRI's Creative Industries portfolio in digital STEM disciplines.

Interventions

EPSRC's Creative Industries related investments take many forms. A significant number of standard research grants are complemented by Fellowships and New Investigator awards but it is perhaps through the continued (10yrs+) support for its Digital Economy Theme and the consequent investment in the network of Next Stage Digital Economy Centres and closely aligned Centres for Doctoral Training that is EPSRC's most distinctive and highly valued contribution to Creative Industries Research and Innovation.

CDTs support a future STEM talent pipeline in significant growth areas for the Creative Industries: AI for the Games sector; music; computer graphics. The Next Stage Centres with strong industry partnerships have formed key foundations for both Audience of the Future and the Creative Industries Clusters Programme.

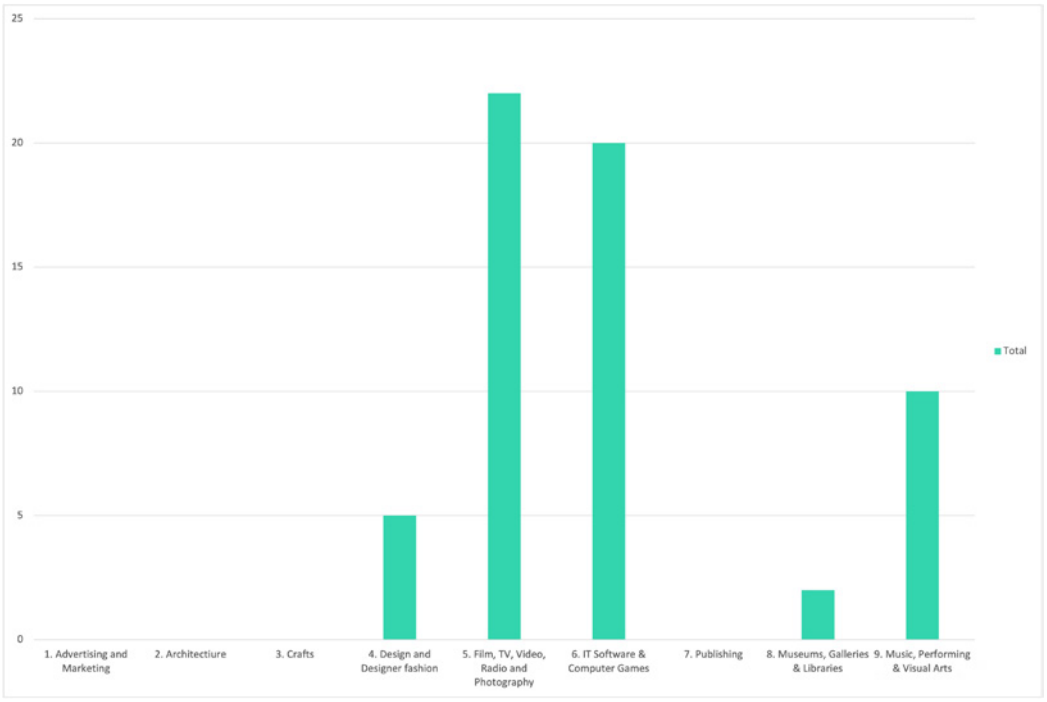


Figure 16.
EPSRC Creative Industries projects by CI subsector. n=59

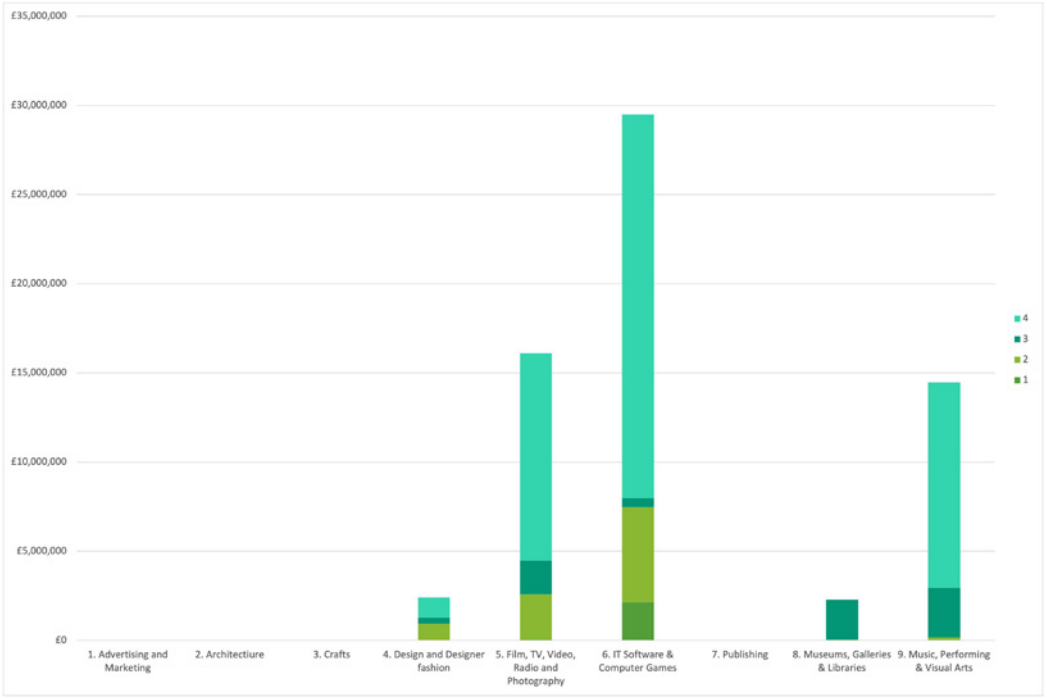


Figure 17.
EPSRC Creative Industries investment by subsector and qualified by Creative Intensity Scale

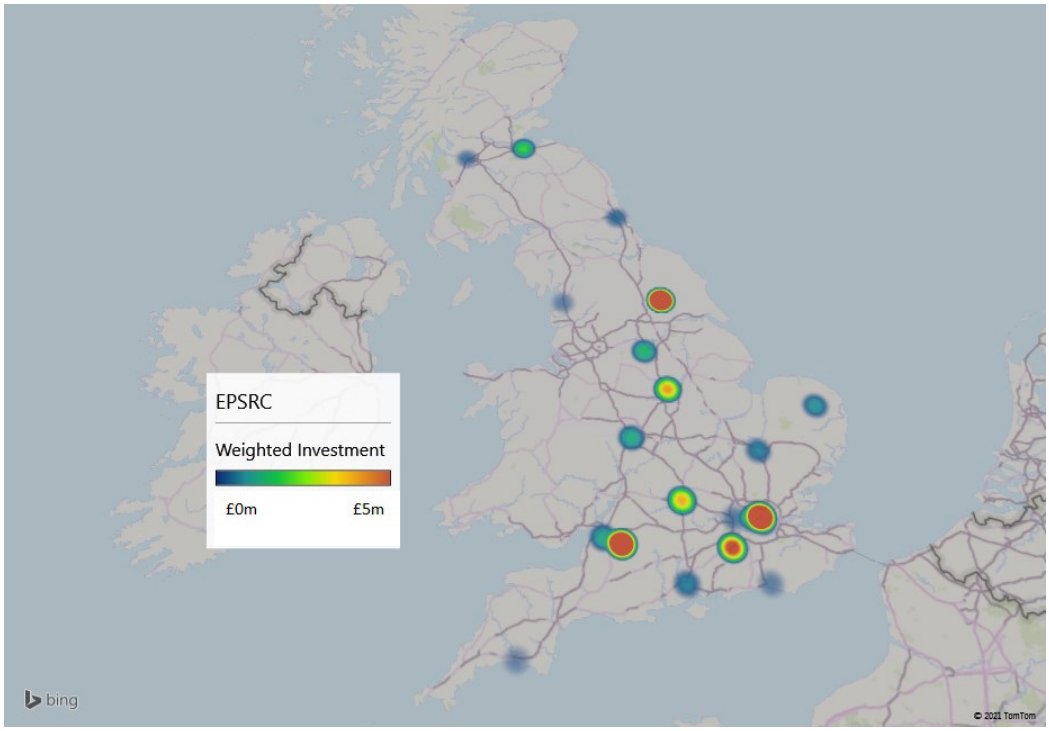


Figure 18. Geographical distribution of ESPRC Creative Industries investments across UK. Heatmap of level of investment by location of funded participants.

The refresh of the digital economy theme in 2020 confirmed future support and Content Creation and Consumption continues to be one of five priority areas for the Digital Economy Theme, but it has also been perceived by industry as a move away from the Creative Industries to a wider vision of the digital economy and its social impact. This has led to concerns in industry about a gap in the future talent pipeline and in applied research and knowledge exchange in critical areas. Industry, through the Creative Industries Council, has formulated this in a call for a Centre for Creative AI, and AHRC and EPSRC developed proposals for two jointly funded CDTs in creative technology focussing on AI and Virtual Production, in the last SR round.

UK Research and Innovation

Case Studies

Digital Creativity Labs (2015-2021)
Digital Creativity (DC) Labs was established in 2015 at the University of York as one of the next generation centres with funding from the EPSRC Digital Economy Theme supported by AHRC and InnovateUK. The aim was to create a world class centre of excellence for impact-driven research in games, interactive media and the space where they converge, bringing together a multidisciplinary community of researchers from computer science, engineering, user experience design, psychology, education, film, TV, theatre and archaeology and beyond. The multidisciplinary skills base, industry relationships and talent pipeline developed through the initial DC Labs investment has been the foundation on which the XR Stories Creative Cluster, WEAVR, the AotF/ Technology Demonstrator in eSports, and Research England investment in regional skills have been built. Partner investment from Screen Yorkshire, BFI, Channel4 Television, ESL and Production Park has built a vibrant, growing screen innovation cluster in the region.

AIM – a UKRI CDT in AI and Music (2019-2027)
AIM is training a new generation of researchers who combine state-of-the-art ability in artificial machine learning and signal processing with cross-disciplinary sensibility to deliver ground-breaking original research and impact within the UK Music sector – both commercial and cultural. It works around three research themes that require critical development for the sector:

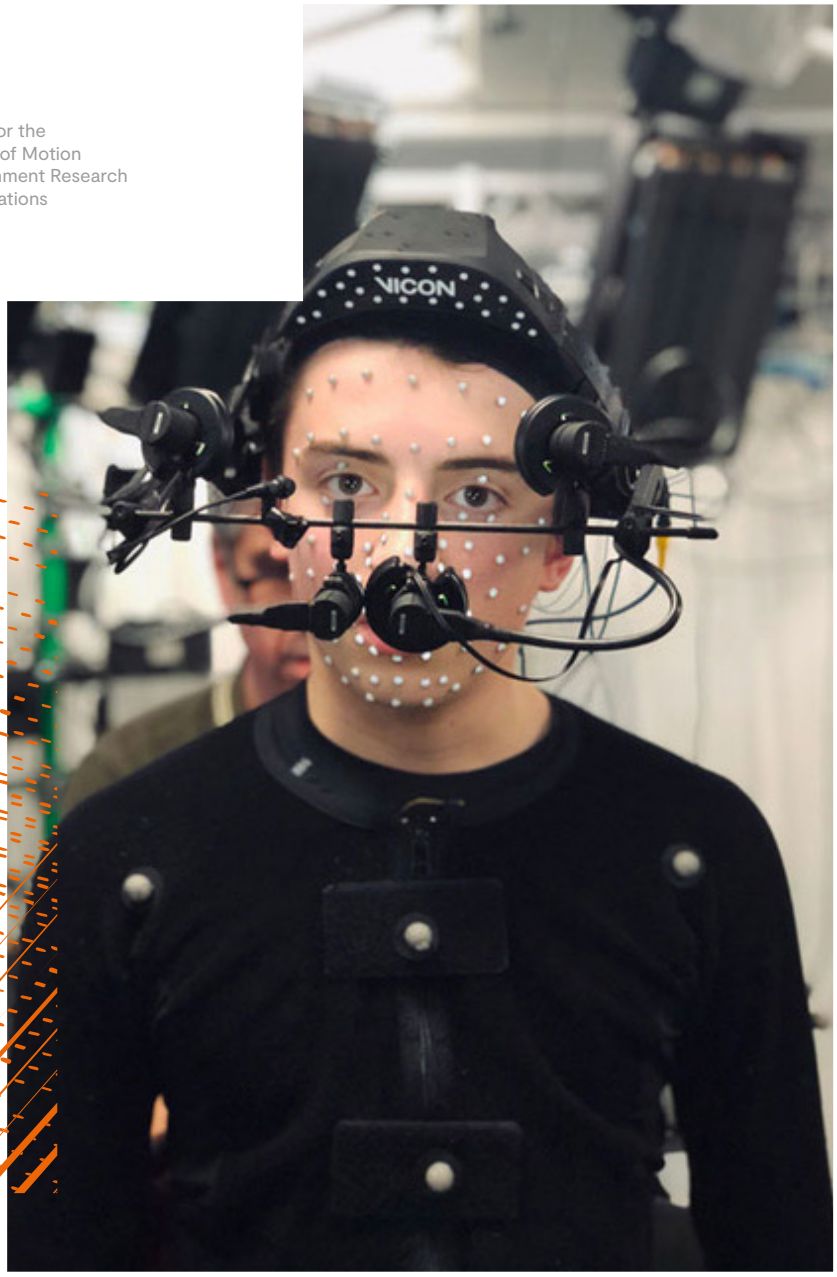
- **Music understanding:** encompassing machine listening, intelligent signal processing, and data- and knowledge-driven approaches to music content modelling and analysis;
- **Intelligent instruments and interfaces:** encompassing embedded intelligence and intelligent sensing for music performance, production, listening and education, and applications of AI to human-computer interaction in creative contexts;
- **Computational creativity:** encompassing generative music composition, automated accompaniment systems, and systems for expressive musical performance and assisted production.

EPSRC CDTs that support high-level skills for the Creative Industries are Digital Entertainment (Bath), Intelligent Games and Games Intelligence (York) and Media and Arts Technology, delivered with AHRC (QMU).

Weavr - Audience of the Future eSports Demonstrator

UK Research and Innovation

Centre for the
Analysis of Motion
Entertainment Research
& Applications



Camera. 2.0 (2015-2025)

The Centre for the Analysis of Motion Entertainment Research and Applications (CAMERA) was also established as a Digital Economy Next Generation Centre in 2015 and has received renewed support through to 2025.

CAMERA's core research expertise in computer vision, graphics, Human Computer Interaction and AI is matched by industry expertise from the software, computer games and Computer Graphics/Special Effects (GFX) industry. CAMERA has become an acknowledged leader in creative technology (CreaTech) research but has also developed innovative tools for industry using computer vision and deep learning methods, which reduce cost, time or complexity for performance capture, animation and 3D graphics.

At the heart of CAMERA's success and its contribution to both the Bristol + Bath Creative R&D Partnership (ISCF/CICP) and the recent £40m 'My World' RE Strength in Places programme (the first in the Creative Industries) are its industry partnerships with the likes of Sony, leading GFX houses Foundry and Happy Finish, games developer Ninja Theory and animation house Aardman. It has leveraged over £6M of funding from industry partners, in addition to the initial £4m investment from EPSRC.

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10.3 InnovateUK

CI Investment (2016-) £34.0m
Projects. 250

Overview

Innovate UK supports business innovation, by providing funding for the development of new products, services, and processes. Unlike other parts of UKRI, it provides funding directly to businesses and also supports a network of agencies providing support to business innovation: a network of Catapults, the KTN, and the Innovate UK Edge network of business growth support companies.

Innovate UK has had a dedicated team supporting Creative Industries since its creation as the Technology Strategy Board in 2007. Before 2016, when the majority of Innovate UK funding became more open or responsive, there were a series of grant funding competitions aimed at specific challenges in the Creative Industries. Although Innovate UK has been involved in the development of sector-specific projects such as the ISCF Audience of the Future challenge for UKRI, since 2016 the main funding mechanisms to support businesses across the economy (including the Creative Industries) have been via IUK's major responsive programmes Open and Smart. Projects funded via Smart and other non-sector-specific calls, such as the Sustainable Innovation Fund, span the Creative Industries subsectors. The majority of Smart awards (67% of all Smart awards) are made to early-stage Micro companies.

However, there are clear areas where IUK's engagement with the Creative Industries is focused – 40% of all IUK grant funding was received by companies in the Film, TV and Video sector with much of this concentrated in the UK's world class GFX, production and post-production sectors, which are driven by advanced computing technologies. This sector is being disrupted by the emergence of virtual production methods and IUK funding is potentially a significant driver in ensuring and enhancing the UK's continuing competitiveness as a global production hub. IUK funding also provides significant support to innovation in the Design & Fashion and Advertising & Marketing sectors (this latter being the greatest engagement across UKRI), sectors also undergoing digital transformation across the whole value chain: user engagement, design, production and distribution. The geographical distribution of IUK's investments differs from that of other Councils in that it is not so strongly clustered around universities being determined by business location. This gives a wide reach across all nations and English regions though there is a concentration in southern England and particularly London.

At present IUK analyse their data around a narrower definition than the DCMS to enable the differentiation between creative digital companies and the wider ICT and Software sector. Using comparable definitions might be expected to increase the number of CI projects significantly.

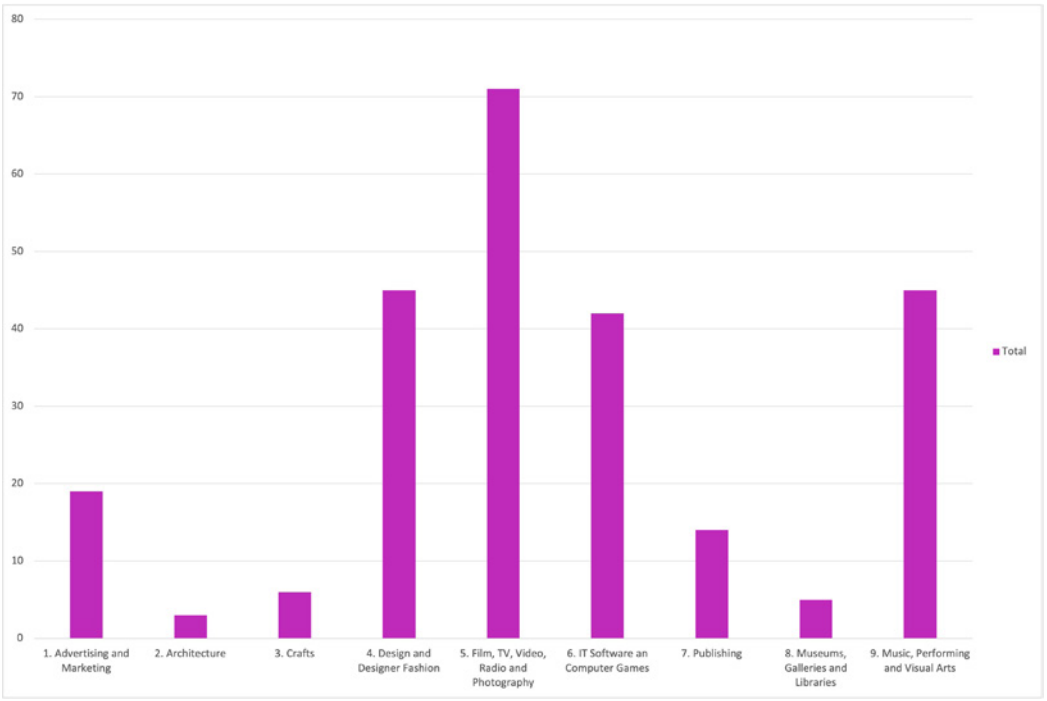

Figure 19.
IUK Creative Industries projects by CI subsector. n= 250

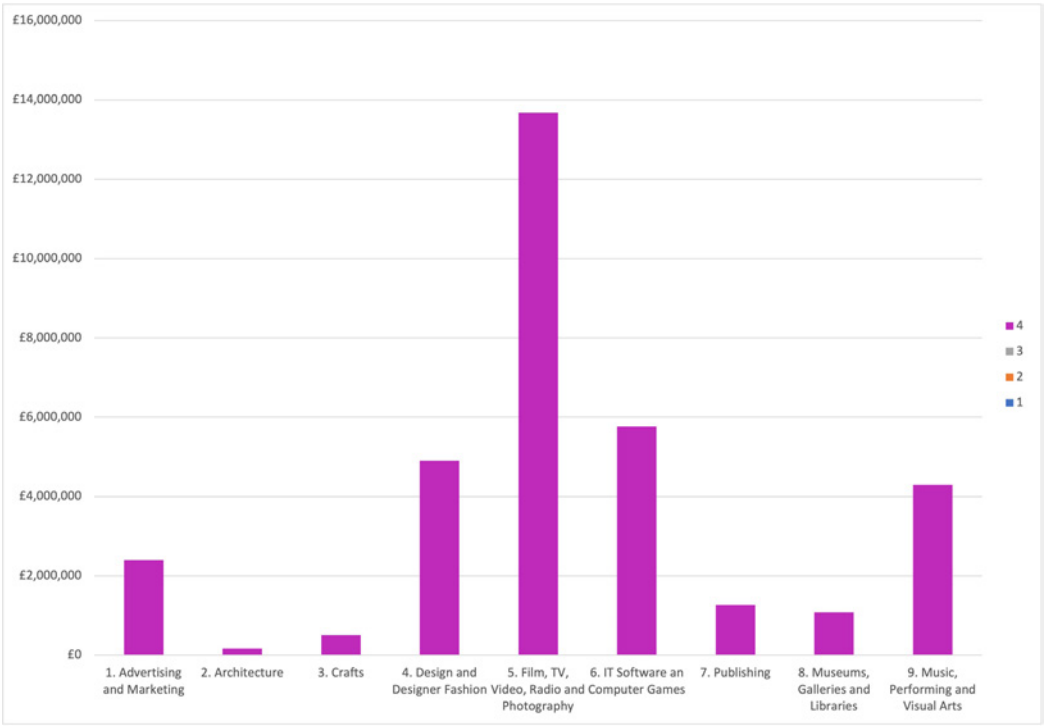

Figure 20.
IUK Creative Industries investment by subsector and qualified by Creative Intensity Scale

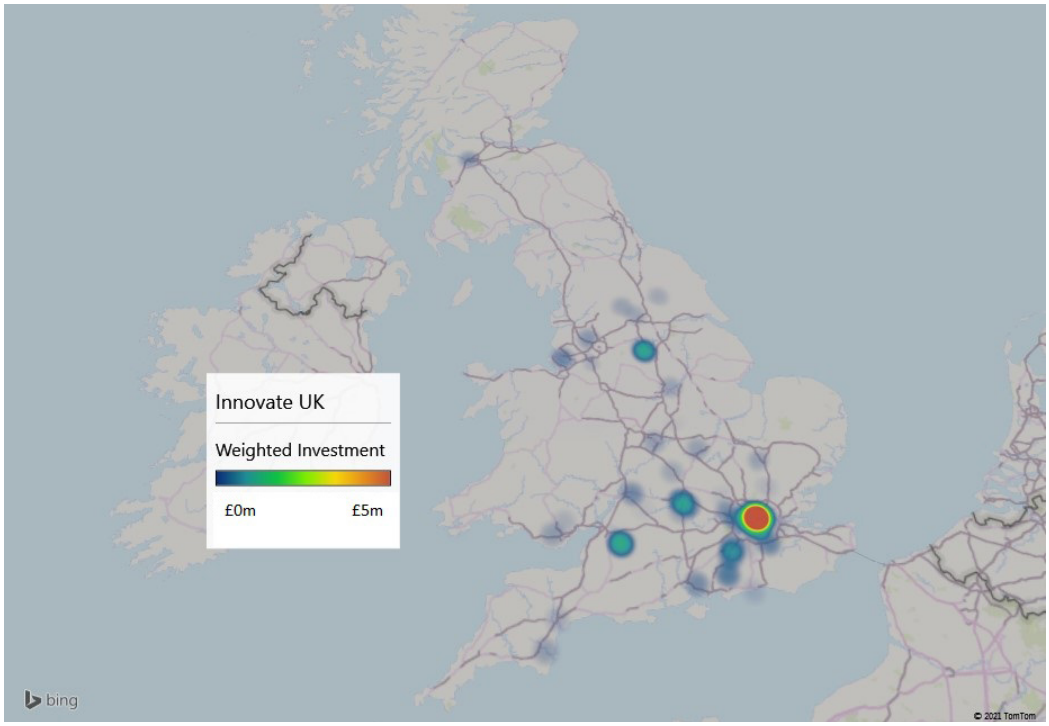

Figure 21. Geographical distribution of InnovateUK Creative Industries investments across UK. Heatmap of level of investment by location of funded participants.

Interventions

Smart grant-funding is IUK's main instrument and is open to applications from businesses in any sector of the UK economy. This call has been a regular activity for Innovate UK in different guises for over ten years. Currently, Innovate UK typically holds four rounds of Smart grants each year, with around £20m of total funding available at each round. Creative businesses receive around 6% of Smart awards.

IUK uses a small number of additional instruments with respect to creative businesses:

- **The Innovation Loans programme** provides loan funding for individual micro, small and medium-sized businesses and can be used to fund the costs of research & development projects only. Lending decisions are based on project quality and company suitability and risk.

- **Design Foundations competitions** offer match-funded grants of up to £60,000 to UK businesses of all sizes to carry out exploratory, Human-Centred Design activity at the early stages of innovation projects. Recipients work with design professionals to understand users' needs and behaviour, before translating that insight into concepts for more desirable and beneficial products, services, and business models. Funded activities include customer engagement, user needs and behavioural research, creative problem solving, ideation, rapid prototyping and testing.

- **Knowledge Transfer Partnerships** (KTPs) link forward thinking businesses with the UK's world class knowledge bases to deliver innovation projects led by inspired graduates. They are delivered by the Knowledge Transfer Network on behalf of Innovate UK, often in partnership with other UKRI councils.

- **Rapid Response/Fast Start Funding** In April 2020 Innovate UK ran a £40m grant funding competition aimed at fast-tracking the development of innovations borne out of the coronavirus crisis. Fast Start utilised a specific state aid allowance which allowed Innovate UK to 100% fund projects up to £50k. 12% of the 865 projects funded were classified as '*from and/or supporting the creative industries*.'

- **Most recently InnovateUK** launched the Creative Industries Fund, a new £2.5m fast-start business growth pilot in partnership with InnovateUK EDGE. This programme combines innovation grant funding from IUK (drawing on the COVID support fund) and a package of targeted business growth support provided by the EDGE network. The programme is open to companies who have not previously received IUK funding.

Innovate UK provides funding to two agencies which play an important role on behalf of UKRI. The KTN has a dedicated Creative Industries team which provides advice and support to creative businesses. Similarly, the Digital Catapult provides specialist support to Creative Industries innovation, including running of schemes for Innovate UK, such as Creative XR – a targeted support programme for small creative companies working in AR and VR, co-funded by Arts Council England.

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Case Studies

Smart Roto, The Foundry - SMART

The Foundry create pioneering creative software for the digital design, media and entertainment industries with customers from Pixar, DNEG and Framestore, to Mercedes, New Balance and Adidas. SmartROTO was a 21 month R&D project which aimed to design, develop and demonstrate intelligent tools for high-end rotoscoping of live action footage for film and TV production. It investigated the sharing of machine learning networks and datasets between industrial and research communities. The ability to share huge datasets from real world productions has the potential of significantly accelerating the research and development of machine learning to help manage complex post-production editing.

WOMAD at Home – Covid19 Rapid Response

WOMAD (world of Music, Arts and Dance) is an international arts festival founded by musician Peter Gabriel that encourages collaboration between musicians and artists from around the world. WOMAD has staged a 40,000-ticket event in the UK since 1982 and international programmes in Australia, New Zealand, Spain, Italy, Chile and UAE. Given Covid19 restrictions on live performance in 2020, WOMAD was funded from the IUK Rapid Response competition to develop a virtual platform called WOMAD at Home - a subscription-based service deploying Immersive Audio technologies to recreate a more compelling live music sound. WOMAD used the funding to develop and test the technology, build the subscription platform and rapidly bring this to market.

WOMAD at Home enabled the organisation to continue working with artists, record their music and promote their work despite the festival being on hold. When festivals return, as WOMAD Australia did in March 2021, the platform will become part of a hybrid experience and business model that is sensorially rich, always-on, and easy to access.

Womad at Home

UK Research and Innovation

Sentric Music Group – KTP

Sentric Music Group is a disruptive independent UK music publisher representing more than 200,000 songwriters and music catalogue owners. Like any music publisher, Sentric's purpose is to ensure that its clients receive all the royalties they are owed from whatever source across the globe (streaming, download, radio play, live performance, sync from film, TV advertising, computer games, ambient), taking a cut of the revenue in the process.

Sentric combines a novel publishing contract with a direct collection network and industry leading technology. For this project the company partnered with academic experts at the School of Social Sciences and Humanities at Loughborough University to create an Innovate UK sponsored KTP with support from AHRC and ESRC. The objectives of the KTP were to analyse the company's complex data sets relating to social media and online fan-bases, to understand the impact on royalties; and to build the companies capabilities to interpret traditional and non-traditional datasets.

Sentric Music Group artist, Ms Banks (Photography © Chris Baker)

UK Research and Innovation

10.4 ISCF Challenge Programmes

CI Investment (2018-2023) £92.7m
Projects. 82

Overview

Audience of the Future (AOTF) and the *Creative Industries Clusters Programme (CICP)* were developed within the framework of the Industrial Strategy Challenge fund following the identification in the 2017 Bazalgette review of the Creative Industries of two key innovation challenges for the sector: that though creative businesses are geographically clustered across the UK they lacked access to the high quality research and innovation to drive growth through the development of new technology enabled products, services and experiences; and that the immersive technologies (Virtual, Augmented and Mixed Reality, virtual production technologies and haptics) offered both significant opportunities for the UK Creative Industries but also a potentially disruptive wave of innovation that could threaten the competitiveness of the UK's world class screen and performance sectors.

These two Challenge programmes have resulted in a step change in the relationship between the Creative Industries and the research ecosystem. Adoption as a key component of the Creative Industries Sector Deal has embedded research and innovation at the heart of Creative Industries policy for the first time and the c£100m funding, though small by the standards of other sectors, is unprecedented in terms of applied Creative Research

CICP (ISCF wave 1a) and AOTF (Wave 2) were commissioned independently but have been delivered as a single Challenge with the Challenge Director managing an integrated team across UKRI from AHRC from which the Clusters programme is funded, to ISCF, InnovateUK the Digital Catapult and KTN using a novel combination of research and innovation grant funding, technology demonstrator partnerships, co-investment with the private sector, high level skills funding, network support and an extensive international trade and showcasing programme engaging business, investors and the public. The geographical distribution of the Challenge funds is the most widely spread of all UKRI's interventions with the size of the programmes enabling significant investments in every English Region and in Scotland, Wales and Northern Ireland (these latter two stand out within the UKRI portfolio and have delivered significant impact in their nations). Whilst the prominence of the nine cluster partnerships in Fig 24.is perhaps unsurprising as a deliberate place-based intervention investments in northwest England, the east and west midlands and Brighton reflect the locations of companies involved in the AOTF Challenge.

Interventions: Audience of the Future; technology enabled innovation

The Audience of the Future Challenge is to ensure that the UK's Creative Industries are able to adopt, use and deploy new and potentially disruptive immersive technologies to ensure that the UK not only retains but grows its position as a globally competitive place to originate IP, deliver creative services and produce innovative and desirable creative products, content and experiences. AOTF has focussed on applied research and innovation in key creative sectors to engage with immersive technologies to advance the state of the art creatively, technologically and in the development of new business models.

AOTFs key interventions are:

- Four Technology Demonstrators in Performance, Visitor Experience, Moving Image and Sports Broadcasting, each chosen as a sector where the potential of immersive experiences was clear but the current case for commercial investment was weak. The Demonstrators brought together a range of IP owners, creative SME's, global technology companies, researchers in spatial computing, data analytics and AI, cultural organisations and commercial partners. Each

Demonstrator was obliged to create a large-scale trial capable of reaching 100,000 public users. Some have exceeded this many times, despite the impact of Covid19 which has, if anything, significantly accelerated the pace of innovation. Industry Partners include SME's Factory 42, Punchdrunk, Tiny Rebel Games, Rewind, Focal Point VR, Dock 10. Technology partners include Epic Games, Intel, Magic Leap, Unity, Sky. IP Owners include Aardman, Natural History Museum, ESL Ltd, RSC, Research Orgs York, Portsmouth, RHUL.

- Collaborative R&D in Virtual Production to develop the platforms and processes that will make virtual production faster, cheaper and more accessible.
- An Investment Accelerator that co-invested AOTF funding alongside private investment capital; de-risking new investors in this emerging sector.
- Design Foundations is a small grant funding model supporting early stage design development and prototypes. Evaluation shows that SME's receiving this funding were able to use it to significantly advance the TRL levels of new products and bring them to market more quickly.
- A National Centre for Immersive Skills to upskill key high-level talent in the UK Screen sectors (Games, TV, Film) by exposure to immersive technologies and technologists. Over 1,000 graduates so far and building an industry talent pipeline.

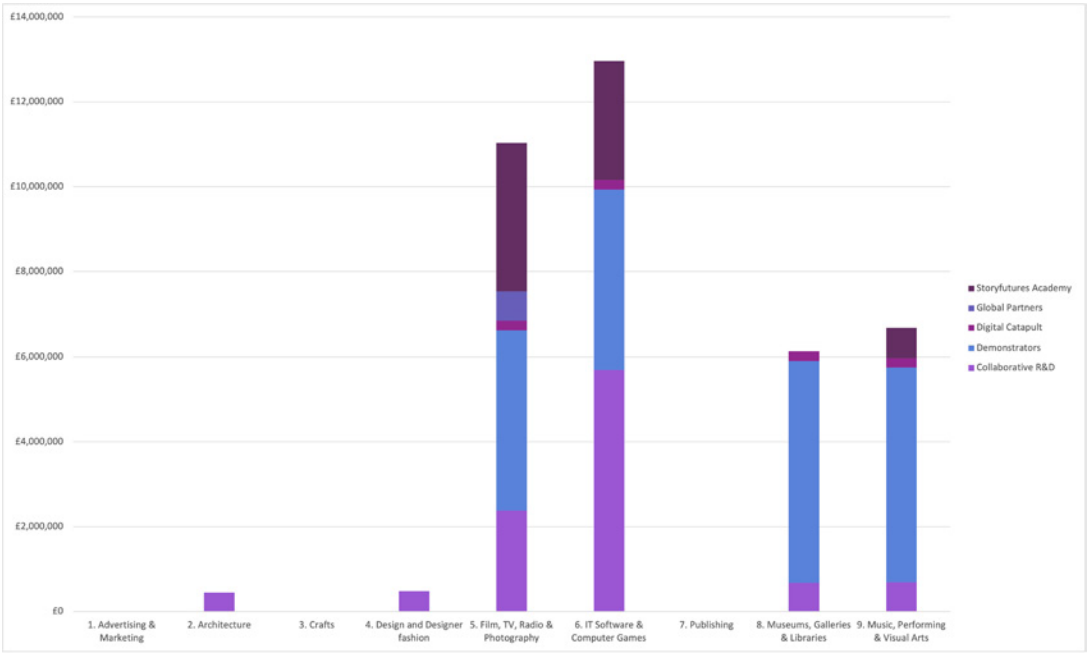


Figure 22.
Audience of the Future (AOTF) investment by Creative Industries subsector.

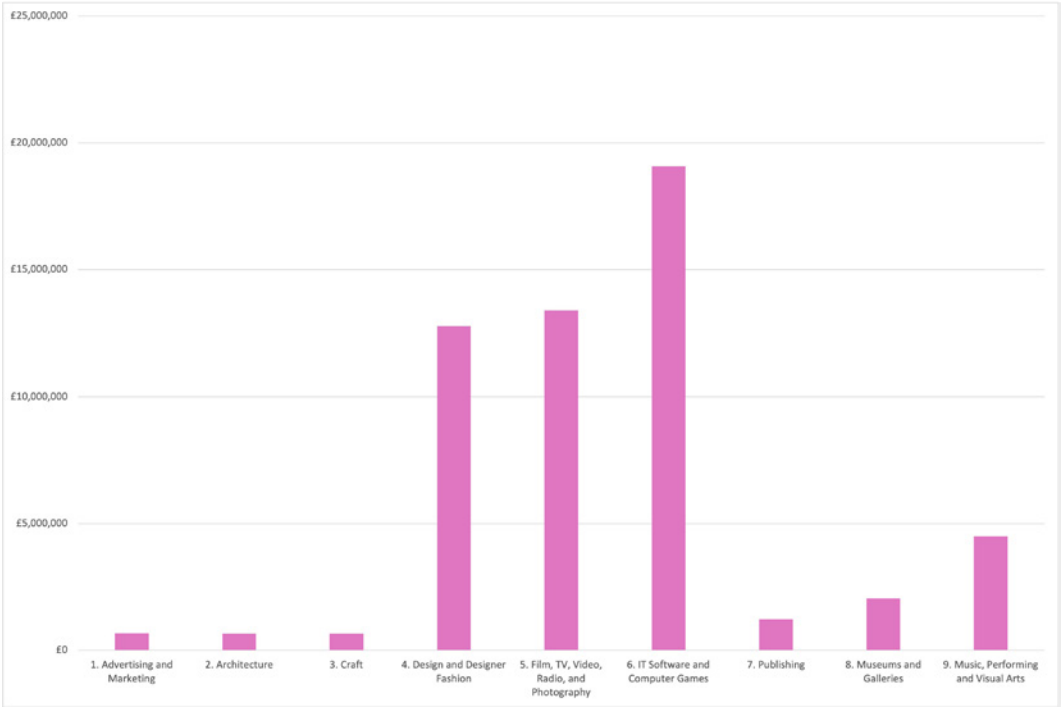


Figure 23.
Creative Industries Clusters Programme (CICP)investment by Creative Industries subsector

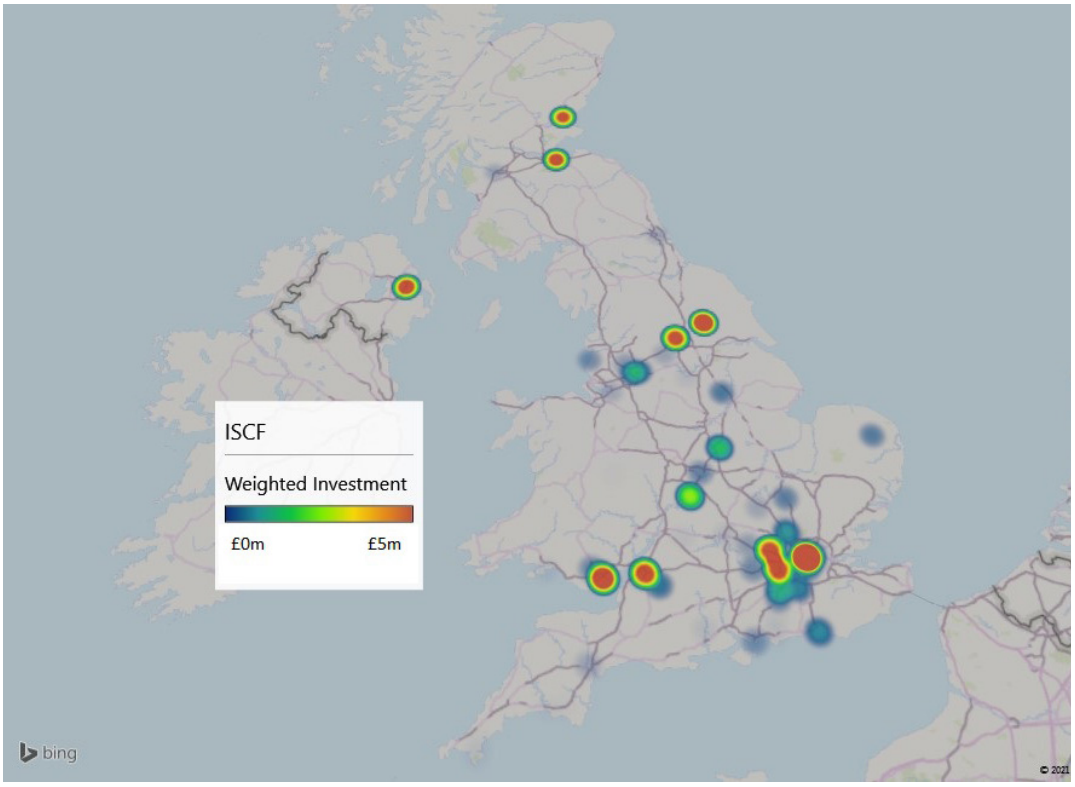


Figure 24.
Geographical distribution of ISCF Creative Industries Programme investments across UK. Heatmap of level of investment by location of funded participants. The 9 R&D cluster partnerships are prominent but the distribution of the combined AOTF and CICP investments is much wider.

Interventions: Creative Industries Clusters Programme: Place based R&D

The hypothesis behind CICP is that investing in applied research and innovation in established creative clusters can achieve a measurable increase in economic growth through increased participation in R&D by Creative Companies. The programme has funded 9 cluster R&D partnerships across the country: InGame (Dundee), Future Screens Northern Ireland (Belfast), Creative informatics (Edinburgh), XRStories (York/shire), Future Fashion Factory (Leeds), Clwstwr (Cardiff), Bristol+Bath, StoryFutures (M3/M4 /M40 corridor) and the Business of Fashion, Textiles and Technology (East London). These are not simple research grants, each partnership is anchored by two universities, has a small number of large companies and a community of around a hundred SME's and the partnership have been encouraged to experiment in developing new models of applied research. The R&D focus of the cluster is dictated by the needs and strengths of the local creative economy and business. As Figure 23. shows there are 2 clusters dedicated to R&D in Fashion and Textiles and one in Design and Data. All have a high component of computer science and AI and there is significant support for regional screen and games industries and performance.

As place-based interventions the Clusters have embedded themselves in local economic planning and policymaking. Through their R&D programmes they have catalysed other partners (City Regions, Economic Development agencies, LEPs) to co-invest on a significant scale. From an initial target of £40m across the programme the 9 clusters are currently projecting co-investment of £140m at the end of year 3 of 5. As an example Future Screens Northern Ireland have recently announced a partnership partnership with Harbour Studios Belfast to build a new R&D facility, the Screen Media Innovation Lab, which will receive £38m from the Belfast City Deal

Alongside the nine R&D partnerships, CICP funds the AHRC's Creative Industries Policy and Evidence Centre, led by Nesta with University and Industry research partners. The CIPEC is dedicated to improving the quality of research and evidence on the Creative Industries and to make this available for policymakers across government and industry. CIPEC has become a critical component in the growing creative research and innovation ecosystem and its ability to rapidly marshal high quality, independent academically verified evidence is highly regarded by DCMS, HMT and industry. A particularly influential example of this was the CIPEC partnership with the IPO early in the pandemic to rapidly establish a large cohort tracking study to evidence changing attitudes and consumption habits for creative, cultural and media content and services during lockdown. This has shaped understanding of the impact and opportunities of the pandemic for the Creative Industries across industry and government.

UK Research and Innovation

Case Studies

Dream.Online - AOTF Performance Demonstrator

Royal Shakespeare Company, Epic Games, Intel Corp, Philharmonia, Punchdrunk, Manchester International Festival, Portsmouth University, I2 Media research, De Montfort University.

Dream.online was the culmination of the Audience of the Future technology Demonstrator and combined live performance capture, real-time game engine technology and live streaming to deploy immersive technology to create new experiences for audiences in live performance. Originally planned for Summer 2020 as an in-person and online live experience, Dream pivoted radically under pandemic conditions to create an entirely novel, globally available end-to-end digital experience whilst theatres remain closed. Inspired by Shakespeare's A Midsummer Night's Dream but focusing on the fairy world of the forest, Dream brought together multiple strands of R&D from advances in motion capture and facial rigging technology through to development of show control systems to manage a live virtual production 'volume' and integrate with real-time rendering platforms to generate virtual 'fairy' avatars in a computer-generated forest, with interactive sound and live animation for the remote audience. Dream ran for 8 live performances, reached an initial audience of 65,000 members of the public and was reviewed around the world. A recorded release will follow.

Future Fashion Factory - CICP Cluster

Future Fashion Factory (FFF) is a £10 million R&D partnership exploring and developing new digital and advanced textile technologies to boost the design of high-value creative products. Centred at the University of Leeds School of Design with industry partners that range from household names Burberry, Dormeuil, Pentland Brands (Speedo, Berghaus, Red or Dead) and Bower Roebuck to microbusiness and new design start-ups. FFF has developed programmes for collaborative R&D across the supply chain, sustainable design, new materials and circular economy models that link its research partners, large companies and SMEs. FFF receives co-investment from Leeds City Region, British Fashion Council and its industry partners.

Future Fashion Factory (CICP)

Writers workshop at StoryFutures Academy

Storyfutures Academy: AOTF National Centre for Immersive Skills

Only three years old, the Storyfutures Academy, based at the National Film and TV School and RHUL, has established itself as the UK's centre of excellence for high level skills innovation and training in all aspects of Virtual Production. This ranges from immersive writers rooms to upskilling TV, film and computer games writers to write successfully for VR, AR or XR; to specialist training for feature film department heads to understand the next wave of immersive technologies coming out of the labs; or hosting experimental productions that bring together technology companies, researchers and highly skilled practitioners. With co-investment from Sony, Pinewood Studios, BBC and ILM after 3 years of funding from AOTF, SFA's funding has been guaranteed by AHRC going forwards.

Framerate by Scanlab - AOTF Production Innovation in Immersive Content

Using technology originating in the construction industry, the Framerate has allowed architectural design SME Scanlab to develop ultra-high definition, wide-area LIDAR scanning technologies and develop the software tools to manipulate the resulting massive data sets. Scans for Framerate include 800m of the rapidly eroding Happisburgh beach in Norfolk, gardens, forests and farms scanned every day for a year. With applications in media production, environmental science and as an immersive experience for COP26, Framerate extends the aesthetic and commercial use of LIDAR.

Creative Informatics - CICP Cluster

Edinburgh has been a centre of both creativity and Artificial Intelligence for the last 70 years. The Creative Informatics R&D partnership brings them together with the aim of creating a new wave of data-driven, AI powered creative businesses with a sense of place. Delivered through funded R&D challenges, labs and data/business accelerator programmes delivered by researchers working in partnership with Codebase (Europe's largest technology incubator though established by UKRI), Creative Informatics is now a delivery asset for the Edinburgh City Region Deal's central theme of Data Driven Innovation.

UK Research and Innovation

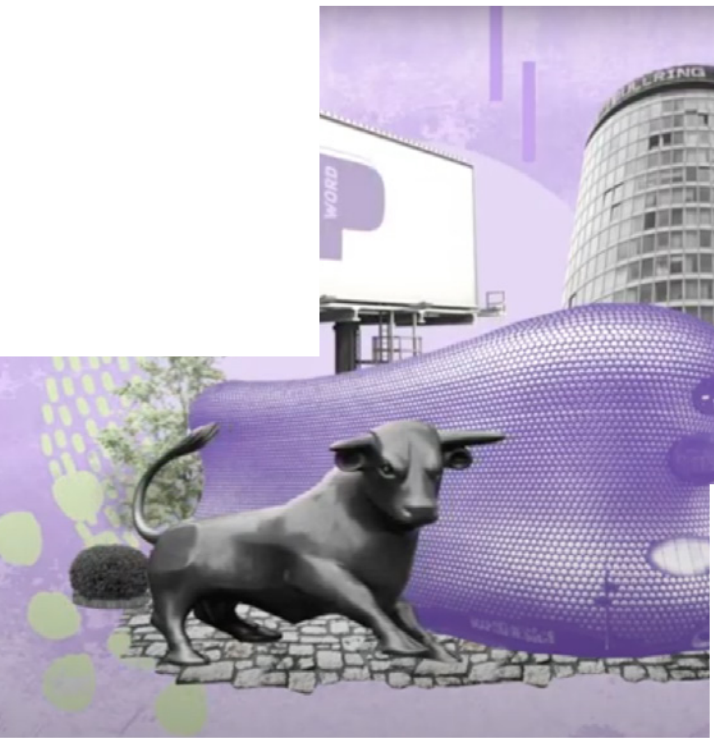
10.5 ESRC

CI Investment (2016-) £5.0m
Projects. 51

Overview

Given the size and structure of the Creative Industries as an employment sector, their inclusion of the cultural sector and the increasing interest between access to and participation in the arts as a contribution to wellbeing, ESRC's current engagement with the Creative Industries may seem quite limited. However, as our mapping data demonstrates, ESRC's interaction with the Creative Industries spans all nine subsectors, though with a clear concentration on engagement with the Music, Performing and Visual Arts subsector and a significant engagement around Design. ESRC investments tend to be at the lower end of the Creative Intensity scale – undertaking enquiry-based research that is relevant to the sector, though not often working directly with the creative companies, organisations or institutions.

Whilst the Creative Industries is not a key sector of focus for ESRC, the disciplines supported by the Council – from psychology and sociology to management and business and economics – produce valuable research and networks of direct relevance to the sector. Outputs from projects funded by ESRC of relevance to the sector are often the establishment of networks, dissemination events or publications that provide a launchpad for further research about the sector, recommendations for creative industry professionals producing products or services that address a social issue (from mental health to urban design), and guidelines for creative industry professionals designing products or services that may have an impact on the consumer's wellbeing or cognitive behaviour (for example around education). As such the work undertaken by ESRC also validates the role of the creative sector in addressing some of most pressing social issues within the UK. There is also a small but important body of funded research which addresses issues such as new business models or productivity within the sector, drawing on management and business and economic expertise. Geographically, ESRC investments are characterised by investments clustered in a small number of university locations, primarily Glasgow, Stirling, Bristol, London, Essex and Sussex.



Productivity from Below
- BLACK NEW STREET

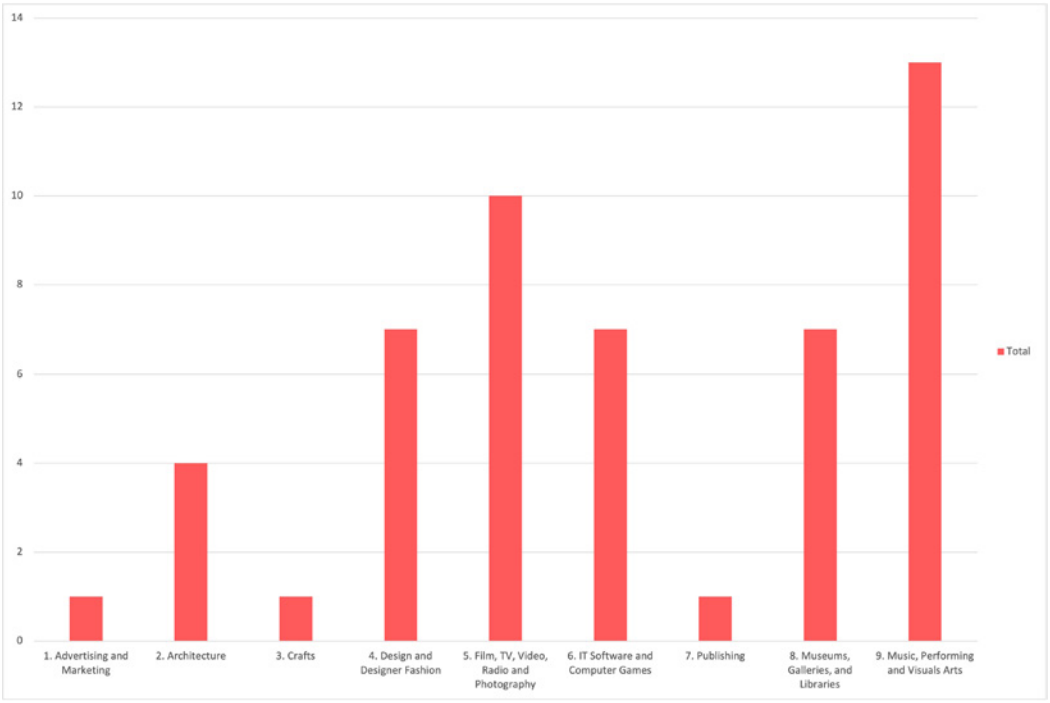


Figure 25.
ESRC Creative Industries projects by CI subsector. n= 51

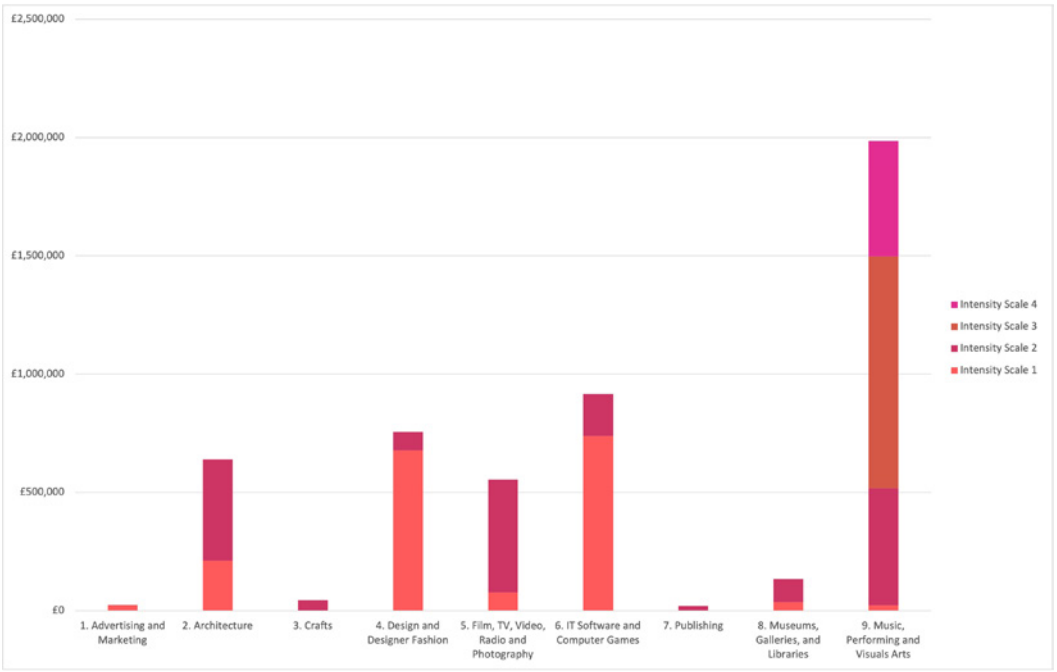


Figure 26.
ESRC Creative Industries investment by subsector and qualified by Creative Intensity Scale

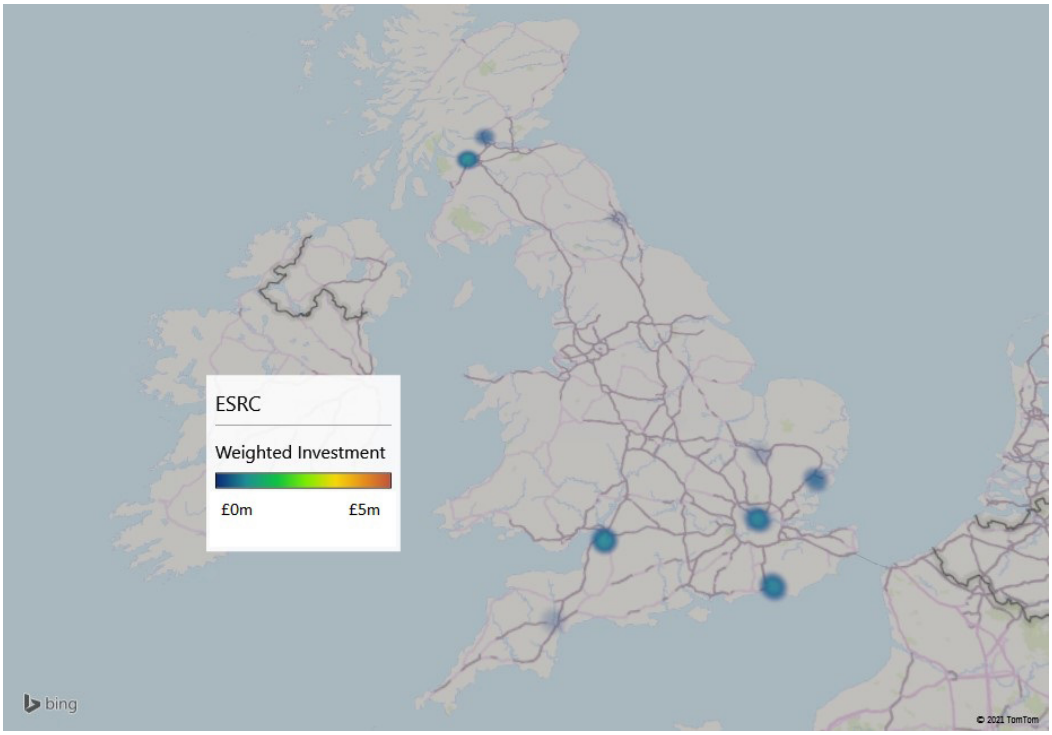


Figure 27. Geographical distribution of ESPRC Creative Industries investments across UK. Heatmap of level of investment by location of funded participants

Interventions

Projects of relevance to the Creative Industries are funded through a wide range of ESRC funding mechanisms, from responsive mode to targeted initiatives, often funded collaboratively with other Councils/ funders. No calls have been focused explicitly on the Creative Industries sector, though some have generated a large number of relevant projects. For example, the UK-Japan SSH Connections Call, funded in collaboration with AHRC, included seven creative industry projects with the majority of those investments being clearly applied within the sector, focusing on cultural heritage and the use of emerging technology in the Creative Industries.

A further feature of ESRC's interventions is the number of major ESRC investments (centres and large grants) which have contributed research of direct relevance to the sector. For example, the UK Collaborative Centre for Housing Evidence (co-funded by ESRC, JRF and AHRC) completed a project on *Design Value: What does it mean and how do we measure it?* and a subsequent project on *Delivering Design Value*. The Digital Futures at Work Research Centre has funded a range of projects about and working with the sector, from mapping online methods of disseminating and monetising the output of creative industry workers, to a debate on whether music streaming was bad for musicians. The Creative Industries has also featured as a sector of focus for the Enterprise Research Centre. The ERC's work on SMEs and microbusinesses has great relevance to the Creative Industries, even when not explicitly applied to the sector – for example, work over the past year on SME finance and investment in design as a result of the pandemic, learning lessons from the financial crash of 2008.

ESRC projects also adopt creative industry methods or work with creative practitioners to engage with subjects or to disseminate findings. For example, 2 ESRC/NIHR projects, 'Seeing what they see', and 'Neighbourhoods and Dementia' worked with animators, visual artists and writers to convey the experience of different forms of dementia. Collaborators included Manchester Camerata (an award-winning chamber orchestra) and Chronicle Films, Tracks and Layers (an animation company based in Salford).

UK Research and Innovation

Case Studies

Productivity from Below: Addressing the Productivity Challenges of Microbusinesses
This project uses rigorous academic research co-produced with non-academic stakeholders to design and implement policies that support management to boost productivity in microbusinesses. It will produce practical outcomes for businesses, including the very large number of creative micro-businesses, by providing support for evidence-based interventions designed to upgrade leadership and management skills leading to a boost in productivity. Punch Records, a business with a strong social mission to promote artists from deprived backgrounds is included in the study, co-commissioning a documentary, BLACK NEW STREET that casts a reflective eye on the legacy of Birmingham's black businesses and customs. The documentary, which premiered on 22nd October 2020, featured interviews with key figures in Birmingham's black business community exploring what the future does and could look like for the city's black entrepreneurs, with a sharp focus on the creative sector.

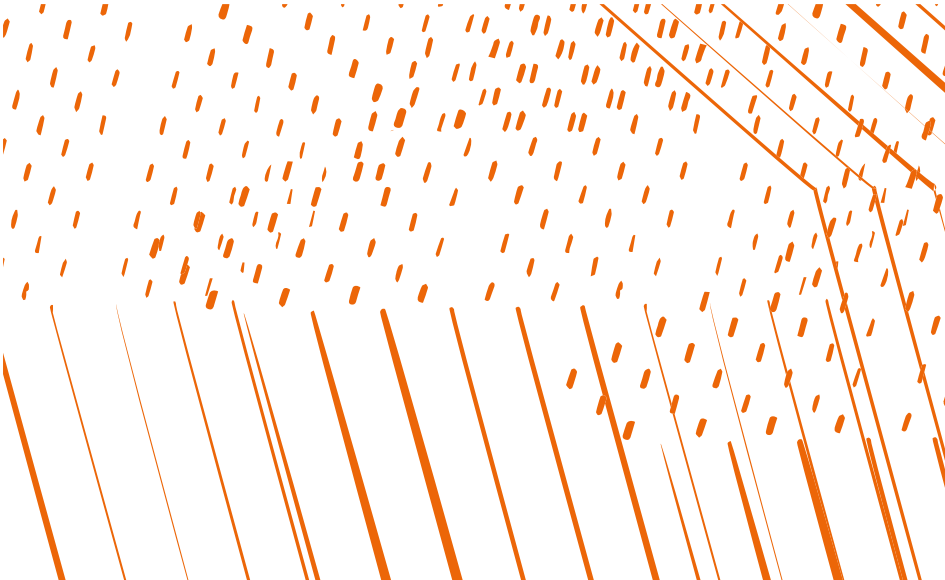
10.6 NERC

CI Investment (2016-) £3.4m
Projects. 78

Overview and interventions

As lead for UKRI on environmental research, an area of understandably increasing public concern, NERC inevitably has special responsibilities to work with the Creative Industries to disseminate knowledge and promote public engagement around climate change and issues of sustainability. Many areas of creative business that create factual or news content or incorporate climate change within artistic works gain great benefit from access to trusted, independent research and the scientists that produce it. The reach of NERC funded projects across the Creative Industries is wide. One might expect engagement with Film, TV and Radio, and Museums Galleries and Libraries but NERC's support for design interventions and music, performing and visual arts is less anticipated. NERC's Creative Industries related investments are clustered in a small number of research-intensive universities, almost all in England, plus Edinburgh.

Research initiatives around air pollution and clean air in buildings have seen NERC funded researchers collaborate with prominent architecture practices such as Foster + Partners. This is a potentially valuable link to a significant Creative Industries subsector not well engaged across UKRI.



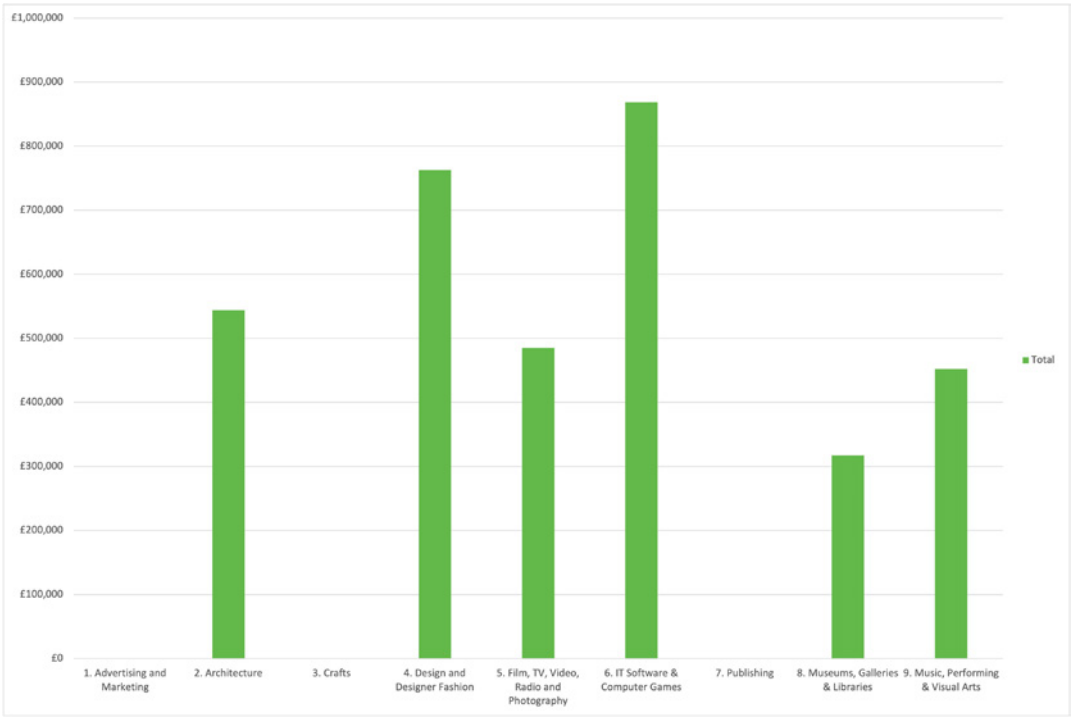


Figure 28.
NERC Creative Industries projects by CI subsector. n = 78

Most recently and perhaps most significantly in terms of NERC's engagement with the Creative Industries has been cross-UKRI work exploring the contribution that the fashion design, production and retail sector has to act as a pioneer sector for circular economy models, for sustainable design and the reduction of wastage. AHRC and IUK have existing investments in this area and though NERC does not, NERC's leadership for UKRI on Clean Environment and Sustainable growth seems a natural opportunity to build a powerful collaboration across UKRI and with industry. The fashion industry and its representative bodies have been both active and vocal in calling for R&D support for sustainable fashion to follow up that made by the ISCF in two sustainable fashion clusters. The industry knows its future is bound up with shortening supply chains, moving away from fast fashion and building a circular model; at present it also knows it is part of the problem. Support from NERC for an ambitious initiative working alongside AHRC and IUK, a willing industry and a research base that is increasingly interlinked across Fashion, Design, Textiles and STEM has the promise of great impact.

Case Studies

Hay Festival: Trans.Mission II

Transmission is a global storytelling project that pairs leading environmental researchers with award-winning storytellers to communicate cutting-edge science to new audiences. NERC and Hay Festival piloted Trans. mission in 2018 with three films: *Message from Antarctica* by polar researcher Emily Shuckburgh and illustrator Chris Haughton; *Clean Air Starts at Home* by Aardman Animation Studios director Dan Binns and atmospheric chemist Professor Ally Lewis (voiced by Marcus Brigstocke); and the *Weather Watching* series by poet Nicola Davies and climate scientist Ed Hawkins. Trans.MISSION II took the project international with films from Peru, Colombia and England launched at Hay events in each territory. Peru's collaboration focused on tropical glaciers research project, 'CASCADA' and featured writer, theatre producer and actress Erika Stockholm who wrote a play '*Glacier Shallap - or the sad tale of a dying glacier*'. Colombia paired the research project, 'BioResilience' which focuses on biodiversity and indigenous communities, with Colombian art critic, curator, translator and author Juan Cárdenas who created a short story, '*Spiral*'. In the UK, research project 'DRY' looking at droughts and water scarcity provided the inspiration for award-winning author Patrice Lawrence to write the short story, '*Day Zero and Chips*'.

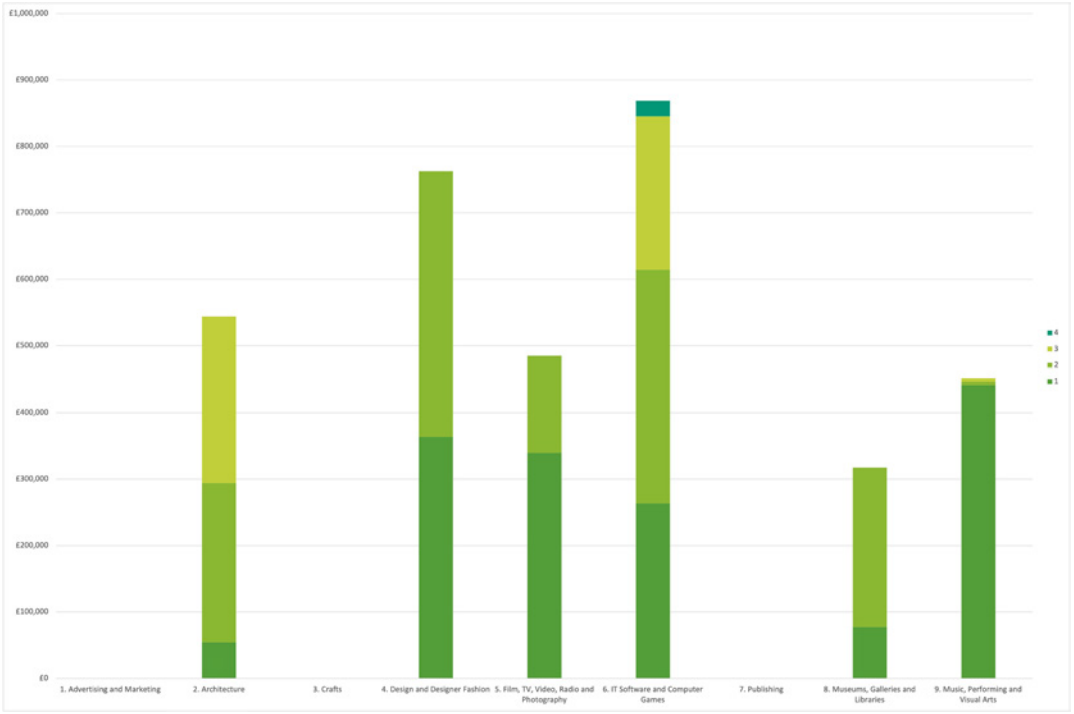


Figure 29.
NERC Creative Industries investment by subsector and qualified by CI Scale

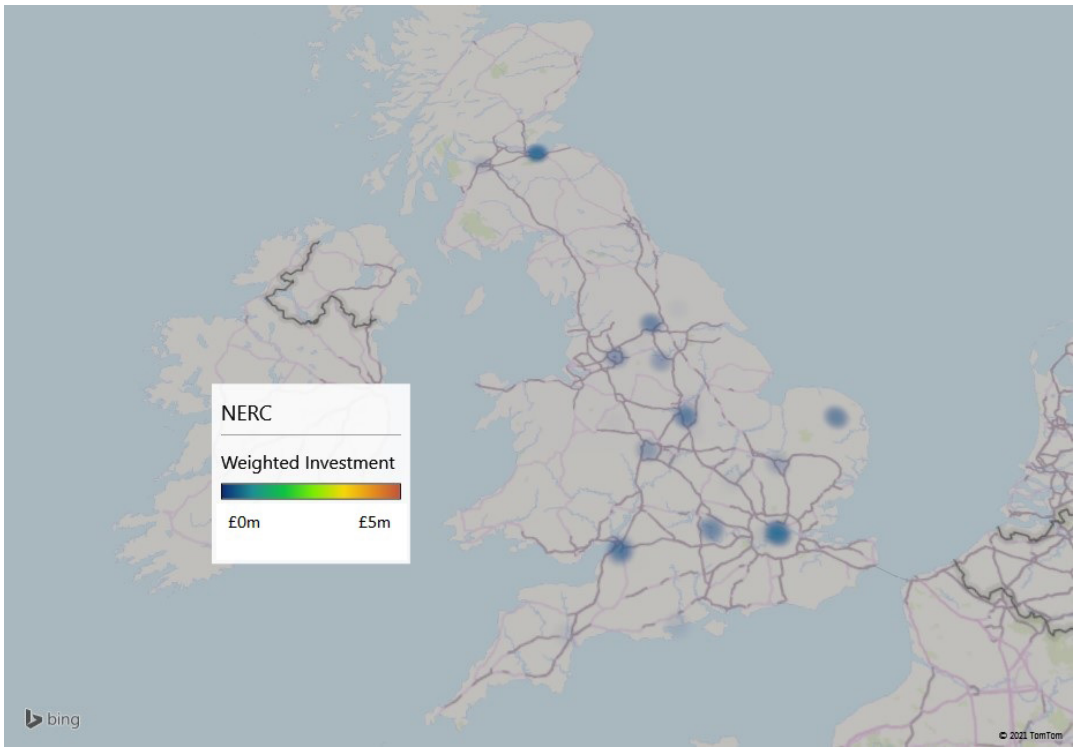


Figure 30.
Geographical distribution of NERC Creative Industries investments across UK. Heatmap of level of investment by location of funded participants

UK Research and Innovation

10.7 Research England

Research England investments engage across the breadth of the Creative Industries spanning research and knowledge exchange supported both through QR and HEIF funding, and strategic initiatives that support research, underpinning capabilities and engagement activities. The level of this funding as an underpinning to the creative research and Innovation ecosystem must not be underestimated, though of course the vast majority of it rests with universities, as partners with but not part of the Creative Industries. Recently a small number of RE investments have been targeted explicitly at the Creative Industries with the potential for significant impact over the next few years.

Interventions

RE's QR funding stream is not hypothecated, but surveys show that many universities deploy QR funding to support research and engagement with the sector. Beyond QR funding, several other mechanisms which focus on underpinning capability have also led to investments of direct relevance to the creative sector. The Expanding Excellence in England (E3) fund, which supports the strategic expansion of excellent research units and departments in ROs across England, led to investment of £19m in two design and one fine print centres of excellence which engage extensively with the sector. The Museums, Galleries and Collections Fund provides £10.7m per annum of funding to 33 university museums, galleries and collections (HEMGs) to help them serve the wider research community.

The Connecting Capability Fund, which complements HEIF by supporting collaborations in commercialisation, has also supported projects focused on the Creative Industries. Two of the largest Research England Development (RED) Fund projects are also focused on the Creative Industries. RED commits £27 million in annual funding to support projects that aid the development and interaction of the UK's research and KE activity. This is in line with government and UKRI priorities and includes a number of significant Creative Industries projects. More recently, RE has also funded the National Centre for Academic and Cultural Exchange (NCACE) which aims to facilitate and support capacity for KE between Higher Education and the arts and cultural sector. It builds on The Culture Capital Exchange's work in supporting such collaborations, including through Creativeworks London, one of the AHRC's four funded Creative Economy Knowledge Exchange Hubs.

Case Studies

Strength in Places Fund: MyWorld

The £28.9m Bristol Digital Futures Institute (BDFI), funded through UK RPIF, will pioneer a transdisciplinary co-production approach across computer sciences, engineering and the arts that will bring researchers together with industrial and civic partners to define new methods for socio-technical innovation and address cross-sector challenges.

The new facility will accommodate world leading multi-disciplinary research for key digital application areas: smart cities, digital connectivity, health, transport, creative media, security, data, autonomy and robotics. The project brings together industry partners including Aardman, BBC, Watershed, Knowle West Media Centre, Airbus, BT and Thales. The BDFI investment and the Bristol + Bath Creative Cluster has catalysed a Creative Industries specific project, MyWorld, which aims to create 700 jobs by building on regional strengths in creative media production, technology and research providing 1,000 square metres of new collaborative R&D facilities, advanced skills programmes and aims to create new experiences in fiction, documentary, games and live performance and the rapidly converging virtual production techniques that underpin them. MyWorld combines the £30m UKRI Strength in Places Fund with £16m committed from more than 30 industry partners.

UK Research and Innovation

10.8 BBSRC

BBSRC does not fund the Creative Industries or obviously-relevant research which can be applied within the Creative Industries. However, our data review of grants suggests that a small but significant proportion of funding can be identified which supports or has the potential to support the Creative Industries.

Case Studies

Building a Boolean framework of multisensory decision making
To interact with the environment, animals including humans constantly use signals from the different sensory modalities including vision, audition, and touch. This research aimed to build a general computational framework to understand how in principle any signals from the different senses are used to control actions. It used Boolean algebra, which is the ground-breaking subarea of mathematics fundamental to all our modern digital electronics. An experimental approach was developed to test the timing of human decision-making behaviour combined with computational modelling to test and develop a general framework of multisensory decision making.

Analysing signals from the different senses to enable multisensory benefits is one of the most important cognitive brain functions and has applications across many Creative Industries subsectors – most obviously Games, but many other sectors, using interactive game-play.

The Functional Dissection of Motion Processing Pathways in the Human Visual Cortex: An fMRI-guided TMS Study
This research project is concerned with the link between neural activity and motion perception. As such it has potential implications for screen-based media (games, film etc.) but also potentially across into Performance sectors such as drama and dance.

Moving visual stimuli elicit neural activity across an extensive network of human brain areas, suggesting that the analysis of motion is dependent upon multiple processing pathways. Using a combination of neuroimaging (fMRI), neurostimulation and psychophysical techniques, the purpose of this research is to establish causal links between neural activity in human brain areas and specific aspects of motion perception. Establishing causal relationships between brain activity and behaviour in this manner is important because at present fMRI can only provide correlative links. This combination of methodologies will provide a clearer understanding as to how and what cortical areas contribute to the perception of moving stimuli in the human brain.

How to optimise imperfect camouflage
This description of a Bio-sciences project which aims to understand predator-prey relationships in the animal world has the potential to have important implications for Human-Computer interaction and in particular games design:

"We will conduct experiments with human observers searching on touch screens for hidden targets against different background images. We will create carefully controlled artificial targets of different colours and patterns conforming to different types of camouflage. Some targets will be made to match one background type alone, whereas other targets will represent a blend of features from two different background types (a compromise or intermediate form). Other targets will possess features of disruptive coloration, with markings placed to break up the outline of the body, or to create false internal shapes and patterns inside the body. These targets will also vary in their level of visual contrast. We will then present these defined target types to participants in scenarios where they can be seen against two different types of background. We will measure detection times to determine how successful each target is against each background used, and overall against the range of backgrounds involved. Human participants will search for targets, and those that are found least often or more slowly will 'survive' and reproduce to form the next generation. Over time, the populations of targets will evolve to match the backgrounds better. We will conduct versions of the experiments whereby populations evolve in scenarios where they are seen against several background types."

UK Research and Innovation

10.9 MRC

Although not a direct funder of the Creative Industries, a significant proportion of the MRC's work is undertaken with or through the Creative Industries, as the three examples below illustrate.

Case Studies

MRC Weatherall Institute of Molecular Medicine
Computational scientist Stephen Taylor and his team at the MRC Weatherall Institute of Molecular Medicine are helping scientists and surgeons explore biological structures up-closer than ever before, using techniques and technology adapted from the Games sector.

The research created software to help explore DNA in more than two dimensions, and turned to the video gaming expertise of a group at Goldsmiths. An interactive 3D visualisation platform for biological molecules was created, enabling access inside the genome in virtual reality using genome sequencing data. By using the specially developed immersive environment and a VR headset, scientists step into a space where they can look at and interact with elements of DNA molecules. This is helping scientists look at DNA 'control switches' – switches associated with specific diseases which can turn genes on or off. By seeing where the switches are in 3D, they are better understanding the role of their structures in disease, and how to fix them when they go wrong.

Air pollution in Kenya
Ethnographic research in sub-Saharan Africa was funded by MRC to explore understanding of community engagement in Air Pollution Research. Air pollution is a global issue, contributing to the ill health and premature death of millions of people. Health impacts are vast, including chronic lung disease in adults and pneumonia in children. Those living in poor urban environments are especially likely to be exposed to dangerous levels of air pollution, with 9 out of 10 related deaths occurring in low and middle-income countries.

The research d musicians, DJs and filmmakers from the community who compose and recorded songs and videos to spark interest and debate around the issue of air pollution. There was also a collaboration with a community arts festival to promote the work of the AIR Network. One of the songs written and recorded for the AIR Network is Mazingira (Swahili for the environment) by Mukuru Kings (#Rafatchizi and Evadredi). Mazingira is being played on Citizen Radio and Radio Maisha, two of the biggest radio networks in Kenya, and the Mukuru community radio station Ruben FM. Using music as a communication tool has opened up new routes for public engagement and targeted social groups that may otherwise be hard to reach.

London Institute of Medical Sciences and University of the Arts, London
The MRC London Institute of Medical Sciences undertakes a number of collaborations with artists and designers working with the University of the Arts London. A Picture of Health in 2019 involved work by five artist-scientist groups exploring antimicrobial resistance and infection, artificial intelligence and data science, environment, mental health: dementia, schizophrenia and trauma, and sleep. A pop-up exhibition was created to present visitors with familiar health terms and topics but visualised in a completely new way. Visitors can expect to see the usual still and peaceful process of sleep brought to life by visualising the data we can gain as we slumber, and how urban environments are affecting what a good night's sleep truly is. Dementia, schizophrenia and the psychological effects of trauma are perceived as individual "brain illnesses". Yet, at this pop-up, how these illnesses are categorised and the boundaries between health and illness will be challenged. With artificial intelligence becoming more and more commonplace in our society, it is only natural that we may become concerned about its uses, particularly in relation to health. Visitors will be able to enter a space and follow along the artists journey of learning and understanding within the field of machine learning and explore our relationship and trust in digital tracking software.

UK Research and Innovation

10.10 STFC

The Science and Technology Facilities Council delivers frontier research in Particle Physics, Astronomy and Space Science, and Nuclear Physics through activities at UK universities, in national laboratories and through a range of long-term collaborative projects.

STFC's funding of major research facilities means that it provides a resource base for a number of key sectors to test and develop ideas. A small but important number of creative products, services and experiences are progressed in collaboration with STFC research projects or facilities.

Projects supporting or engaging with the Creative Industries include the following:

- STFC has established a network of business incubation centres, linked to science parks – as part of the European Space Agency. These are located at the Space Park in Leicester, the Harwell Campus in Oxfordshire, at Sci-Tech Daresbury, and the Royal Observatory in Edinburgh. These are providing facilities for creative companies and others looking to collaborate with space scientists. For example, one of the partnerships bidding to form part of Festival 2022 was made up of people linked to the ESA, who partnered with Tate Collective Producers – a network of young artists associated with the Tate galleries.

- Led by American scholars, a project entailing the 'unwrapping' of 2,000-year-old scrolls from Herculaneum made use of the STFC-supported UK national synchrotron facility. Drawing on technical expertise from one of the STFC's senior scientists, beamline technologies were used to gather data from the scroll-samples. Using bright, high energy X-ray beam technology, carbon ink on the scrolls can be identified in such high resolution that it is possible to detect changes in the microscopic structure of the papyrus and to reconstruct when the writing happened. This has important implications for museums and galleries globally, providing the expertise and facilities to access precious collections. This project could have important implications for R&D in the Museums, Galleries and Libraries sector.