Matrix Creative Technology Report 2018

Tara's Locket by Big Motive

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Foreword

I am delighted on behalf of MATRIX to present a short report examining the creative technology sector in Northern Ireland. When we undertook our study into the Digital ICT sector in 2016 we quickly identified that the creative technologies were a discrete sector with unique characteristics and close interdisciplinary relationships. We saw that this sector had the same potential for growth as the Digital ICT sector and a number of similar characteristics, particularly in the way it is both an industry sector in its own right, but also enables and underpins other sectors. However, we recognised that the support the sector needed to fulfil its potential was quite different. It was therefore felt that the Creative Technologies sector merited its own report.

Over the course of this study we have engaged with business leaders, academic bodies, government and representative associations, both locally and nationally. We have listened closely to the needs of businesses and formed a clear view of the characteristics that creative technology businesses have as well as the specific needs they have and the barriers they face.

This is not a technical report – instead, it seeks to identify the opportunities, skills and support available to the sector and show how best the creative technologies can grow, collaborate and evolve. For the purposes of this study the creative technologies are characterised as businesses using digital technologies in a creative way. Immersive technologies, user experience, games and animation fall within this definition and form the scope of this study. Creative tech companies often focus on more than one of these disciplines and can also shift that focus from project to project.

The small but burgeoning games industry here ranges from pure entertainment to the development of apps which gamify healthcare and the development of immersive games in VR. Animation skills in Northern Ireland offer significant potential for export growth, particularly in 2D episodic shows. There is an increasing focus on User Experience (UX), reflected by the development of Ulster University's new Interaction Design and UX skills are in great demand from fintech, life & health sciences and other software development businesses as well as from government, as it develops its "digital by default" services.

Finally, the growing cluster of immersive technology companies now operating in Northern Ireland is strongly focussed on the development of content for virtual and augmented reality and the recently formed Immersive Tech NI is helping those companies and individuals to define Northern Ireland's capability and to provide a platform for further exploration of immersive technologies. The launch of the Immersive Tech NI Lab in Belfast this year, supported by the Department for the Economy, Belfast City Council and the UK Digital Catapult, cements Belfast's reputation as a leader in immersive technologies. And with the UK Government Industrial White Paper focussing on immersive technologies in its "Audience of the Future" challenge fund, there will be real opportunities in the coming months and years to create the next generation of products, services and experiences.

There is an extraordinary level of productivity within the creative tech sector – Gross Value Added (GVA) in the technology subsector of the creative industries in NI rose 60% 2009-2013, compared to 15% for the whole creative industries sector and 5% for all NI industries. This is a remarkable trend and one which indicates that creative technologies have the potential to play a major part in the NI economy.

There are currently 44,000 people working in the NI creative economy, representing 5% of the total NI workforce. Creative technology practitioners make up 46% of the creative economy workforce (20,000 people) and creative technology companies employ 13,000 people (52% of the creative industries

workforce). Good design and a satisfying user experience improves and enhances any digital product or service and creative technology offers new ways for businesses to market ideas, tell stories, develop concepts and create connections. In addition, evidence shows that creative occupations will be more resistant to automation than most other jobs – indeed, Nesta estimates that 87% of UK workers in the highly creative category will be at low or no risk of automation. So a healthy creative technologies sector will support sustainable growth across all technology sectors.

What we learned from our engagement with these businesses is that there are very specific interventions needed for this sector to thrive. This study makes many recommendations and while some of them will appear to be minor in nature, the benefits they would offer the sector would be significant.

The characteristics of the sector means that it has historically been able to draw funding from a range of bodies providing specialist creative, technological or business support. While these interventions have obviously been welcome, the funding landscape for this sector has become highly complex. A streamlined support framework with a single point of contact for businesses and clear signposting to available and appropriate support is therefore recommended.

The current low levels of collaboration in the sector also need to be addressed and the most effective way to do that is through clustering, which will help break down barriers and provide support to small businesses as they work, invest and train together. The recommendation of cluster creation and support has been made in many reports, both regionally and nationally. Northern Ireland has yet to seize this opportunity, but with creative technologies forming a major focus for both NI and UK industrial strategies, there has never been a better time to do so.

There is an urgent need for leadership and sectoral representation at government level so that business needs are heard, skills shortages identified at the earliest stage, opportunities identified and economic potential fully realised. A leadership group focusing on export and working with government will help develop the sector into a more cohesive, collaborative entity.

Finally, we need to acknowledge the fast paced nature of the sector, where new hardware and software is being developed every year, and make sure that the education and skills development opportunities on offer are appropriate to requirements. From primary schools upwards, we must ensure that there is access to the right resources, that teachers are confident in delivering training and that skills development can be packaged and offered in a way that suits the individual. We must appreciate and encourage the relationship between technology and creativity at every stage in education – encouraging a creative approach to technology and using technology to support creativity.

This is a sector which will flourish if it is supported and represented appropriately. The Northern Ireland creative technology sector has the talent, the innovation, the drive and the confidence required to succeed. It needs government to recognise its unique characteristics and requirements – if what has been achieved in transforming our cybersecurity and Film & TV sectors in recent years could be replicated across all creative technologies, we will truly be able to fulfil the Programme for Government aim of a more innovative, creative economy.

Tim Brundle

Chair of the MATRIX Creative Technologies Study

Executive Summary

GAMING

italicpig
AppAttic
BillyGoat ENTERTAINMENT

The NI Creative Technology Landscape

Northern Ireland is home to over 1,300 Creative Tech businesses creating games, apps, immersive experiences and animation. There is a high degree of crossover between disciplines within the sector – for example, Boom Clap makes immersive games, AppAttic makes healthcare apps and Big Motive makes virtual reality games.

USER EXPERIENCE

kainos
Deloitte. Digital
Big Motive

13,000 employed by NI Creative Technology businesses

44,000 working in the NI Creative Economy

ANIMATION

doublejump
Dog Ears
Sixteen South

IMMERSIVE TECH

BOOM CLAP GAMES
RETiniZE
SILVERINK
SENTIREAL

Source: DfC 2015 figures

Key issues and recommendations

Access to funding

The way government currently provides funding needs to be repackaged in a way that better supports the project driven nature of the sector – NI Screen is currently providing funding which is structured to meet those needs very well and has developed the respect of the sector, so there may be scope to widen their remit to include all creative tech funding.

There is a need to examine how best to fund the Creative Technologies sector more effectively. It is clear that the NI Screen model (project based, able to take risks and having sectoral expertise in house) works very well, so it would be worth investigating whether NI Screen could be sufficiently resourced to take over all government funding for creative technologies or whether the NI Screen funding model could be used by a new Creative Technologies body.

Support for new products

The loss of the Creative Industries Innovation Fund (which was stopped in 2015) is very keenly felt and again, the reintroduction of this simple intervention could greatly help new product development. Many highly successful products (including Sixteen South's Lily's Driftwood Bay) were initially funded through the CIIF.

The reintroduction of the CIIF for creative technology companies only, through a new or existing organisation, should be considered.

The benefits of clusters

The need for cluster development which fully supports the specific needs of the sector, which is mainly comprised of specialised microbusinesses needing good connectivity, business support services and networking opportunities.

The development of a city centre hub focussing on creative technology microbusinesses, with access to Ultrafast broadband, business support services and networking events would help encourage collaboration.

There is a real opportunity for BBCNI to further develop collaborations through the Rewind project, particularly if it was physically hosted in Belfast again. Easy access to these archives for local creative technology companies would allow them to create innovative new ways to experience Belfast's history and could form an important part of the View Belfast Project.

The need for skills

HE & FE skills providers need to acknowledge the fast paced nature of the sector, where new hardware and software is being developed every year, and develop their offering accordingly. In primary schools, there is a real concern that Digiskills NI is not being supported and developed properly to ensure that primary school teachers are confident in developing children's digital literacy skills and that children have the right resources to learn.

The Digital ICT recommendation to appoint a Chief Digital Officer should be revisited, and even widened to encompass a Digital Office to cover all digital skills and economic development functions. Thought also needs to be given to how government could work with businesses like Google to help with teacher CPD, as with the Trinity21 project in Dublin and the potential for the Techspace programme to be relaunched in Northern Ireland. Finally, Digiskills NI needs to have the necessary funding and cross departmental support to succeed.

A UX Bootcamp should be developed, with input from businesses, similar to the 2016 Data Scientist Academy which was designed by industry, delivered by the Universities and supported by DfE and Invest NI.

Additional recommended actions

Sales & marketing support

- Government should investigate the potential for developing a Creative Tech specific travel voucher/bursary scheme to allow small companies to pitch to companies outside Northern Ireland.

Support for new products

- Government should aim to run up to 4 SBRI (or similar challenges) per year aimed at the creative technology sector.
- Reintroduce the CIIF for creative technology companies only through a new or existing organisation with an accompanying marketing campaign.
- Government could partner with business incubation services to run events on IP protection and develop model contracts and investigate the feasibility of offering vouchers for specialist legal advice on IP.
- HMRC should target creative technology companies to make sure they are aware of R&D Tax Credits. Investigation is also needed on how best to deliver government R&D grants so that they are more accessible & useful for this sector.

The benefits of clusters

- Government could examine the potential for vouchers for connectivity to Ultrafast broadband for creative tech companies. They could also look at the potential for a Belfast city centre creative tech hub with access to best available connectivity alongside the software tools needed by the sector.
- We would like to see full support for the NI application to the AHRC Creative Industries Clusters programme.
- DfE should work closely with BCC to help develop creative tech projects in Belfast and use the findings to create a template for other councils.

- The National Museums of Northern Ireland (NMNI) priorities could be well supported by working with the creative tech sector to develop new, innovative ways of looking at artefacts, telling stories and connecting with audiences. By working more directly with the sector, through clusters or government challenges (such as the augmented reality tourism challenges run by Belfast City Council and Tourism NI), NMNI could add to the user experience through digital resources while delivering on their own future priorities.

The lack of sectoral leadership

- Northern Ireland needs a creative technologies representative body for Northern Ireland to work with government and represent the NI brand abroad. This could be as a subsector of a wider Digital ICT group or as a standalone body. A representative body could also offer sectoral groups support to learn about best practice, for example through expert speaker events. In addition, the development of an online creative tech hub to allow businesses and freelancers to share projects, opportunities and events and to allow the various existing sectoral groups to share cross disciplinary opportunities.
- Given the focus on the sector, particularly on immersive technology, in the UK Industrial Strategy White Paper and the NI Draft Industrial Strategy, a 3 year sectoral action plan should be developed for Northern Ireland to maximise access to the support available.

The need for skills

- The DfE Skills Barometer should develop models which take into account the effect of automation on the predicted need for future skills.
- MATRIX will undertake a precis on STEM skills and education, drawn from the research undertaken in previous studies, to outline recurring issues which need to be tackled to ensure that the increasingly multidisciplinary nature of our future industries is being served by our education system.
- Universities need to examine entry requirements to creative tech courses to ensure that they do not create unnecessary barriers.

Conclusion

This study has identified a small but thriving sector with tremendous potential both for growth in its own right and in collaborating with other Northern Ireland technology industries to enhance their products and services.

It is clear that the sector has a unique set of characteristics and business behaviours and because of this, it is not currently being supported as effectively as it should be to maximise its potential. The good news is that small adjustments to the way government supports these businesses could help transform the sector.

Introduction

The MATRIX 2016 Digital ICT Report identified that the creative digital and content sector, whilst highly dependent on digital technologies and professional ICT skills, was a highly progressive sector in its own right. It recommended a report dedicated to that sector to provide a focus and determine how the economic potential can be exploited.

This short report seeks to examine the growing cluster of businesses in Northern Ireland who are creative and depend heavily on technology – particularly in film & TV, gaming & animation, e-learning, immersive reality and mobile/web content. It also looks at the growing interest in graduates in gaming and related subjects from large banking and financial organisations and the increasing awareness that user experience (UX) and user interface (UI) play a vital role in business growth and customer retention. Businesses in this sector often have expertise in more than one of these areas. They also tend to have close relationships with the wider creative industries and the Digital ICT sector.

The research carried out for this study used a mixture of existing data and literature on foresight and global trends and opportunities, supplemented by primary research with businesses and stakeholders. Practitioners, academics and other stakeholders have been interviewed to gain an understanding of the sector in Northern Ireland. In addition, workshops were held in Belfast and Derry to find out exactly what was required to support the sector and an online survey was open to businesses and stakeholders. While the survey drew only a small response of 35, the results were reflected back consistently by the workshops and interviews. As previous MATRIX studies have noted, a large proportion of what may be considered contributing to the Digital Economy is not captured using analysis based on traditional industry classifications (SIC) code.[1] This has made collecting NI economic data for this study particularly challenging.

Creative tech companies not only form an important proportion of the Knowledge Economy, they also work very closely with other Knowledge Economy businesses – those in Digital ICT, Life & Health Sciences, Fintech, Cyber Security, Data Analytics or Advanced Engineering. It has been noted in previous Matrix reports that increasingly, the greatest potential for economic success comes at the point where two advanced technologies intersect.

Creative technology companies are well placed to benefit from this convergence as they bring improved usability and accessibility to interaction with products developed in other sectors. Northern Ireland has a small but strong base of Creative Digital companies and this report sets out to examine how they can best be supported and developed to help grow the sector.

[1] http://webarchive.nationalarchives.gov.uk/20160106032328/http://www.ons.gov.uk/ons/dcp171776_419158.pdf

The economic landscape

There are a number of terms commonly used when describing the creative technologies and it is important to make the necessary distinctions between each term to avoid confusion. Here is a brief summary of the definitions currently in use – note that many of these terms have a significant overlap:

Creative Technologies

A subsector of the Creative Industries, used to describe businesses using digital technologies in a creative way. Immersive technologies, user experience, games and animation fall within this definition and form the scope of this study.

Invest NI's "TV, Film & Digital Media" subsector

This subsector defined by InvestNI includes mobile, digital & interactive, digital media technology, e-learning and film & TV production. This last sector covers film & TV, games, animation and post-production and identifies the businesses which have their funding delivered by NI Screen. The other businesses have their funding delivered by Invest NI. Funding ultimately comes from DfE.

Creative Industries

The term "Creative Industries" refers to a range of economic activities which are concerned with the generation or exploitation of knowledge and information. The UK Government Department for Digital, Culture, Media & Sport (DCMS) defines it as "those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property".

Creative Economy

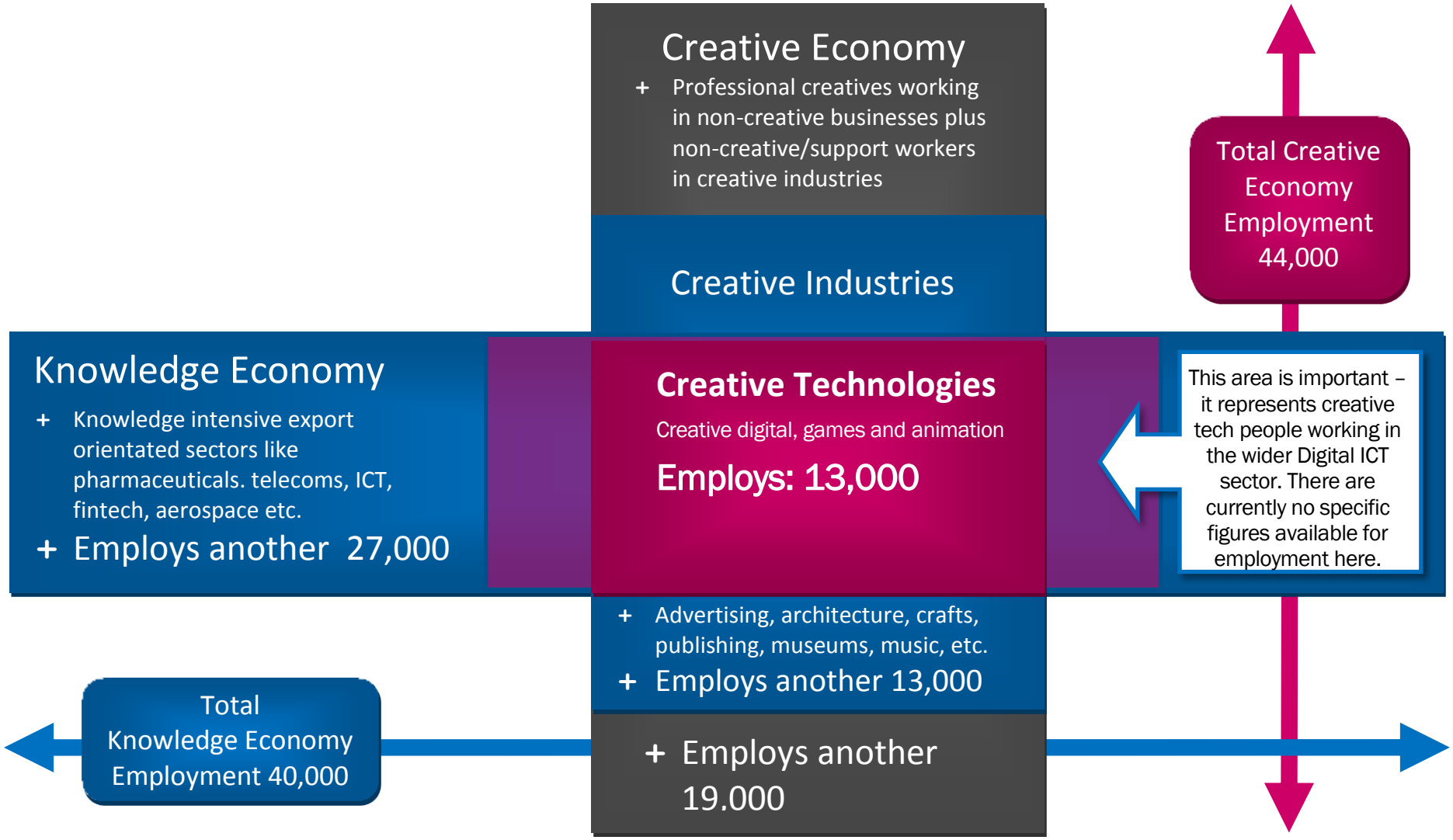
The DCMS measures creative economic activity by publishing data not just on creative businesses but also on creative professionals working in non creative businesses, i.e. inhouse web developers or graphic designers. These employees, when added to the creative industries data, form the creative economy.

Knowledge Economy

Defining the business types that come under the umbrella phrase 'Knowledge Economy' is much-debated. Catalyst Inc., who produce the Northern Ireland Knowledge Economy Index each year, use the sectors identified by the CONNECT organisation in San Diego with some customisation for the Northern Ireland context to identify the businesses with the greatest potential to sell high value goods and services across the globe, generating additional income for the companies and employees in NI.

Figure 1 on the next page illustrates how these terms relate to each other.

Figure 1: The economic landscape



Sources: KEI 2017, DfC, DfE

The characteristics of Creative Technology companies

Creative technology companies in Northern Ireland have a number of characteristics which differentiate them from other technical sectors, meaning that they require tailored support mechanisms. The key characteristics are:

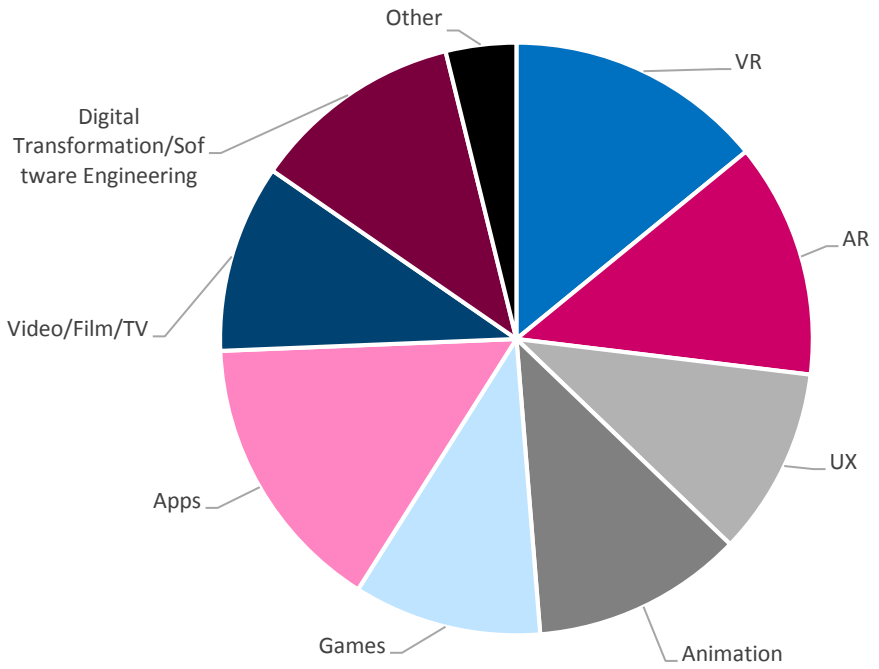
Size	Companies are either creative microbusinesses such as Sentireal, Silverink and Billygoat or large organisations such as Kainos, Deloitte Digital, PWC and Allstate. There is little overlap between the two business target markets, although there is some collaboration and subcontracting, and they use the same skills pool.
R&D	Cash flow to fund R&D is difficult for this sector. As companies fund their innovations primarily through commissions from their customers, building product ahead of customer demand is very challenging.
Clustering	The range of shared services such as good connectivity, reception and book keeping as well as the networking opportunities offered by physical hubs are of particular value to this sector. Naturally interdependent, with a large freelance/microbusiness workforce working across different creative technical disciplines, creative technologies are often at the forefront of technological change and this diversity needs to be harnessed, rather than siloed, to maximise its commercial potential.
Collaboration	Collaboration levels among businesses are low, although participation in sectoral groups is high.
Access to finance	Creative tech companies can find it particularly difficult to secure a bank or startup loan as the sole method of funding their business at the early stages. Access to finance for scaling is the priority in this sector and venture capital tends not to work as well as might be expected, with companies focused on long term sustainability. The level of awareness of creative technologies amongst investors and funders poses a problem, with companies finding a lack of understanding of the key developments and innovations, leading to poor advice and decision making.

So the sector is largely composed of microbusinesses who specialise in one or perhaps two creative technologies but are usually involved in several others. They are project led, so use freelancers and subcontractors to manage workload. They network well through sectoral groups but collaboration levels are low. They tend to innovate through client work rather than formalised R&D projects, which can lead to issues with funding and IP. They generally find funding and scaling a challenge due to the constraints of currently available support.

The NI focus

Northern Ireland has several key areas of growth in creative technology. This section outlines the main disciplines involved. Survey results indicate that there was a large amount of interdisciplinary work within businesses, with VR & apps the most common secondary discipline. The figure below shows the range of "secondary disciplines used by creative tech companies – so, for example, a web development company could also be developing games and apps and using immersive technology and animation.

Figure 2: Other creative technologies businesses worked with in addition to their main area of work



Source: MATRIX Creative Technology Survey

Immersive Technologies

Virtual reality (VR) and augmented reality (AR) technologies are becoming increasingly popular, particularly as hardware costs fall and usability improves. While recent successes such as Pokemon Go and PlayStation VR demonstrate the value of immersive technologies to the gaming industry, they are also being embraced by museums, artists, tourism bodies and architects as they start to explore the potential these technologies have to help them better engage with their audiences. According to the BCC report Virtual and Augmented Reality: Technologies and Global Markets, the global market for virtual and augmented reality was nearly $4.5bn in 2014 and the market is expected to reach $105.2bn by 2020 from $8.1bn in 2015, increasing at a compound annual growth rate (CAGR) of 67% from 2015 to 2020.

During the same period the gaming sector of this market is expected to grow from $2.5bn in 2015 to $32bn in 2020 (CAGR of 66.3%) while the education sector will grow from $1bn in 2015 to nearly $15.6bn in 2020 (CAGR of 72.3%). Education and healthcare are considered to be the sectors with the greatest potential for growth in terms of content.

The VR market is split into hardware (processors, headsets, etc.), software (to enable hardware or allow delivery of content) and content creation. While VR is just gaining traction, augmented reality (AR) has been around for a while now. It involves supplementing the physical or real-world environment with computer-generated content. As with VR, the key components are hardware, software and content. Improvements in head-up displays (HUDs) and head-mounted displays (HMDs) are driving innovation in the development and usage of both VR and AR. The main innovations in AR, however, are being driven at phone level, with ARKit from Apple and ARCore from Google. In other words, the enabling technology is now potentially in everyone's pockets.

A healthy cluster of immersive technology companies now operates in Northern Ireland, all in the content creation and software space (rather than in the production of hardware). Companies include Sentireal, PerformanceActive, Silverink, Retinize, Story FX and Big Motive.

The recently formed Immersive Tech NI community is helping companies and individuals to define Northern Ireland's capability and to provide a platform for further exploration of immersive technologies. Immersive Tech NI has an active Meetup group with over 300 members.

In March 2017 Digital Catapult NI, Belfast City Council and Invest NI supported 23 digital and immersive technology companies from Northern Ireland to attend and demo at SXSW, one of the largest and most creative digital events in the world. Companies developed meaningful partnerships, new distribution channels and contacts with companies like Sony.

All the Immersive Tech companies interviewed said that they were technology agnostic – this reflects the fast developing hardware and software landscape. Virtual reality companies tend to focus on either low end (eg Google cardboard) or high end (eg Oculus Rift), depending on their output and intended audience. Many felt that immersive technology was just on the cusp of becoming a mainstream entertainment channel and when that happens there will be a sudden, huge need for compelling content. Whether or not that proves to be the case in the very near future, other sectors are already starting to see the value of immersive technologies, particularly in industry, property, training and tourism.

Games

The Newzoo 2017 Global Games Market Report estimates that 2.2bn gamers across the globe are expected to generate $108.9bn in game revenues in 2017. This represents an increase of $7.8bn, or 7.8%, from the previous year. Digital game revenues account for $94.4bn or 87% of the global market. Mobile is the most lucrative segment, with smartphone and tablet gaming growing 19% year on year to $46.1bn or 42% of the total market. In 2020, mobile gaming will represent just more than half of the total games market. Newzoo expects the global market to grow at a CAGR of 6.2% toward 2020 to reach $128.5bn.

The games sector in Northern Ireland has some highly successful companies. As well as those producing games for mobile & PC purely as entertainment such as Italic Pig, BillyGoat Entertainment and Blackstaff, companies like Appattic develop apps which gamify healthcare and companies such as Enter Yes and Iglu are developing immersive games in VR.

The gamification of aspects of health and finance to improve uptake of services or encourage positive behaviours is a particularly exciting development and Appattic has demonstrated that there is good potential for growth here, recently securing the first ever Northern Ireland Health SBRI to develop their gamification of medication management with the South Eastern Health Trust.

The games sector is notoriously difficult to support and to measure, with most games companies in NI being microbusinesses. But the potential prize is great – the market is expected to grow more quickly than Film & TV. NI Screen, Invest NI, Games NI and others are actively supporting the sector.

NI Screen plans to launch the NI Games hub in Spring 2018. The aim is to create a physical innovation environment shared by the universities and other stakeholders that can support collaboration between industry, academia & government, maximise resources, increase peer to peer learning, create pathways into the sector, improve interaction between stakeholders and establish research opportunities for commercialisation.

The hub will feature a co-working space that will provide accommodation for the teams involved in incubation programmes, access to executive level support to navigate production, technical, creative, publishing, outsourcing, legal/Finance challenges and a focal point for industry activities such as seminars, workshops and hackathons.

Animation

The size of the global animation industry was about $244bn in 2015. The major animation markets include the United States, Canada, Japan, China, France, Britain, Korea and Germany. Most of the segments in the animation industry are growing at the rate of 5% year on year. The outsourced computer animation production market is increasingly being tapped into by North American and European film and television programme producers.

> "It's important that kids learn to make and code as early as possible. At 3D Dojo they get to learn about 3D animation using free software like Autodesk Maya. We do this to raise 3D literacy as it underpins many emerging technologies, not only animation, but 3D printing, Virtual Reality and Augmented Reality."
>
> **Greg Maguire, Ulster University**

Animation skills in Northern Ireland are focussed around companies such as Sixteen South, Humain, Flickerpix and JAM. A key influence in the growth of this subsector has been Professor Greg Maguire, now CEO of Humain, who headed up Animation at Ulster University at Belfast from 2010 to his return to industry in 2017. He developed an internationally respected suite of animation courses at Ulster University. In response to the perceived lack of communication between the many small animation studios in Northern Ireland, Professor Maguire also formed Toody Threedy, an animation cluster for students, researchers and industry.

The Animation courses on offer in Ulster University are fundamentally different from those offered elsewhere in the UK because they are based in an Art & Design campus rather than a film school. They teach design thinking and narrative and the courses are essentially design led.

Northern Ireland has significant potential for export growth in animation (particularly in 2D episodic shows, such as the children's TV programmes being produced by JAM and Sixteen South).

The animation skills pipeline is supported by 3D Dojo which was started in 2013 – this an informal computer animation club for 10-18 year olds which runs on alternate Saturdays to teach essential animation skills and allow students to try out ideas and learn to make movies, models and animation.

User Experience

User experience (UX) encompasses all aspects of the end-user's interaction with the company, its services and its products.

Good UX allows a product or service to meet the exact needs of the customer, without fuss or bother and with simplicity and elegance. It allows a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design.

UX should not be confused with either usability or user interface (UI). Simply put, usability is a component of UX covering whether the system is easy to learn, efficient and pleasant to use, while UI focuses on the look and feel, the presentation and interactivity of a product.

User Experience Design (UXD) is theoretically a non-digital practice, but it is used extensively by digital industries. It can be seen as inhabiting the convergence between art, technology and psychology.

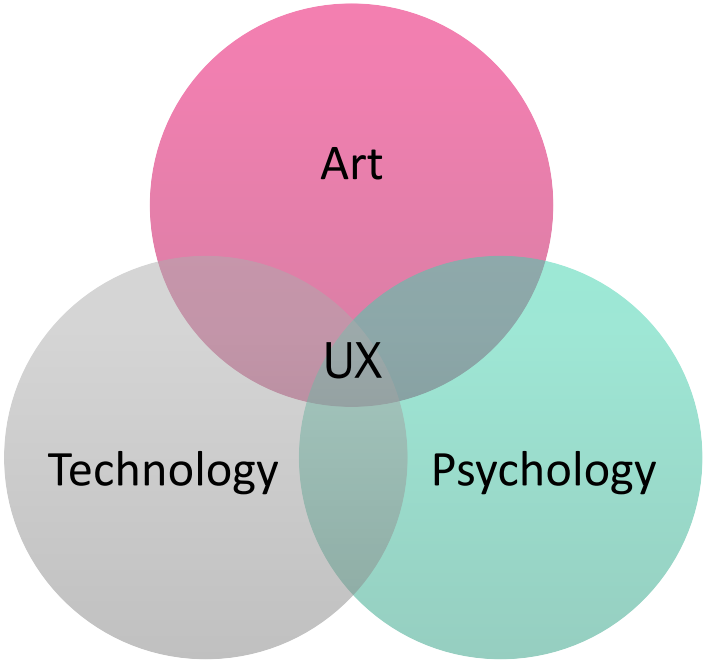
Whereas the first generation of web agencies in Northern Ireland (1995 onwards) focussed on UI, there is now an increasing focus on UX, reflected by the development of Ulster University's new Interaction Design degree.

UX skills are in great demand from fintech, life & health sciences and other software development businesses as well as from government, as it develops its "digital by default" services.

Recently some of the large consultancy houses have developed their own inhouse UX teams to help them serve their customers more efficiently, while some Fintech companies are also developing inhouse teams. Overall the landscape is fast changing, with the skills requirements growing apace.

User Experience (UX) and User Interface (UI) are some of the most confused and misused terms in our field. A UI without UX is like a painter slapping paint onto canvas without thought; while UX without UI is like the frame of a sculpture with no paper mache on it. A great product experience starts with UX followed by UI. Both are essential for the product's success."

Rahul Varshney, Foster FM



Film & TV

The global film industry shows healthy projections for the coming years, as the global box office revenue is forecast to increase from about $38bn in 2016 to nearly $50bn in 2020. The U.S. is the third largest film market in the world in terms of tickets sold per year, only behind China and India. Just under 1.2bn movie tickets were sold in the U.S. in 2016. There are about 5,800 cinema sites in the U.S. as of 2016.

Northern Ireland has been extremely successful in attracting large-scale film and television production in recent years. This success is largely down to the efforts of NIScreen, the agency responsible for TV, Film (along with games, animation and interactive content). The Northern Ireland Screen Fund is both a development investment fund and a production investment fund and is Northern Ireland Screen's primary tool in accelerating the development of the screen production sector. By 2018 they expect to have invested a total of £42.8m, generating 2,800 direct full-time equivalent job years valued at £107.8m.

Belfast's newest film studio is currently being constructed at Giant's Park, Belfast. The £20m project will include over 120,000 sq ft of studios, workshops and offices. The film studio will take up 8 acres of the overall 340 acre Giant's Park/North Foreshore site.

The Film & TV sector aligns very closely with the other disciplines examined in the report, with the investments in the Film & TV sector providing significant opportunities for those other disciplines. These include Queen's University's recent investment in new undergraduate pathways in Broadcast Production, music and audio production, sound design and audio engineering.

We have a significant number of highly skilled small businesses operating in a sector that can add value to other emerging and established high value sectors. But how can we support them and ensure that they have the contacts, the business skills and access to the facilities needed to succeed?

Lily's Driftwood Bay, by Sixteen South

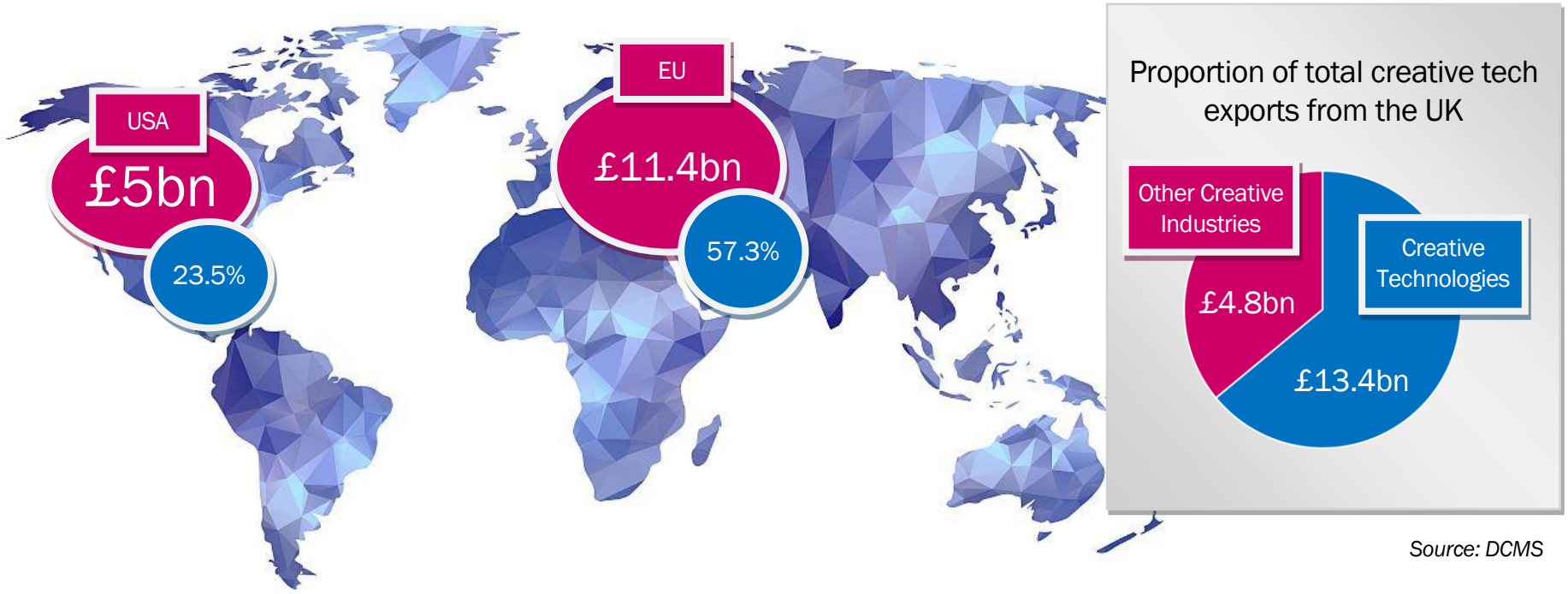
The market focus

One in twenty of the NI workforce works in the creative economy and our creative industries generate 2.4% of our GVA. It's a small but fast growing part of our economy which supports and collaborates with other fast growing sectors. There are currently around 1,200 creative technology businesses in NI.

Exports

Exports by the UK Creative Industries in 2014 were worth £19.8bn, up 10.9 % from 2013 and accounting for 9% of total UK exports of services. 57.3% or £11.4bn of those exports went to the EU and 25.3% or £5bn went to the USA. Creative technologies made up 64% or £13.4bn of the total UK creative industries export.

Figure 3: UK Creative industries exports 2014 (DCMS)



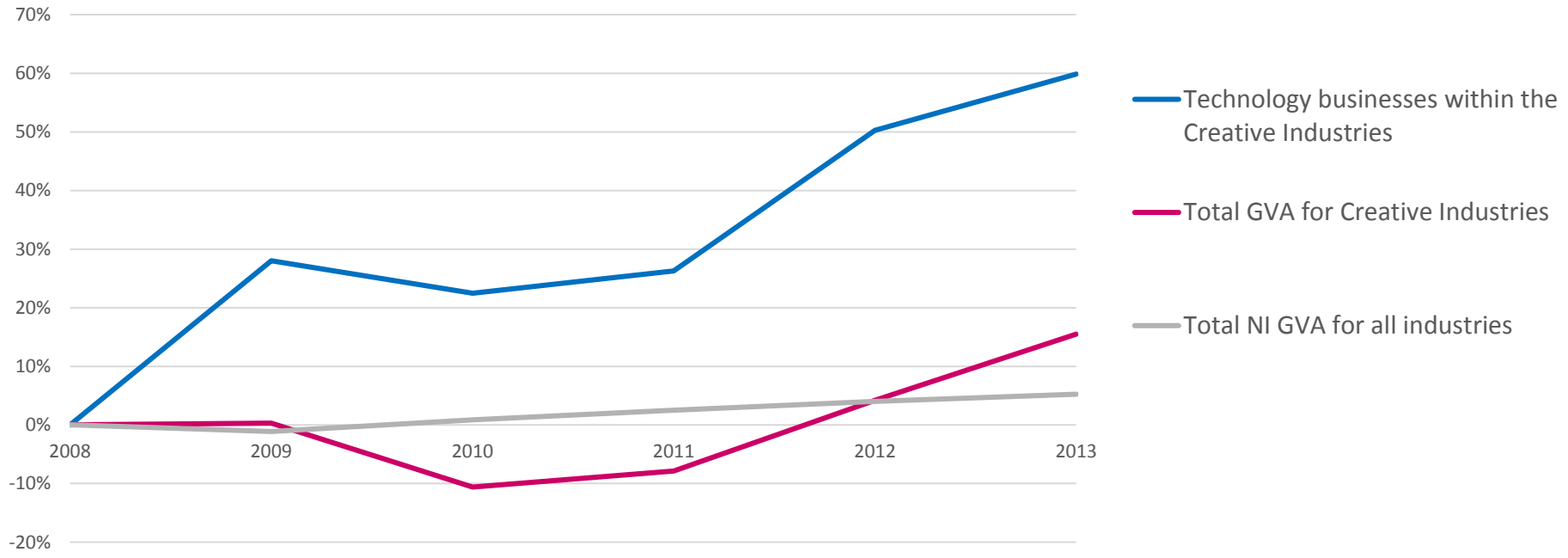
Source: DCMS

Gross Value Added (GVA) for Creative Technology sector in Northern Ireland

Gross Value Added (GVA) for the creative industries was £797 million in 2013, representing 2.4% of Northern Ireland's total GVA . The GVA for creative industries increased by 11.3% between 2012 and 2013, compared to a 1.2% increase for total GVA. Within the creative industries, technology based businesses provided the greatest contribution to NI GVA (£481 million).

GVA in the technology subsector of the creative industries in NI rose 60% 2009-2013, compared to 15% for the whole creative industries sector and 5% for all NI industries.

Figure 4: Gross Value Added growth in NI 2008-2013



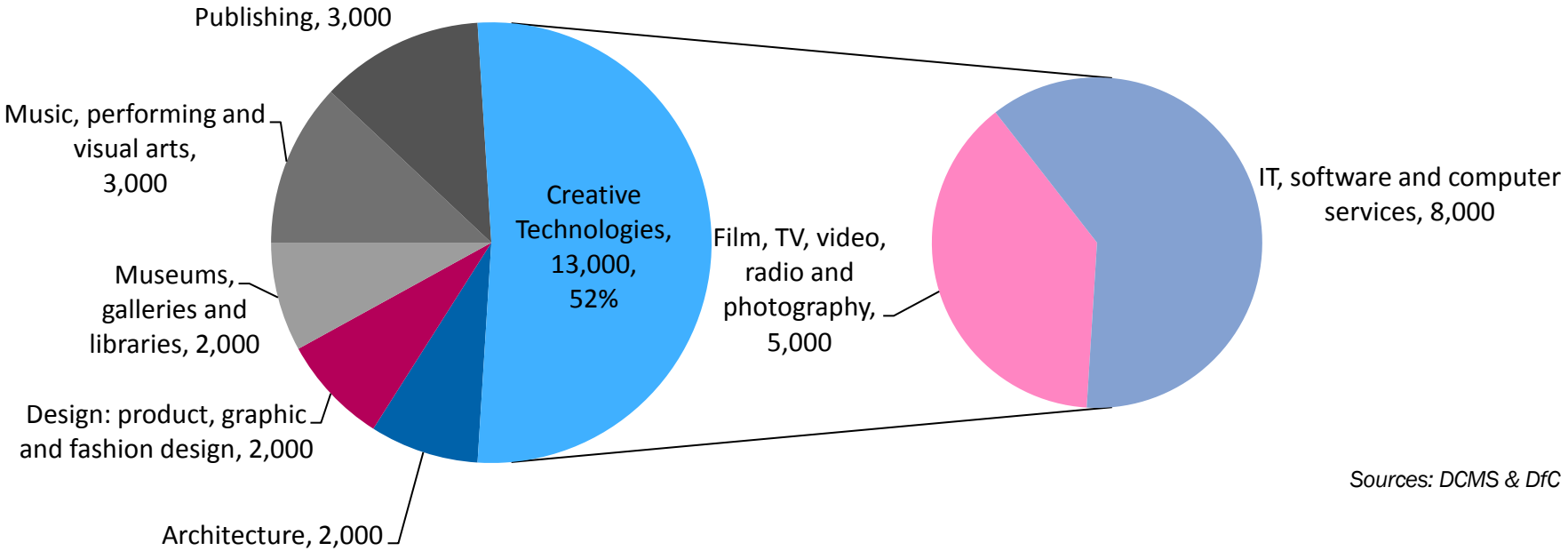
Source: DfC

This is a remarkable trend and one which indicates that creative technologies have the potential to play a major part in the NI economy.

The NI workforce

The Department for Digital, Creative, Media & Sports (DCMS) estimates that in 2015 there were 26,000 people working in the creative industries and 19,000 working in creative roles outside the creative industries, giving a total of 44,000 working in what is known as the creative economy and which represents 5% of the total NI workforce.

The Department for Communities (DfC) has further broken down the employment in the creative industries to show that creative technologies make up 52% of the creative industries workforce (and 46% of the wider creative economy workforce). The latest DfC figures are for 2013[2] and the next figures will be released in 2018.



Sources: DCMS & DfC

The estimated number of business units in the creative industries sector was 2,610 in 2015. This represented 3.8% of all business units in Northern Ireland. Almost two-fifths (39.7%) of all creative industries in Northern Ireland in 2015 were in the IT, software and computer services group.

[2] https://www.communities-ni.gov.uk/publications/creative-industries-economic-estimates-northern-ireland-2015

The creative tech sector is significant and well established and we know that it is the fastest growing part of the wider creative industries. But what strategies are in place to support it?

Tara's Locket by Big Motive

Strategic context

Currently there is no dedicated strategy in Northern Ireland for Creative Technologies, although the sector has been identified in the Draft Industrial Strategy as one of just six sectors prioritised for targeted investment and government support. In the UK, there is a dedicated strategy for the Creative Industries and the Industrial Strategy White Paper identifies Creative Industries as having significant opportunities for growth, awarding it one of only six early sector deals. This suggests an opportunity for the creation of an NI sectoral body to represent businesses in much the same way the CIF is doing at national level, developing a dedicated strategy and action plan to reflect the importance of the digital & creative technologies in Northern Ireland's overall industrial strategy.

Northern Ireland

While current Northern Ireland strategies remain in draft form they highlight the recognised value of the creative technologies. This presents a clear opportunity for the sector to ask government to secure policies that would directly support the sector. Good representation is needed, possibly through a NI sectoral organisation as outlined in the 2016 CIRB Sectoral Study, which recommended a single unified voice for the creative industries, acting as a link between businesses, government, professionals and aspiring creatives and acting as an advisor to the Government to align policies and ensure appropriate support to the sector.

Draft NI Programme for Government (2016-2021)

The Draft Programme for Government focuses on the major societal outcomes that the NI Executive wants to achieve. Outcome 5 states the aim for Northern Ireland to be an innovative, creative society, where people can fulfil their potential.

This desired outcome not only offers an opportunity for creative tech companies themselves, but also where they collaborate with other emerging sectors to create new products and services.

The 'indicators' which the PfG will use to demonstrate the success of this outcome (such as the percentage of companies engaging in innovative activity, the proportion of companies with access to superfast broadband and the percentage of population engaging in cultural or artistic activities) also offer the sector significant opportunities for development.

> "Outcome 5 is about having a more innovative, creative economy, with a broadening base of businesses engaged in innovation and R&D, and where there is increasing collaboration between companies inside and outside the region....ensuring we will be one of the UK's leading high-growth knowledge based regions which embraces creativity and innovation at all levels in society."
>
> Draft PfG 2016

The NI Draft Industrial Strategy (2017)

The NI Draft Industrial Strategy was published by DfE in Jan 2017. It identifies Digital and Creative Technologies as one of the six broad sectors of the economy, across both manufacturing and services, where Northern Ireland has world class capabilities.

In order to fulfil the ambition to build a globally competitive economy, this strategy will offer enhanced investment and support to market opportunities most likely to lead to strong and sustained economic growth. It aims to provide the strongest support for those sectors and sub-sectors where we are already world class and where we can become world class.

> "Northern Ireland has gained a global reputation in the creative industries with notable success in the TV and film industry as well as the burgeoning animation sector. High profile, large scale TV and film productions like HBO's Game of Thrones, shot on location here, provide significant investment in the local economy and promote Northern Ireland to global audiences. We will continue to work with NI Screen and other key stakeholders to build and expand on the success achieved to date."
>
> Draft NI Industrial Strategy 2017 (Economy 2030)

UK

Creative Industries Council - Create Together Strategy (2016)

Create Together is a growth strategy for the UK creative industries, developed by the CIC. It offers a roadmap for industry and government to help the creative industries grow over the next five years. Among its aims are the desire to promote the benefits of collaboration and connectedness across creative sectors as a source of innovation, value creation, and joined-up practice by industry and government and encourage regional creative clusters and work with devolved authorities to ensure all parts of the UK participate in the success and economic rewards of the creative industries.

The UK Industrial Strategy Green Paper (2017)

The UK Industrial Strategy Green Paper was published by BEIS in January 2017 and noted significant opportunities for growth within the Creative Industries and aimed one of only six early "sector deals" at digital and creative industries[3]. This means that the government would be prepared to deregulate, help with trade deals or create institutions to boost skills or research if any of these sectors can show that it would address specific problems.

Creative Industries Federation response

The Creative Industries Federation is taking a highly proactive approach to the UK Draft Industrial Strategy, focussing on the "sector deal" for the Creative Industries. These deals will only be available to sectors that have organised themselves and made the case for government action - the automotive and aerospace industries sectors have already successfully used this model.

[3] https://www.gov.uk/government/news/pm-unveils-plans-for-a-modern-industrial-strategy-fit-for-global-britain

CIF is therefore focussing its efforts on putting together collaborative bids for "ribbon cutting" projects – high profile, innovative projects which highlight the value of the creative industries to other sectors. Its key recommendations are:

- Creative enterprise zones - modelled on the tax breaks and dedicated government support offered in existing enterprise zones, but tailored for the creative industries
- A 'business booster' network - to provide access to high-quality advice for startups and small enterprises on exporting, intellectual property (IP) and access to finance
- A creative careers campaign - to diversify recruitment and counteract inadequate and misleading advice on jobs available and the education and training needed for them.

Sir Peter Bazalgette has conducted an independent review into how the UK's creative industries can help underpin future prosperity by utilising and developing new technology, capitalising on intellectual property rights, and growing talent pipelines.[4] The review also sets out areas where, as part of the Industrial Strategy, government and industry should work together to develop a Sector Deal for the Creative Industries.

DfC/DfE response

Key issues identified for Creative Industries in NI by the Department for Communities and included by the Department for the Economy in its response to the Green Paper included better careers advice and information on the creative sector, an improved Education/Curriculum Programme to promote creativity in schools, better access to skills training and professional development and more creative job opportunities. The response broadly supports the CIF recommendations.

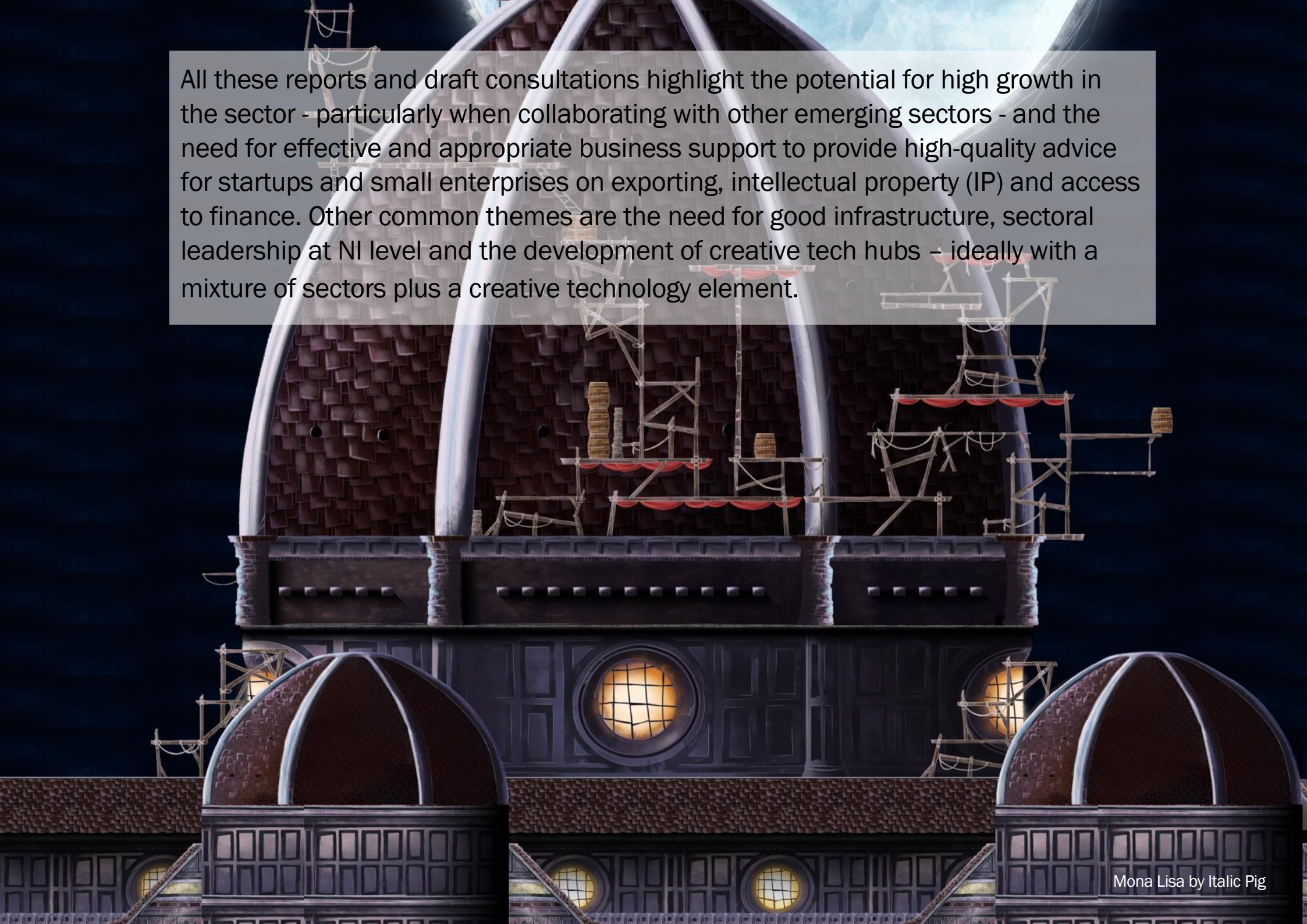
The UK Industrial Strategy White Paper (2017)

The white paper confirmed that a sector deal with the Creative Industries was at an advanced stage. Government has already made a commitment to support eight AHRC Creative Clusters and establish a new National Creative Industries Policy & Evidence Centre.It also outlined the role of the new Industrial Strategy Challenge Fund and identified the first five programmes. One of them ("Audience of the Future"), will offer up to £33m to projects using immersive technologies. It is hoped that this programme will help create the next generation of products, services and experiences and help position the UK as the global leader in immersive technologies.

Given the focus on the sector, particularly on immersive technology, in the UK Industrial Strategy White Paper and the NI Draft Industrial Strategy, a 3 year sectoral action plan should be developed for Northern Ireland to maximise access to the support available.

[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/649980/Independent_Review_of_the_Creative_Industries.pdf

All these reports and draft consultations highlight the potential for high growth in the sector - particularly when collaborating with other emerging sectors - and the need for effective and appropriate business support to provide high-quality advice for startups and small enterprises on exporting, intellectual property (IP) and access to finance. Other common themes are the need for good infrastructure, sectoral leadership at NI level and the development of creative tech hubs – ideally with a mixture of sectors plus a creative technology element.



Mona Lisa by Italic Pig

The NI advantage

Benchmarking Northern Ireland

Several recent studies identify Northern Ireland as having the right skills and infrastructure to support a thriving creative tech economy, with most specifically identifying Belfast as a hot spot for technical creativity.

2016 Knowledge Economy Index

The KEI notes that Northern Ireland's knowledge economy is the UK's second fastest growing region (albeit from a low base), bettered only by Scotland.[5]

Tech Nation 2017

The most comprehensive analysis of the UK Digital Tech Ecosystem, TechNation 2017 rated Belfast as being in the top thirty cities in the UK, measuring jobs, startup rate and growth potential.[6]

CBRE Creative Regions 2017

"Creative Regions" identified the Top 25 Regional Creative locations in the UK [outside of London]. The ranking was calculated through a weighted analysis of fifteen metrics covering employment, demographics, costs and real estate measures across 64 different urban areas in the UK, outside of London. Belfast was placed 11th, with over 12,000 people employed in Information & Communication in 2015 (up 12.5% over the previous 5 years), over 600 Information & Communication SMEs, a millennial population of over 82,000 (23% of the total population of Belfast) and 25% of employees educated to degree level or above.[7]

2016 Nesta European Digital Cities Index

The Nesta EDCI measures all 28 EU capital cities on a range of indicators, ranking them to measure how well they supported startups and scale-ups in digital industries. It then added 32 more high performing EU cities to bring the total measured to 60. In 2016 London was 1st and Dublin was 8th, but no NI city was

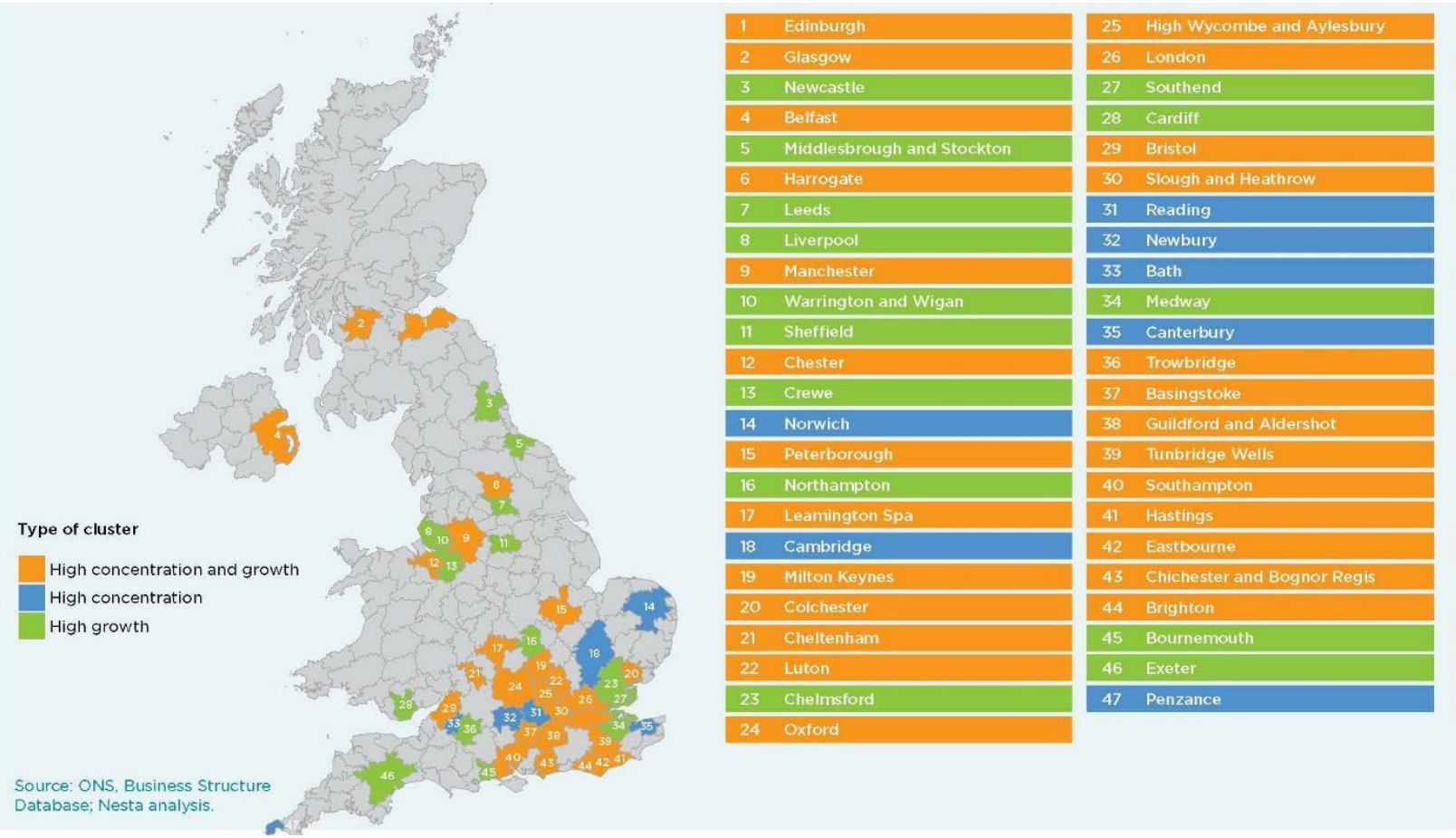
[5] http://matrixni.org/wp-content/uploads/2016/12/Connect-Final-Draft-Low-res-2.pdf
[6] http://technation.techcityuk.com/cluster/belfast/
[7] http://www.cbre.com/research-and-reports/United-Kingdom-Major-Report—Creative-Regions-May-2017-Interactive

included, not because they performed poorly but because NESTA could not access the necessary data. MATRIX commissioned a further report from NESTA and supplied the required data for Belfast. Belfast was then rated 41st and NI city data will be evaluated for the Index going forward.

Nesta - The Geography of Creativity in the UK, 2016

Another Nesta report published in 2016 identified Belfast as a significant creative cluster, with a high concentration of businesses and high growth.

Figure 5: Creative clusters in the UK (Nesta - The Geography of Creativity in the UK, 2016)



Derry~Londonderry

The North West Region is also well positioned to build a competitive edge, albeit on a smaller scale than Belfast, with over 50 creative digital content companies covering everything from e-learning and games development to mobile apps and TV production. There is an active digital community with regular networking events and regional digital media conferences. The region has a strong integrated educational base from secondary to FE to HE - over 1,500 students enrol annually in digitally-focused courses across the North West.

Connectivity

Creative technology companies need excellent connectivity, so access to superfast (around 30- 80Mbps) and ultrafast (up to 330Mbps) is essential. "Improving internet connectivity" was included as a performance indicator in the Northern Ireland Executive's Draft Programme for Government Framework 2016- 2021.

Superfast & ultrafast connectivity

Northern Ireland has a good level of superfast connectivity – it is currently available to 85% of business premises across NI (compared to a UK average of 91%), although this figure drops to 57% in rural areas (UK rural average 66%). Uptake is 48%, slightly higher than the UK average of 43%.[8]

25% of premises can access Ultrafast broadband (<300Mb/s). Only 4,000 premises (0.5%) have FTTP - fibre to the premises.

Ultrafast broadband requires fibre all the way to the premises (Fibre to the Home/Premises, FTTH/FTTP). The installation is more expensive and retail products are pitched at businesses with high speed connectivity requirements and/or a lot of employees sharing the bandwidth. Availability is very low.

The recent announcement of £150m investment in broadband infrastructure in NI is very welcome, although it is still not clear whether the focus will be on improving general coverage or speed. Whether the investment is spent on superfast or ultrafast broadband is an important point. It is not just about speed, but coverage and ultimately about whether the priority is maximum overall coverage or maximum connectivity for those businesses who may need it.

Previous government interventions

Government intervention in broadband takes two forms:

- Investment in availability and supporting the upgrade of infrastructure that would otherwise not be commercially viable to improve.
- Subsidising uptake through voucher schemes to defray the off-putting cost of installation of satellite and fibre installation.

[8] Ofcom Connected Nations 2017

Both interventions have operated in Northern Ireland successfully. A few recent examples include:

- The three-phase Northern Ireland Broadband Improvement Project – which has funding from the EU as well as DCMS and the local Economy and Agriculture departments – is helping rollout fibre from exchanges that serve "communities in remote areas".
- The Belfast Connection Vouchers Scheme (part of the SuperConnected Cities programme that targeted 22 cities across the UK) ran between December 2013 and October 2015 and spent £3.86m to provide 2,062 businesses, charities and social enterprises with grants for up to £3,000 to cover the cost of high-speed broadband installation. Anecdotally, some of the Ultrafast services ordered with the vouchers in Belfast experienced lengthy delays given the difficulty in scheduling streetworks to install fibre on busy city-centre streets.
- The Northern Ireland Better Broadband Scheme is open until December 2017 and provides subsidised satellite or wireless broadband installation to homes and businesses that cannot access a 2Mbps service.

Project Kelvin

Project Kelvin connects Northern Ireland to North America and Europe, providing a high capacity network through Hibernia's industry leading fibre optic submarine cable. The network attracts local and global companies who require fast, low latency bandwidth.

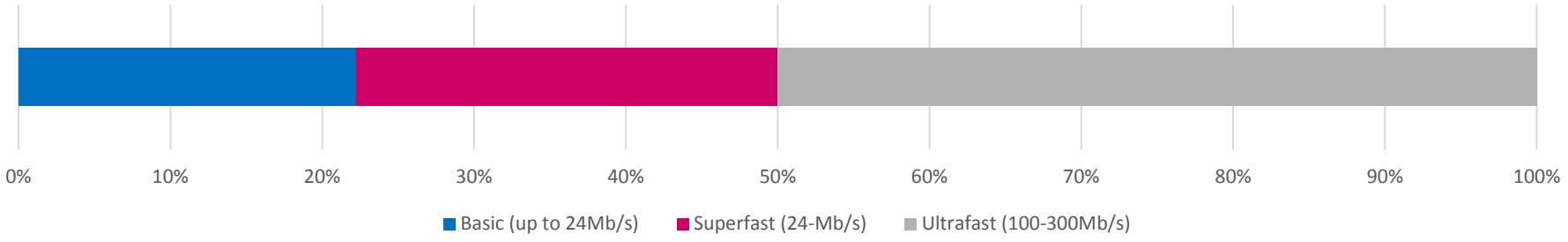
The new Atlantic Link Enterprise Zone in Coleraine will be built at the site where the Project Kelvin transatlantic fibre comes ashore. The hub has been achieved by securing the investor and anchor tenant 5Nines which is a global data centre company. The next stage will be establishing a Digital and Creative Causeway within the enterprise zone.

While Project Kelvin is an asset, any advantages it offers are dependent on co-location with the cable and direct access to it. Several Belfast City Centre companies interviewed for this report criticized available broadband speeds, with many reporting low upload speeds of 1Mb/s.

They said that a city centre studio complex for creative technologies companies with ultrafast broadband would be attractive. Most survey respondents were happy with their broadband speed – those that weren't said that it was because of lack of availability rather than cost.

A connectivity voucher funded by DfE and administered through councils allowing creative tech companies to access ultrafast broadband would increase uptake, thus allowing small creative tech businesses to access the best possible connectivity.

Figure 6: Survey response – What speed of broadband does your business have access to?



Source: MATRIX Creative Technology Survey

So in summary, access to ultrafast and superfast broadband in Northern Ireland is generally good in urban areas and designated zones, and the recent announcements on proposed infrastructure investment are very welcome. However, sustained and focussed investment in infrastructure is essential. According to the 2017 Europe's Digital Progress Report[9] both Ireland and the UK lag behind countries such as Portugal and Latvia, where more than 80 % of homes can already subscribe to ultrafast FTTP/H services, compared to less than 10 % in Northern Ireland.

In addition, we don't have any way of knowing what the future requirements for high speed connectivity in Northern Ireland will be – increased use by consumers (e.g 4G streaming of media) could easily outstrip the needs of creative tech businesses. Indeed in the last year alone, average monthly data use (upload and download) per broadband line in Northern Ireland has risen almost 50% to 187GB.[10] What we can say is that targeted, well planned investment in digital infrastructure is vital to our economy.

How the £150m broadband investment is spent over the next two years, and whether the emphasis is on overall coverage – ensuring that every premises in NI has broadband of some sort – or access to ultrafast broadband for the businesses that may need it, could affect the potential growth of the region's creative economy.

Government could examine the potential for vouchers for connectivity to Ultrafast broadband for creative tech companies. They could also look at the potential for a Belfast city centre creative tech hub with access to best available connectivity alongside the software tools needed by the sector.

[9] https://ec.europa.eu/digital-single-market/en/news/europes-digital-progress-report-2017
[10] OFCOM Connected Nation 2017

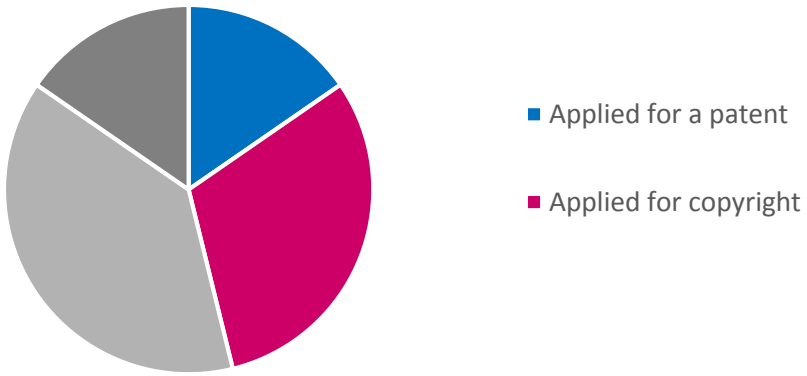
IP Protection

Innovation in the creative technologies sector is often a collective process involving several participants, each with different objectives and needs.

In 2013 Creative Works London, AHRC & Queen Mary University published a white paper[11] on using Intellectual Property in the Creative Industries which examined the particular issues experienced by the sector and which observed, "Creators are too busy creating (and trying to make a living) to bother with the paperwork, and only large enterprises have the resources to enforce these kinds of rights." The authors recommended government investment in model contracts to allow businesses to use them as a basis from which to develop a customised contract. This could be developed along the same lines as the Lambert Toolkit, a suite of collaboration agreements which was developed for universities and companies wishing to undertake collaborative research projects with each other.

Many interviewees cited Intellectual property (IP) as an area of difficulty, and only 40% of survey respondents had taken any steps to protect their IP, whether by applying for a patent, protecting copyright or taking specialist legal advice.

Figure 7: What steps have you taken to protect your IP?



Source: MATRIX Creative Technology Survey

Government could partner with business incubation services to run events on IP protection and develop model contracts and investigate the feasibility of offering vouchers for specialist legal advice on IP.

[11] http://www.creativeworkslondon.org.uk/wp-content/uploads/2013/11/White-Paper-Using-Intellectual-Property-in-the-Creative-Industries.pdf

Northern Ireland has been identified as offering particular benefits for the creative tech sector by a number of national and international reports. What kind of support is available to businesses?

Little Roy by JAM Media

Access to finance

Creative tech companies can find it particularly difficult to secure a bank or startup loan as the sole method of funding their business at the early stages. Access to finance for scaling is the priority in this sector – businesses are mainly looking for help to help to grow from 1 person to 5, and from 5 people to 20.

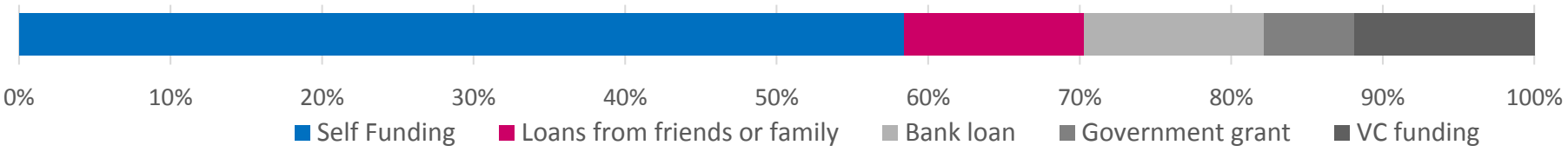
Venture capital tends not to work as well as might be expected, as companies are not focused on exits but on long term sustainability or "patient capital". The level of awareness of creative technologies amongst investors and funders poses a problem, with companies finding a lack of understanding of the key developments and innovations, leading to poor advice and decision making. For these reasons, loan schemes are particularly attractive to the sector and Catalyst Inc has introduced Capital Match which has built up a database of and relationships with many UK venture capital companies and other non-NI funders. Capital Match uses these relationships to bypass the knowledge gap and to provide funding introductions in a manner which is time efficient for both the selected companies and funders.

Table 1: Bank finance vs. Early Stage & Growth Finance

	Bank Finance	Early Stage & Growth Finance
Risk	Typically lower risk to businesses in established markets	Much higher risk to younger businesses in new and emerging markets with the expectation that many will fail
Criteria	Based on the ability of the business to repay	About "picking a winner" and identifying growth opportunities
Type	Traditional loans	Loans alongside non-traditional finance such as equity, angel investments, mezzanine etc
Demands	Owner retains control of the business	Owners often have to dilute control of their businesses and give up shares to investors

Our survey asked about the funding methods businesses had used to start up.

Figure 8: Funding mix for startups in the NI creative technology sector



Source: MATRIX Creative Technology Survey

Government Support

A range of sector specific tax reliefs are available for films, high-end TV productions, animation, Children's TV programmes and video games. [12] A full overview of funding options in Northern Ireland is outlined at Appendix 3. In addition, support and funding are available from these principal sources:

Invest NI

Invest NI offers good levels of generalist support for startups and scaling businesses right across the sector. However businesses reported low engagement between Invest NI and the sector, and awareness of Invest NI products was generally very low. The exception was TechStart and its Proof of Concept scheme, which was highly praised by those who applied. Study participants reported a perceived lack of understanding of the way creative technology businesses operate. Businesses said that they would like to see Invest NI's overseas offices actively targeting games and animation FDI opportunities and helping indigenous companies find export and overseas opportunities.

NI Screen

NI Screen administers funding specifically aimed at games, animation, interactive content, TV & Film. It differs from Invest NI in that it tends to support individual projects and its team has an industry background. Some funding is provided on a rolling basis (mainly as recoupable loans) while other funds are offered on a "call" basis; timebound competitions for specific areas. The NI Screen approach was viewed favourably by all study participants. When asked to define exactly what made NI Screen so successful, the main reasons given were:

- Funding is for a specific project, rather than towards increasing employment, which fits better with the way the sector works
- The NI Screen team all come from within the sector so have an excellent understanding of the particular challenges and opportunities faced by businesses
- NI Screen is seen as less risk averse than Invest NI

Recommendation 1:	Examine how best to fund the Creative Technologies sector more effectively. It is clear that the NI Screen model (project based, able to take risks and having sectoral expertise in house) works very well, so it would be worth investigating whether NI Screen could be sufficiently resourced to take over all government funding for creative technologies or whether the NI Screen funding model could be used by a new Creative Technologies body.

[12] http://www.northernirelandscreen.co.uk/funding/tax-relief-incentives/

Small Business Research Initiative

The Small Business Research Initiative (SBRI) is a type of procurement process which connects public sector challenges with innovative ideas from industry, so that instead of a specific request for a solution, it poses a problem for industry to solve. Where a government department or other public sector body needs a way to engage with new ideas and new suppliers, SBRI provides a secure mechanism to do so. It also offers SMEs and startups the opportunity to further develop an idea or product or collaborate with other businesses on a new product, supporting economic growth, R&D and innovation while improving public services.

In 2017/18 Tourism Northern Ireland ran an SBRI to develop Augmented Reality solutions for self guided tours of unmanned sites. The competition attracted a total of 31 applications.The top 8 were shortlisted and invited to attend a live pitch in front of the assessment panel in mid December 2017. Two projects were selected to receive funding of £30,000 each:

- Monastic Habits – The use of AR to significantly enhance the visitor experience at monastic sites throughout Northern Ireland - Sentireal (David Trainor)
- Into the Past – Giving specific insights, using AR, into what life used to look like in Fermanagh - Fermanagh and Omagh District Council (George Bradshaw)

Several study participants said that an SBRI targeted at the creative technology sector would be a great help in developing sector collaboration as well as raising the profile of indigenous businesses within the public sector.

Government should aim to run up to 4 SBRI (or similar challenges) per year aimed at the creative technology sector.

The Creative Industries Innovation Fund (2008-2015)

The CIIF offered grants up to £75k in Phase 1 and £10k in Phase 2 (of which up to 50% could be spent on salaries) and ran in two stages from 2008-2015. It was funded by the Department of Culture, Arts & Leisure (DCAL) through the Arts Council. It was seen as offering valuable support for innovative development of commercially viable content, products, services and experiences capable of competing in global markets. It was mentioned by numerous participants in this study as having been a particularly valuable support, with many companies reporting that their first product had been funded via this scheme.

Recommendation 2:	Reintroduce the CIIF for creative technology companies only through a new or existing organisation with an accompanying marketing campaign.

Support for sales trips/showcases

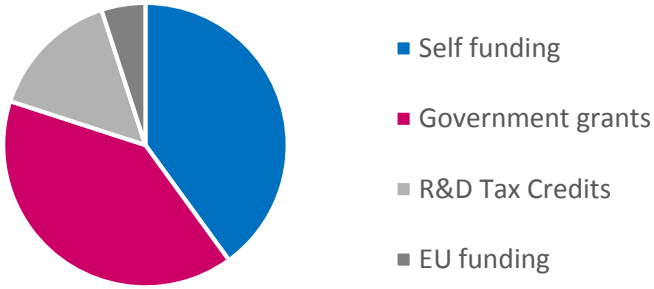
Several government bodies and councils offer support for showcase style trips to big expos like SXSW. While these opportunities are welcome and were largely positive experiences for participants, they represent a massive commitment for small businesses and follow up on contacts can be difficult. Study paticipants felt that some kind of 'voucher scheme' for international trade visits might be a more useful support.

Government should investigate the potential for developing a Creative Tech specific travel voucher/bursary scheme to allow small companies to pitch to companies outside Northern Ireland.

R&D Support

Only a third of survey respondents had carried out any R&D, with half of those spending less than 25% of their turnover or less on it. Research was largely self funded,and grant aided with only a small proportion making use of HMRC R&D Tax Credits.

Finding cash flow to fund R&D is difficult for this sector. Study participants reported that NI Screen programmes are easier to administer and apply for than those offered by Invest NI, however, companies report that they are more likely to fund new product development through commissions from their customers.



Source: MATRIX Creative Technology Survey

The goal of these companies is to be more innovative than their competitors, which requires investment. However, as these companies are funding their innovations primarily through commissions from their customers, building product ahead of customer demand is very challenging. They are reporting a need for an Invest NI-type Grant for R&D scheme, but packaged in the way that NI Screen funds are made available.

HMRC should target creative technology companies to make sure they are aware of R&D Tax Credits. Investigation is also needed on how best to deliver government R&D grants so that they are more accessible & useful for this sector.

Collaboration

Only 30% of businesses who took our survey had undertaken any kind of collaboration, with half of those collaborating with universities. We need to make collaboration easier to undertake and communicate the opportunities and advantages more effectively.

Any online hub for creative tech in Northern Ireland should include a collaborative section which signposts collaborative opportunities and available support.

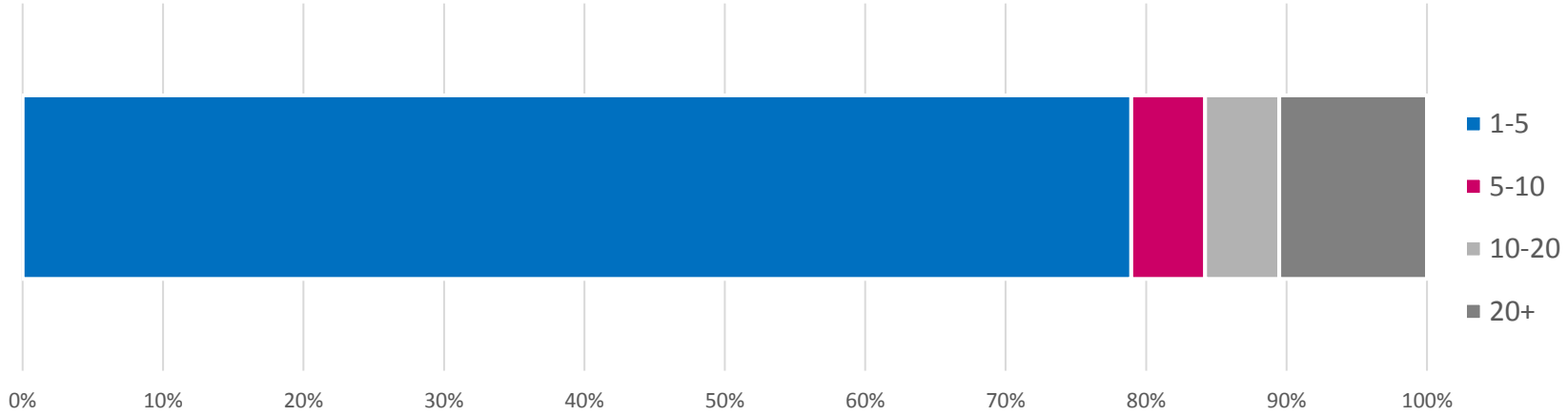
Although access to finance has improved overall in recent years, creative technology startups still experience difficulty obtaining finance, with over half of survey respondents having to self-finance. Support offered by government needs to be appropriate to the sector. SBRIs and project based funding such as that offered by NI Screen may be the best fit.

Retne by Neon

Sectoral support & representation

Businesses in this sector require specific kinds of support. The sector is naturally interdependent, with a large freelance/microbusiness workforce working across different creative technical disciplines. Creative technologies are often at the forefront of technological change (e.g. online streaming, UX developments) and this diversity needs to be harnessed, rather than siloed, to maximise its commercial potential. The high level of microbusinesses in this sector was reflected by the survey.

Figure 9: If your main business is creative technology, how many creative tech specialists are in your company?



Source: MATRIX Creative Technology Survey

This section looks at the types of business support available from government and Northern Ireland area councils. The main characteristic to bear in mind when looking at the successful provision of sectoral support is the fragmentary nature of the sector, the high level of microbusinesses and the value of collaboration.

Many reports over the years continue to recommend clusters as the best way to grow this sector but while there are some excellent examples of remote and co-located ventures (particularly Blick Studios, E-Spark and Immersive Tech) but there is little evidence of a cluster which fulfils the needs of the sector completely, with the particular levels of support and connectivity required by these businesses.

It's clear from responses to this study that the focus is Belfast, and this is reflected in several UK studies quoted earlier. With two universities and Belfast Met providing skills, the council offering excellent targetted support and accelerators like E-Spark enabling businesses to develop PoC and access valuable contacts and support, Belfast is well placed for the further development of a purpose built creative tech hub.

Workspaces, Clusters & Hubs

In 2016 the British Council published "Creative Hubs: Understanding the New Economy"[13]. This report outlined how creative hubs can produce a wide range of impacts including start-up ventures, jobs, new products and services, future investment (public and commercial), talent development, regional talent retention, informal education and engagement, training, urban regeneration, research and development, new networks, innovative models of organisation, quality of life enhancements and resilience.

As part of their research, the British Council surveyed creative hubs across the UK in an effort to define best practice. Belfast was one of the cities they focussed on, mainly due to the work done by Belfast City Council's Creative Industries Team and Blick Studios. They noted that Belfast City Council had played a critical role in funding initial projects.

Co-working has become increasingly popular recently and there are currently over 40 co-working initiatives in Northern Ireland[14]. This is a relatively new concept where independent professionals from many disciplines form a community and work alongside one another in one space. It is a model that suits creative tech startups particularly well, allowing flexible, short term contracts, a range of support services and good connectivity along with networking opportunities. Participants in this study believe that the co working studio model would also help build collaborative product and business opportunities.

A few notable examples of Northern Ireland workspaces/hubs include:

Blick Studios

Blick Studios was set up in 2007 by a group of creative entrepreneurs in Belfast. It provides fully serviced shared desk space and private office space to more than 60 creative and digital start-ups across four locations within Belfast and Derry~Londonderry. Blick also provides virtual services, meeting room hire and event spaces and runs different events, workshops and courses to help build community and provide support for small and start-up creative and digital businesses. Blick is a non-profit social enterprise recycling profits generated from its workspace and business services to help build community and provide events and support for start-up creative and digital businesses.

Catalyst Inc

Catalyst (formerly the Northern Ireland Science Park) currently has four campuses – multiple buildings in Belfast's Titanic Quarter; the Innovation Centre in Derry~Londonderry; the ECOS centre in Ballymena and the CoLab facility at the Letterkenny Institute of Technology in Co. Donegal. It offers flexible lease arrangements rangin from the use of a desk with one month's commitment through to long term building leases. All workspaces have Tier One internet connectivity through Project Kelvin. Catalyst Inc also operates Capital Match which matches high growth potential NI companies with non-UK sources of

[13] http://creativeconomy.britishcouncil.org/media/uploads/files/HubsReport.pdf
[14] http://wabisabi.work/coworking-spaces-in-northern-ireland/

funding. These are typically VC, funds, family offices, syndicates and serious individual investors. Companies are seeking £500k-£2m and will have come through one of the Catalyst Inc programmes

Atlantic Link Enterprise Zone

The Atlantic Link is an ambitious new £2.7m project near Ulster University Coleraine Campus. Interest is currently sought from potential tenants, with data centre company 5Nines signed up as the anchor tenant. The company will be investing an additional £20m in its operations at Atlantic Link Campus and creating up to 15 jobs. The Atlantic Link is NI's first Enterprise Zone since the 1980s and is now formally welcoming interest from tenants who will benefit from Enhanced Capital Allowances and the fastest high speed connectivity point between North America and UK via Project Kelvin, a high speed transatlantic fibre. The Department for the Economy has worked closely with Causeway Coast & Glens Borough Council to facilitate the designation of the Enterprise Zone by HM Treasury to enable Enhanced Capital Allowances to be offered to prospective investors at the site.

Accelerators

There are several accelerators operating in Northern Ireland, such as Springboard, PwC Ignite and NI Screen Pact. Accelerators offer co-working space plus intensive mentoring support to focus participants on developing proof of concept and then growing the business. One of the most exciting accelerators examined is Belfast ESpark, part of a UK wide network run by RBS in Great Britain and Ulster Bank in NI.

Entrepreneurial Spark

Entrepreneurial Spark (ESpark) in Belfast is run by the Ulster Bank in partnership with KPMG, Pinsent Masons and Dell. It has been running for over a year now and offers programmes targeted at companies in four distinct phases of growth:

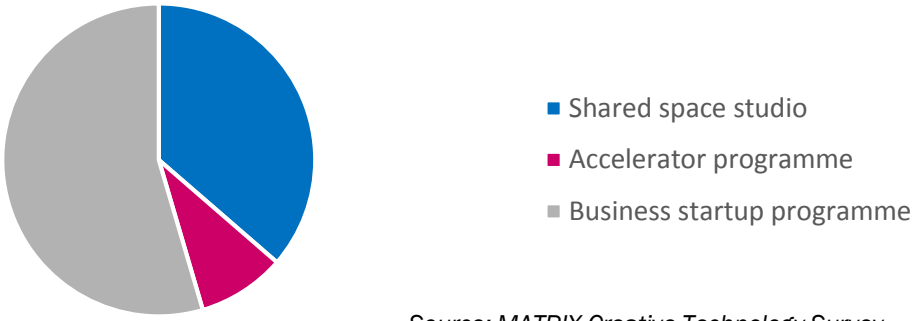
- Sprint – for entrepreneurs with an idea, or in the early stages of starting up. This is a 3 month sprint focussed on a specific outcome
- Enable – for entrepreneurs who have successfully passed through Sprint. This is a further six months with hands on support to continue acceleration
- Grow – for businesses already generating a turnover of £100k+ or those who have secured £25k+ in funding with potential for high growth
- Scale – for businesses with a turnover of £200k+ or investment/funding of £150k+ and who are looking for further investment

ESpark provides free office space on Lombard Street with a network of focussed support; Enablers, Entrepreneur Development Managers and specialist advisors from within Ulster Bank who can advise on HR, IP, presentations, business planning etc.. But as Lynsey Cunningham, Director of ESpark Belfast says, "One of the most valuable ways E-Spark can support start-ups is through its network of contacts – the ability to put the right people in a room together and to make the kind of high level introductions that start-ups find so hard to secure on their own."

Uptake of support

Around two thirds of survey respondents had used some form of sectoral support when starting up:

Figure 10: When you were starting your business, did you make use any of the following forms of support?

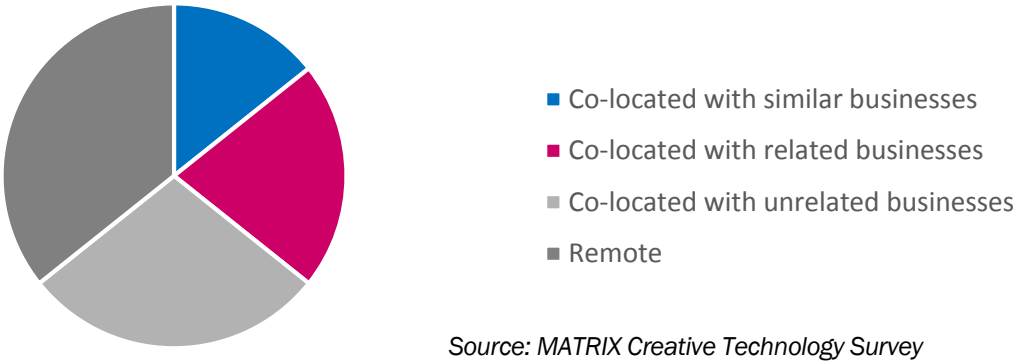


Source: MATRIX Creative Technology Survey

Level of clustering

Additionally, almost half of all respondents had worked in a cluster at some point, whether physical or remote. Of those who had, over a third were doing so remotely, which would suggest a higher level of collaboration rather than just physical proximity. In total 71% of those working in clusters were doing so with similar or related businesses.

Figure 11: Types of clustering that survey respondents had been involved with

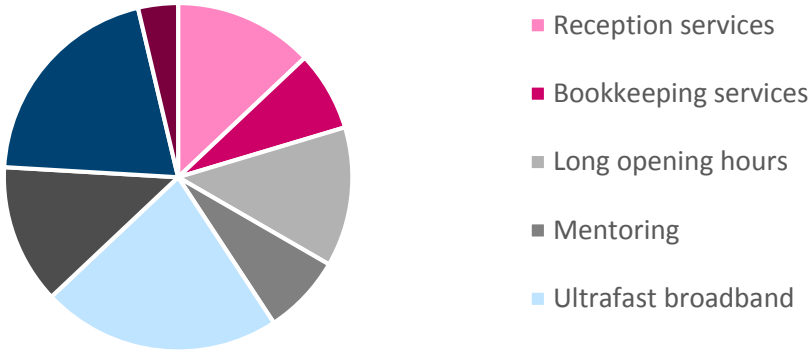


Source: MATRIX Creative Technology Survey

Support services

We asked which workspace services startups found most useful – ultrafast broadband was by far the most popular, followed by networking events.

Figure 12: What services do you consider to be particularly useful to have in hubs or shared workspaces?



Source: MATRIX Creative Technology Survey

Recommendation 3:	Support the development of a city centre hub focussing on creative technology microbusinesses, with access to Ultrafast broadband, business support services and networking events to help encourage collaboration.

Sectoral Groups

There are a number of specialist sectoral groups currently active in Northern Ireland, though they tend to focus on knowledge sharing and career development rather than government lobbying They are popular and well attended - 90% of our survey respondents were members of a sectoral group.

Study participants were enthusiastic about the level of peer support and advice they got from these specialist sectoral groups, but felt that there wasn't sufficient interdisciplinary communication. Many of them said they would like to see an online hub to help businesses collaborate, find out about events and funding and advertise or look for opportunities.

Sectoral representation

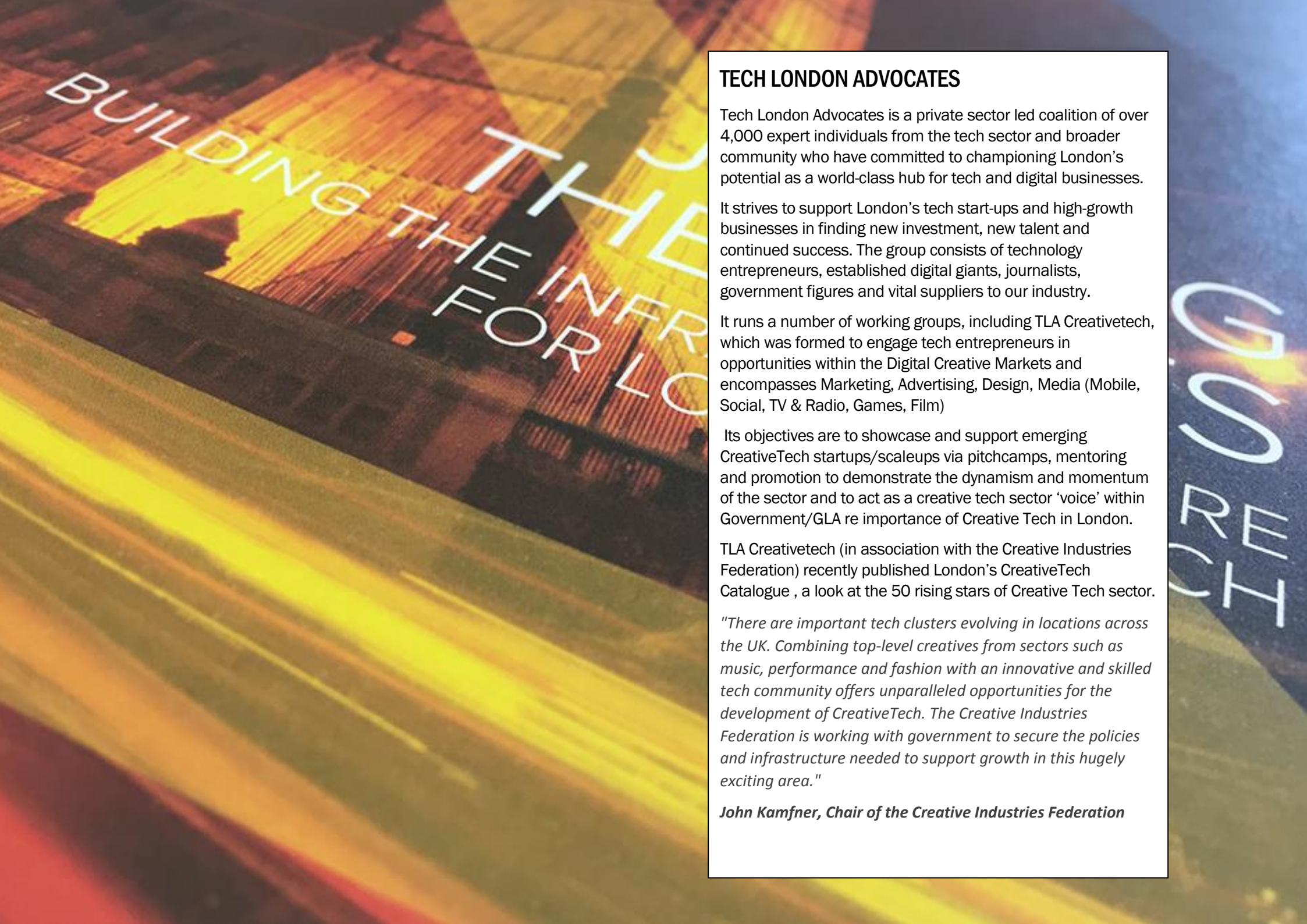
The growing popularity of sites like Meetup and social media groups means that there is unlimited potential for likeminded people to find each other and talk about specific interests. Most workers in the sector are members of multiple specialist groups, allowing them to discuss opportunities, developments in technology and working methods. There is currently no overarching sectoral representation, and the 2016 CIRB study identified the need for a new forward thinking, ambitious creative industries representative body in NI which would: Provide a single unified voice for the creative industries;

- Create a platform to access relevant support and advertise different company services;
- Support collaborative thinking;
- Signpost, support, and organise events for all creative businesses;
- Help develop regional and international partnering opportunities;
- Act as a link between businesses, government, professionals and aspiring creatives;
- Raise the sector's visibility in NI and beyond; and
- Act as an advisor to the Government to align policies and ensure appropriate support to the sector.

While the CIRB dealt with the wider creative industries, the issues above are all highly relevant to the creative technologies, which are already highly interrelated and interdependent. There is an argument for creating an alliance of creative tech groups to deliver the functions listed above. Tech London Advocates (see next page) is a good exemplar of what could be achieved.

Northern Ireland needs a creative technologies representative body for Northern Ireland to work with government and represent the NI brand abroad. This could be as a subsector of a wider Digital ICT group or as a standalone body. A representative body could also offer sectoral groups support to learn about best practice, for example through expert speaker events.

In addition, the development of an online creative tech hub to allow businesses and freelancers to share projects, opportunities and events and to allow the various existing sectoral groups to share cross disciplinary opportunities.



TECH LONDON ADVOCATES

Tech London Advocates is a private sector led coalition of over 4,000 expert individuals from the tech sector and broader community who have committed to championing London's potential as a world-class hub for tech and digital businesses.

It strives to support London's tech start-ups and high-growth businesses in finding new investment, new talent and continued success. The group consists of technology entrepreneurs, established digital giants, journalists, government figures and vital suppliers to our industry.

It runs a number of working groups, including TLA Creativetech, which was formed to engage tech entrepreneurs in opportunities within the Digital Creative Markets and encompasses Marketing, Advertising, Design, Media (Mobile, Social, TV & Radio, Games, Film)

Its objectives are to showcase and support emerging CreativeTech startups/scaleups via pitchcamps, mentoring and promotion to demonstrate the dynamism and momentum of the sector and to act as a creative tech sector 'voice' within Government/GLA re importance of Creative Tech in London.

TLA Creativetech (in association with the Creative Industries Federation) recently published London's CreativeTech Catalogue , a look at the 50 rising stars of Creative Tech sector.

"There are important tech clusters evolving in locations across the UK. Combining top-level creatives from sectors such as music, performance and fashion with an innovative and skilled tech community offers unparalleled opportunities for the development of CreativeTech. The Creative Industries Federation is working with government to secure the policies and infrastructure needed to support growth in this hugely exciting area."

John Kamfner, Chair of the Creative Industries Federation

The AHRC Creative Industries Cluster Programme (UK)

The Creative Industries Clusters Programme, which will start in 2018, will help catalyse economic growth and provide the skills needed for the jobs of the future. It will find innovative ways to identify opportunities for new products and services at an early stage and get them on the road to success.

Led by the Arts and Humanities Research Council (AHRC), the Programme will support eight Research and Development (R&D) Partnerships between industry and a group of universities to respond to challenges identified by the creative industries in their cluster.

The R&D Partnerships will support ground-breaking innovation by companies of all sizes – from micro-businesses and start-ups to multinational corporations – so that they can prosper in the UK, ensuring this country benefits from their success and building on its global reputation as one of the world's leading engines of creativity.

In parallel, a national Creative Industries Policy and Evidence Centre will be established to produce independent evidence and analysis for the industry and for policy-makers. The Centre will produce high-quality understanding of the creative industries, including how they are working together in clusters and across the wider economy, so that future policy and strategy can be informed by world-class insights to further accentuate success.

The Industrial Strategy Challenge Fund will invest £39m in the Programme until 2021, which will be matched by university and private sector funding that will take the total investment to at least £80 million.

A proposal for a Northern Ireland based Creative Industries R&D Partnership has progressed to the second stage of the call, led by UU, QUB and NI Screen, along with BBC R&D, Belfast City Council, Belfast Harbour, Causeway Enterprise Agency, Digital Catapult NI, Games NI, Immersive TECH NI, Invest NI, Kainos and RTE.

We would like to see full support for the NI application to the AHRC Creative Industries Clusters programme.

Area Councils

All Northern Ireland area councils offer a well-developed suite of general startup and business development support packages, but some have identified this sector as a focus for investment. For example, Causeway Coast & Glens Borough Council is currently developing several objectives but has not yet launched specific programmes. Derry & Strabane Council has a good range of sector specific support in place. But unsurprisingly Belfast City Council has by far the most highly developed offering - with a dedicated Creative Industries team they have worked very closely with the sector over the last decade.

In the last three years, under the name Output Belfast, BCC has been working with partners including Invest NI, NI Screen, Digital Catapult, Tourism Ireland and Generator NI to help develop the creative technologies sectors. They have been careful to support and facilitate existing programmes so as to avoid duplication. They have also supported events such as Digital DNA, BelTech, Cartoon Business and the AVA Conference. The one-day Output Belfast conference has run annually since 2015 and has now established itself as the largest music sector conference in Ireland.

BCC's Creative Accelerator initiative is designed to support new and early stage creative digital businesses seeking access to affordable hot desks and co-working space in Belfast, plus access to industry-specific coaching networks and international opportunities. This programme aims to accelerate the growth of participating businesses and help boost the sector via knowledge transfer, networking, mentoring and access to new international business development opportunities. It is open to businesses located in the Belfast City Council area. A priority subsector for this initiative is to support the development of companies working in the key sectors of film, TV, digital content, immersive technology and music.

BCC has also organised showcasing trips for Belfast businesses to South by Southwest (SXSW), the world's leading conference for the music, film and interactive technology.

In addition, Belfast City Council is currently developing plans for an ambitious new visitor attraction – "View Belfast" – near the Belfast UU campus. It will have a digital focus and intends to make use of AR, VR and other creative technologies to tell the "Belfast Story". There are clearly opportunities for the development of a creative hub in this area and this project could be the anchor required, particularly if the BBC were involved (its Rewind project could offer a wealth of digitised archive material). The council is currently exploring the potential for collaboration with Libraries NI, UU and NI Screen.

The Council sees the Greater Belfast area as an ideal place to establish a creative cluster, with the connectivity, skills and infrastructure already in place. It also sees the creative technologies as having a major role to play in Belfast's efforts to develop a 'Smart Belfast' framework (see next page).

DfE should work closely with BCC to help develop creative tech projects in Belfast and use the findings to create a template for other councils.

BBC Northern Ireland

BBC Northern Ireland occupies a unique position – as a broadcaster, innovator, employer and collaborator. Its audience differs significantly in its behaviour from the UK wide audience across all delivery channels. Because BBCNI is physically isolated from the other BBC regions it is considerable more self-sufficient than the other regions. For example, it employs nearly 100 engineers - 1 in 7 employees are technical or operational.

This strong engineering base has allowed BBCNI to undertake a significant pieces of research, such as moving from traditional SDI (Serial Digital Interface) technology to Internet Protocol (IP) technology to move broadcast data and signals around their buildings. Mervyn Middleby (Head of Technology Operations BBC NI) and his team continue to lead much of this research and development from the "IP Lab" in Belfast.

Another major BBCNI innovation has been the development of the Rewind project, which digitised the whole BBC Archive and developed a powerful search tool, opening the archive up to BBC staff and collaborators alike. The BBC Rewind project was developed through a joint editorial and engineering team based in BBC Northern Ireland. It focuses on using smart data management technologies to improve the way the archive can be searched and content discovered.

The primary aim has been to connect the various disparate systems that have been built and acquired over the years, and make archived content searchable from one single place. The more content that can be unlocked, the greater the chance of finding relevant material to put online for people to enjoy once more and the greater potential for new IP to be developed.

Rewind has been able to build on past efforts of BBC archive managers by improving access to assets on the largest scale in its history. The focus has now shifted towards ways of allowing large volumes of data to be managed and searched at scale with accuracy and speed. This offers an enormously fast, accurate and powerful way to find content and not only offers time savings for the BBC's own planning team - the platform can also turn up more unusual, but still relevant results. Just as importantly, Rewind offers significant IP development opportunities for collaborative projects.

Unfortunately technical constraints within Blackstaff House meant that the Rewind portal has moved to Glasgow. While there is potential for Rewind to come back to Northern Ireland, the portal would need to be based in a building with world class connectivity.

BBCNI has successfully collaborated with a number of local digital businesses such as StoryFX, Kainos, Big Motive and Aetopia and is planning a number of creative projects on topics such as the anniversaries of the suffragette movement and the troubles as well as the centenary of NI. They are keen to find new ways of collaborating using the Rewind project because when the BBC uses archived content in its storytelling, the response is incredible, not only in numbers of hits but also stickiness. Audiences are more likely to watch entire videos than with other content.

They therefore invest in 'creative collisions' - innovative solutions where BBCNI make technologies and people available for R&D collaborations – and some of those solutions are subsequently adopted in-house.

Collaboration with Universities

BBCNI has recently set up a tripartite agreement with Ulster University and Queen's University Belfast to develop innovative projects. This will be the first such agreement of its kind in the BBC.

BBCNI has however worked with both universities on a one-to-one basis in the past, and ran a particularly successful project with UU animation undergraduates to give them some insight into the production of news graphics, where the need for speed and accuracy is paramount. The best students were offered the chance to produce graphics which were used in live news broadcasts, and BBCNI expects to take some of the 3rd year students on placements.

Close collaboration with the universities has also allowed BBCNI to engage at every level, from undergraduate right through to IP research. SARC, the Sonic Arts Research Centre at Queen's is currently working with BBCNI sound engineers to develop an audio broadcast system which will offer a better listening experience for those with a hearing impairment without affecting the overall quality.

Collaboration with NI Screen

The BBC and Northern Ireland Screen recently renewed their successful partnership agreement, which sees them continue to work together to invest in developing an internationally competitive screen industry in Northern Ireland. This will see the BBC commit to spend a minimum of three per cent of the network television budget in Northern Ireland, in line with proposals in Ofcom's draft operating licence.

The agreement will help ensure that Northern Ireland is better represented to audiences across the UK and internationally and will underpin efforts to ensure that network production spend is split across a range of genres, including drama, children's, animation, factual and entertainment, feature documentary and independent film. It will also focus on the sustainability and strengthening of the local creative sector.

Since the signing of the original partnership agreement in 2015, the BBC and Northern Ireland Screen have successfully collaborated in a range of areas from new network content to skills development. In terms of network television content across genres, the BBC has invested almost £40 million and Northern Ireland Screen invested just over £5 million, levering a further £20 million of additional investment on top of the BBC investment.

Recommendation 4:	There is a real opportunity for BBCNI to further develop collaborations through the Rewind project, particularly if it was physically hosted in Belfast again. Easy access to these archives for local creative technology companies would allow them to create innovative new ways to experience Belfast's history and could form an important part of the View Belfast Project.

National Museums Northern Ireland (NMNI)

Over the course of this study it has been observed that where strong creative tech clusters are in place there is often a high level of participation from national museums, acting as an invaluable resource of material and information. The NMNI's strategic vision specifically focuses on digital engagement – it aims to offer more collections, content and images online and it wants to maximise the opportunities offered by digital engagement to connect with a broader range of audiences.

There is currently no formal partnership with NMNI and the creative tech sector and such a partnership would be highly beneficial to all parties, providing a unique collection of resources and content and allowing innovative new ways to interact with them to be developed.

This would align well with NMNI's future priorities, which include:

- Connecting with more people - particularly by growing non-traditional audiences and reaching those who don't yet visit museum sites, so increasing access to and engagement with the collections.
- Opening up and sharing museum spaces - developing the sites to deliver greater local benefit, being better connected to (and acting as a hub within) the communities in which they are located, diversifying how spaces are used to increase usage of assets and supporting local creatives.
- Building museum services of the future - improving the quality of the visitor experience, strengthening the commercial infrastructure to facilitate growth of self-generated income and making sure that the infrastructure and visitor experience is fit for purpose, internationally competitive and relevant for future generations.

These priorities could be well supported by working with the creative tech sector to develop new, innovative ways of looking at artefacts, telling stories and connecting with audiences. By working more directly with the sector, through clusters or government challenges (such as the augmented reality tourism challenges run by Belfast City Council and Tourism NI), NMNI could add to the user experience through digital resources while delivering on their own future priorities.

BBCNI is perfectly placed to act as an ‘anchor’ for a creative hub in Belfast through its Rewind project – it could work with UU and BCC on the View Belfast project, bringing hosting of the project back to Belfast and allowing IP to be created which would benefit all stakeholders. In addition, NMNI could offer a wealth of resources and content suitable for development by the sector.

Puppet Quest by Italic Pig

People & skills

The World Economic Forum suggests that 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist.[15] In many industries and countries, the most in-demand occupations did not exist ten or even five years ago, and this pace of change is set to accelerate. Nowhere is this more apparent than in ICT and the Creative Technologies. As educators and policy makers struggle to address the speed at which automation could affect employment, fresh thinking is required. The current phase of automation is often compared to the Industrial Revolution, but in fact it will have a much faster, more aggressive impact on careers which were previously thought to be "a safe bet". Many jobs will require substantially different skillsets from what is currently required as, for example, soft skills become more valuable than analytic or diagnostic skills. It's believed that creative occupations will be much more resistant to automation than most other jobs. Nesta estimates that 87% of UK workers in the highly creative category will be at low or no risk of automation[16]. So it makes sense that to develop a healthy and productive economy we should encourage people to fully develop their creative skills, but it's equally vital that they have the opportunity to access training throughout their careers, to keep up with new software and hardware and to investigate new disciplines that can help them maintain currency.

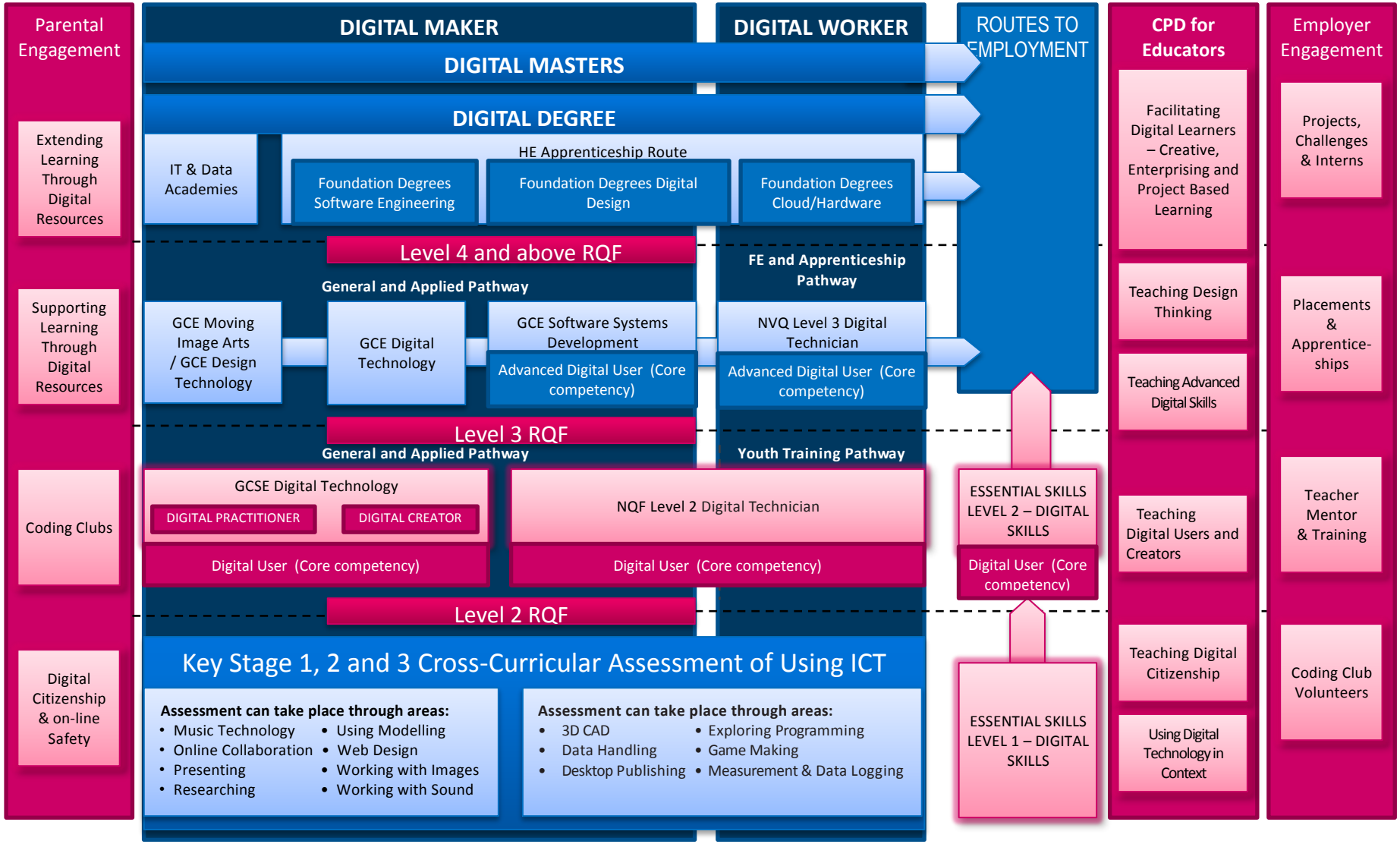
In "Creativity v Robots" (Nesta, 2015) Hasan Bakhshi was optimistic about the potential for the creative economy to grow in this disruptive environment, but warned against government complacency: "As technology progresses, creative skills will become more important, meaning that places that have specialised in creative work will most likely be the main beneficiaries of the digital age. The United Kingdom is thus seemingly in a relatively good position to take advantage of new technologies becoming available. However, as other countries e.g. in Asia and the Americas prioritise their creative economies for development, the United Kingdom will have to continuously create jobs in new creative professions if it is to retain its competitive edge."

This section looks at the current skills landscape in Northern Ireland and the support available for creative tech practitioners and businesses. Much of the research pointed to wider issues in the delivery of STEM education; this is beyond the scope of this study and is a recurring theme in MATRIX reports.

The DfE Skills Barometer should develop models which take into account the effect of automation on the predicted need for future skills. MATRIX will undertake a precis on STEM skills and education, drawn from the research undertaken in previous studies, to outline recurring issues which need to be tackled to ensure that the increasingly multidisciplinary nature of our future industries is being served by our education system.

[15] http://www3.weforum.org/docs/WEF_ASEAN_HumanCapitalOutlook.pdf
[16] http://www.nesta.org.uk/sites/default/files/creativity_vs._robots_wv.pdf

Figure 13: The CCEA Draft Digital Skills Map



Primary & Secondary Education

The Council for the Curriculum, Examinations and Assessment (CCEA) recognises the importance of digital skills for all students and has done significant work in this area, both in mapping the routes to employment (see Figure 13) and in producing resources for teachers.

The CCEA has defined three levels of ability - Digital Citizens (with the skills that will enable them to take part in digital aspects of society), Digital Workers (those who are able to apply their digital skills to further their learning or in work) and Digital Makers (those who are starting to build their own digital technology). This last, highest tier will have opportunities to develop career paths towards ICT and creative technologies.

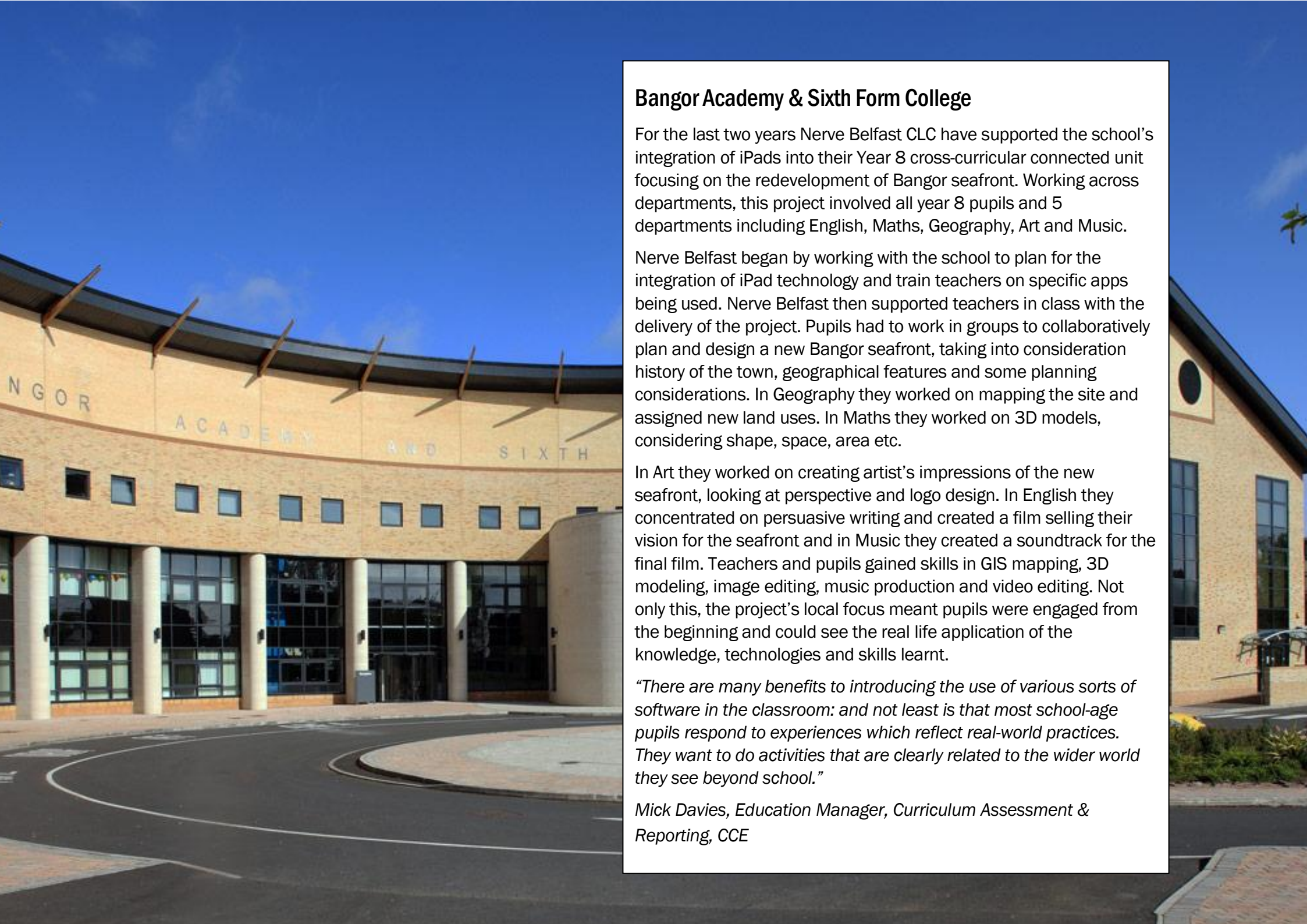
Two additional projects - Digiskills NI and Future Classrooms NI – are invaluable in building capacity and developing digital literacy at primary school level. A detailed overview of both programmes is available at Appendix V. Digiskills is a cross departmental programme that represents industry professionals, educators and key stakeholders across government, led and funded by the Department for Communities. Building on research and engagement with primary schools carried out in 2015-16, it aims to develop a Digital Learning in School Programme across Northern Ireland. The programme will support the development of excellence in the teaching of digital skills and computing for young people and enable them to be more than just digital consumers, but to become digitally literate and to be successful participants in the workplace of the future. As part of DigiSkills NI, Northern Ireland Screen is developing digital educators so that they can help create the next digital generation.

Under the Future Classrooms Programme, NIScreen also supports three Creative Learning Centres in Belfast, Derry & Armagh, delivering skills development programmes for teachers and young people in digital literacy and in understanding and deploying creative technologies and new approaches to learning in the classroom as a support across the curriculum. A key objective for the CLCs has been to provide learning programmes for the most disadvantaged young people and those experiencing social exclusion. Over 80% of CLC activity takes place in schools with high numbers of disadvantaged pupils. The strategy focuses on reaching more schools, particularly in rural areas.

While all of this progress is welcome, it is not happening at sufficient scale or pace. Digital literacy is still not a statutory requirement, in the way that literacy and numeracy are. While this remains the case, there can be no expectation of consistency, either in delivery or in support for teachers to build skills and confidence.

The development of the Digiskills programme in particular has highlighted wider issues concerning digital development in Northern Ireland; in particular, questions relating to structure, departmental responsibility, ownership and regional capacity and leadership. In addition, projects such as Techspace, which builds the capacity of youth organisations to run creative technology and STEM education programmes in RoI, but which could not continue past pilot stage here due to the abolition of its NI sponsor, the Youth Council for Northern Ireland in 2016[17] could offer much needed training in both schools and youth clubs.

[17] http://www.bbc.co.uk/news/uk-northern-ireland-35062748



Bangor Academy & Sixth Form College

For the last two years Nerve Belfast CLC have supported the school's integration of iPads into their Year 8 cross-curricular connected unit focusing on the redevelopment of Bangor seafront. Working across departments, this project involved all year 8 pupils and 5 departments including English, Maths, Geography, Art and Music.

Nerve Belfast began by working with the school to plan for the integration of iPad technology and train teachers on specific apps being used. Nerve Belfast then supported teachers in class with the delivery of the project. Pupils had to work in groups to collaboratively plan and design a new Bangor seafront, taking into consideration history of the town, geographical features and some planning considerations. In Geography they worked on mapping the site and assigned new land uses. In Maths they worked on 3D models, considering shape, space, area etc.

In Art they worked on creating artist's impressions of the new seafront, looking at perspective and logo design. In English they concentrated on persuasive writing and created a film selling their vision for the seafront and in Music they created a soundtrack for the final film. Teachers and pupils gained skills in GIS mapping, 3D modeling, image editing, music production and video editing. Not only this, the project's local focus meant pupils were engaged from the beginning and could see the real life application of the knowledge, technologies and skills learnt.

"There are many benefits to introducing the use of various sorts of software in the classroom: and not least is that most school-age pupils respond to experiences which reflect real-world practices. They want to do activities that are clearly related to the wider world they see beyond school."

Mick Davies, Education Manager, Curriculum Assessment & Reporting, CCE

A Digital Skills Strategy for Northern Ireland

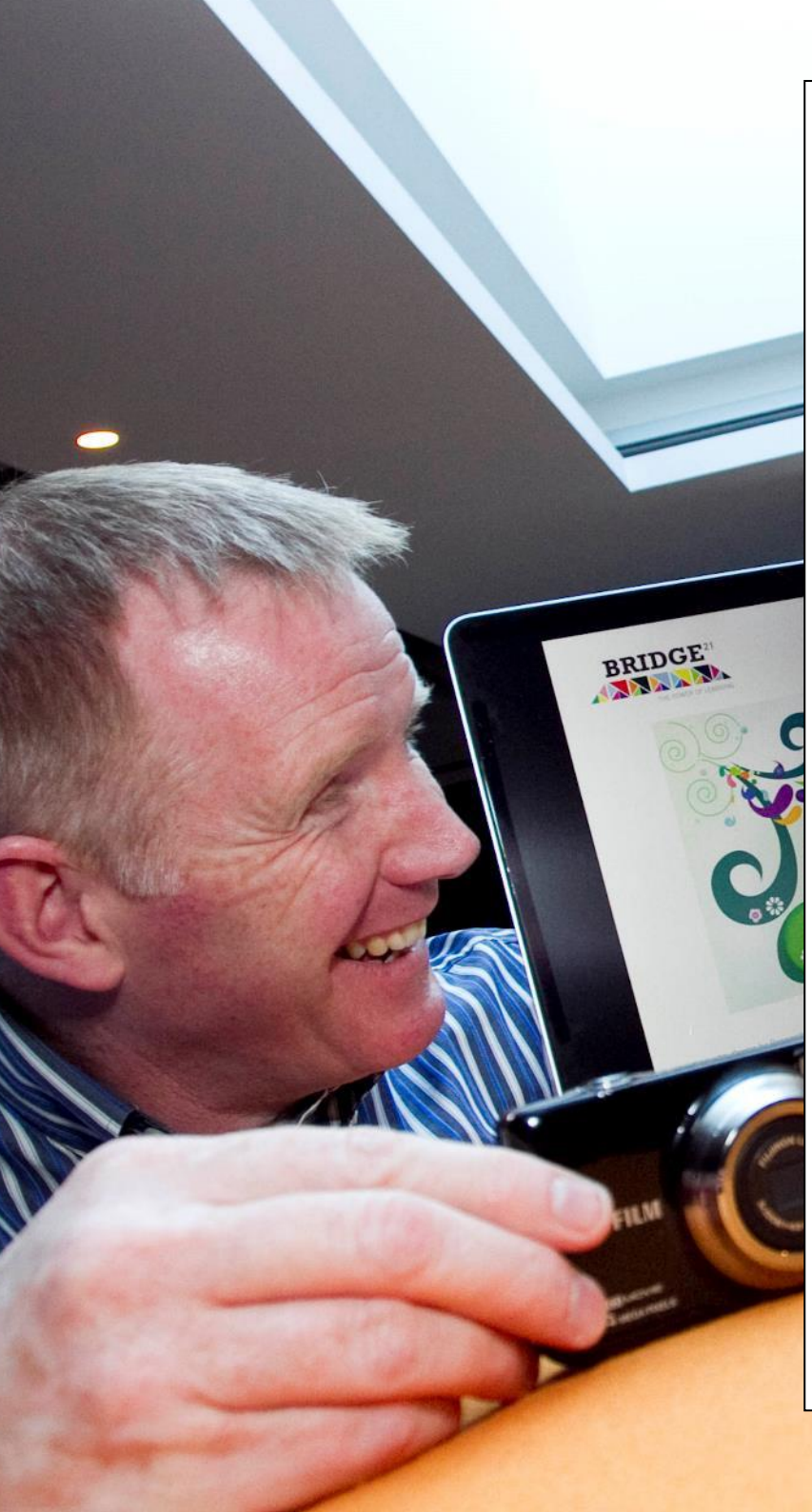
Other regions with digital strategies have a much more focussed and appropriately funded approach to developing digital skills. Scotland has made significant strides in preparing education for digital. The Scottish Curriculum for Excellence (CfE) has a Digital Learning and Teaching Strategy (Sept 2016). Professional standards for digital have also been set by the General Teaching Council for Scotland (GTCS). It includes objectives such as developing skills and confidence of educators, improving access, ensuring digital forms a central consideration for all areas of curriculum and assessment and empowering leaders to drive innovation and investment.

Wales has also been driving curriculum reform. The Digital Competence Framework in the revised Welsh curriculum includes strand of Citizenship, Interacting & Collaborating, Producing and Data and Computational Thinking. And in 2015, the Irish Government launched a €210million Digital Strategy for Schools, an ambitious programme to embed digital learning across education including themes relating to teaching, learning and assessment; teacher professional development; leadership, research and policy; and ICT infrastructure.

In the current economic climate, with the Department of Education facing cost pressures it is difficult to see how that department can appropriately fund what is required in isolation. It is also difficult to argue that it should be solely responsible – a collaborative approach would be much more productive. The work that Trinity21 (see next page) has done demonstrates the value of collaboration between academia, government and industry (in this case, Google) in teacher development.

Northern Ireland does not have a regional digital strategy. There is no single ministerial group, government department or agency leading our digital development and there is no single entity or person responsible for developing Northern Ireland's digital future. The MATRIX 2016 ICT Digital Report recommended that a Chief Digital Officer be appointed to advise government and industry on the digital transformation of Northern Ireland and to develop a digital strategy. This would undoubtedly create a focus on digital skills and the digital economy, as the Scottish, Welsh and Irish Digital Strategies have done. Indeed, we would now expand that recommendation to say that a separate Digital Office should be set up to deal with all aspects of digital skills and economic development, centralising budget and expertise from the various government departments that currently oversee different aspects. The removal of silos and the creation of a single body focussed on developing a healthy skills pipeline and linked directly to economic development of digital businesses (including the creative technology sector) could galvanise the whole economy.

Recommendation 5:	The Digital ICT recommendation to appoint a Chief Digital Officer should be revisited, and even widened to encompass a Digital Office to cover all digital skills and economic development functions. Thought also needs to be given to how government could work with businesses like Google to help with teacher CPD, as with the Trinity21 project in Dublin and the potential for the Techspace programme to be relaunched in Northern Ireland. Finally, Digiskills NI needs to have the necessary funding and cross departmental support to succeed.



Trinity21

Trinity21 (TA21) was established in 2014 with support from Google Ireland and is a collaboration between the Trinity Access Programmes (TAP), Bridge21, the School of Computer Science & Statistics and the School of Education, Trinity College Dublin. The project includes delivery of a new Postgraduate Certificate in 21st Century Teaching and Learning, alongside workshops in technology-mediated, team-based learning and the development of three other 'core practices' to encourage a strong, college-going culture: Pathways to College, Leadership through Service and Mentoring. Outcomes from the TA21 project indicate it is supporting schools to build a strong, college-going culture, where high aspirations are the norm and there is a more active, engaged, teaching and learning environment. Project Year 1 highlights include:

- Over 200 teachers have completed, or are taking modules, on a new Postgraduate Certificate in 21C Teaching and Learning, with an 89% satisfaction rating among participants in 2014-15.
- 150 students on Trinity's teacher training degree (Professional Masters in Education) completed a module in 21st century learning with technology.
- 1,100 students in the eleven project schools have completed year one of the structured three year project which has included visiting college campuses, completing career planning assignments, leading social change and structured mentoring sessions.
- Teachers report more use of collaboration and technology-mediated learning in the classroom following completion of the Postgraduate Certificate.
- Teachers are more confident about use of technology in their teaching.
- Students participating in the TA21-CFES project show more college knowledge after year one and more confidence in their ability to navigate higher education.
- Students are more likely to aspire to go to college and aim for careers that require a degree.
- Students report more active communication with their parents and the wider community about their future.

In 2014/15, 84 teachers from 27 Dublin-area secondary schools took the Certificate with a 98% completion rate. In 2015/16, 102 teachers from 80 schools across 16 Dublin postcodes and 19 counties are registered on the Certificate. These teachers are building a community of practice, with 31 teachers who completed the Certificate in 2014/15 continuing to develop their practice through progression onto a Masters in Education, a Masters of Science in Technology and Learning or a PhD programme.

Further Education

There are six FE colleges across Northern Ireland. Belfast Metropolitan College and North West Regional College supply the two largest urban areas and deliver a wide range of qualifications which support skills development in creative technologies. Both are well equipped with up-to-date facilities and have a strong vocational focus with an emphasis on industry project briefs within their curriculum delivery. Given the introduction of the apprenticeship levy and the planned radical reforms to technical education; FE has a hugely significant role to play in meeting the skills needs of the creative industries. Further details of the FE landscape are available at Appendix VIII.

Industry and education need to work together to provide skills solutions which are responsive, relevant and build progression routes for young people. Apprenticeships are a good example of where this can work really well, and there is scope for much more in order to establish and grow a successful creative talent pipeline for NI. Creative & Cultural Skills works with FE colleges across the UK through the 'National Skills Academy for Creative & Cultural'. Both North West Regional College and Belfast Met College are Leadership Colleges within this network, demonstrating their commitment to meeting the needs of young people wanting to work in the creative sector and to working closely with industry in addressing skills challenges.

A great example of how industry and FE colleges are working together is a recent project by Quinn Building Products and South West College in Enniskillen. A major employer in Fermanagh, Quinn approached SWC to look at developing innovative ways to demonstrate their insulation products. Quinn's in-house technical team collaborated with SWC's visual technologists and programmers to produce a Virtual Reality home, where the participant can walk through a room which has key junctions highlighted to demonstrate heat loss due to Thermal Bridging. The viewer can then learn how to select the right insulation products and construction detail. Quinn has now embarked on a comprehensive digital skills development plan, providing digital skills training for their staff and developing long-term partnerships with schools, community groups and SWC, providing equipment for schools and placements for school-age students.

Higher Education

Queen's University Belfast has a number of established world-leading research facilities in creative arts and technology including the Sonic Arts Research Centre (SARC) and the Institute of Electronics, Communications and Information Technology (ECIT), as well as a wider range of strategic investments in the Creative Industries which represent a total investment in the area of over £30m. Ground breaking research in immersive technology is also taking place in the Movement Innovation Lab at Queen's as well as through the Queen's Pioneer Research Programme– Intelligent Autonomous Manufacturing Systems that is looking at the role of VR in shaping our smart future. The Immersion and Inclusive Music Performance at Queen's is examining how immersive technologies can be used to better understand the experiences of young musicians affected by a physical disability.

Ulster University in Belfast has a long tradition of excellence in creativity and design and has responded well to the changing requirements in creative technologies. The university has just unveiled a new £20m Creative Industries Institute as a core part of the flagship £263m Belfast campus. This is in addition to the new £9m media and broadcast facilities at the Coleraine campus and a £5m investment in posts to drive new courses and research in virtual and augmented reality, game design and post-production video effects. The UU has also signed a tripartite agreement with QUB and the BBC to support the latest research and stimulate innovation for cutting edge broadcasting. A number of joint projects are planned which will help enhance and develop media

technologies through applied research. They will enable new concepts and techniques to be rapidly deployed to tackle some of the challenges facing the Digital Media sector.

Graduates traditionally came through the UU Visual Communications or Product Design BA courses and took conversion courses or learned in house. UU now offers Interaction Design (IXD) - BDes (Hons) with first graduates due this year – considered a huge improvement by employers. UU also offers a BDes (Hons) in animation which is very highly regarded and their BSc in Creative Technologies is a transdisciplinary course encompassing several areas of study within audio, visual, Interface (Physical & Software) and arts. The BSc Creative Technologies degree combines creativity with technical innovation through a range of disciplines such as visual design, audio/music, art, coding, 3D and physical computing. Whilst a few graduates come through QUB Computing BSc and convert, the legacy of the former Art College with its strong design tradition means that Ulster University is regarded as the key HE skills provider. However, because of this very legacy, UU still requires students to have an Art A Level or Foundation Certificate to access these Creative Technology courses. In doing this, a barrier is created for good STEM students who could well have the necessary creativity to excel in this area.

Universities need to examine entry requirements to creative tech courses to ensure that they do not create unnecessary barriers.

Skills supply

Study participants reported a skills bottleneck – student demand outstrips available places and employer demand outstrips the supply of suitably qualified people. 95% of our survey respondents said they had difficulty recruiting people with the Creative Tech skills they needed. There needs to be a much better match of demand and supply. The 2017 Skills Barometer[18] puts Creative Arts in the top 5 subjects undersupplied at NQF L4-5 (Degree and above). Nesta has carried out some research using Burning Glass software, which uses information from job adverts, to identify the skill needs of creative talent. [19] They recommend that Government recognises that creative jobs require both creative and complementary skills, noting how often digital tech skills are demanded in occupations that are creative. This suggests that learners need access to a broad range of subjects and technologies, to expose them to the range of skills and knowledge that employers need.

In a sector where hardware and software develop so quickly, any delay in the development of new programmes is too long. Study participants said a new approach was required, a more agile system that would better support SMEs. They wanted to see much greater awareness of what skills are required by businesses and what courses are available from HE & FE. Ultimately the skills requirement must be driven by business.

It is essential that core education provides a robust framework to support ongoing skills development. Flexible training on specific technologies can then be delivered in or near to business as needs dictate. The ideal skills solution will not focus on narrow skill sets because these will change - rather the need is for people who can easily change with the technology and type of role.

[18] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/NI-Skills-Barometer-2017-Full-Slide-Deck.pdf
[19] http://data-viz.nesta.org.uk/creative-skills/index.html

Allstate

Allstate Northern Ireland was established in Belfast in 1999 to provide high quality software development services and business solutions in support of the U.S. parent company's global operations.

Allstate NI plays a strategic role in developing, transforming and maintaining the various technology platforms used within Allstate. Its Compozd Lab employs over 100 people developing UX and design for the wider business.

The office deliberately cultivates a creative and relaxed atmosphere, and the workforce is broken into small teams working in 5 week sprints on projects. They hire programmers, UX researchers & architects, content writers, visual designers, creative technologists and product designers. They use on the job training and shadowing, with junior staff pairing with or shadowing more experienced team members.

Allstate participates in an outreach programme with UU & QUB. Many of their graduate employees come through UU – formerly through the Vis Comms degree (though that lacked specific UX skills) and more recently through the IMD degree, which was recently replaced by the new BA in Interactive Experience Design (IXD) – this year saw the first graduates from this course. QUB supply the ICT developer graduate roles.

All new team members attend a 4-6 week Bootcamp in Pivatal Software. Allstate's training department is currently looking at the potential for an apprenticeship programme (though this will not be specific to UX).

"Personal development is really important to us at Allstate. We provide a framework to learn within and the teams in Compozd act like mini startups. We offer interesting roles with responsibility straight out of training and ownership of project."

Laura Sweeney

Photo: William Murphy

Continuing Training & Skills Development

As with all technology driven sectors, the need for continued training & skills development is a constant issue. In a sector where first year course content could be obsolete by the time a student graduates, HE and FE have made concerted efforts to develop courses which have the right degree of flexibility. Once in the workplace however, it can be difficult to access the right training packages. Overall, NI employers are the least likely in the UK to provide any training (62% in the previous 12 months when surveyed for the UKCES Employer Skills Survey 2015, compared with a range of 63-72% in other UK regions).[20] The main software skills shortages identified by businesses in this study were UX, Unity, C#, C OpenGL, Maya API. A full listing of skills requirements outlined in the survey is available at Appendix V. Businesses particularly wanted to see more cross disciplinary opportunities, reflecting the way they tend to work across a range of interrelated creative areas (see Figure 2). They also want to see better mapping and dissemination of information about available courses. The new breed of companies hiring UX designers (large software firms like Allstate who need a dedicated inhouse team or consultancies like PWC & Deloitte who need to offer their clients a full, integrated solution) are leading the way with skills development, from developing bootcamps and immersive courses for their new intakes to running apprenticeships such as the Deloitte BrightStart scheme.

Deloitte BrightStart

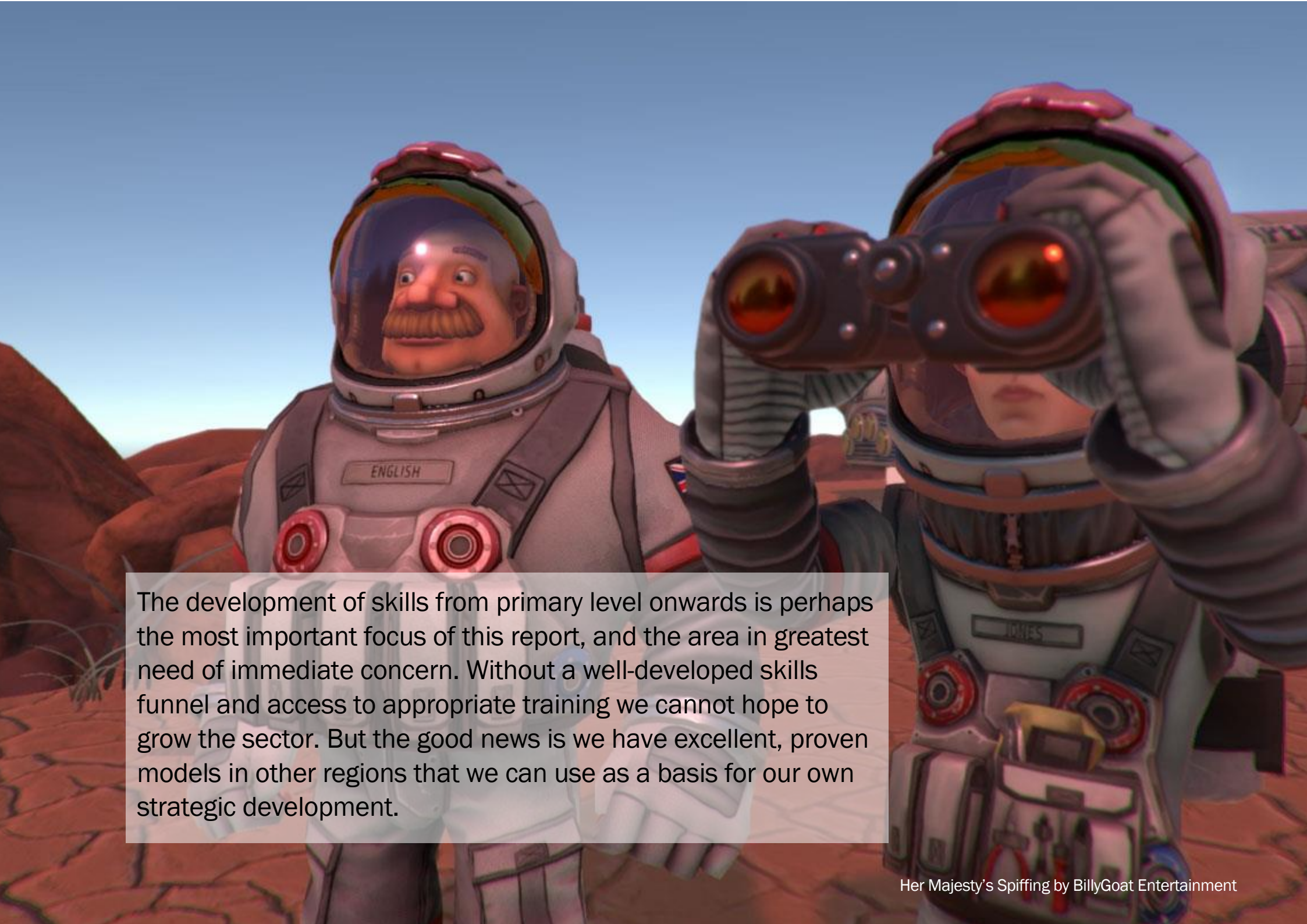
Deloitte's BrightStart Programme offers an alternative path to career development. Developed in partnership with Ulster University, it offers school leavers full-time employment together with a fully funded degree. The Deloitte Digital team has now launched its own Brightstart for UX development and there are currently three BrightStarts in the team. They came straight from school at 18 and they are now on a 5-8 year degree programme while working with Deloitte Digital. The competition for places on the programme is strong, and Deloitte is able to get school leavers with 3 or 4 As at A-Level. The students can get a degree while they work, travel and develop their skills so it's a real win-win.

Allstate

Allstate hire from a similar skills pool and have made concerted efforts to work with NI universities (see previous page). They also use the General Assembly UX bootcamp[21] and find it a good fit or the skills gap they have. Policy developers could take a great deal from what these companies are doing to shape their teams, and indeed the SMEs we talked to in this study were enthusiastic about the idea of making bootcamps or similar short term immersive courses dealing with specific software or design concepts available through government.

Recommendation 6:	Develop a UX Bootcamp with input from businesses, similar to the 2016 Data Scientist Academy which was designed by industry, delivered by the Universities and supported by DfE and Invest NI.

[20] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525444/UKCESS_2015_Report_for_web__May_.pdf
[21] https://generalassemb.ly/education/user-experience-design-immersive



The development of skills from primary level onwards is perhaps the most important focus of this report, and the area in greatest need of immediate concern. Without a well-developed skills funnel and access to appropriate training we cannot hope to grow the sector. But the good news is we have excellent, proven models in other regions that we can use as a basis for our own strategic development.

Her Majesty's Spiffing by BillyGoat Entertainment

Themes and recommendations

Access to funding

The way government currently provides funding needs to be repackaged in a way that better supports the project driven nature of the sector – NI Screen is currently providing funding which is structured to meet those needs very well and has developed the respect of the sector, so there may be scope to widen their remit to include all creative tech funding.

Recommendation 1:	Examine how best to fund the Creative Technologies sector more effectively. It is clear that the NI Screen model (project based, able to take risks and having sectoral expertise in house) works very well, so it would be worth investigating whether NI Screen could be sufficiently resourced to take over all government funding for creative technologies or whether the NI Screen funding model could be used by a new Creative Technologies body.

Sales & marketing support

Sales and marketing support is particularly needed, though it is felt that simple interventions such as travel vouchers could help greatly.

Suggested actions

1. Government should investigate the potential for developing a Creative Tech specific travel voucher/bursary scheme to allow small companies to pitch to companies outside Northern Ireland.

Support for new products

The loss of the Creative Industries Innovation Fund (which was stopped in 2015) is very keenly felt and again, the reintroduction of this simple intervention could greatly help new product development. Many highly successful products (including Sixteen South's Lily's Driftwood Bay) were initially funded through the CIIF.

Recommendation 2:	Reintroduce the CIIF for creative technology companies only through a new or existing organisation with an accompanying marketing campaign.

Suggested actions

1. Government should aim to run up to 4 SBRI (or similar challenges) per year aimed at the creative technology sector.
2. Government could partner with business incubation services to run events on IP protection and develop model contracts and investigate the feasibility of offering vouchers for specialist legal advice on IP.
3. HMRC should target creative technology companies to make sure they are aware of R&D Tax Credits. Investigation is also needed on how best to deliver government R&D grants so that they are more accessible & useful for this sector.

The benefits of clusters

The need for cluster development which fully supports the specific needs of the sector, which is mainly comprised of specialised microbusinesses needing good connectivity, business support services and networking opportunities.

Recommendation 3:	Support the development of a city centre hub focussing on creative technology microbusinesses, with access to Ultrafast broadband, business support services and networking events to help encourage collaboration.
Recommendation 4:	There is a real opportunity for BBCNI to further develop collaborations through the Rewind project, particularly if it was physically hosted in Belfast again. Easy access to these archives for local creative technology companies would allow them to create innovative new ways to experience Belfast's history and could form an important part of the View Belfast Project.

Suggested actions

1. Government could examine the potential for vouchers for connectivity to Ultrafast broadband for creative tech companies. They could also look at the potential for a Belfast city centre creative tech hub with access to best available connectivity alongside the software tools needed by the sector.
2. We would like to see full support for the NI application to the AHRC Creative Industries Clusters programme.
3. DfE should work closely with BCC to help develop creative tech projects in Belfast and use the findings to create a template for other councils.
4. The National Museums of Northern Ireland (NMNI) priorities could be well supported by working with the creative tech sector to develop new, innovative ways of looking at artefacts, telling stories and connecting with audiences. By working more directly with the sector, through clusters or government challenges (such as the augmented reality tourism challenges run by Belfast City Council and Tourism NI), NMNI could add to the user experience through digital resources while delivering on their own future priorities.

The lack of sectoral leadership

While there are a number of specialist sectoral groups currently active, an overarching sectoral leadership group focusing on export and working with government would raise awareness and develop the sector into a more cohesive, collaborative entity.

Suggested actions

1. Northern Ireland needs a creative technologies representative body for Northern Ireland to work with government and represent the NI brand abroad. This could be as a subsector of a wider Digital ICT group or as a standalone body. A representative body could also offer sectoral groups support to learn about best practice, for example through expert speaker events. In addition, the development of an online creative tech hub to allow businesses and freelancers to share projects, opportunities and events and to allow the various existing sectoral groups to share cross disciplinary opportunities.
2. Given the focus on the sector, particularly on immersive technology, in the UK Industrial Strategy White Paper and the NI Draft Industrial Strategy, a 3 year sectoral action plan should be developed for Northern Ireland to maximise access to the support available.

The need for skills

HE & FE skills providers need to acknowledge the fast paced nature of the sector, where new hardware and software is being developed every year, and develop their offering accordingly. In primary schools, there is a real concern that Digiskills NI is not being supported and developed properly to ensure that primary school teachers are confident in developing children's digital literacy skills and that children have the right resources to learn.

Recommendation 5:	The Digital ICT recommendation to appoint a Chief Digital Officer should be revisited, and even widened to encompass a Digital Office to cover all digital skills and economic development functions. Thought also needs to be given to how government could work with businesses like Google to help with teacher CPD, as with the Trinity21 project in Dublin and the potential for the Techspace programme to be relaunched in Northern Ireland. Finally, Digiskills NI needs to have the necessary funding and cross departmental support to succeed.
Recommendation 6:	Develop a UX Bootcamp with input from businesses, similar to the 2016 Data Scientist Academy which was designed by industry, delivered by the Universities and supported by DfE and Invest NI.

Suggested actions

1. The DfE Skills Barometer should develop models which take into account the effect of automation on the predicted need for future skills.

2. MATRIX will undertake a precis on STEM skills and education, drawn from the research undertaken in previous studies, to outline recurring issues which need to be tackled to ensure that the increasingly multidisciplinary nature of our future industries is being served by our education system.
3. Universities need to examine entry requirements to creative tech courses to ensure that they do not create unnecessary barriers.

Conclusions

This study has identified a small but thriving sector with tremendous potential both for growth in its own right and in collaborating with other Northern Ireland technology industries to enhance their products and services.

It is clear that the sector has a unique set of characteristics and business behaviours and because of this, it is not currently being supported as effectively as it should be to maximise its potential. The good news is that small adjustments to the way government supports these businesses could help transform the sector. Although this report makes almost thirty recommendations, many of them are minor interventions and they can be grouped under three themes:

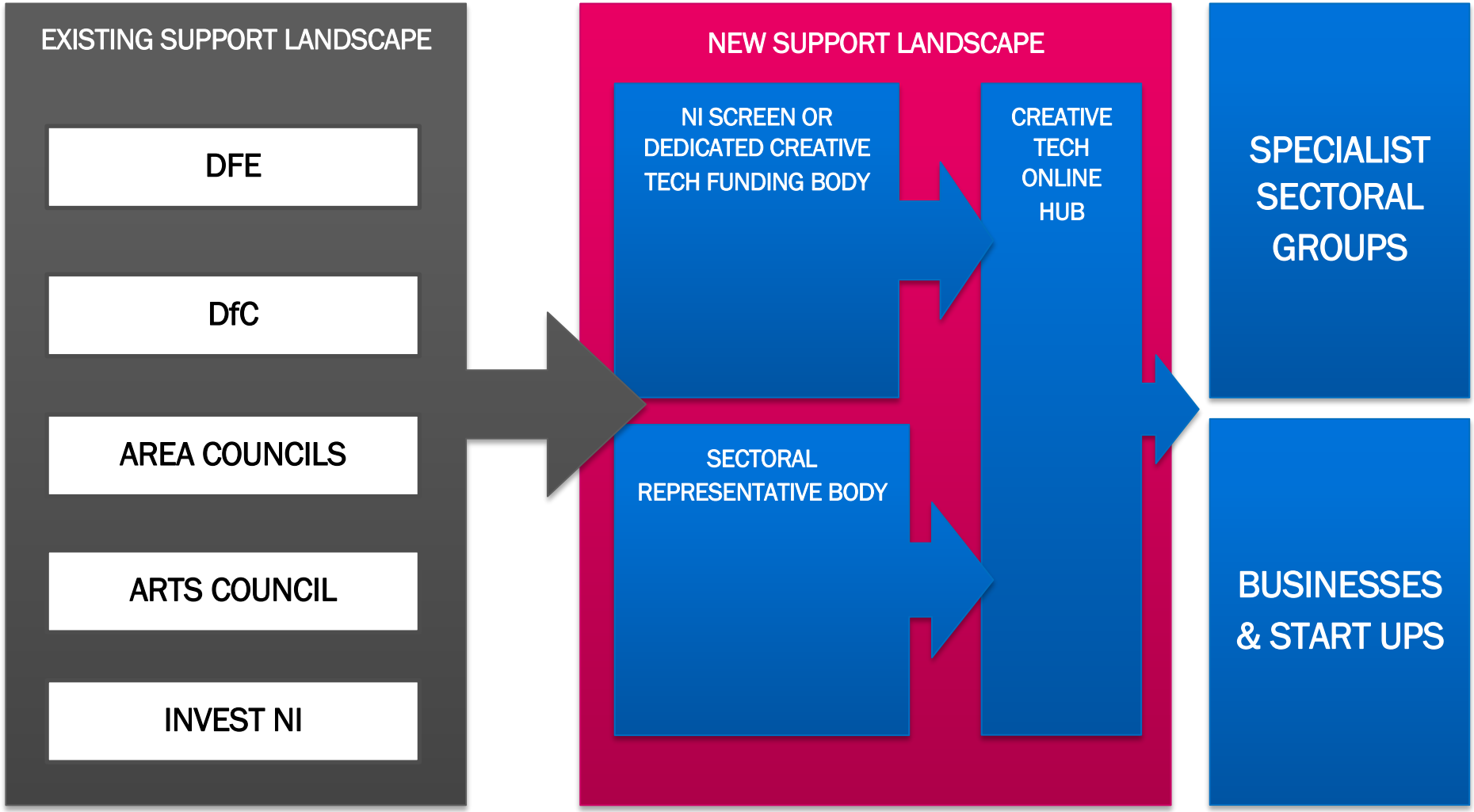
Simplifying the funding landscape

The support landscape is more complex than that for other sectors. This stems from the crossover within the sector between technology and creativity, meaning that a wide range of organisations fund and support in a piecemeal way with no overarching responsibility or focus. The current business growth support available from Invest NI is not a good fit for the project led way these businesses work.

The work that NI Screen has done in supporting the disciplines within the sector that it has current responsibility for demonstrates that they have an effective model in place and a deep understanding of the sector's needs. The respect with which NI Screen is held by the whole sector is testament to its efficacy. It therefore makes sense for NI Screen to be resourced to support the whole sector – bringing the various funds currently disbursed by various organisations and departments for creative technology businesses together to create a one stop shop for support. The suite of additional support methods recommended in this report (for example, travel vouchers, connectivity vouchers, the relaunched CIIF) could also be managed through this mechanism.

Further simplification of the landscape could be achieved with the development of an online hub to allow information on sectoral groups, funding opportunities, projects and clusters to be shared.

Figure 14: Simplifying the funding landscape



Promoting clusters & collaboration

The current low levels of collaboration in the creative tech sector need to be addressed and support should be provided. The clustering model helps break down barriers and provide other benefits to the sector, supporting small businesses as they work, invest and train together. The recommendation of cluster creation and support has been made in many reports, both regionally and nationally. Northern Ireland has yet to seize this opportunity, but now, with creative technologies forming a major focus for both NI and UK industrial strategies, we should do so without delay.

Across all stakeholders there is a clear desire to establish a creative hub in Belfast. With a flourishing creative technology industry, a range of incubators, accelerators and workspaces, two universities, a dynamic and fully supportive council, plus a well-established wider tech sector ripe for collaboration opportunities, Belfast is the obvious place to develop a creative tech hub. The model could then be used as a replicable template for other areas in Northern Ireland. A physical presence in Belfast, located near universities and offering co-working space, innovation labs, business support and skills development and drawing on the expertise and resources of organisations such as the BBC, NMNI, QUB and UU to create IP is an idea with almost universal support. But barriers to success must be actively tackled by all stakeholders with a real sense of determination and pace.

Leadership

The need for leadership within this sector is particularly strong due to the very high proportion of microbusinesses, often led by practitioners with little insight to, or appetite for, the workings of government. Yet without sectoral representation at government level, business needs will not be heard, skills shortages will remain hidden, opportunities will be missed and economic potential lost. It is vital to the development of this sector that a leadership group is formed, focusing on export and working with government to raise awareness and develop the sector into a more cohesive, collaborative entity. Given the focus on the sector in the UK Industrial Strategy White Paper and the NI Draft Industrial Strategy, a 3 year sectoral action plan should also be developed.

Skills

Evidence suggests that creative occupations will be much more resistant to automation than most other jobs. So it makes sense that to develop a healthy and productive economy we should encourage people to fully develop their creative skills, but it is equally vital that they have the opportunity to access training throughout their careers, to keep up with new software and hardware and to investigate new disciplines that can help them maintain currency. The provision of bootcamps and other “short, sharp” training modules in creative tech subjects will achieve this, along with the ability to try out new ideas in places like the Digital Catapult’s Immersive Lab in Belfast.

HE & FE skills providers need to acknowledge the fast paced nature of the sector, where new hardware and software is being developed every year, and develop their offering accordingly. In primary schools, there is a real concern that Digiskills NI is not being supported and developed properly to ensure that primary school teachers are confident in developing children’s digital literacy skills and that children have the right resources to learn. There is also a concern that the Arts and STEM subjects are still kept separate – the need to appreciate and encourage the relationship between technology and creativity has never been more important.

This report has tried to show that Northern Ireland has a unique opportunity to use its creative technology talents to add value to its whole economy. Good design and a satisfying user experience improves and enhances any digital product or service. Creative technology offers new ways to market ideas, develop concepts and create connections.

This is a sector which will flourish if it is supported and represented appropriately. The Northern Ireland creative technology sector has the talent, the innovation, the drive and the confidence required to succeed. It needs government to recognise its unique characteristics and requirements – if what Invest NI has achieved with the cybersecurity sector through CSIT and NI Screen has achieved with our Film & TV sector could be replicated with the creative technologies, we will truly be able to fulfil the Programme for Government aim of a more innovative, creative economy.

Appendices

APPENDIX I: Sectoral statistics

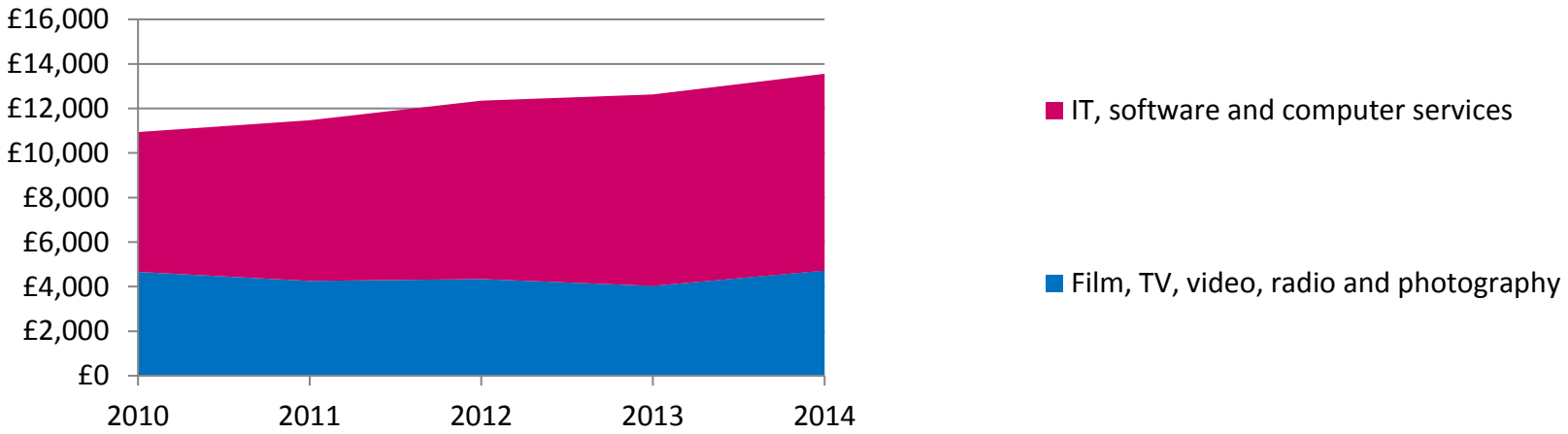
Introduction

IT, software and computer services is the largest of the creative economy classifications used by the Department of Culture, Media and Sport (DCMS) to measure the "creative economy". The creative economy comprises the total number of jobs in creative industries as well as creative jobs outside those industries. IT/software and computer services accounted for an estimated 31.5% of all UK jobs in the creative economy in 2013. The UK figures are produced by DCMS on an annual basis. In NI, DfC only produces data every three years (using the same methodology as DCMS), with the next update not due until mid 2018.

Exports

There are no official export figures available for creative technologies in NI. However, the value of services exported by the UK Creative Industries in 2014 was £19.8bn, an increase of 10.9 % from 2013 and making up 9% of all UK service exports. Creative technologies made up £13.4bn, or 64% of the total UK Creative Industries export.

Figure 15: UK Exports in Creative Technologies 2010-14 in £m



Source: DCMS https://www.gov.uk/government/statistics/dcms-sectors-economic-estimates-2016

Gross Value Added (GVA)

GVA measures the value of goods and services produced within a region or economic sector and demonstrates relative productivity. In the UK, creative technologies accounted for 43.5% of GVA of the creative industries in 2014.

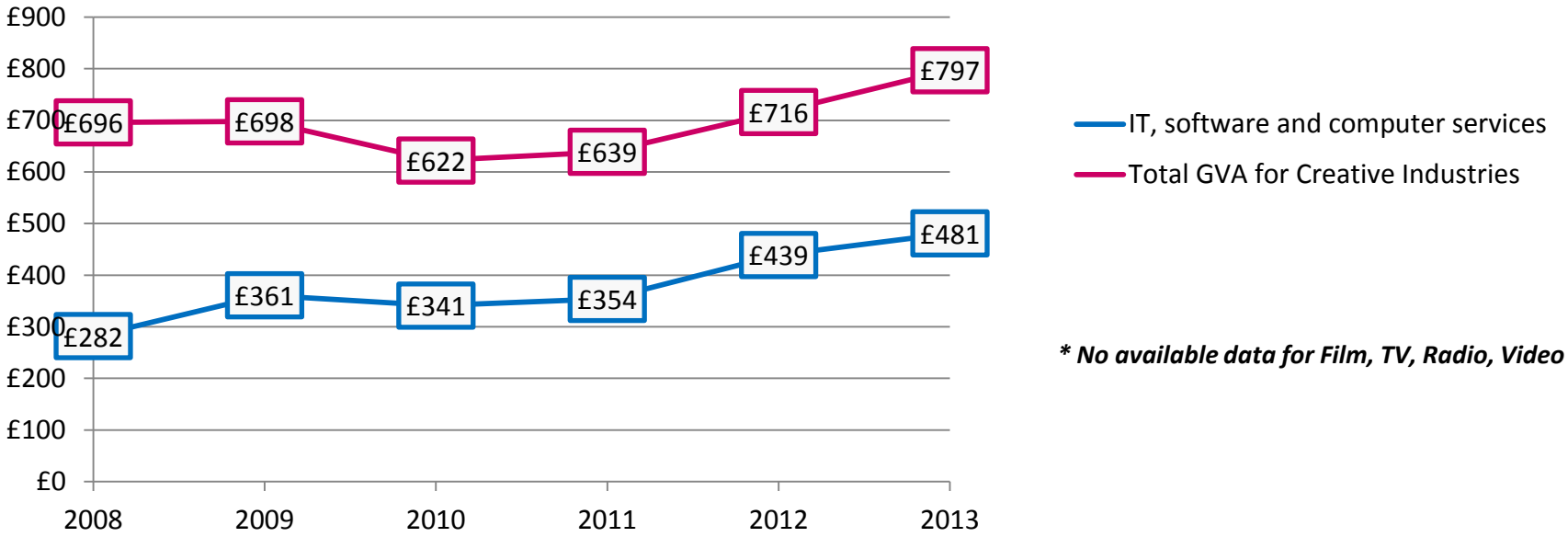
UK GVA for creative technologies

Between 2008 and 2014, the creative technologies sector's GVA rose by an average 5.8%, above the average for the creative industries.

NI GVA for creative technologies

Gross Value Added (GVA) for the creative industries was £797 million in 2013, representing 2.4% of Northern Ireland's total GVA . The GVA for creative industries increased by 11.3% between 2012 and 2013, compared to a 1.2% increase for total GVA. Among the creative industries groups, IT, software and computer services provided the greatest contribution to NI GVA (£481 million).

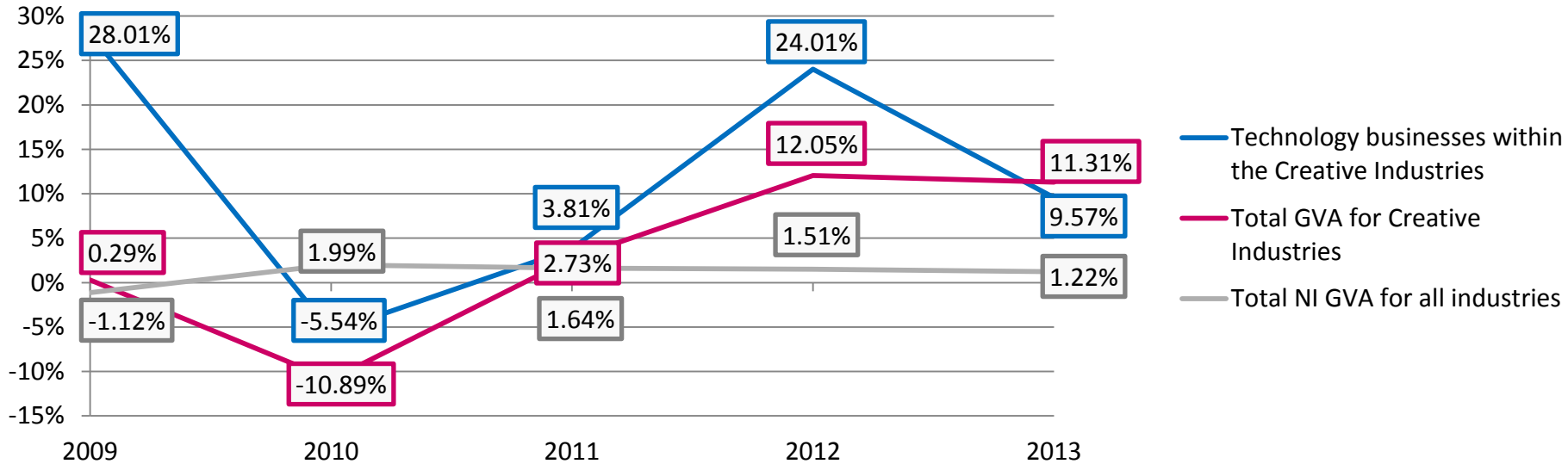
Figure 16: NI GVA for Creative Technologies 2008-13 in £millions



Source: DfC - Creative Industries Economic Estimates Northern Ireland 2015

GVA in the technology subsector of the creative industries in NI rose 70% 2009-2013, compared to 15% for the whole creative industries sector and 5% for all NI industries.

Figure 17: NI GVA year on year growth 2009-2013

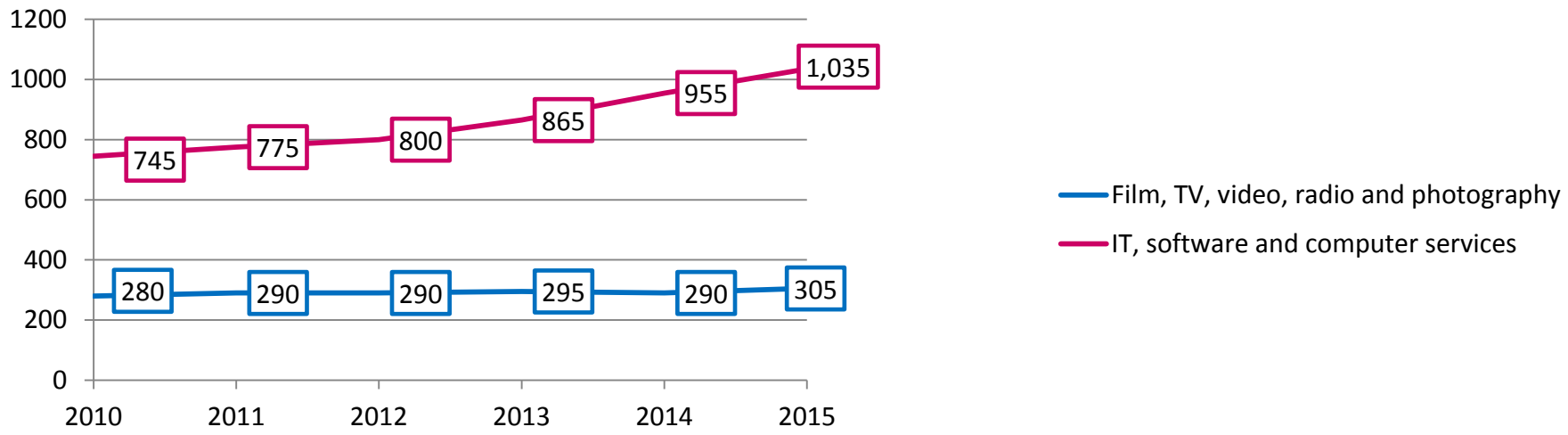


Source: DfC - Creative Industries Economic Estimates Northern Ireland 2015

Registered Businesses

The estimated number of business units in the creative industries sector was 2,610 in 2015. This represented 3.8% of all business units in Northern Ireland. Almost two-fifths (39.7%) of all creative industries in Northern Ireland in 2015 were in the IT, software and computer services group.

Figure 18: Number of registered NI Creative Technologies companies 2010-15



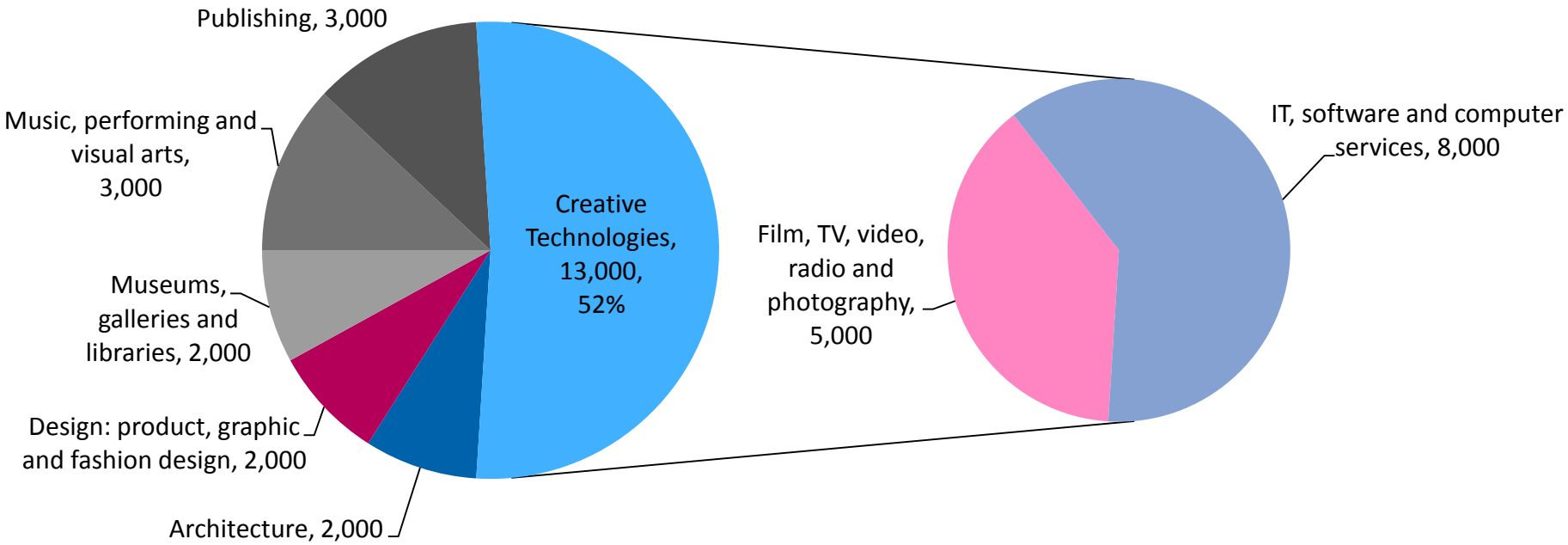
Source: DfC - Creative Industries Economic Estimates Northern Ireland 2015

Employment

DCMS estimates that in 2015 there were 26,000 people working in the creative industries and 19,000 working in creative roles outside the creative industries, giving a total of 44,000 working in what is known as the creative economy and which represents 5% of the total NI workforce.[22]

DfC has further broken down the employment in the creative industries to show that creative technologies make up 52% of the creative industries workforce (and 46% of the wider creative economy workforce). The latest DFC figures are for 2013.

Figure 19: Employment in NI Creative Industries 2013



Source: https://www.communities-ni.gov.uk/publications/creative-industries-economic-estimates-northern-ireland-2015

[22] https://www.gov.uk/government/statistics/creative-industries-2016-focus-on

APPENDIX II: Sources of Funding

Early Stage Funding

- **Techstart NI** - a pre-commercial grant-awarding fund which offers two grants – Concept Grant up to £10k and Concept Plus Grant up to £25k
- **University Spinout Funds** - two £1.5m funds, one for each University (Ulster and Queen's) to spin-out companies ranging between £50k - £250k.
- **Qubis Ltd** – aims to commercialise R&D activities at Queen's University through the formation of spin out companies.
- **Co-Fund** - If you can source 55% of the investment round privately, Clarendon will match the remaining 45%. Round size typically £250k - £450k.
- **Innovation Ulster** - provides support to commercialise technology from within the UU in the form of cash equity investment, support and advice.
- **Halo** – business angel network for NI providing private investors typically £100k-£500k

Venture Capital

- **Kernel** - primary focus is £1m - £4m investments, though they also make early stage investments from £200k - £1m.
- **Crescent** - typically makes investments between £250k and £1.5m and can participate in follow on rounds up to £2.25m in any one company.

Crowdfunding

Crowdfunding works by raising money in smaller amounts from a wider range of individuals, as opposed to a single investor. The two best known platforms are:

- **Kickstarter** – a good way to raise £500 - £100,000, typically within 30 days. Recent Northern Ireland Kickstarter successes include Brewbot, the beer brewing robot which raised £114K and modular synthesiser, Patchblocks (£67K).
- **Seedrs** - offers a more suitable equity crowdfunding platform in which companies can raise an investment round through the commitment of tens, or hundreds of individuals investing small amounts.
- **Indigogo** – similar to Kickstarter
- **Syndicate Room** – an equity platform with a different model which only allows funding into companies which have already secured 25% of their raise from experienced investors. Majors on 'invest with the professionals' because of this. Investment in Adoreboard.

Invest NI

Invest NI offers a range of government grants to boost capital raised through investment rounds. There is De minimis aid limit of £157K that you can claim over a three year period.

- **Propel Programme** - a 9 month programme to guide early stage startups with high growth potential from the initial proof of concept stage, offering up to £20,000 non-repayable, non-equity based grant. It includes a fully serviced, shared working space in Belfast City Centre with broadband and business skills workshops plus mentor support.
- **Development Grant** - The development grant offers funding to support travel and subsistence, external consultancy and marketing costs plus help to employ a key worker.
- **Technical Development Incentive** - the TDI grant supports outsourced technical projects such as app development as well as support protecting intellectual property such as patents and trademarks and offers 50% funding of the project cost up to a maximum of £4,000 ex VAT.
- **Research and Development -** the R&D grant can be used to fund up to 70% of project costs (up to a maximum of £50,000) for researching and developing new technology or products.
- **Innovation Voucher** - a £5,000 grant that can be used to acquire specialist knowledge from a participating university that would not available from the private sector.
- **Interim Manager** - provides up to 49% of the cost of contracting an external consultant as an interim CFO, COO or other managerial position over a period of 9 months and up to a maximum project cost of £30k

NI Screen

NI Screen administers funding specifically aimed at games, animation, interactive content, TV & Film. It differs from Invest NI in that it tends to support individual projects and its team has an industry background. Some funding is provided on a rolling basis (mainly as recoupable loans) while others are "calls", timebound competitions for specific areas. Examples of currently available funding include:

- **Northern Ireland Screen's Creative Animation Scheme** – up to £40,000 to develop Northern Ireland resident junior creators/animators through the production of animated short films.
- **PACT Export Accelerator programme** - expert support (up to a maximum of £500) to help businesses develop an export strategy.
- **Project development funding** – up to £100,000 for companies working in the interactive content sector for the development of games, e-learning, web and mobile projects for international markets and distribution.

- **Project production funding** – up to £500,000 for productions which contribute to building a sustainable digital content industry in Northern Ireland and which can show a direct economic benefit to the region.
- **Film, TV & interactive content production funding** – up to £800,000 for feature film and television production funding and a maximum of £500,000 for interactive content production.

APPENDIX III: Interviews

Thanks to:

- BBC
- Story Fx
- Deloitte Digital
- Invest NI
- NI Screen
- Allstate
- Belfast City Council
- Appattic
- Retinize
- Big Motive
- Silverink
- UU
- Entrepreneurial Spark
- Creative & Cultural Skills
- Kainos

APPENDIX IV: Digiskills NI & Future Classrooms

Digiskills

- DigiSkills NI (supported by the DfC) represents industry professionals, educators and key stakeholders across government who are committed to developing Northern Ireland's digital skills capacity.
- Building on research and engagement with primary schools carried out in 2015-16, it aims to develop a Digital Learning in School Programme across Northern Ireland.
- The programme will support the development of excellence in the teaching of digital skills and computing for young people and enable them to be more than just digital consumers, but to become digitally literate and to be successful participants in the workplace of the future.

DigiSkills NI is a cross departmental programme that represents industry professionals, educators and key stakeholders across government who are committed to developing Northern Ireland's digital skills capacity. Building on research and engagement with primary schools carried out in 2015-16, it aims to develop a Digital Learning in School Programme across Northern Ireland. The programme supports the development of excellence in the teaching of digital skills and computing for young people and enable them to be more than just digital consumers, but to become digitally literate and to be successful participants in the workplace of the future. Meaningful digital skills development is also essential to ensure young people have the ability to create the new digital services and businesses our economy needs, but not yet imagined, and to use creativity and innovation to best effect in the workplace, regardless of sector.

Northern Ireland Screen, as part of its Opening Doors strategy, is committed to developing education and skills programmes that help all young people to achieve their potential and to participate fully in the social, cultural and economic life of Northern Ireland. This strategic intervention will also help transform the screen industries in Northern Ireland by supporting the future development of the film, television and digital content industries. As part of DigiSkills NI, Northern Ireland Screen is developing digital educators so that they can help create the next digital generation.

Future Classrooms

Under the Future Classrooms Programme, NIScreen also supports three Creative Learning Centres in Belfast, Derry & Armagh, delivering skills development programmes for teachers and young people in digital literacy and in understanding and deploying creative technologies and new approaches to learning in the classroom as a support across the curriculum. A key objective for the CLCs has been to provide learning programmes for the most disadvantaged young people and those experiencing social exclusion. Over 80% of CLC activity takes place in schools with high numbers of disadvantaged pupils. The strategy focuses on reaching more schools, particularly in rural areas.

- In 2015-16 the CLCs worked with over 800 schools right across Northern Ireland.
- Almost 800 young people and over 200 teachers participated in 26 customised STEAM programmes in 2015-16.
- In total, almost 5,000 teachers and 8,000 young people participated in CLC programmes in 2015-16.

The CLCs were evaluated by the Education Training Inspectorate (ETI) in 2014 for their training provision for teachers and youth leaders in Digital Technologies. The provision was evaluated as "very good" with ETI recommending that the CLCs should:

- continue to support schools and youth organisations to plan systematically for the further embedding of emerging technologies to support effectively individual pupil learning and progression;
- develop further inter-schools, technology-based, learning opportunities which minimise the boundaries between learners in socially and educationally advantaged settings and those learners in less-advantaged settings to improve overall achievements; and
- develop further the self-evaluation and quality improvement planning processes to focus more sharply on helping schools to raise standards and achievements through innovative and creative approaches to pupils' learning

However, the ETI also noted that not all schools were planning effectively for the inclusion of technology-enhanced learning across the curriculum.

"References to technology-enhanced learning are not embedded sufficiently in the development planning of all schools, and there are too few targets set for the development of innovative, technology-based strategies to support, monitor and evaluate pupils' learning and progression. There is also insufficient evidence of the evaluation of the positive impact of digital technologies on pupils' learning at whole school level. The work of the CLCs to date demonstrates that they are strategically placed to continue to support schools to facilitate more effective technology-based collaboration across the curriculum, and across a wide range of learning settings. The CLCs now need to develop their role to support schools in this wider collaborative context through the use of digital technologies by uniting pupils in their learning across a variety of boundaries. In using technology to link pupils across transition stages, the potential for increased collaboration between schools, especially where technology-based learning is at an early stage, can be intensified."[23]

[23] https://www.etini.gov.uk/sites/etini.gov.uk/files/publications/%5Bcurrent-domain%3Amachine-name%5D/training-provision-in-digital-technologies-creative-learning-centres.pdf

APPENDIX V: Skills required – MATRIX questionnaire responses

Roles required

Intermediate/Experienced CG artists

VFX Compositors (AE and Nuke)

3D tracking

Concept artists

Modelers and Riggers

Game engine specialists

Programmers

QA testers

User Experience Consultants - mid-level to senior

Designers - junior to senior

Experience Analysts - mid-level to senior

Generalist full-stack software engineers - junior to Principal

Developers

Software experience required

C & C#

OpenGL

Maya API

Unity

Skills required

User Experience (UX)

Experience of project management

Research active with some evidence of publications & conference papers

Facial animation experience especially facial rigging experience

3D modelling and animation skills

Strong computer graphics programming skills

Good communication and team working

Drupal architects, developers and front-end themers.

First-class BSc degree or MSc degree in computer animation, computer graphics, computer games, or computer science.

Research or industrial experience in computer animation, computer graphics, computer games, geometric modelling, computer science, or relevant subjects.

A good working knowledge of computer graphics and geometric modelling techniques

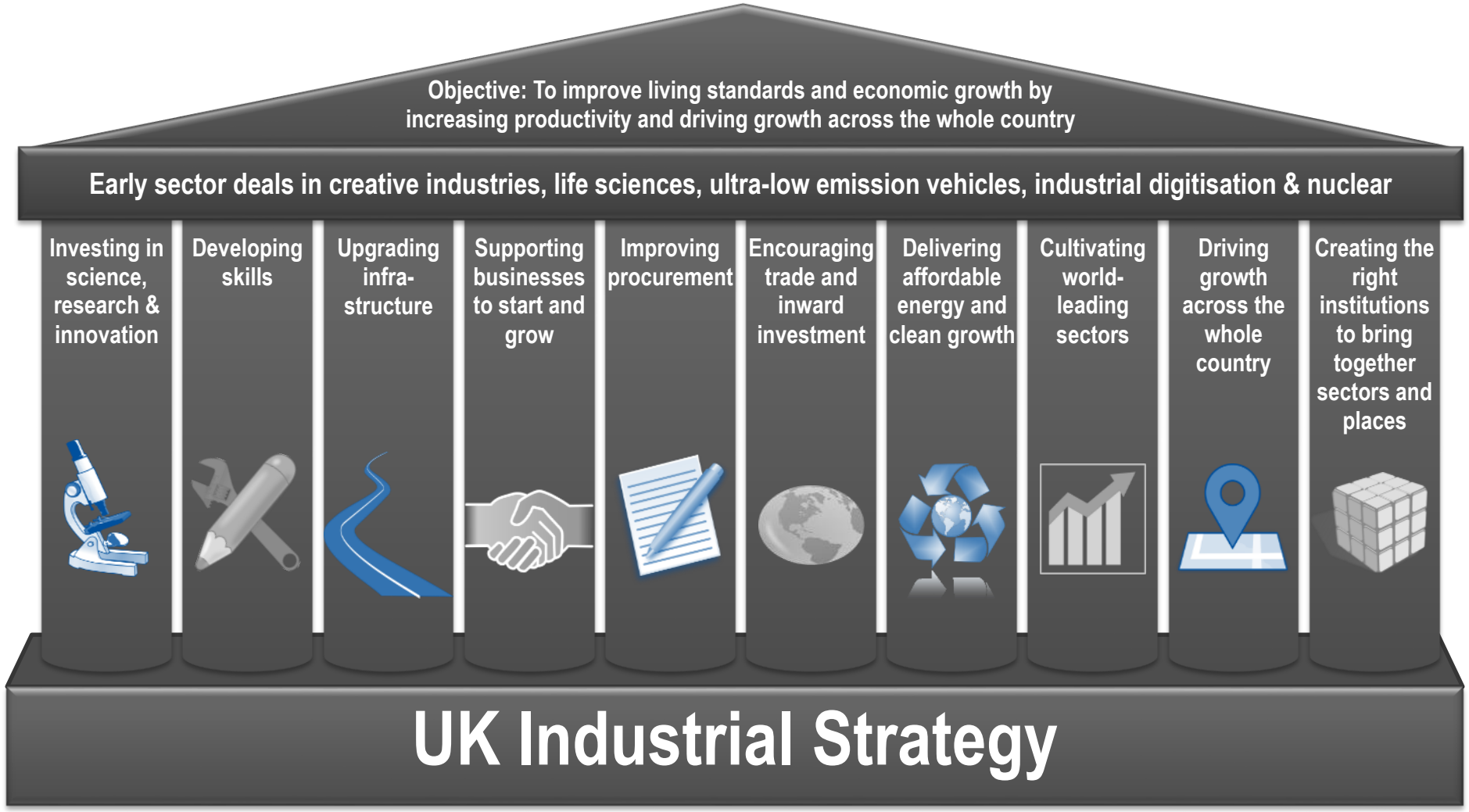
A strong background in mathematics and physics-based geometric modelling and computer animation especially involving ordinary and/or partial differential equations

Virtual/augmented reality app development.

Machine learning, and artificial intelligence.

360-degree video capture, production and post-processing.

APPENDIX VI: The UK Industrial Strategy Pillars



APPENDIX VII: If Government could do one thing to support us....

The local industry needs a BIG name to open shop here. There's enough people with the skills, they need to be unitized before they go elsewhere. If the government could incentivize the first one, the floodgates would open.

What I would like to get help with is accessible programs that allow people of any age who have the skill set and want to move into the industry. For a growing industry there isn't a lot of info or support on how to get your foot in the door.

Define a meaningful Digital Strategy that supports NI's ambition to be a Digital Leader and then execute effectively.

Review the end-to-end education system to ensure that it is fit for purpose for individuals who will be entering the workforce between 2020 and 2030.

Networking, sales and marketing support.

Maintain and develop funding streams to support innovation and development. There are also concerns regarding the unknowns associated with the impact of BREXIT.

Games development grants in particular, start-up grants for young people, assistance with hiring on a part-time basis that doesn't have to be above the industry average

Foster relevant skills development in 2nd and 3rd-level education.

Bring back the Creative Industries Innovation Fund. It's sorely missed.

Incentives for taking on interns/ apprentices

I think it's starting to get much better. But Creative Industries is not ICT. And needs to nurture the 'creative' as much as the industry to keep talent on these isles. So wide ranging funding opportunities linked to a government wide range of sector opportunities.

APPENDIX VIII: FE Sector Creative and Digital Industries Capability

The FE Sector in Northern Ireland has significant creative and digital capability and indeed provides the most significant input across a range of full-time, part-time courses, creative and digital apprenticeships and business engagement activities to the creative digital sector in the region. The development of the creative, digital and ICT Sectors are closely aligned in Northern Ireland, with significant cross over in terms of skillsets associated with ICT Infrastructure, cloud solutions, software development, digital media, including gaming and animation.

Belfast Met chairs both the ICT Sector Partnership in Northern Ireland set up by the former Minister of Employment and Learning and provides the secretariat working with InvestNI for the ICT Employers Group to shape and understand the skills requirements across this sector.

Belfast Met and North West Regional College are founding partners in the Creative Skillset Media in Northern Ireland which is a hub of the UK-wide strategic skills body that works with employers, learning and training providers to ensure that the UK's Creative Industries have continued access now, and in the future, to the skills and talent they require. Creative Skillset takes the lead in developing the national occupation standards for careers in the creative industries, which then provide the basis for new education, training and apprenticeship standards.

In addition Belfast Met and North West Regional College are leadership colleges working with the UK National Skills Academy for Creative and Cultural Skills. CCS is the licensed Sector Skills Council for the UK's creative and cultural industries, including craft, cultural heritage, design, literature, music, performing arts and visual arts. Since 2015, both Colleges have been involved in hosting the Northern Ireland Creative & Cultural Skills Awards. Both Belfast Met and NWRC have representation on the National Skills Academy Advisory Committee and take the lead in promoting careers in the cultural and creative industries.

The skills developed by students at Levels 2 to 5 in the Creative and Digital Media Curriculum across the FE Colleges in Northern Ireland include : Image Production, TV Film and Video Editing, Camerawork, Lighting and Sound, Digital Video Post-Production and Editing, Documentary Production, Animation Techniques for Interactivity, Games Design, 3D Computer Modelling, Animation, VFX Skills and Web Design

In addition the Colleges deliver a range of Higher Education Programmes in areas such as Media, Moving Image, Interactive Multi-Media, Journalism, Fashion Design and Textiles, Graphic Design.

In terms of digital animation and games design SERC have extensive experience in the computer games development industry from both a development and educational perspective. Utilising current industry standard software packages such as Unity, Autodesk Maya, and Blender to design and develop both 2D and 3D gaming content. SERC have the capability to produce games for multiple platforms such as mobile, PC, console and a range of virtual/mixed reality technologies. In addition SERC have a dedicated OptiTrack motion capture space designed for precise data collection for the games, animation and film markets.

One of the key developments in the sector has been the efforts to enhance the use of emerging technologies such as Virtual and Augmented Reality. (VR/AR). The Colleges are using VR techniques with the Construction Sector to deliver the creative digital design skills required for Building Information

Modeling (BIM) where a digital representation of physical and functional characteristics of a facility are used to support construction and engineering decisions. NWRC is leading the way with significant investment in VR/AR technology and the creation of a 7D animation working group and Belfast Met is involved in a Horizon2020 project to develop a BIM Cert qualifications process which can be rolled out across the European Union. South West College has been using drone technology to enhance, AR and VR experiences and also using holographic and haptic technology.

Through the Innovateus and Skills Focus Programmes funded by DFE, the Colleges provide significant technical and prototyping support to small and medium enterprises (SMEs in a range of areas as diverse as : digital marketing and social media, CAD Design, BIM Modelling, Virtual and Augmented Reality, Video Production, Data Visualisation, Software Integration, Data Analytics and Software Development, Mobile and App Development, Graphical User Interface development, and e-learning platform creation. In 2014, Belfast Met delivered the Creative Hub programme which was funded by the Arts Council and focused on the business development support for range of creative and digital SME's across NI. In 2015, Belfast Met worked with Belfast City Council and BT to delivere the Super-Connected Cities programme which focused on bespoke mentoring, masterclasses and training on developing Digital Skills for several hundred SME's.

Collectively the Colleges can showcase significant experience in developing content and embedding digital e-learning solutions to support the delivery of professional and technical training. Northern Regional College Creative Media Teaching Team received a Pearson Silver Award in October 2017 and creative media students from the College are competing in the Worldskills Final in November 2017. The Creative Media Department in NRC has also been the recipient of 4 Royal Television Society Awards within the past 5 years.

Belfast Met are partners with BBC UK and Accenture in the delivery of the national Make It Digital Programme. This programme works with young people seeking to find a career in the creative and digital industries sector to bring them through an intensive training programme.

The course offers a mix of BBC-designed classroom training, and a work placement with a local employer in the creative and digital sector, helping young people work towards gaining an apprenticeship, job or continuing with further education.

Since its launch in March 2015, the BBC Make it Digital Academy has successfully partnered with 26 Training Providers throughout England, Scotland, Wales and Northern Ireland to bring digital skills and work experience to young people. Working with the Department for Work and Pensions, the Skills Funding Agency in England and the Department for Economy in Northern Ireland , the BBC Make it Digital Traineeship has already helping over 1,300 unemployed young people achieve their potential.

Belfast Met has been contracted by the Deparment for Economy in agreement with the ICT Sector Skills Bodies in Northern Ireland to manage the outreach BringItON[24] programme across schools and training organisations in Northern Ireland. The purpose of the BringItON programme is to reach out to young people at the earliest opportunity to promote and encourage interest in future careers in creative, digital and ICT sectors. Belfast Met has worked with Schools and Employer Partners to develop an extensive range of case study materials and resource packs. The Bring IT On programme is helping Colleges

[24] https://bring-it-on.do-ttl-stage.com/

and universities across Northern Ireland to identify the next generation of digital experts to help prepare them for a wide range of roles in one of the fastest growing sectors in Northern Ireland.

Over and above the FE College capability in Creative and Digital Industries, the Colleges have extensive STEM curriculum in a number of areas including : Engineering Operations, Welding Skills, Manufacturing, Mechanical Engineering, Aeronautical Engineering, Electrical/Electronic Engineering, Animal Care & management, Applied Science, Biological Sciences, Dental Nursing, Computer Aided Design, Creative and Digital Industries, Construction and the Built Environment, Building Information Modelling, Renewable Energies & Sustainable Construction, Architectural Technology, Civil Engineering, IT, Networking and IT Infrastructure, Computing and Systems Development, Computer Games Development, Software Development and Cybersecurity.

APPENDIX IX: Bibliography

Virtual and Augmented Reality: Technologies and Global Markets (2016) - BCC
https://www.bccresearch.com/market-research/information-technology/virtual-augmented-reality-tech-markets-report-ift124a.html

Creative Industries Economic Estimates Northern Ireland 2015 - DfC
https://www.communities-ni.gov.uk/sites/default/files/publications/dcal/creative-industries-economic-estimates-in-northern-ireland-2015.pdf

DfC - Creative Industries Economic Estimates Northern Ireland 2015
https://www.communities-ni.gov.uk/publications/creative-industries-economic-estimates-northern-ireland-2015

OFCOM Connected Nations 2016
https://www.ofcom.org.uk/__data/assets/pdf_file/0037/95878/CN16-NI.pdf

OFCOM Communications Market Report: Northern Ireland 2016
https://www.ofcom.org.uk/__data/assets/pdf_file/0030/69555/CMR_Northern_Ireland_2016.pdf

EAG Access to Finance update 2015
http://eagni.com/wp-content/uploads/2015/10/EAG-Access-to-Finance-Update.pdf

That's not all folks: Developing the Animation Sector 2015 – The Honeycomb Centre
http://thehoneycomb.net/public/research-reports/Animation-Report-Final-2015.pdf

Draft NI Programme for Government (2016-2021)
https://www.northernireland.gov.uk/sites/default/files/consultations/newnigov/draft-pfg-framework-2016-21.pdf

Ireland's Digital Future – Foresight Report on the Digital Sector in Ireland
http://thehoneycomb.net/public/research-reports/Honeycomb-RoI-Foresight-Report-Online.pdf

Creative Industries Council – Create Together (2016)
http://www.thecreativeindustries.co.uk/media/367095/final-version-july-5.pdf