UNIVERSITY OF PORTSMOUTH

CCIXR: CENTRE FOR CREATIVE AND IMMERSIVE XR

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Centre for Creative and Immersive XR (CCIXR) - Full Business Case

Introduction

This document is the Full Business Case (FBC) in support of the development of the Centre for Creative and Immersive XR (CCIXR) at the University of Portsmouth. The proposal outlines the development of the UK's first integrated facility to support innovation in the creative and digital technologies of virtual, augmented and extended realities. Building on recognized excellence and expertise, the CCIXR will provide a specialist focus for innovation for a range of Solent LEP priority industries, consolidating and enhancing the strength of the creative, digital and cultural sectors in the Solent region.

This case outlines the regional and national contexts against which this proposal has been developed. It details the drivers for change, objectives and benefits the proposal will bring and confirms its affordability in terms of capital and revenue. By outlining those aspects of the project currently funded and planned for development, this Full Business Case demonstrates the opportunity that further funding from Solent LEP would bring to significantly accelerate and enhance the activities and outputs of the CCIXR.

Time is of the essence. The digital technologies of visual and spatial computing develop at considerable pace. The rapidly emergent and integrated fields of 'eXtended Reality' (XR) have yet to fully consolidate in institutional, sector and regional terms. This initiative is then an attempt to capitalise on our longstanding and pioneering research and innovation within these fields, to make Portsmouth and the Solent region a centre of excellence for R&D, innovation and business development for eXtended Reality through visual and spatial computing in the UK.

The University of Portsmouth is well-placed to deliver this initiative, having established a reputation for excellence in digital innovation and the application of emerging technologies to different sectors since the creation of the Faculty of Creative and Cultural Industries (CCI) in 2006. Through the development of the CCIXR, there is now an opportunity to secure our position as a world leader for research, development and innovation of XR technology and the skills development

to meet the needs of this growing industry. Importantly, CCIXR would have a significant impact on the productivity of the existing industrial base and other industry sectors such as marine, defence, medical and aerospace that employ creative digital disciplines in their own research and development. CCIXR has significant potential to help realise Solent LEP's ambition to increase the region's economy to £50 billion by 2050.

This Full Business Case has been prepared using the Five-Case Model:

- The strategic case sets out the strategic context and the case for change.
- The economic case demonstrates that the organisation has selected the choice of investment that best meets existing and future needs and optimise value for money (VfM).
- The commercial case outlines the content and structure of the proposed project.
- The financial case confirms funding arrangements and affordability.
- The management case demonstrates how the project will be achieved and sustained.

1. Executive Summary

Strategic Case

The University of Portsmouth will create a Centre for Creative and Immersive Extended Reality (CCIXR) within its Faculty of Creative and Cultural Industries. The CCIXR will deliver state-of-the-art immersive and creative extended reality (XR) facilities to enable, support and grow the significant Digital Creative Industries sector within the Solent LEP region. The innovation and application of XR technology will also stimulate growth and productivity in the Solent LEP region's other priority sectors.

This project will increase the Solent's prosperity by delivering the following LEP aims:

- Pioneering innovation and research
- Developing skills and talent
- SME growth
- Improved productivity in priority sectors
- Employment growth

By integrating facilities in Volumetric Capture, Large Scale Motion Capture, Virtual Reality, Augmented Reality, Photogrammetry and Mixed Reality, CCIXR will provide a step-change in creative and immersive XR that is not available elsewhere. This project also represents a significant opportunity to address the Solent Region's higher level and STEM skills challenge, enhance the capacity for supporting design-led innovation amongst local companies and attract a global technology company to Portsmouth.

Economic Case

Investment in the CCIXR will deliver a range of outputs and outcomes during its first 10 years; 4 FTE jobs directly created; 19 temporary jobs directly created; 200 new jobs created within the Solent LEP area; 800 businesses supported through technical, business and R&D expertise; 130 collaborative R&D bids; 500 new learners supported through CPD, courses and workshops. The CCIXR will support businesses and individuals to develop state of the art creative, digital and STEM skills in its exploitation of creative and immersive XR technologies. Talent

and skills development will drive productivity to create and sustain the talent pipeline required by the burgeoning creative / digital sector of the region. The GVA to the local economy will be £49.2 million over the first ten years, rising to £92.5 million over fifteen years.

Commercial Case

The support received by the University from our strategic industry partners and large company customers gives us the confidence that the preferred option for the CCIXR will result in a viable well-structured project that will deliver the significant outputs and outcomes set out in the Economic Case. In terms of value for money, the CCIXR project represents an exceptional opportunity to develop creative digital skills and improve access to leading edge creative, digital, immersive and XR technology.

Financial Case

The University is applying for £[redacted] capital funding towards the total project cost of CCIXR of £[redacted]. The University has confirmed its match (capital and revenue) contribution of £[redacted], and has also confirmed additional revenue support of £[redacted] K over the first two years. This revenue funding has not been used to calculate the NPV of the project, as this expenditure will not be capitalised. Costings for this project are primarily concerned with the provision of equipment and associated software for this leading-edge project. The University has considered to its satisfaction that the impact of the CCIXR project cash flow on the overall balance sheet is manageable. There are robust project management and governance controls in place to ensure the budget will be kept in check.

Management Case

The University has undertaken an extensive process of consultation and engagement with all relevant parties to ensure that this project is achievable. The University has a successful track record of delivering capital projects on time, within budget and in accordance with recognised best practice. There are robust arrangements in place with an overall governance framework, contract management, the delivery of benefits and the management and mitigation of risk.

2. Strategic Case

This section explains how the Centre for Creative and Immersive XR (CCIXR) fits into the strategic ambitions and goals of the University of Portsmouth and in so doing, outlines its alignment with Solent LEP priorities.

2.1 The University of Portsmouth

The University of Portsmouth is a comprehensive and multi-disciplinary institution committed to meeting future challenges through research, development and innovation. The University has identified five overarching themes through which to focus and guide its academic development; Future and Emerging Technologies, Health and Wellbeing, Security and Risk, Sustainability and the Environment and Democratic Citizenship. Creative and Immersive XR technologies and applications are already enabling and driving the advancement of these themes and the potential for future development is significant.

2.1.1 The Faculty of Creative and Cultural Industries

Established in 2006 following the absorption of the Portsmouth College of Art & Design into the University of Portsmouth, the Faculty of Creative and Cultural Industries brings together the creative arts and technologies in one academic community. Organised in four academic schools, faculty disciplines include architecture and interior design, art, design and performance, film, media and communication, and the creative technologies of games, animation and visual effects (VFX), digital and creative media, music technologies and visual computing. The faculty is located in the Eldon Building and White Swan Building in Portsmouth.

2.1.2 Digital and Creative Technologies at Portsmouth

As the 2016 Solent LEP Innovation Strategy noted ‘The University of Portsmouth hosts the world’s leading gaming centre and offers an extensive range of under- and postgraduate courses including Computer Games Technology and Computer Games Enterprise.’ These disciplines offer a spine of activity from which a number of allied specialisms such as computer animation, visual effects, virtual and augmented reality and motion capture have developed. In each of these areas our specialism manifests itself in two distinct yet wholly connected ways as both technical development and user interface applications. This marriage of the creative AND the

technical is central to our academic strategy and drives us towards ‘real world’ applied research and innovation.

2.2 The Centre for Creative and Immersive XR (CCIXR)

XR, or eXtended Reality, is a term encompassing all forms of additional reality - Virtual Reality, Augmented Reality, Mixed Reality and Spatial Computing. Early adoption of nascent XR is already transforming multiple priority sectors, and market analysis demonstrates significant and sustained economic opportunity for its application. Often originating in the Games and Media industries, the application of immersive and experiential interface XR technologies are helping to address a broad spectrum of challenges faced by society. XR is expanding its influence and applications at a significant rate, providing disruptive and transformational solutions to diverse sectors such as medical, manufacturing, and maritime.

Examples of current cross-sector XR applications include:

- Medical e.g. chemotherapy pain management (UoP / [redacted])
- Simulation training for firefighting and emergency evacuation (UoP / [redacted])
- XR applications in Manufacturing, see report *Through the Looking Glass - the rise of augmented reality and its role in the future of manufacturing* (Institute of Engineering and Technology / High Value Manufacturing Catapult).
- Simulation to de-risk training in high risk environments e.g. bomb disposal (UoP / [redacted])

As pioneers in Creative and Immersive Technologies, the creation of the CCIXR at the University of Portsmouth will realise the global opportunity of XR to provide a competitive edge for the benefit of the region.

The Centre for Creative and Immersive XR (CCIXR) in the Solent Region aims to:

- Establish the CCIXR in the Solent region with world-class facilities and expertise in Virtual, Augmented and Mixed Realities, Volumetric Capture, Motion Capture and Photogrammetry – known collectively as eXtended Reality (XR) technologies.

- Contribute to establishing the Solent region as a prime location for innovative XR-enabled companies, so increasing inward investment and facilitating large scale industrially focused projects currently hosted outside the region.

- Deliver a step-change in R&D, innovation and uptake of XR technologies, through bringing universities and business together in easy access development facilities.

- Create a robust talent pipeline through undergraduate, graduate and business-facing training programmes to produce a skilled workforce able to capitalise on the increasing demand for cross-sector capabilities in XR technologies.

- Deliver adoption of XR technologies into multiple LEP priority industry sectors, leading to jobs and GVA creation (esp. Defence, Life Sciences & Healthcare, Digital Technologies, Digital Creative Industries, Construction, Clean/Green Technology).

2.2.1. Establish the CCIXR in the Solent region with world-class facilities and expertise in Virtual, Augmented and Mixed Realities, Volumetric Capture, Motion Capture and Photogrammetry – known collectively as eXtended Reality (XR) technologies.

- Establish the UK's first integrated facility offering access to Volumetric Capture, Large Scale Motion Capture, Photogrammetry and Mixed Reality early access development lab in one location, thereby securing the region's position as a world leader in XR technologies.
- CCIXR will offer a unique technical facility by bringing together the cutting-edge technologies that are rapidly converging to define the creative and immersive XR sector.
- It will constitute a community of academic and technical specialism committed to technological integration and adaptation in support of enhanced interface, use-ability and application.

XR Case Study: Virtual Reality RIGPr (Real Integrated Group Project) Simulation Training Technology (Novatech, [redacted] and University of Portsmouth)

This third-year undergraduate student project was commissioned by the [redacted] and Novatech. Its aim was to create a VR simulation tool to support the training for [redacted] piloting and navigation. Using a three degrees of freedom (DoF) platform and/or chair the original aim of the project was simply to create a proof of concept. However, these ambitions were significantly surpassed and the project was eventually realised as a full training simulation. To date, [redacted] have relied on the right weather and available resources to train their part-time members. These external variables have frustrated training by limiting crucial training required to prepare [redacted] members for the unpredictable ocean conditions that [redacted] coxswains constantly face. This project was able to address this challenge by using a combination of commercially available gaming hardware within training, and has developed into a first-of-its-kind affordable and portable motion simulator. This was developed on a[redacted].

Following a trial conducted by a [redacted], the motion simulator was deemed a realistic and efficient training sim alternative. However, participant feedback and review led to the development of the simulator from using just a pitch + roll facility, to incorporating heave so as to enhance the reality of the simulated experience. With this addition, the team were able to correctly mimic the ocean's waves that affect a [redacted] in deployment. This VR training tool has been presented at VentureFest South, DSET (Bristol) and in ITECH (Sweden), demonstrating the power of Creative and Immersive technologies within the marine and maritime, and defence sectors. As set out in the [redacted] letter of support, this is just one outcome of many years of successful partnership with the [redacted], and underlines the University's key role in skills development and talent pipeline in the region.

'We are particularly excited to see the world-class facilities that CCIXR will include, such as photogrammetry and volumetric capture, being brought to the to the local region. These facilities will enable us to explore new XR technologies and inform R&D. This world-class strength in enabling practical applications for future and emerging technologies means that Portsmouth represents an ideal place to develop our research and development, and we look forward to engaging with these facilities - and the expertise within the team - on a regular basis.'

Peter Waggett
Director Emerging Technology, IBM

2.2.2. Contribute to establishing the Solent region as a prime location for innovative XR-enabled companies, so increasing inward investment and facilitating large scale industrially focused projects currently hosted outside the region.

- CCIXR will facilitate and support larger scale projects such as those undertaken in partnership with national bodies such as [redacted] which are currently hosted outside the region due to restrictions in the region's existing facilities.
- Bring more innovation, research and development to the area, through enabling larger scale collaborative projects and in support of strategic partnerships.
- CCIXR will support inward investment, providing a significant boost to supply chains in the area thus enabling further business growth and sustainability.
- Building upon current strengths and partnerships, the CCIXR will constitute a focal hub for national and international initiatives concerned with the creative and digital economy in XR innovation.

2.2.3. Deliver a step-change in R&D, innovation and uptake of XR technologies, through bringing universities and business together in easy access development facilities.

- CCIXR will offer dedicated support for business partnership and development.
- It will work to exploit opportunities for creative and immersive applications both within and beyond the creative and digital sectors by bringing together and expanding the pools of specialists, participants, and users for creative and immersive XR.

'Immersive Technologies are a key area in the sector with growth potential the development of the Centre for Creative Immersive XR could therefore play a key role in differentiating the creative sector in the Solent area, growing talent, and supporting cluster development.'

Maureen Frost
Chief Executive
Hampshire Chamber of Commerce

Charles Freeman
Coordinator Creative Network South.

- It will facilitate and host a programme of developmental opportunities including formal CPD, demonstrations and practice sharing, sandpit and testing workshops and project development and workflow support.
- It will work to demonstrate the potential for XR applications and work in partnership to support proof of concept through research and development and business development support.

‘As the creators of Unreal engine, we are very much aware that the greatest applications for our technologies are very often through thinking “outside” the box. Working with CCIXR will enable us to continue to do that, and will also help to enable us to allow access to the power of Unreal engine for smaller SME’s and micro’s. CCIXR will lower the barrier to entry – and the LEP funding will allow CCIXR and partners to encourage, support and showcase just how revolutionary Creative and Immersive technologies can be.’

Ben Lumsden
Business Development Manager, Unreal Engine
Epic Games

XR Case Study: Immersive Performances of the Future: Audiences of the Future Demonstrator Project, part of the Industrial Strategy Challenge Fund. Funded by Innovate UK and Arts Council England. (Total Project value £[redacted]

The CCIXR team are currently engaged in the Audiences of the Future Demonstrator project for Performance, which aims to revolutionise the use of Creative and Immersive Technology within the theatrical environment. Led by the Royal Shakespeare Company, the University of Portsmouth is one of 15 world-leading partners, including EPIC games, Intel, Magic Leap, Punchdrunk, Manchester International Festival and the Philharmonia Orchestra.

[redacted]. The profile and prestige that this project brings is already raising the profile of creative and immersive XR at Portsmouth, and we have seen our engagement with national and international businesses expand at an impressive rate.

Image: CCIXR Team Member demonstrating Magic Leap spatial computing technology to Margot James MP, Minister of State for Digital, Culture, Media and Sport at the announcement of the Audience of the Future Demonstrator projects, January 2019.

The knowledge and expertise gained through this project will significantly benefit the region, through increased inward investment and recognition. Through seeing the potential of this technology, companies will also be helped to understand the benefits that it can bring to them. The open-door approach of CCIXR will invite companies who are curious as to the benefits of Creative and Immersive Technologies to engage with us, our expert team and world-class facilities.

2.2.4. Create a robust talent pipeline through undergraduate, graduate and business-facing training programmes to produce a skilled workforce able to capitalise on the increasing demand for cross-sector capabilities in XR technologies.

- The CCIXR will work with industry to ensure that we are producing the creative / digital graduates that will be necessary to exploit and sustain the creative and immersive XR economy.

- It will offer a range of in-and outreach activities to businesses and the wider creative and technical communities in order to develop specialist skills and participant and user awareness.
- It will build on existing success to deepen the alignment of the student and academic experience of learning within ‘real world’ contexts through the further development of the Creative Technologies Enterprise Project Office.
- It will deepen its partnership with local Further Education (FE) and school partners in the region to develop and strengthen the creative skill-base and pipeline necessary for professional development, whilst also helping to raise aspiration and attainment levels.

XR Case Study: *Designing Disgust, why do we feel the need to judge?*
A Partnership between [redacted] and University of Portsmouth. Funded by Innovate UK as part of the Audiences of the Future: Design Foundations programme, part of the Industrial Strategy Challenge Fund (ISCF). Project Value £[redacted]

This project sought to discover how Creative and Immersive XR could be used within a heritage context to design an exhibition which used digital technologies to augment real objects. Faced with the challenge of caretaking often fragile and precious exhibits, museums, galleries and heritage environments are well versed in the need for careful presentation and interpretation of their collections. Designing Disgust was a proof of concept project that sought to use creative XR technologies to support and enable the story-telling of historical objects which in a contemporary environment and for political or moral reasons, are now viewed as problematic, inappropriate or just plain disgusting.

An example of this is a high-style Victorian silk dress which would have entailed the death of over 1300 silkworms in its creation. Using a selection of different Creative and Immersive XR technologies the team created a number of successful proof of concept artefacts, overcoming the perceived challenges associated with exhibition and presentation of these objects.

‘The importance of the opportunity to enable research and development within this facility cannot be underplayed as it will promote the creation of future skillsets, talent pipelines and innovations which will, in tum, lead to the creation of jobs and economic growth in the region.’

Andy Lanning
Executive Creative Director
Magic Leap

For this dress, the team created an animated light projection of silkworms cascading down and slowly filling up the dress in order to illustrate and reveal the challenging history that lay behind such an apparently beautiful object and its creation. Audience research shows that the ‘animated’ yet non-invasive augmentation of this object attracted visitor interest and deepened their engagement and understanding of the collection.

2.2.5. Deliver adoption of XR technologies into multiple LEP priority industry sectors, leading to jobs and GVA creation (esp. defence, life sciences & healthcare, digital technologies, digital creative industries, construction, clean/green technology).

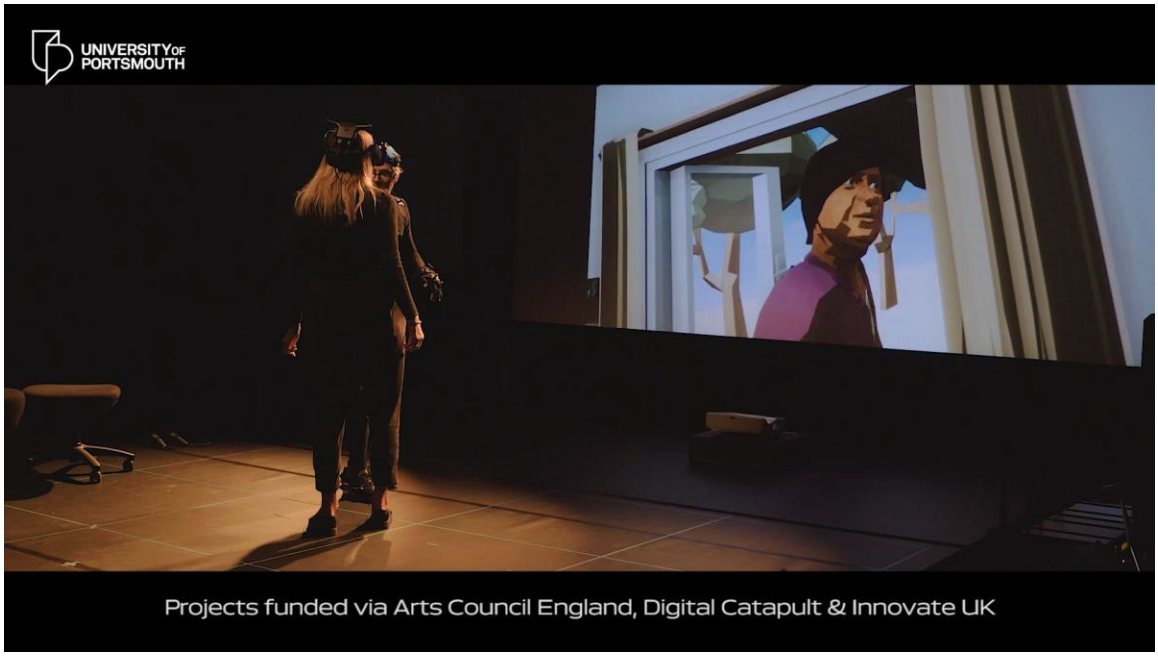
- Drawing upon the multi-disciplinary constitution of the university, the CCIXR will work to exploit the cross-sector opportunities of XR application
- Taking a problem-based approach to R&D, CCIXR will work with industry partners to find new applications that address diverse sector needs and challenges
- Building upon existing research and development, CCIXR will deepen cross-sector understanding of XR workflow and value chains in support of increased productivity and business growth

XR Case Study: Fatherland XR - a Partnership Production between Limbik Theatre and the University of Portsmouth. This project has been funded by Creative XR, Digital Catapult, Arts Council England and Innovate UK. Project sponsors include [redacted]. Project Value £[redacted]

Fatherland, a story of one man's experience of his father's dementia, is a mixed reality performance production. This project grew from an open invitation for theatrical performers to take part in a motion capture open workshop event led by the CCIXR team. The developing project that came out of that day was subsequently developed for application to the Digital Catapult / Arts Council England Creative XR scheme. Fatherland won support and funding at both stages of this highly competitive scheme and the work has since been presented in development in a number of leading venues.

The central challenge of this work was to investigate how the personal and intimate environment of the immersive experience might be put into the collective and shared experience of real-time performance. Through real-time motion capture technology and virtual reality, the production makes the audience participant performers in the work and the technology creates a responsive contingency between the performers

and their audience. Fatherland was subsequently supported through an Audience of the Future Design Foundation grant, which enabled the team to investigate how the audience themselves perceived and experienced interaction with Creative and Immersive XR technologies.



Digital Catapult Creative XR, Fatherland: https://youtu.be/-x4kzXPaxSQ

As Director of Research and Innovation for PHT for the last ten years, I have seen the potential for innovative new approaches in digital technologies to help address some of the major challenges the healthcare sector faces. We support the CCiXR proposal because we want to see opportunities for researchers, innovators and businesses to work together in world class facilities at the cutting edge of these technological developments. We want to ensure there is a skilled workforce that understands the potential of digital technologies and how it could be applied in healthcare settings.

Professor Anoop Chauhan
Director of Research and Innovation, Portsmouth Hospitals NHS Trust

2.3 Alignment to Solent LEP priorities

The strategic ambitions of the CCIXR align closely to many of the Solent LEP strategic priorities:

- Supporting new businesses, enterprise and ensuring SME survival and growth
- Investing in skills to establish a sustainable pattern of growth, ensuring local residents are equipped to take up jobs that are created and businesses can source local skills, and labour underpins growth
- Developing strategic sectors and clusters of marine, aerospace and defence, advanced manufacturing, engineering, transport and logistics businesses, low carbon and the visitor economy – establishing the areas as a business gateway, at both local and international levels and developing local supply chains
- Building on our substantial knowledge assets to support innovation and build innovative capacity in the Solent area to stimulate growth in Solent businesses and in new high growth sectors, particularly linked to Higher Education (HE) excellence.

Additionally, the Solent LEP large projects documentation highlights the following priority outcomes, which are applicable to the CCIXR:

- Pioneering innovation and research
- Developing skills and talent
- SME growth
- Improved productivity in priority sectors
- Employment growth

Creativity skills contribute not just to the creative sector but also are 'embedded' in creative economies not classed as creative industries, for example, those in design for engineering, marine, aerospace and construction, those in advertising, marketing and communications for business, and those in software and innovation strategy for public / private sectors. Creatives also contribute to innovation and economic growth'

Solent Skills Plan

CCIXR maps onto the Solent LEP Skills Agenda:

- Support greater business engagement and skills brokerage to increase the pool of employers engaging with schools, colleges, universities and other learning providers, and providing work placements
- Improved leadership and management skills to promote better employer investment in skills
- Promote entrepreneurship skills
- Support innovation linked to skills
- Raise the level of STEM skills in the economy to create a world-class skilled labour pool
- Raise higher-level skills in the economy by: raising resident participation rates in HE, improving vocational pathways to higher-level skills such as through Higher Apprenticeships, and improving graduate retention
- Address sector-specific skills requirements of employers, support new emerging high-growth sectors and service industries. Linking employer and learner need to local provision to meet skills gaps and shortages
- Improve employability skills – placing increased focus on the work-readiness of school, college and university leavers

The Strategic Economic Plan recognised the considerable contribution that the diverse range of creative, cultural and digital industries makes to the economic health of the region and also that many of the creative jobs are embedded in the region's other priority sectors. In developing its Innovation Strategy Phase 1: Evidence Base (PACEC, 2016), Solent LEP confirmed creative industries as one of the region's core specialisms and sectors with a competitive and comparative advantage with the potential to create economic value. This report further confirmed that the Solent currently ranks 8th out of all LEP areas for employment in the digital and creative industries sectors, and that the highest growth of jobs in the Solent region is likely to come from creative industries and life sciences. Creative Industries is expected to feature prominently in the Solent LEP's Local Industrial Strategy.

Through the Solent Prosperity Fund, the LEP aims to invest in capital projects which will support the Solent economy to be fit for the future. Solent LEP has an ambition to grow the Solent economy into a £50 billion economy by 2050. In order to achieve this growth and prosperity, the region must address productivity challenges. In its report into the economic impact of the Solent area universities (Biggar Economics, 1 March 2018), the LEP recognised that universities are drivers of economic activity and enhance the productivity of the region when they provide a steady stream of graduates equipped with the knowledge and skills industry need. Furthermore, the Solent region is well placed to champion the transformative power of technology to raise productivity (Solent LEP Annual Report 2018). Investment in the CCIXR will therefore impact the productivity of the Solent region.

[redacted] establish the region as a centre of excellence in this rapidly growing arena. CCIXR will enable and develop multi-disciplinary world-leading innovation and research to support business growth throughout the LEP's priority sectors. With regard to productivity, CCIXR will unlock step-changing efficiencies for businesses and offer skills development and training to increase productivity through efficiency savings.

2.4 Creating the future workforce through creative / digital skills

The University of Portsmouth can evidence significant success and achievement in supporting the employability of its graduates. The University is committed to ensuring that all of our teaching and academic provision is career-focused and delivered where possible with the partnership of our professional sectors. Alongside the Universities of Oxford, Surrey and Kent, the University of Portsmouth was one of just four Universities in the South East to achieve a Gold rating in the first iteration of the Teaching Excellence Framework in 2017, and our success in supporting graduates into high quality employment was key to this. The most recently published employment data for University of Portsmouth graduates in Games Technologies, Digital Media and areas allied to creative and immersive XR show that between 94-96% of graduates were employed within 6 months of graduation and that of these

between 93-95% were employed in highly-skilled graduate-level occupations. This testifies to both the strong employment market for creative technologists and the high graduate level baseline of skills required by industry.

Notwithstanding the fact that specialist employment within the creative and immersive XR sector remains largely graduate level, the University of Portsmouth is committed to strengthening the skills pipeline. Above and beyond the University's sponsorship of the University Technical College, the Faculty of Creative and Cultural Industries is working with regional FE colleges to expand its collaborative provision and partnership. The University has recently approved delivery of HND Creative Media and Technology at Eastleigh College and is in the process of franchising its BSc Creative Media Technology for delivery at Chichester College. Building on our existing articulation agreements with Havant and South Downs College, we are currently supporting the development of their level 3 games technology provision, and have recently begun discussions with Isle of Wight College to support the development of their creative and technical curriculum.

Widening participation in games, creative and immersive technologies beyond formal education remains an important aspect of our work. The annual week long Games Jam is now in its 11th year and students and academics have recently participated at the 2nd Comic Con at the Guildhall Hall, Portsmouth. In addition to this we are presently developing a Games Technology Summer School to widen access to pre-degree level students.

2.5 National Context for the Creative Industries, Digital and Cultural sectors

The UK has a world leading digital economy, is 5th in the global innovation index and currently exports £18 billion in cultural exports. Most recent DCMS data shows the increasing strength of the UK Creative Industries, Digital and Cultural Sectors. Since 2010 Creative Industries in the UK has expanded by over 53%, the Digital Sector by 33% and the Cultural Sector by 38.5%. This strength reflects significant convergence across these sectors.

DCMS Economic Estimates for 2017 propose that there were over 2 million jobs in the Creative Industries. Comprising 6.1% of UK employment, the Creative Industries

contributed an estimated £101.5 bn. to the UK economy, 5.5% UK GVA. Data for the Digital Sector shows 1.5 million people employed in the sector (4.6% UK Jobs) contributing an estimated £130.5 bn., 7.1% UK GVA. Whilst for the Cultural Sector it shows nearly 675,000 people employed (2.0% UK Jobs) making a contribution of £29.5bn., 1.6% UK GVA.

DCMS data recognises the close alignment and overlap of its three largest sectors and their subsectors, estimating a GVA overlap of £52 bn. between the Creative Industries and Digital sectors alone. 'IT, Software and computer services' is the largest sub-sector of the Creative Industries comprising 35.5% of the jobs and £40bn GVA. Considered alongside the two largest areas of employment in the Digital sector, 'computer programming, consultancy, related activities' and 'Film, TV, Video, Radio and Music', this data demonstrates the very significant convergence that has taken place in recent years between the creative, media, and digital sectors.

This is echoed by the finding that 153,900 businesses are identified as in both the Creative Industries AND Digital sectors. This represents 24.7% of the businesses within the DCMS portfolio area and 6.3% of business in the UK as a whole. Importantly, data shows 'IT Software and computer services' to be the fastest growing subsector of the Creative Industries and that in 2016 it contributed 48% of all Creative Industries exports. Between 94-95% of businesses in the Creative Industries, Digital and Cultural sectors are micro-business comprising under nine employees, significantly above the UK wide figure of 89.2%.

2.6 Local and Regional Context for the Creative Industries, Digital and Cultural sectors

The Digital and Creative Industries are a core strength of the Solent region ranking 8th amongst LEPs. Strength in STEM subjects, the arts and creative industries offered by the region's universities has been identified as enabling a strong interface with a range of cross-cutting areas of innovation and highlights important synergy and critical mass for future development within the region. Drawing on European Cluster Observatory data, the *Solent LEP Innovation Strategy* report notes the importance to the European creative industries of 'experience industries' that 'stimulate emotions and senses, move,

entertain and surprise, thrill, enthuse and involve', and places Hampshire and IoW at number 11 in the ECO index for Experience Industries.

DCMS business location data demonstrates London and the South East to be the areas of highest business density across the DCMS sub-sectors of the Creative Industries, Digital and Cultural Sectors in the UK. Employment data by region shows that 24.8% of the DCMS workforce is in London and 15.2% in the South East. Within the Creative Industries, Digital and Cultural sub sectors regional employment density is even greater showing between 46-47% employment located in London and the South East.

The Partnership for Urban South Hampshire (PUSH) Business Plan 2016-18 identified the Creative Industries as a priority for business development. Noting over 20,000 people employed in 4,000 creative industry businesses in South Hampshire, the report drew on established growth trajectory to predict 50% increase in scale by 2026. Drawing on this data the Solent LEP Innovation Strategy noted the significant cross-over in activity between creative and digital industries in areas such as software development, a sub sector notably concentrated in Portsmouth. Importantly the Innovation Strategy also notes that the Solent's proximity to Bournemouth, Guildford and Brighton - areas of related creative and digital concentration - makes this region an attractive and more cost-effective alternative to start-up and develop a business. Coupled with a considerably deeper talent pool than in either Sussex or Surrey the opportunity for further development of this sector in this region is noted as significant.

2.7 The Immersive Economy

Alongside Artificial Intelligence (AI) and Cloud Technologies, Immersive Technologies form one of the priority growth technology areas for innovation and investment by UK Government and Industry. Research by the Digital Catapult suggests that 'immersive media' is rapidly constituting a creative media in its own right. Identifying 15 distinct creative format trends including activity simulation, data visualisation, immersive maker tools, and audio journeying, their report*, Immersive*

Content Formats for Future Audiences (2019) identifies that immersive media is now poised to cross the notorious chasm of technological adoption by moving from early adoption to early majority.

Image: VR Hoverbike Simulator Game (UoP in partnership with [redacted])

The UK immersive sector has capitalised on historical strengths in the arts, science and technology to become one of the most rapidly developing areas of the creative and digital sector. In 2017, there were an estimated 1,000 immersive specialist companies in the UK employing around 4,500 people and generating an estimated £660 million in sales. Significantly, whilst 80% of these companies identified as operating primarily within creative and digital markets, two-thirds noted other markets, including education and training, architecture, military applications, advanced manufacturing and energy. This demonstrates the significant opportunity for immersive applications across a range of sectors with benefits that include

increased competitiveness, innovative products, improvement in processes and increased visibility in markets.

The UK government has recognised the significance of the creative immersive sector and in its Industrial Strategy Creative Industries Sector Deal committed an estimated £58m to harness the power of immersive technologies and double the UK's share of the global creative immersive content market by 2025. Central to its strategy is supporting greater partnership between businesses and universities and breaking down barriers to R&D. Since 2018 the CCIXR team has secured two design foundation awards each to a value of £[redacted], and is part of the £[redacted] Royal Shakespeare Company-led consortium that won one of four Industrial Strategy Challenge Fund demonstrator projects.

Research and development has been key to the expansion of this sector and data shows that priority funding from UK Research Councils, Innovate UK and Horizon 2020 continues to increase with R&D investment expanding significantly in recent years. Importantly, however, whilst research shows that the immersive economy is a young and emerging sector it also shows that it suffers from fragmented technology ecosystems and issues with skills supply, two highly significant barriers to further expansion. Currently skill shortages are the biggest and most immediate challenge to the sector. Additionally, access to research, advice and market knowledge, access to infrastructure including digital and office space, and lack of time to explore immersive opportunities remain significant barriers to development.

Mirroring the concentration of the wider digital and creative sector in London and the South East, the *Immersive Economy in the UK* report identifies 14 locations of relative specialisation in the UK with over 40% coalescing in the London and the South East. Portsmouth, Southampton and Brighton are the key centres in the South East, currently focusing in the technology, professional services, media and arts, non-profit and education, and real estate and construction sectors.

2.8 What difference will LEP investment make to CCIXR?

LEP investment is key to realising the potential of the CCIXR. With LEP support, the CCIXR will be in a position to establish itself as a centre of excellence for research and development that brings sustainable growth to the existing industrial base of the region.

Early adoption of nascent XR is already transforming priority sectors, and market analysis demonstrates significant and sustained economic opportunity for its application. CCIXR supports the development and adoption of digital and creative technologies into other priority sectors, expanding and developing the creative/digital sector of the region. The case study of our partnership with Novatech shows the significant potential for application within the marine and defence sectors, and as pioneers in this sector CCIXR will realise this global opportunity for the benefit of the region.

LEP investment will enable the CCIXR to achieve a distinctive and sustainable offer that ensures knowledge transfer in support of SME growth is central to its function. Building on our excellent reputation and record for graduate employability and employment, LEP investment in CCIXR will enable a step-change in skills training and development. This in turn will support the creation of high-value jobs within the region. Analysis of the Economic Impact of CCIXR by external consultants [redacted]. This analysis further reinforces the value of LEP involvement in CCIXR, showing a GVA benefit to the Solent LEP region of
£92.5 million over 15 years.

In short, investment from the LEP will enable the CCIXR to both factor up the scale of our activity and bring it forward, thus enabling us to seize the opportunity to capitalise on first-mover advantage. Importantly, investment from the LEP will ensure that the CCIXR is configured to be outward facing and open to the local business community.

3. Economic Case

3.1 Current Situation

The success of the existing local, national and global partnerships and our excellent reputation as an emerging leader in XR that we have built up has been accomplished while operating in cramped and outdated facilities, and often while managing the conflicting industry, research and teaching demands for the same space and equipment.

Through developing the CCIXR, we have an opportunity to establish facilities that are not only fit for purpose but industry leading. The new facilities within CCIXR will enable the next stage of Creative and Immersive XR innovation and skills development to take place within the Solent LEP region, whilst simultaneously raising aspirations and benefiting the talent pipeline. Currently, our graduates are employed by the leading XR companies, notable examples are[redacted]. Crucially, CCIXR will ensure that future graduates, and those from businesses who take short courses and CPD within CCIXR, are well equipped to meet the talent shortage within the industry. Without these talented individuals, the current rate of growth within the Creative Industries is simply not sustainable. In order to maintain, and to continue to increase, the rate of growth the creative industries currently enjoys and the GVA it produces as a result, we need to invest in the world class facilities CCIXR will provide in order to train, educate and inform the workforce.

[redacted] are paying a very high premium to have this capture done in the USA or France, due to a lack of skills and facilities in the UK. Providing this facility on the South Coast would draw a revenue stream in to CCIXR and the wider area, as well as enabling skills development.

The LEP's involvement will allow us to open this facility to industry more broadly through workshops and knowledge exchange programmes. The revenue CCIXR will generate ([redacted]) will contribute to its overall sustainability.

LEP support of CCIXR has clear economic benefits, which are clearly summarized in the Analysis of the Economic Impact of CCIXR by external consultants[redacted]. This report highlights the economic impact that the preferred option CCIXR will have on the Solent LEP region through:

- Core Impacts
- Services to Industry
- Student Impacts
- Graduate Premium Impact
- Capital Investment Impact

The assumptions used to calculate these figures can be seen in the full report, a summary of the impact of the CCIXR by source over the initial 10-15 year period can be seen in the table below.

Table 1 NPV of Impact by Source over 10 and 15 years

NPV of Impact	10 Years	15 Years
Core Impact	[redacted]	[redacted]
Services to Industry Impacts	[redacted]	[redacted]
Student Impacts	[redacted]	[redacted]
Graduate Premium Impacts	[redacted]	[redacted]
Capital Investment Impacts	[redacted]	[redacted]
Total Impact	[redacted]	[redacted]

Source: [redacted]

The BCR for CCIXR over the same duration is laid out in the table below, showing the significant benefits that the CCIXR will bring to the Solent LEP region.

Table 2 Summary of Key Impact Ratios

Ratios	10 Years	15 Years
Private Sector Investment: LEP Investment	[redacted]	[redacted]
Benefit to LEP Cost Ratio	[redacted]	[redacted]
Benefit to All Cost Ratio	[redacted]	[redacted]

Source: [redacted]

The economic impact spreadsheet, which has been provided by [redacted] (Annex 14), sets out the calculations which underpin the Economic Impact report (Annex 10) demonstrating that the project will unlock wider additional private sector investment at a ratio significantly greater than 4:1.

The HCA Guidance considers average rates of additionality by type in the assessment of previous projects, in order to guide assessors, rather than providing recommended figures. The levels of displacement for Education and Training, [redacted] are the average levels of displacement for some training and education interventions that occurred between 1992 and 1998. The levels of displacement and substitution for any project are dependent on the specifics of the project and the context in which a project is being developed. In this instance, both displacement and substitution are set at [redacted] for the Solent LEP area due to the uniqueness of the project offering and the statement from the University that the student places would be additional. Leakage of indirect employment is set at [redacted] and induced employment is set at [redacted] for the Solent LEP Area.

Acting to create the CCIXR, and to bring world-class facilities to the Solent LEP region, now enables us to capitalise on the [redacted] the University currently enjoys. [redacted]

3.2 Benefits for Students and Organisations from CCIXR

At the heart of CCI's offering as a Faculty is its strength in digital storytelling and production skills. This is attracting considerable engagement from industry and students. Enhancing the facilities on offer will enable further development of our courses and growth in our research and innovation engagement with industry. Through the CCIXR our students will have the opportunity to work with cross-sectoral industry partners using XR technologies to address real world industry

problems. Our students will therefore develop and strengthen skills needed to meet the demand for talent from across the LEP's priority industry sectors.

Location based experiences which utilise a backpack based XR system (in order to enable the user to roam freely whilst within a VR experience) are a key growth area for the application of XR technology – as evidenced by the success of [redacted] which has had its original 4 week run extended 4 times to date. In order to lead in this field, the CCIXR needs the ability to develop for and test these systems, and would require a large, open floor space with configurable walls. Currently only large scale operations such as [redacted] in the USA can utilise these, due to the size and the expertise/talent needed and high initial outlay required to purchase the kit. These large-scale facilities enable multi-user VR experiences, effectively allowing people to share the same VR experience in real-time - working together to solve a puzzle, complete a challenge or experience a new world. Access to this within CCIXR would lower the barrier to entry for industry – reducing the financial burden of creating this type of experience. Revenue created through the hire of this facility at CCIXR, and through consultancy/R&D in this area would support the sustainability of this technology.

Motion Capture is a key part of the skills and talent pipeline for the Film, Animation and Games industry – and access to the innovation expertise needed, alongside the specialist facilities, is currently restricted due to lack of suitable large-scale facilities in the UK. The University of Portsmouth has an excellent reputation within Industry in this area developed over the last fourteen years. Despite our recognised expertise, working with partners such as the[redacted], we are unable to host large-scale projects, workshops/events within the region as we do not have adequate facilities. For example, the University of Portsmouth has recently delivered a workshop/training event on motion capture with the Digital Catapult (April 2019), but this was hosted in London as we do not have adequate large scale facilities in our region.[redacted]. The CCIXR will address this by incorporating a large-scale motion capture studio with viewing gallery. [redacted] event to the Solent region in future. In order to secure our leading position, we need facilities which are not only fit for purpose but future facing.

CCIXR will also inspire businesses across the region and nationally to realise the

potential impact XR technologies can have on their growth. XR technology is now more widely available within the consumer market, but the barriers to entry are still much too high - particularly for an SME. In addition to the considerable financial outlay, expertise and an understanding of the applications of this technology are essential. To a non-creative industry specialist in other sectors, learning how XR technologies can provide a step-change innovation is challenging and can be daunting as mistakes can be costly and discourage continued engagement with innovation utilising XR technology.

CCIXR will overcome this barrier to entry, providing tailor-made solutions. Businesses will be able to access the wealth of creative and business expertise within CCIXR to ensure that they engage with the XR technologies that will work for them - delivering the results they need. Through skills development opportunities CCIXR will also ensure that innovators across sectors have the skills they need to sustain and maximise the benefits of early adoption of XR technology.

In addition to the motion capture technologies discussed above, CCIXR will also provide access to a wide range of technologies, including Virtual and Augmented Reality, Sound and Visualisation/Simulation and Creative Digital Coding. Some of these technologies are not yet commercially available in this country - such as [redacted] - and the CCIXR will establish a centre of expertise for such emerging technology in the Solent region. CCIXR will enable us to further develop and extend global partnerships with industry, further establishing the region as a centre for excellence and enabling income generation in the region. CCIXR will, in partnership with [redacted], host a number of workshops on an ongoing basis in order to provide guidance as to how Creative and Immersive XR can benefit businesses across the region.

CCIXR will deliver a targeted Women in Immersive XR/Creative Technologies series of events. This will be delivered in partnership with industry, and participation will be free of charge to industry, cultural partners, students and academics. This is in line with the University's focus on widening participation and the Athena Swann charter. There is a real need to encourage more women into Immersive XR, and a number of key female role models have already agreed to take part and will be providing some of the inaugural workshops. These include[redacted].

Minister for the Creative Industries, Margot James, emphasised the importance of skills development: "Our creative industries are a vital part of the economy, contributing over £100 billion to the economy so it is important we maintain the pipeline of talent." To enable us to transmit knowledge effectively to both students, staff and industry we need to have cutting edge industry facilities. The CCIXR will provide a multidisciplinary approach, providing future and emerging XR technology facilities, expertise and skills enhancement for our student population and for the businesses engaging with them. This will lead to an upskilling in XR capabilities for the local, national and global creative industries and also embed these capabilities across the region's key sectors that engage with CCIXR. This will further enable our R&D partnerships with industry, and contribute to the CCIXR's sustainability.

3.3 Main Market, Customers and Competitors

3.3.1 Main Market

CCIXR main markets for growth will comprise of three segments: Local, National and Global. Whilst there is a near unlimited market of potential partners - due to the ability to apply Creative and Immersive XR across other sectors, the table below shows those that we are in early stage discussions with and that would benefit from the increased facilities, expertise and engagement that CCIXR will offer.

(This table has been redacted due to commercial confidentiality.)

3.3.2 Current and Potential Customers

There is considerable demand from local, national and global companies for access to these facilities and expertise, as evidenced by the overwhelming number of corporate applications to attend a workshop we delivered in partnership with the Digital Catapult and [redacted]. Many of the [redacted] applications we received were from [redacted] companies interested to explore the potential of XR. Given the limitations of our current facilities, this workshop was held outside the region at [redacted]. Hosting these businesses in the Solent LEP region would be hugely beneficial to both the region and the CCIXR, supporting the deepening of our partnership with the [redacted], providing nationally-connected offering for the Solent's businesses and innovators at all levels. LEP support would enable us to regularly run workshops/dissemination events of this type in partnership with the [redacted] in Portsmouth.

Current Partners include:

(This table has been redacted due to commercial confidentiality.)

Over the last two years, the University of Portsmouth team has developed plans for CCIXR in partnership with leading industrial organisations, identifying the requirements within the industry and geographic area. Culture is Digital (DCMS) and Digital Culture (Nesta 2017) as well as the Bazalgette Report of Creative Industries all support the importance of access to facilities, workshops, training and business development support which is focused upon the Creative Industries. The findings of our Creative Census (2016) also highlight the importance to the region's creative industries of having access to facilities, networking opportunities and business skills - all of which will be offered through CCIXR and the new roles the Centre will create. Enabling pioneering new ideas and experiences, utilising cutting edge immersive technologies, provides fuel for the wider creative economy, nationally and globally (Culture is Digital, 2018). This report also highlighted the importance of giving cultural organisations the access to digital talent, equipment, skills acquisition and experimentation with technology. This focus on skills development and knowledge transfer is absolutely key to the strategic aims of CCIXR.

The University of Portsmouth has participated in a wide range of industrial collaborations exploring applications of emerging XR technologies across different areas. Additional examples to those shown above in Section 2.2 include the role of VR in phantom limb pain, the use of motion capture to capture and interpret the performance of orchestral conductors, public engagement and dissemination through animation for the NHS and many more.

The creation of CCIXR will also unlock access to further innovation and research funding for the region, making us well placed to apply for future Creative Cluster, Arts Council England (ACE) and Industrial Strategy Challenge Fund (ISCF) funding. Increased facilities will also make the CCIXR offering more attractive to national and international partners - thereby attracting more income through consultancy. CCIXR will also help to enable the vision of the wider Portsmouth community, building on the steps recently identified in [redacted] within the region. This city-wide engagement and focus on the Creative Industries will ensure that the region is well placed to benefit from the innovation, facilities and expertise that CCIXR will provide - maximising the benefit to the City.

Further details of our stakeholders, and planned management structure can be seen below:

(This table has been redacted due to commercial confidentiality.)

The extent and range of industry support can be seen in the many letters written in support of the application[redacted].

3.3.3 Competitors and potential collaborators

(This table has been redacted due to commercial confidentiality.)

3.4 Options Analysis

The following options analysis was undertaken aligning with both the Solent LEP Prosperity Fund guidance and the Treasury's Green Book 5-Case Model.

Summary Table

Element	Option 1 CCIXR not created	Option 2 CCIXR (UoP Support Only)	Option 3 CCIXR (Solent LEP & UoP Supported)
Decision	**Not supported**	**Least Preferred**	**Most Preferred**

Options Analysis

Option 1: CCIXR not created
Description Existing individual researchers will continue to be supported to pursue additional responsive and non-responsive R&I funding applications from traditional funding solutions, to develop both the underpinning research as well as routes to external

impact/commercialisation. No new organisation established to help researchers work together.

LEP Solent Growth Fund Outputs

SME Growth

New knowledge created with the potential for commercial impact as well as addressing new relevant research and innovation challenges. External engagement commensurate with available resources, both staffing and financial. Impact will be limited by increasing competition as other institutions' facilities are developed, and will surpass ours.

Productivity in Priority sectors

Limited facilities mean that we will not be able to increase our engagement with other sectors, and so will not be able to engage with the wide range of priority sectors identified by the LEP.

Employment Growth

No new jobs are created within UoP, and job growth in the region will not be supported. In the medium-term jobs may be put at risk, as student numbers may drop as we face increasing competition from other areas with better facilities.

Developing Skills and Talent

Recruitment and retention commensurate with R&I performance. Skills and career progression supported through existing staff and graduate mechanisms such as Graduate School, mentoring and internal training programmes. Skills and talent development will be limited as we will not have the required facilities to train staff and students on the latest technologies. No new programmes will be developed to offer CPD, skills and workshops to local industries.

Pioneering Innovation and Research

Growth centred in individual research fields and academics areas. Anticipated organic growth of capacity and quality derived from successful grant funding applications. Growth will be limited by increasing competition as others facilities are developed which surpass ours - drawing students and research projects to other institutions. This may affect the Faculty and University's growth trajectory.

UoP R&I Strategic Objectives Fit

Objective 1 To develop an embedded research and innovation culture across all our activities: maintaining

Objective 2 To attract and develop internationally recognized research and innovation staff: does not deliver

Objective 3 Deliver innovative solutions to our partners in industry, the public sector and the wider community – regionally, nationally and internationally: does not deliver

Objective 4 Establish nationally and internationally leading research and innovation cross-discipline thematic areas that address key issues facing society: does not deliver

Objective 5 Strengthen our world-leading research and innovation capabilities in areas of current and potential excellence across all faculties: does not deliver

Objective 6 Nurture our postgraduate researchers to become the next generation of research and innovation leaders: does not deliver

Management

Utilises existing research and innovation leadership capabilities and organisations resources and capabilities to deliver activities and monitor performance.

Financial

Affordable, but not sustainable in the long term as will lead to declining NPV and student numbers.

Key Risks

Retention of key staff.

Ability to attract students.

Ability to develop and attract new commercial partnerships.

Failure to capitalise on the opportunity (academic, commercial and financial perspectives).

Other institutes out-compete University for research and innovation activity.

Failure to realise the impact of the technologies across the sectors.

Summary - Main Advantages

Financially affordable in the short term.

Ease of implementation.

Summary - Main Disadvantages

Weak alignment with the University's commitment to grow interdisciplinary R&I activity.

Failure to capitalise on this timely opportunity to secure our position as a world leading Centre for Creative and Immersive XR (academic, financial and societal impact perspectives).

Poor strategic alignment across all objectives.

Missed opportunity for developing significant interdisciplinary research and innovation activity and culture.

Failure to benefit from organised and coherent joined-up interdisciplinary working between colleagues, and our industry collaborators.

Financially not sustainable in the medium-long term.

Will result in reduced student numbers and reduced industry collaborations.

Option 2: CCIXR (UoP Support Only)

Overview

Creation of CCIXR through capital refurbishment within Eldon Building to support the interdisciplinary research and innovation based on bringing together existing staff and activity within the institution. Equipment would not initially be updated and the facilities would be scaled back (i.e. - no photogrammetry or volumetric capture facilities). Provides a formal organisational structure to grow and develop creative and immersive XR, people and impact.

LEP Solent Growth Fund Outputs

SME Growth

Engagement with SME's will be limited to lack of new technologies and facilities. New knowledge created with the potential for commercial impact as well as addressing new relevant research and innovation challenges. External engagement commensurate with available resources, both staffing and financial. Impact will be limited by increasing competition as other institutions' facilities are developed, and will surpass ours.

Improved Productivity in Priority Sectors

Enabling greater engagement to make research and innovation outcomes more relevant to external challenges. Facilitates greater knowledge exchange activities through provision of a single point of contact for external organisations, and new research and innovation partnerships. The mechanism is expected to reduce the time taken to realise the impact from the knowledge generated by the institution and partners.

Employment Growth

No new jobs are created within UoP. In the medium-term jobs may be put at risk, as student numbers will drop as we face increasing competition from other areas with better facilities.

Developing Skills and Talent

Creates a limited research and innovation environment to support staff. Recruitment and retention commensurate with R&I performance. This will continue current levels of industry collaboration, however this will decline over time due to lack of cutting edge facilities and technologies - such as Volumetrics and Photogrammetry. Limited skills and career progression supported through existing staff and graduate mechanisms such as Graduate School, mentoring and internal training programmes which are enhanced by the interdisciplinary nature of the Centre.

Pioneering Innovation and Research

Additional resources provided to support the creation, function and development of research and innovation activity of the centre. Further growth achieved through securing additional funding. Increased R&I quality from the coherent structure of the Centre fostering interdisciplinary working. New societal challenges and innovation questions will be addressed. Improved recruitment opportunities building a strong more vibrant research and innovation environment.

UoP R&I Strategic Objectives Fit

Objective 1 To develop an embedded research and innovation culture across all our activities: maintaining

Objective 2 To attract and develop internationally recognized research and innovation staff: maintaining

Objective 3 Deliver innovative solutions to our partners in industry, the public sector and the wider community – regionally, nationally and internationally: does not deliver

Objective 4 Establish nationally and internationally leading research and innovation cross-discipline thematic areas that address key issues facing society: maintaining

Objective 5 Strengthen our world-leading research and innovation capabilities in areas of current and potential excellence across all faculties: maintaining

Objective 6 Nurture our postgraduate researchers to become the next generation of research and innovation leaders: maintaining

Management

Investment in dedicated management and technical support to enable enhanced business planning and programme management to deliver ambitious KPIs and a greater ROI. Builds upon existing research and innovation leadership capabilities and organisation's structures.

Financial

Requires financial investment by the institution.

Commitment to ongoing structural costs.

Sustainability dependent on securing external funding.

Key risks

Failure to recruit quality staff, students and external collaborators.

Facilities and technologies will be surpassed by competitors.

Failure to secure the external income needed to generate the anticipated ROI and the anticipated external impact.

Failure to capitalise on external collaboration opportunities due to insufficient facilities and resources.

Limited attraction for businesses/SMEs.

Summary - Main Advantages

Ease of implementation.

Reasonable alignment with University strategic objectives.

Firmly establishes the research and innovation field as a strategically important area within the University.

Creates greater capacity and a more coherent offer for internal and external audience.

Begins to address the opportunities from interdisciplinary working.

Summary - Main Disadvantages

Insufficient resources and facilities to fully capitalise on the opportunity, risk that we will be overtaken by competitors.

Limited impact on the national and international cultural and creative landscape.

Not fully maximising and commercialising the application of Creative and Immersive XR technology across the sectors.

Option 3: CCIXR (Solent LEP & UoP Supported)

Overview

Creation of a world leading CCIXR with significant facilities, technology and expertise that will advance considerably the research and innovation and associated translational opportunities. Creates an internationally high-profile coherent mechanism to bring together academic, business and societal expertise to address the challenges and secure maximum value from the opportunities. CCIXR enables the practical application of future and emerging technology through the convergence of a specialist expertise and world-leading facilities.

LEP Solent Growth Fund Outputs

SME Growth

SME's will benefit from a vibrant R&D culture, which - alongside CCIXR's engagement strategy - will provide improved access to facilities, expertise, skills and talent.

Improved Productivity in Priority Sectors

Establishes the CCIXR as a focal point for academic and non-academic organisations to shape the future of Creative and Immersive XR in a timely and effective manner. The convergence provided through the creation of a "one-stop" facility will enable considerable cost-effectiveness savings, and offer facilities and expertise that are unavailable elsewhere. The mechanism will dramatically reduce the time taken to realise the impact from the knowledge generated by the institution and partners.

Employment Growth

[redacted] future jobs within UoP as the increased facilities will attract higher student numbers and secure continuing income.

Developing Skills and Talent

Creation of a very significantly more varied, vibrant and rich research and innovation environment that will encourage development and growth of the staff and student base. Strong mechanism for industrial-academic staff exchange and knowledge transfer across the sectors. Enhanced potential for CCIXR staff to work in partnership with industry. Enhanced opportunities for external collaborations at all levels, and opportunities to expand staff knowledge and expertise to encompass new technologies.

Pioneering Innovation and Research

Size and credibility to influence and address the wider research and innovation agenda and associated socio-economic opportunities and impacts. High-profile centre with strong national and international reach facilitates bringing together internal and external partners. Transformative increase in delivering new research and innovation capacity, both in additional resources and new areas of research and innovation activity. Through the creation of critical-mass it improves the ability to secure additional funding to deliver continued growth in capacity and quality. Ability to recruit high-profile and high-quality staff.

UoP R&I Strategic Objectives Fit

Objective 1 To develop an embedded research and innovation culture across all our activities: Delivers

Objective 2 To attract and develop internationally recognized research and innovation staff: Delivers

Objective 3 Deliver innovative solutions to our partners in industry, the public sector and the wider community – regionally, nationally and internationally: Delivers

Objective 4 Establish nationally and internationally leading research and innovation cross-discipline thematic areas that address key issues facing society: Delivers

Objective 5 Strengthen our world-leading research and innovation capabilities in areas of current and potential excellence across all faculties: Delivers

Objective 6 Nurture our postgraduate researchers to become the next generation of research and innovation leaders: strongly enhancing

Management

Investment in dedicated management and technical support to enable enhanced business planning and programme management to deliver ambitious KPIs and a greater ROI. Builds upon existing research and innovation leadership capabilities and organisation's structures.

Financial

Requires significant financial investment from external and University sources.

Commitment to increased ongoing running costs.

Additional University costs (Procurement, HR, Estates) associated with implementation of the Centre.

Will generate significantly improved ROI compared to current University trajectory.

Sustainability dependent on securing external funding, and meeting the deliverables associated with any external funding secured.

Risks

Failure to meet challenging KPIs from internal and external funders.

Failure to recruit quality staff and students.

Failure to secure the external income needed to generate the anticipated ROI and the anticipated external impact.

Opportunity costs in other potential areas of growth for the University.

Summary - Main Advantages

The investment available enables the timely establishment of the Centre's capacity and capability, ensuring a significant growth trajectory and enables first-mover advantage.

Strong potential for academic and financial ROI.

Increased future student numbers.

Increased industrial collaborations - at a global level.

Improved likelihood of a major impact on creative and cultural industries.

Strong strategic alignment.

Significant national and international profile.

Strongly capitalises on the current opportunities.

Clearly maximise the opportunities from interdisciplinary working.

Summary - Main Disadvantages

Opportunity costs in the restriction for funding other potential areas of growth for the University.

Restrictions on opportunities for accessing other funding schemes

3.5 CCIXR Project Outcomes

The CCIXR Project Outcomes can be summarised as follows;

Measure	Output/Outcome	Further details
Additional jobs created as part of the scheme	[redacted]	[redacted] [redacted] Construction jobs will be created through the duration of the physical build stage of the project These roles will be located within the Solent LEP region, and will be in addition to those which would have been created without CCIXR's involvement (as these have already been taken in to account).
New learners supported through CPD, short courses and workshops	500 over 5 years	A significant number of new learners will be supported to gain new skills in a supportive cross-disciplinary environment. This responds to a clearly identified need from the regional, national and global letters of support, and also from the demand for places at our recent workshop in partnership with the digital catapult. These are new specialist skills which are incredibly valuable to businesses and organisations, due to the productivity increases they can generate through innovations, cost-savings and efficiencies. XR technologies, such as motion capture, are not easy to trial - due to the very high barrier to entry caused by high equipment costs, and lack of teaching expertise. CCIXR will address both of these, to enable businesses to maximise the benefits XR technologies can generate for them through lowering the barrier to entry.
Number of learner assisted courses developed as a result of CCIXR	17 new courses over 5 years	These courses will be developed in consultation with the CCIXR Industry Group, to ensure that the courses developed are meeting the needs of Industry. These courses will enable a wide range of sectors to access XR technology, and will include areas such as [redacted] The success of projects such as [redacted] showcase the power of the XR industries to have a transformative effect on individuals, helping to build resilience, increase ambitions and raise aspiration. We are currently working with our industrial partners to develop the next phase of this project through CCIXR.

XR labs fitted with specialist equipment which learners, academics and businesses will be able to access	12 XR labs	The XR labs that will be fitted with specialist equipment not otherwise accessible to the region's learners include: Motion Capture large scale facility Location Based Experience Volumetric Video Capture Photogrammetry for full body and facial capture Spatial Computing Mixed Reality/Smart Stage Technology Digital Coding Development space Music Technology Facilities Virtual Reality Lab Simulation Facilities Digital Communications Lab 360 Degree Production Space Each of these will be available through the support the LEP provides to regional, national and global businesses, drawing significant attention to the region for the world-class facilities it will house.
Business engagement and skills/training floorspace refurbished	1792m2	The capital refurbishment will deliver a wide range of 12 Immersive XR spaces and labs that will be fully utilised for business engagement, skills and training.
Businesses supported through CCIXR facilities and expertise	300 businesses over five years, rising to 800 in first 10 years.	At least 180 of the initial 300 businesses in the first 5 years will be SME's from across a broad range of sectors. This will rise to 500 of the 800 businesses over the first 10 years. We will work with our Industry Group to ensure that all parts of the supply chain are able to come together in order to develop partnerships and maximise benefits - and our strong relationships with Digital Catapult, Arts Council England and local institutions such as Hampshire Chamber of Commerce to ensure SME's are engaged with the CCIXR and are fully supported to engage with the benefits XR technology can bring.
Collaborative R&D bids	50 bids developed over 5 years, 130 over the first 10 years.	Through the additional benefits that the LEP funding will bring to CCIXR, 50 additional R&D bids will be developed in the first 5 years – and 130 over the first 10 years - in order to fully utilise the transformative power of these technologies. These will be submitted to a wide range of funders, including [redacted] and many others. These will be submitted in partnership with our collaborators, and will therefore enable R&D within these organisations, and bring considerable income into the region, and nationally through our partners.
Partnership initiatives established	15 national and global partnerships Established in first 5 years, 40 in the first 10 years.	CCIXR will continue to develop regional, national and global partnerships, and at least 15 national and global partnerships will be established as a result of the LEP funding in the first 5 years - as the new facilities will open up considerable new opportunities for collaboration. This will grow to 40 new partnerships in the first 10 years.

Academic outputs (publications, papers etc.)	50 over initial 5 year, 110 over first 10 years.	International conferences will be housed within CCIXR, helping to promote the facility and the region as a beacon of innovation, research and development. A significant number of academic outputs, including publications, conference papers and books will be produced throughout the initial five years of operation. All of these would not be possible without the world-leading facilities which makes the work possible.

3.5.1 Employment Growth

4 FTE new jobs are planned to be created directly within the CCIXR. Project delivery and implementation will be managed by a dedicated Business Development and Project Manager (1 FTE) and Technical Manager (1 FTE). Once up and running, a further 2 FTE roles will be created: Business Support Officer, and Technician.

The capital works to construct the CCIXR will create 19 temporary construction jobs and it is planned that business growth and increased productivity as a consequence of CCIXR activities will indirectly support the creation of a further 20 FTE roles in SME's within the region.

In the first 10 years analysis by [redacted] of the Economic Impact of CCIXR shows that 200 jobs will be created within the Solent LEP region, rising to 230 jobs in the first 15 years. Additional jobs will be created as businesses utilising the CCIXR develop new products and services to grow their businesses and workforce, graduates are retained in the area and new learners attracted to the area. Work underpinning CCIXR has already demonstrated the ability to create employment, the GVA estimates as set out in the Solent LEP Large Project Application Form show a significant positive impact which will be generated as a result of CCIXR. Table 1 below further highlights the economic benefits CCIXR will unlock for the Solent LEP region. An expanded analysis of the Economic Case for Option 3 (LEP investment in CCIXR) can be seen in the full economic impact analysis by external consultants [redacted] in Annex 10. In summary, CCIXR will unlock wider additional private investment at a ratio of 5.6:1 at 10 years, and 8.3:1 at 15 years.

NPV of Impact	10 Years	15 Years
Core Impact	[redacted]	[redacted]
Services to Industry Impacts	[redacted]	[redacted]
Student Impacts	[redacted]	[redacted]
Graduate Premium Impacts	[redacted]	[redacted]
Capital Investment Impacts	[redacted]	[redacted]
Total Impact	**£49.2m**	**£92.5m**

The economic impact spreadsheet, which has been provided by [redacted] (Annex 14), sets out the calculations which underpin the Economic Impact report (Annex 10) - demonstrating that the project will unlock wider additional private sector investment at a ratio significantly greater than 4:1.

The opportunity to unlock and enable private investment through CCIXR is demonstrated in the latest report from the Creative Industries Council (released 11th June 2019) which cites Fatherland XR, the University of Portsmouth's collaborative project with Limbik Theatre, as one of the 50 "ones to watch" in the UK. This further evidences the timeliness and importance of the CCIXR, and the urgency to capitalise on the region's first mover advantage.
https://www.thecreativeindustries.co.uk/media/529970/ones_to_watch_v4_singles.pdf

It is estimated that within 20 years, 90% of all jobs will require digital skills (The Digital Strategy, 2017). SME Growth and improved productivity in priority sectors will be supported through access to world leading facilities, business support officers and a full engagement plan, which will be developed in partnership with the CCIXR Industry Group. Further details and assumptions regarding the Jobs impact of CCIXR, along with the calculations used for this can be seen in Annex 14.

Lowering the considerable barriers to entry within the Immersive XR arena through the work of CCIXR will also help to create jobs across the sector, and increase skills knowledge and sharing across disciplines. CCIXR will incorporate a number of collaborative office/meeting spaces which will be available to our partners, locally, nationally and globally.

3.5.2 Skills Development

CCIXR will support the crucial talent pipeline within Immersive XR. Motion Capture, for example is a specialist growth area – used across the Creative Industry from gaming to film production. We are a key part of the talent pipeline providing graduates to global brands such as [redacted] as well as to local businesses.

CCIXR will enable the development of at least 17 new courses, including CPD short and long courses, which will be available to the businesses and organisations within a wide range of priority sectors locally and nationally. There will also be the potential to offer training in creative digital disciplines for other industry sectors such as marine, engineering design and aerospace. The precursor to these workshops, which highlighted the impact of motion capture and real-time production, took place on 18th April 2019. Due to insufficient space within the existing University facilities this was hosted at the[redacted]. The number of expressions of interest [redacted] shows unequivocally the clear need for skills development in this area.

The development of short courses/workshops is in line with the University's aim to expand opportunities in this area, and the courses offered will also help to address the skills shortage, whilst enriching our offering to our partners and attracting new potential collaborators locally and nationally. The resulting skills development will help to meet the Industrial Strategy Challenge Fund (ISCF) goal, which aims to enable the UK to continue to lead the world in producing immersive content.

This is in line with Arts Council England, who have also identified building digital skills as a priority – with a high proportion of the sectors' organisations citing a lack of knowledge and capability was a significant barrier to achieving their digital aspirations (Tailored Review of Arts Council England, 2017). CCIXR will directly address this – working closely with local, national and global cultural organisations to enable them

to access the facilities and knowledge they need to achieve their digital aspirations – whilst simultaneously supplying the talent pipeline.

The additional 500 learners proposed as an outcome of CCIXR span a number of existing and new portfolio developments:

- 160 additional students - [redacted]
- 160 additional students - [redacted]
- 80 additional students – [redacted]
- 100 additional students – [redacted]

Although it will be a University and Faculty facility which will enable cross-sector application, the student recruitment associated with CCIXR and outlined above sits within the School of Creative Technologies. [redacted]

Data shows that [redacted]

In partnership with the University's [redacted]

Some of these courses will be developed in conjunction with our partners, [redacted] Evidence shows that the UK remains the most attractive destination in Europe for Tech investors (Culture is Digital, 2018), but we need the skills and talent pipeline to support and enable this. The Independent Review of the Creative Industries (Sir Peter Bazalgette, 2018) clearly identifies the importance of the Creative Industries to the UK's Industrial Strategy, contributing over £90 billion to the GVA in 2016 – with faster growth between 2010 and 2016 than any other sector.

3.5.3 Support for Solent-based SMEs

Business support outcomes are based upon meeting the businesses' XR needs through providing 1 to 1 advice, skills training, expertise and/or use of facilities to businesses, in order to lower the barrier to entry to XR technologies.

The number of businesses accessing this support has been broken down as follows:
Year 1: 0 (construction period)
Year 2: 53

Year 3: 62
Year 4: 85
Year 5: 100
Years 6-10 are steady state with a minimum of 100 businesses per year being supported.

CCIXR will enable them to understand how XR can successfully work for them - and will act as an enabling conduit between businesses in the Solent LEP area and national/global organisations. An example of this is our recent business support to regional company [redacted] which resulted in a successful and sustained collaboration with [redacted] – an organisation with whom they had not previously worked with before the project's inception.

Local businesses will gain access, support, skills (through workshops and short courses) and the resources they need in order to make a step-change in their development.

Currently to access these immersive technologies companies have to travel to London (Large Scale Motion Capture) or further afield. This is prohibitive to many businesses. Therefore, having such a facility in the Solent LEP area will lower the barrier to entry in this growing market – allowing more businesses to engage with Immersive XR.

CCIXR needs to have in-house Volumetric Capture and other cutting-edge facilities to train and supply the talent pipeline. If we cannot supply these skills to our graduates and businesses, they will not be able to bring this wealth of knowledge to the LEP's priority sectors.

As an integrated centre of excellence, CCIXR will enable the world-leading expertise that we have to be fully utilised – boosting the regional and UK economy through the resulting increase in activity and jobs which will be created. This need is evidenced through the wide range of supporting letters provided from industry and third sector.

Innovation will be enabled across the region. Innovation was identified as one of the

key priorities in order to unleash the creative potential of technology within the Digital is Culture report (2018). The fast rate of growth within the Creative Industries is powered by creative risk taking and Research & Development (Nesta, 2017). CCIXR will support this process – directly addressing the identified lack of access to technical skills and spaces (Eurostat Science and Tech Database 2017). Smaller organisations are particularly likely to lack the capacity for the strategic cross sector R&D which would drive growth in the sector (Independent Review of the Creative Industries, 2018).

CCIXR will address this need directly – providing access to facilities, expertise and skills. This will have a multiplier effect, as companies engaging with CCIXR will be able to benefit from a step change in their digital usage through an enhanced talent pipeline, greater ability to work collaboratively on research and development projects and the ability to access facilities/expertise they wouldn't otherwise be able to access.

CCIXR will also attract inward investment in to the region. In addition to supporting the local supply chain, there will be international pull to the area. The development of CCIXR will also support the growth of the emerging Creative Cluster within the Portsmouth area, in accordance with the recent [redacted] The findings of the Creative Census (2014) in the area reinforced the need for access to facilities, and it is imperative that CCIXR meets that need, acting as a knowledge hub which will attract major industry partners, whilst also creating jobs and skills.

As a result of the enhanced facilities that CCIXR will provide, the Centre will be able to leverage further funding from a broad range of Research and Innovation sources to further support the dissemination and business facing activities. This further R&D funding, alongside industrial partnerships and collaborations, will help to ensure the sustainability of CCIXR.

The CCIXR team have developed an implementation plan which sets out further the timelines for the funding bids and partnerships which will be generated by CCIXR. A minimum of 54 funding bids will be submitted during the first 5 years, rising to 130 over the first ten years - as illustrated in the following breakdown.

The number of funding bids has been broken down as follows:
Year 1: 6 (construction period)
Year 2: 10
Year 3: 12
Year 4: 12
Year 5: 14
Year 6: 14
Years 7-10: are steady state with a minimum of 16 funding bids per year being submitted.

These submissions will be across a wide range of funders - which will include [redacted]. Most funders will only cover revenue costs of collaborations, not capital investment in equipment - therefore the investment in new technology that CCIXR brings will be transformative in opening new areas of research funding to the team, and to the region as a whole.

The increased demand for collaboration which will be created by the facilities within CCIXR will enable the funding bids, and can be evidenced through the number of letters of support from Industry. The recent “Skills for Immersive Experience Creation” report (2020), shows that 97% of companies who responded indicated skills were missing in this sector - CCIXR will be perfectly positioned to respond to this need through collaboration, training and undergraduate & CPD courses.

CCIXR will be transformative for the region, bringing regional, national and global brands to the area to develop cutting-edge innovation and collaborations - harnessing the power of these facilities, combined with world-leading expertise, to deliver impactful results.

Discussions are already underway to confirm strategic [redacted]

The number of national and global partnerships has been broken down as follows:
Year 1: 0 (construction period)
Year 2: 2
Year 3: 3
Year 4-10: are steady state with 5 partnerships per year being consolidated.

Discussions are also underway with [redacted] regarding future collaboration and partnerships.

3.5.4 Other wider positive impacts to the economy

The enhanced capacity and international standing of CCIXR has the potential to deliver the following wider positive benefits;

3.5.4.1 Developing strategic sectors and clusters of marine, aerospace and defence, advanced manufacturing, engineering, life sciences and health, transport and logistics businesses, low carbon and the visitor economy – establishing the area as a business gateway, at both local and international levels and developing local supply chains.

3.5.4.2 Bringing major brands such as [redacted] to work with the University, CCIXR will provide new business opportunities for the local supply chain.

3.5.4.3 Building on our substantial knowledge assets to support innovation and build innovative capacity in the Solent area to stimulate growth in Solent businesses and in new high growth sectors.

3.5.4.4 CCIXR will offer dedicated support for business partnership and development both within and beyond the creative and digital sectors by bringing and expanding the pools of specialists, participants, and users for creative and immersive XR.

3.5.4.5 The CCIXR will work with industry to ensure that we are producing the creative and digital graduates that will be necessary to exploit and sustain the creative and immersive XR economy.

3.5.4.6 CCIXR will deepen its partnership with local FE and school partners in the region to develop and strengthen the creative skill-base necessary for professional development and improve employability skills, aspiration and ambition – placing increased focus on the work-readiness of school, college and university leavers.

3.5.4.7 CCIXR will support the crucial talent pipeline within Immersive XR. Motion Capture, for example is a specialist growth area – used across the Creative Industry from gaming to film production.

4. Commercial Case

The Management Case section details the planning and management of the procurement in line with the University's regulations.

Capital expenditure is a key part of the University of Portsmouth's Strategic Plan, and the University has financial regulations which govern the purchase and procurement of capital expenditure (University of Portsmouth Financial Management, Nov 2014). This ensures that projects included in the University's capital plans have clearly defined strategic ambitions and are affordable in both the short and long term with clearly defined long term benefits.

Projects for the provision of building works or IT projects, as well as Measured Term Contracts, must be procured in accordance with the procedures and limits set out in the University's Purchasing Manual. Consultants shall be appointed if the project is too large or too specialised for the Estates Department's resources and shall be procured in accordance with the procedures and limits set out in the Purchasing Manual.

The University requires that all contracts attempt to ensure best value for money, shall be mindful of lifetime costs of projects and should deliver defined and identifiable benefits to the University over and above those available from alternative actions.

The Director of Finance is responsible for providing regular statements concerning expenditure on estates projects to Finance Committee for monitoring purposes, including the final costs of completed projects.

Details of Procurement Framework					
Key Project Aspects	**Summary Description**	**Procurement mechanism**	**Start Date**	**Finish Date**	**Evidence**
Initial feasibility, preparatory work and concept design	**Design Stage**	**In line with procurement procedures published in the University's Purchasing Manual.**	**02/02/19**	**31/12/19**	**Design brief and floor plans to be provided**
Procurement Strategy planning process	**Design/ Tender stage**	**In line with procurement procedures published in the University's Purchasing Manual.**	**1/1/20**	**30/3/20**	**Procurement Strategy document, specifications**
Procurement of specialist CCIXR equipment undertaken	**Equipment procurement**	**In line with procurement procedures published in the University's Purchasing Manual.**	**1/4/20**	**31/1/21**	**Responses to tender, quotes, contracts, receipts/ invoices will be available**
Detailed Design	**Detailed Design**	**In line with procurement procedures published in the University's Purchasing Manual.**	**1/4/20**	**29/4/20**	**Final floorplans will be available**
Construction	**construct new spaces**	**In line with procurement procedures published in the University's Purchasing Manual.**	**30/4/20**	**30/9/20**	**Spaces will be complete and can be visited**
Fit out	**Fit out of new spaces, including specialist installation for motion capture, white light smart stage etc.**	**In line with procurement procedures published in the University's Purchasing Manual.**	**1/10/20**	**31/1/21**	**Spaces will be complete and can be visited - specialist facilities will be online and will be able to be seen working.**

Procurement Principles
The University has a robust procurement policy that ensures that goods and services are procured meeting both legislative and high value-for-money standards. Keys aspects include: Orders may be placed to an amount not exceeding £500 without prior authorisation of the Purchasing Department. Contracts above £4,999 need approval of the Purchasing Department Contracts between £5,000 - £25,000 require three formal written quotes Contracts between £25,000 - £180,000 require three formal written quotes from approved suppliers. Other suppliers require additional checks. Contracts over £180,000: Tenders will be invited through an official advert being placed in the "European Journal" publication (OJEU). Suppliers are approved following due diligence There is a detailed process for purchasing from single suppliers for specialist equipment not available elsewhere ensuring that purchasing standards are maintained.

5. Financial Case

5.1 Project costs

The cost of the Centre for Creative XR project is £[redacted]. [redacted] is sought from Solent LEP through its Large Project Capital Fund as an overall contribution to the project.

Match funding of £[redacted] has been secured and confirmed by the University. LEP funding will be transformative, delivering this world-leading facility at greater scale, allowing increased outputs in shorter timescales.

Project Capital Requirements for CCIXR Project	2019/20	2020/21	Total
Local Public Sector Contribution (University of Portsmouth)	[redacted]	[redacted]	[redacted]
LEP Large Capital Funding Request	[redacted]	[redacted]	[redacted]
Total Project Costs	[redacted]	[redacted]	[redacted]

The University has considered to its satisfaction that the impact of the CCIXR project cash flow on the overall balance sheet is manageable.

Details of the project cost breakdown in £:		
Project Cost Component	**Cost including VAT**	**Cost excluding VAT**
Design	[redacted]	[redacted]
Building Refurbishment Works	[redacted]	[redacted]
ICT & FF&E	[redacted]	[redacted]
CCIXR Motion Capture Industry Studio	[redacted]	[redacted]
Location Based Experience Origins Systems	[redacted]	[redacted]
Volumetric Video Capture	[redacted]	[redacted]
Photogrammetry for full body and facial capture	[redacted]	[redacted]
Magic Leap Spatial Computing facility	[redacted]	[redacted]
Mixed Reality Tech Lab (White Light Cube)	[redacted]	[redacted]
Digital Coding Development Space	[redacted]	[redacted]
Music Technology Facilities	[redacted]	[redacted]
Virtual Reality Lab	[redacted]	[redacted]
Simulation Facilities	[redacted]	[redacted]
Digital Communications Lab	[redacted]	[redacted]
360 degree Production Space	[redacted]	[redacted]
TOTAL	[redacted]	[redacted]

Annex 12 provides a breakdown of the budget for each of the 12 XR labs.

5.2 Overall Funding and Affordability

The preferred option for the CCIXR has been considered in a full options analysis, and is considered to be a fundable and affordable project, which offers excellent value for money for the Solent LEP and the University. Funding from the University has been secured and the LEP funding is sought to complete the funding package and in order to generate the additional benefits as set out in the Economic Case. The LEP funded works will all have been completed by end January 2021.

The project has been costed in accordance with our standard Estates building procedures, and costs are supplied in the updated costing spreadsheet (Annex 15). The costing spreadsheet shows which items will be procured through existing University frameworks. Where items fall outside of the Framework, quotes have been received - and can be provided on request. Current costs (which can be seen in detail in Annex 15) will be updated once the detailed design is completed, and these costs are reviewed by the CCIXR Delivery Board.

The figures for estates works are derived from an independent cost consultant's ([redacted]) review of designs and outputs prepared to the end of RIBA stage 2 Concept Design (RIBA Plan of Works 2013). Costs were benchmarked against the Department for Education Summary Cost Model and Spons rates as well as market rates established by AECOM. These were applied on a per square meter basis for some items such as decoration and cooling whilst specific cost items were included wherever possible.

5.3 Key Financial Risks

The following potential financial risks have been identified:

Financial project risks and impact on the project finances.			
Risk	**Likelihood**	**Impact on Cost**	**Mitigation**
Lack of financial resources to complete project	Low	High	UoP has secured and committed project funding of £[redacted] The University has considered to its satisfaction that the impact of the CCIXR project cash flow on the overall balance sheet is manageable. There are robust project management controls in place to ensure the budget is kept in check.
Failure of sub-contractors resulting in increased time and cost	Low	Med	Financial checks as part of due diligence on key suppliers as part of procurement process. Strong project management from an experienced Estates team.
Building costs exceed budget	Low	Med	Allow for cost contingency to cover unexpected additional costs. The considerable expertise of the UoP Estates team will also ensure work is completed within time and budgetary constraints.

Equipment not purchased or supplied in time for spend deadline as a result of a delay in decisions, approvals, tendering or delivery	Low	High	Set key dates for equipment purchase and allow for sufficient lead time with key suppliers. Monitor installation programme closely to achieve target dates. Strong project management experience from a dedicated Business Development Project Manager and Technical Manager.

5.4 EU State Aid

[redacted]

5.5 Financial Sustainability

[redacted].

6. Management Case

6.1 Project Management

Proven project governance arrangements will be implemented, with the Business Development and Project Manager (BDPM) reporting to the CCIXR Delivery Group Chair and the University's Estates Project Board. The University's Estates Project Board will be responsible for project oversight and decision-making in relation to material changes to scope, cost or programme. All contract award decisions relating to consultants and contractors will be made by the Estates Project Board, in accordance with financial regulations.

The CCIXR Delivery Group Chair is a member of the University's Executive Board. The University's Purchasing Manager is responsible for delivering the University's Procurement Strategy. The Director of Finance is the final arbiter on all matters relating to procurement. The CCIXR Delivery Group is chaired by the [redacted]. Members include:

- [redacted]

The CCIXR Delivery Group ensures cross-representation from contributing management structures. These include the Estates Project Board, University Finance Committee, University Research and Innovation Committee, and University Executive Board. All committees and boards report to University Governance Committees.

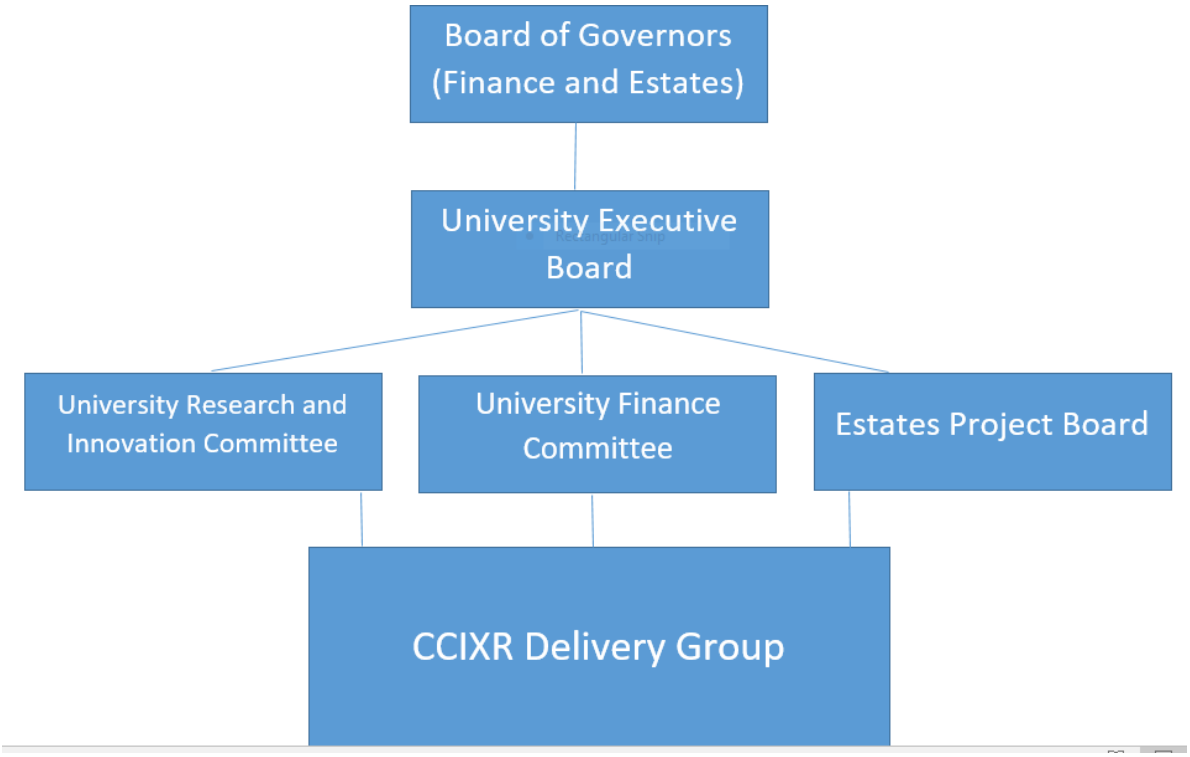


Fig. 1 Organisational diagram of CCIXR Management Committee.

In addition to the highly experienced teams which comprise the CCIXR Delivery Board, and the CCIXR Industry Advisory Board, the wider University team brings to the project a wealth of additional experience which has been achieved over many years.

The University has an excellent track record of delivering large scale projects to a high standard, having successfully completed a number of funded regional development projects (delivering new employment opportunities and exceeding targets) and developed a network of successful innovation spaces across the city. The University has recently secured additional funding to deliver three large-scale ERDF projects with a focus on supporting regional SMEs to become more competitive and impact the region's economy. The University has demonstrated its ability to deliver high quality estates projects with the construction of the recently completed Future Technology Centre within budget. It has successfully secured significant external capital to enable it to embark upon a full-scale estates masterplan to ensure that its teaching and research facilities match its ambition to be the top modern university in the UK by 2030. The development and implementation of our new Sports Science facility and the Centre for Enzyme Innovation highlight the University's commitment - both to the City and to the future. All members of the CCIXR team have extensive experience of the successful delivery of large scale infrastructural estates and technical projects.

The CCIXR team has considerable experience of successful project management and delivery, as well as extensive industrial links and partnerships, which enable them to deliver the project objectives successfully. The Faculty of Creative and Cultural Industries is currently leading over £5M of ERDF funded collaborative work. Current R&D work includes the Innovate UK Audience of the Future Performance Demonstrator project “Dream”. As an R&D partner in this £[redacted] collaborative project led by the [redacted], the CCIXR team has worked in partnership with the other national and international industrial partners to deliver the creative technical solutions required of the project. As demanded by the demonstrator nature of the project this exceptional work is of the highest possible standard and begins its public exhibition and testing at[redacted].

All key dates and milestones will be regularly reviewed by the CCIXR Project Board, as part of the weekly meetings, to ensure the project is kept on schedule.

Details of the Project Plan.				
Project Milestones/Key Stages	**Summary Description**	**Start and Finish Date**	**Evidence (if relevant)**	**Additional comments (if any)**
Initial feasibility, preparatory work and concept design	Overall design of floor plan and equipment for CCIXR finalised	**1/9/2019 - 31/12/2019**	Copy of documents, Business Development Project Manager (BDPM) report	
Procurement strategy planning process	Procurement strategy finalised, and Invitations to tender issued (where appropriate) and responses received according to UoP procurement process	**1/1/2020 - 30/3/2020**	Procurement Strategy, Specification of requirements, Copy of tenders received, BDPM report	

Procurement of specialist CCIXR equipment	Project team and colleagues in UoP Procurement review and evaluate supplier tenders submitted (where applicable) and engage with frameworks.	**1/04/2020 - 31/01/2021**	Copy of commissioning letters / emails from UoP to successful suppliers, BDPM report
Final technical Specification for CCIXR spaces and facilities finalised	Contractors for refurbishment and build work, and specialist suppliers briefed by Project Team, delivery plan agreed	**1/04/2020 - 30/04/2020**	Notes of meetings and discussions between Project Team and appointed suppliers & contractors, BDPM report
Construction works undertaken	Contractors undertake work necessary to renovate space on 2nd floor of Eldon Building and build studios / labs / meeting and office rooms	**30/04/2020 – 30/9/2020**	Progress of renovation and build work recorded on project plan
Fitting out facilities	Installation of procured equipment for CCIXR facilities	**1/10/2020 - 30/01/2021**	Progress of installation recorded on project plan, BDPM report
Centre handover	Completion of works, installation and testing of equipment. Facilities operating to expectations	**1/2/2021**	Project plan signed off by Project Team and UoP Procurement

Official Opening of CCIXR	Event held with project partners, stakeholders and local businesses held at CCIXR to demonstrate facilities	**1/4/2021 – 30/4/21**	Programme for official opening event
First businesses accessing the facilities	Initial projects with business customers commence	1/4/21 – 30/4/21	Copies of agreed programme of work with businesses

6.2 Stakeholder Management

Letters of support have been included from 39 local, national and global businesses, with whom the team have already developed an existing relationship. The breadth and diversity of these organisations shows the expertise within the CCIXR management committee at relationship development, and this will form a key part of the BDPM's role. The industry group will be comprised of key stakeholders from a range of sectors including maritime, arts, defence and creative industries.
This group will inform the CCIXR management committee, ensuring views and needs from a range of sectors are represented. It is anticipated that the group will comprise initially from the [redacted].

CCIXR will develop a full stakeholder management and communication plan in partnership with stakeholders to ensure this meets their needs. The Business Development and Project Manager (BDPM) will manage the stakeholder relationships, using the University's new [redacted]. The Industry Group will be in regular communication throughout the development of the CCIXR. Stakeholders will be invited to attend regular Industry Group meetings, and receive regular updates.

6.3 Project Risks

The risks associated with the CCIXR project have been well defined, documented and mitigations set out for each risk by the CCIXR Development team. The risks and associated mitigations for CCIXR is set out below:

CCIXR Project Risks and mitigations				
Risk	**Likelihood**	**Impact**	**Responsibility**	**Mitigation measures**
Construction risk - delays in construction and handover of CCIXR (Build Risk)	Low	Low	Director of Estates	The project delivery plan will be used by the BDPM to monitor progress through to handover, with oversight from the Estates Project Board
Financial risk - Lack of financial resources to complete capital project (Funding Risk)	Low	High	Executive Director of Finance	Project budget has been agreed internally within UoP and matched funding has been secured (£1.5m). There are robust project management controls in place to ensure the budget is kept in check.
Operational risk - Failure to deliver outputs	Low	Medium	Senior Responsible Officer for Project	UoP will appoint a dedicated BDPM to manage the CCIXR. Oversight will be provided by CCIXR Project Board who will identify remedial actions as required.
Operational risk - Failure or reduced level of SMEs accessing facility	Low	Medium	Senior Responsible Officer for Project	UoP will appoint a dedicated BDPM who will work with Industry Group to develop stakeholder engagement plan.
Operational risk - Delay to operations while technicians are waiting to be trained to use specialist equipment	Low	Medium	Senior Responsible Officer for Project	UoP will appoint a dedicated Technical Manager for CCIXR who will be involved from the planning stage. Training will be forward scheduled to facilitate early uptake of businesses accessing facilities.
Contractual risk - clawback of all or part of LEP funding due to breach of grant funding agreement terms and conditions	Low	High	Senior Responsible Officer for Project and Executive Director of Finance	UoP will provide a BDPM to ensure this project is delivered in a manner that is compliant with terms of the grant funding agreement. Project Board will provide oversight and monitor the delivery of outputs, and put in place timely mitigating actions to address compliance issues.
Contractual risk - clawback of all or part of funding due to failure to comply with publicity regulations	Low	Medium	Senior Responsible Officer for Project	UoP will ensure publicity and logo requirements from Solent LEP are passed to Estates Dept. and Marketing and Communications Dept. to ensure compliance.
Operational risk - Loss of key strategic staff	Low	Low	Senior Responsible Officer for Project	The University's excellent personal/professional development policy enables succession planning to minimise the disruption caused

				by the loss of key personnel. Also the expertise of the dedicated HR Dept. enables the ability to undertake rapid recruitment. UoP will also nominate other staff to take over this role to ensure smooth handover to new team members.
Operational - Loss of key strategic partners	**low**	**medium**	**Senior Responsible Officer for Project**	**Implement a stakeholder engagement plan focusing on relationship management to ensure partners are engaged and valued.**
Business Risk – UoP/CCIXR fails to deliver its commitments and cannot meet objectives	**low**	**High**	**Senior Responsible Officer for Project**	**UoP has an experienced team, and the Project Board will closely monitor objectives. A BDPM will be appointed to ensure project is kept on track. Quarterly monitoring meetings will be used to monitor objectives, and take remedial action if it should be required.**
Reputational Risk – risk that confidence in organisation's ability to fulfil business objectives will be undermined	**low**	**Medium**	**Senior Responsible Officer for Project**	**UoP will ensure that the wider university team and resources required to support the CCIXR team. The Project Board will ensure objectives are met. Reputational risk will be further mitigated through a marketing and communications plan for CCIXR, showcasing the achievements of the project and its partners.**
Service Risk – risk a service is not fit for purpose	**low**	**Medium**	**Senior Responsible Officer for Project**	**The services will be developed in close consultation with our Stakeholder industry group, and will be reviewed at the Quarterly Project meetings to ensure they are fit for purpose.**
Design Risk – risk a design cannot deliver services to the required quality standards	**low**	**Medium**	**Senior Responsible Officer for Project**	**UoP will ensure that Stakeholders, Project Board, BDPM and technical manager are all involved in the design process to ensure all needs are taken in to account. Quality standards will be ensured by close monitoring, and liaison with our highly experienced estates team as well as our stakeholders.**
Planning Risk – risk that implementation of CCIXR fails to meet planning permission conditions, or	**Low**	**Low**	**Senior Responsible Officer for Project**	**No planning permission is required for this project, so this is not a risk for this project.**

requires greater costs to meet conditions				
Decant risk – risk of needing to decant staff/clients from one site to another	**Low**	**Low**	**Senior Responsible officer for Project**	**Due to the size of Eldon Building, temporary relocations of staff/equipment can be managed in house. This will minimise any need to decant to another site. The BDPM will manage this process, supported by the Project Board.**
Environmental risk – risk the nature of the project has a major impact on an adjacent area and there is an objection from the public	**Low**	**Medium**	**Senior Responsible officer for Project**	**All work will be within the University building, and will not impact on the surrounding environment. Risk of increased visitors to the site will be mitigated by strongly encouraging visitors to use public transport, and through providing details of public car parks where required. The University has standard procedures for managing this risk.**
Operational Risk – risk operating costs vary from budget and that performance standards slip, or a service cannot be provided	**Low**	**Medium**	**Senior Responsible officer for Project**	**The budget has been prepared by highly experienced staff, with considerable expertise in this area. The University has committed to providing the operating costs for CCIXR, and has demonstrated its commitment to the project. The Project Board will work closely with BDPM and Technical Manager to ensure costs are kept in check. Performance standards and costs will be monitored at the quarterly review meetings, and any required remedial action will be taken promptly.**
Availability and performance Risk – risk the amount of service provided is less than required under the contract	**Low**	**Medium**	**Senior Responsible officer for Project**	**The project Board and BBPM will work with our Stakeholder Group to ensure the amount of service required is provided. Regular quarterly monitoring of this will also ensure the project is kept on track.**
Demand Risk – risk that the demand for a service does not match the levels planned	**Low**	**High**	**Senior Responsible officer for Project**	**This project has been developed in response to the clear industry need (evidenced through our letters of support). Services can be adapted to meet the needs and demands of the market. Project Board and BDPM will work with the Stakeholder**

				group to ensure that this risk is mitigated.
Volume Risk – risk actual usage of the service varies from the levels forecast	**Low**	**High**	**Senior Responsible officer for Project**	**The Project Board and BDPM will review the services against quarterly targets, and amendments can be made in partnership with our Stakeholder group to ensure that the courses and services offered are meeting the needs to the market. New courses and services will be continually be developed in response to market demand.**
Maintenance Risk – Risk that the costs of keeping the assets in good condition vary from budget	**Low**	**Medium**	**Senior Responsible officer for Project**	**The BDPM and Technical Manager will work together to ensure that the maintenance costs remain within budget. UoP has over 20 years' experience maintaining equipment of this type within the University, and is will ensure the assets are kept in good condition. The significant expertise of our team, along with our excellent relationships with our stakeholders and suppliers will also help to ensure this.**
Technology Risk – risk that changes in technology result in services being provided using old technology	**Low**	**Medium**	**Senior Responsible officer for Project**	**UoP and the CCIXR Project Board have ensured that CCIXR will have an appropriate budget for the renewal and updating of technology. This has been factored in to our calculations at a higher rate than standard University Capital Investment. This will be closely monitored by the Project Board to ensure that the Technology remains cutting edge. Further equipment will also be procured through the significant research and development projects which will take place within CCIXR. The significant expertise of our team, along with our excellent relationships with our stakeholders and suppliers will also help to ensure this.**
Residual Value Risk – risk due to uncertainty of the physical asset at the end of the contract period	**Low**	**Low**	**Senior Responsible officer for Project**	**UoP will mitigate this risk through monitoring the residual assets on an annual basis, reappraising this as necessary.**

Catastrophe risk – unpredictable risks such as natural disasters, technological disruption, unexpected policy changes and other unforeseen occurrences	**Low**	**High**	**Senior Responsible officer for Project**	**UoP has an institutional Risk Register that sets out mitigations and responses to a variety of risks, including catastrophe risk. The Project Board will use their significant experience and resources to adapt and respond swiftly to any unforeseen occurrences, should they occur during the Project. The Project Board will be guided by our in-house legal, HR and financial teams to ensure that CCIXR responds in a timely and appropriate manner should any unforeseen risks occur.**
Regulatory Risk – risk a change in the law or regulations will affect the costs or benefits of a project	**Low**	**Low**	**Senior Responsible officer for Project**	**Due to the nature of the project this is a very low risk. However, if this should occur UoP and the Project Board would work with the Stakeholder Group to ensure suitable responses, ensuring a solution in a timely manner in order to minimise any effect on the costs and benefits of the project.**

6.4 Governance Framework

Appropriate tried and tested governance arrangements for the project will be implemented, with the BDPM and TM reporting to the CCIXR Management Committee. The BDPM and TM will have delegated authority to make operational decisions within appropriate agreed limits for their roles. The CCIXR Management Committee will be responsible for oversight of the project and for decision-making in relation to any material change to scope, cost or programme. All contract award decisions relating to consultants and contractors will be made by the CCIXR Management Committee, in accordance with our financial regulations. The Chair of the CCIXR Management Committee, [redacted] is a member of the University's Executive Board.

The Purchasing Manager is responsible for formulating and delivering the University's Procurement Strategy. The Purchasing Manager is responsible for the delivery of an effective cycle for the acquisition of goods, materials and services together with the provision of a policy-making, advisory and monitoring service. The Purchasing Manager also acts as focal point for general procurement issues and escalation of specific procurement problems. The Director of Finance or the Finance Committee are the final arbiters on all matters relating to procurement at the University.

6.5 Key Project Milestones

Please note a full Gantt chart is in Annex 11.

CCIXR Project Plan				
Project Milestones/Key Stages	**Summary Description**	**Start and Finish Date**	**Evidence (if relevant)**	**Additional comments (if any)**
Finalise concept design and specification of CCIXR requirements drafted	Overall design of floor plan and citing of equipment for CCIXR finalised	1/2/2019 - 30/12/2019	Copy of documents, BDPM report	
Procurement Strategy in place	Invitations to tender Issued (where applicable) according to UoP procurement process	1/1/2020 - 31/3/2020	Copy of tenders received, BDPM Report	

Procurement of specialist CCIXR equipment undertaken	Project team and colleagues in UoP Procurement review and evaluate supplier tenders submitted	1/04/2020 - 31/01/2021	Copy of commissioning letters / emails from UoP to successful suppliers, BDPM report	
Specification for CCIXR spaces and facilities finalised	Contractors for refurbishment and build work briefed by Project Team, delivery plan agreed	1/04/2020 - 30/04/2020	Notes of meetings and discussions between Project Team and appointed contractors, BDPM report	
Construction works undertaken	Contractors undertake work necessary to build studios / labs / meeting and office rooms	30/04/2020 – 30/9/2020	Progress of work recorded on project plan	
Fitting out facilities	Installation of procured equipment for CCIXR facilities	1/10/2020 - 31/01/2021	Progress of installation recorded on project plan, BDPM report	
Centre handover	Completion of works, installation and testing of equipment. Facilities operating to expectations	1/2/21	Project plan signed off by Project Team and UoP Procurement	
Official Opening of CCIXR	Event held with project partners, stakeholders and local businesses held at CCXIR to demonstrate facilities	1/4/2021 – 30/04/21	Programme for official opening event	
First businesses accessing the facilities	Initial projects with business customers commence	1/4/2021 – 30/04/21	Copies of agreed programme of work with businesses	

CCIXR Technical Facilities

Based on the needs evidenced, and in order to create an innovative solution to the problems identified by our industry partners and wider government reports (Digital in Culture, 2018), CCIXR will include:

- **Motion Capture Studio**
- **Location Based Experience (LBE) Virtual Reality Development Space**
- **Volumetric Capture**
- **Photogrammetry**
- **Spatial Computing Lab**
- **Digital Coding development spaces**
- **Sound Studio Facilities**
- **Virtual Reality Lab**
- **Simulation Facilities**
- **Mixed Reality Tech Lab**
- **Digital Communication space**
- **Immersive production space**

(Details of the labs listed above have been redacted due to commercial confidentiality)

CCIXR Glossary

Terminology	Definition
CCIXR	Centre for Creative and Immersive XR
XR	eXtended Reality - a cover all term for VR, AR & MR
VR (Virtual Reality)	Virtual reality is an experience taking place within simulated and immersive environments that can be similar to or completely different from the real world. It is usually delivered through a headset that isolates the viewer from the real world, and can support up to 6 degrees of freedom tracking such as the major brands: [redacted]
AR (Augmented Reality)	Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real-world are enhanced by computer-generated perceptual information, including visual and haptic feedback. This medium was popularised by mobile games such as [redacted]
MR (Mixed Reality)	Mixed reality (MR), is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time. It is sometimes compared to AR, but is different in the fact that the worn device is more aware of the real world and can incorporate digital elements more effectively, by using techniques such as Depth of Field (focus), and object occlusion i.e. digital objects are obstructed and can hide behind real world objects.
Immersive XR	A blanket term used to describe Immersive content that uses one or more of the above techniques (VR, AR & MR)
Volumetric Video (Volumetrics)	The cutting-edge technique of using multiple video cameras to record a full 3-dimensional moving model of a performance, it is similar to the technique of photogrammetry, but produces moving 3d models instead of static 3d Models.
Photogrammetry	The use of multi angle photography to reconstruct a 3d scan or model of persons and objects. This technique is widely used in the visual effects and games industry to speed up the making process of real world objects so they appear photorealistic in 3d applications and films. This is also being used in areas such as [redacted]
Motion Capture	The process of digitising the movement of actors, animals and props for the purpose of animating digital characters in the Film, TV and Games Industries. This technique was popularised by actors such [redacted]
Optical tracking for motion capture	Within the field of motion capture, there are multiple processes that can be used to capture the movement for motion capture. Optical

	tracking uses multiple cameras or computer vision devices to record and reconstruct the movements required.
Inertial suits for Motion Capture	As above, but using the use of IMU (Inertial Measurement Unit) placed on the actors or objects. These IMUs use a combination of accelerometers, gyroscopes and magnetometers to measure the 6 degrees of freedom (see below) required to track an object in a physical space.
DoF	Degrees of Freedom, and refers to the planes of motion that the platform can move within. There two main terms used for this 3DoF and 6DoF these can describe the movement (up, down, side to side) or rotation (Pitch, Roll and Yaw) or the combination of both.
Visual and spatial computing	The technique of using computer algorithms to analyse moving images (either from a recorded sequence or in real-time through camera feeds) to track or recreate real world objects and environments for the use of making 3d computer graphics. Recent developments are utilising Artificial Intelligence (AI), Neural Networks and Deep Learning to speed up the process.
Location Based Experiences (LBE's)	User experiences based in specific locations, that utilise any number of the above techniques to create immersive content. The digital visuals are used in combination with physical props and sets to enhance the experience for the users. This allows the user to use senses such as touch, smell and taste that cannot be re-created digitally.
White Light Smart Stage - cube system	This is a combined system of video screens and camera tracking technology that allows a presenter to be surrounded by Virtual Sets and environments, that alleviates the use of Green Screen techniques. This means that effects such as these are now recorded "in camera" in real time, saving large amounts of money in post-production and real time effects for TV and film.
Digital Coding	The use of computer programming to develop any of the above, including software and tools in the Immersive XR fields. This can include computer languages such as C++, Python and Java to make software and tools that allow complex systems to talk to one another.
Digital production	The production of content of any or all of the above.
STEM	Science Technology Engineering Maths (Sometimes STEMM - including Medicine) and recent discussions centre on the use of STEAM to include the Arts.
DCMS	Department of Culture, Media and Sport.
Artificial Intelligence (AI)	The appearance of human intelligence (or beyond) by machines. This is achieved through computer programming techniques that develop machine learning, neural networks and deep learning algorithms.

Spatial audio	Sound effects (and music) that is used in XR applications that emulate real world positioning and effects that accurately “place” the sound in the digital environment through headphones worn by the user.
Binaural	The technique of capturing audio through specialist microphones that mirror the shape and texture of the human ears. By doing this the sound is recorded as a human would hear it, and when played back through headphones creates very realistic Spatial Audio.
Haptic devices	Computer controllers and devices that give feedback to the digital content. This can be as simple a rumble effect in a Playstation or an Xbox controller, through to sophisticated motion simulation platforms, and gloves and devices that emulate the sensation of touch or resistance.
Virtual Production Projection Mapping system system	A set of digital screens that completely surround a user in a computer simulation. Screens are used as walls, ceiling and floor and immerse the user without the use of a VR headset. This can be more suitable for some applications and people who struggle with headsets.
360 degree Video & Projection	The technique of filming and delivering in 360 degrees, often with 2 views that represent the left and right eye views, that creates videos that fully surround the viewer. These can be viewed in headsets and in domes such a planetariums and specialist screens.
CPD	Continuous Professional Development
BDPM	Business Development and Project Manager
TM	Technical Manager

Annexes 1-15 have been redacted due to commercial sensitivity.