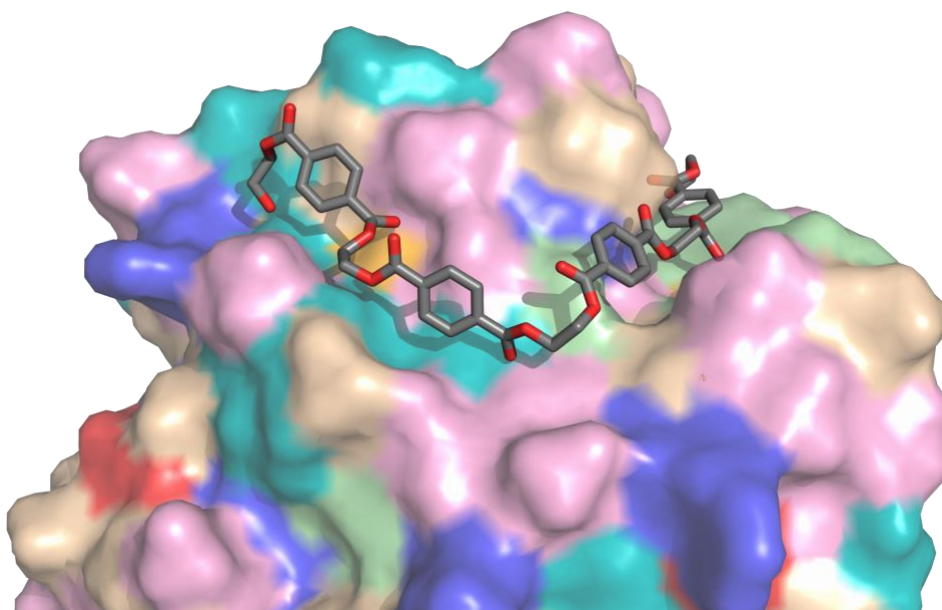


# Centre for Enzyme Innovation (CEI) Expansion - Industrial Engagement Hub Full Business Case

The University of Portsmouth (UoP) opened its Centre for Enzyme Innovation (CEI) in January 2020 to provide novel enzyme-based recycling solutions for plastic waste through an integrated research and innovation pipeline. The CEI develops biological enzyme solutions for the breakdown of commonly polluting plastics into their monomer building blocks for reuse, or as sustainable feedstocks for improved materials. This technology paves the way for establishing a truly circular economy for plastics, which in turn addresses one of the world's greatest challenges - plastic pollution.

The Industrial Engagement Hub project creates a unique environment for industry and academia to work together to shape, refine, develop and test the new technologies emerging from this ground-breaking research into commercial solutions with a ready exploitation route.



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# 1. Introduction

## 1.1 Establishing the Centre for Enzyme Innovation at the University of Portsmouth

The University of Portsmouth (UoP) opened its Centre for Enzyme Innovation (CEI) in January 2020 to provide novel enzyme-based recycling solutions for plastic waste through an integrated research and innovation pipeline. The CEI develops biological enzyme solutions for the breakdown of commonly polluting plastics into their monomer building blocks for reuse, or as sustainable feedstocks for improved materials. This technology paves the way for establishing a truly circular economy for plastics, which in turn addresses one of the world's greatest challenges - plastic pollution.



**Figure 1 St Michaels Building at University of Portsmouth, housing the Centre for Enzyme Innovation**

This project creates a unique environment for industry and academia to work together to shape, refine, develop and test the new technologies emerging from this ground-breaking research into commercial solutions with a ready exploitation route.

The CEI mission is twofold; (1) to discover, engineer and produce new enzyme technologies at scale; (2) to partner with UK small-medium enterprises, national companies and multi/international industry to bring these technologies to market.

The CEI has been initially established with three arenas to:

- discover new enzymes from the environment that break down plastics,
- engineer these enzymes and their production mechanisms to optimise their activity, stability and yield
- formulate the conditions needed to deploy these enzymes in industry.

To date we have built a team of 30 research scientists to focus on this global challenge and have received worldwide recognition and awards including the Times Higher Education STEM Research

Project of the Year 2019.

## 1.2 First Phase of Investment in the Centre for Enzyme Innovation

Following global interest in our demonstration that a naturally-occurring enzyme can be engineered to enhance its ability to breakdown the single-use plastic PET, the University of Portsmouth was successful in securing an investment of £5.8m from the Expanding Excellence in England (E3) award from Research England. The investment from Research England's E3 programme, coupled with significant investment from UoP, enabled the initial establishment of the CEI with its world leading facilities to enable the research and innovation pipeline for the Discovery, Engineering and Deployment of novel enzymes as solutions to the plastic pollution problem. The CEI combines state-of-the-art facilities and world-leading expertise to not only drive forward scientific breakthroughs, but also for translating that new knowledge into recycling solutions. The E3 investment also facilitated the establishment of research groups and accelerated the pace of development of solutions for the circular recycling of plastic waste into chemicals and fuels.

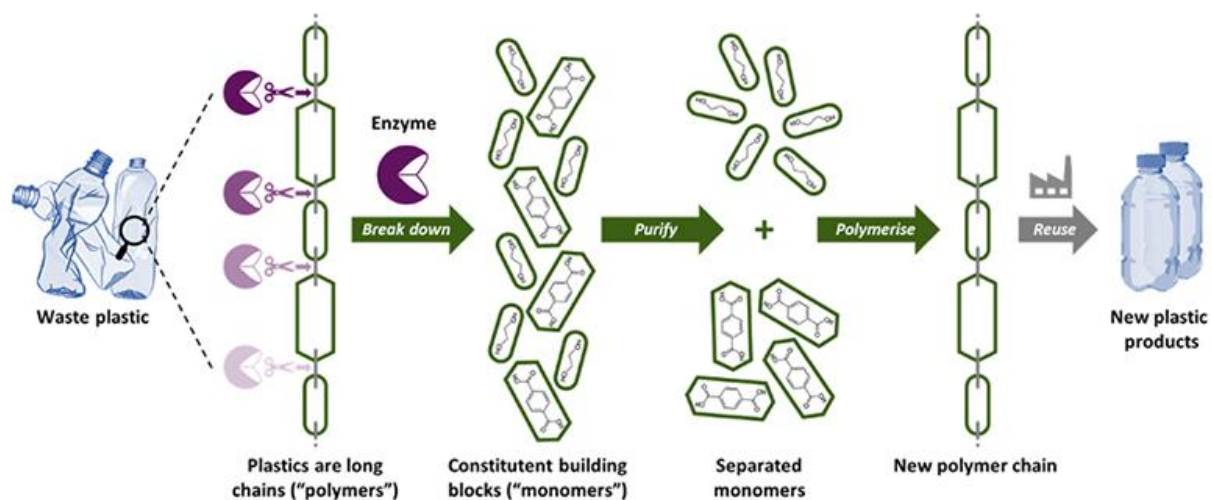


Figure 2 The CEI's vision is to enable the infinite recycling of plastics using engineered enzymes

## 1.3 Next Phase Investment Opportunity for CEI Expansion - Industrial Engagement Hub project

Informed by interactions with and feedback from industrial stakeholders to date, we now have ambitions to further develop the CEI facilities and capabilities. Embedded within these plans is an integrated Industrial Engagement Hub, a testbed for growing local, national and international partnerships. We are seeking an investment from Solent LEP to enable the expansion of the CEI, further enhancement of facilities and capabilities to address requirements of industry, and development of an Industrial Engagement Hub.

The CEI Expansion - Industrial Engagement Hub project will almost double the current floorspace of the CEI through further refurbishment of floor two of the Old St Michael's building which currently houses the CEI's Enzyme Engineering laboratories and management offices. This project will also create three specialist laboratories specifically to bridge the gap between the current research

capabilities and what this technology needs to develop in order to be adopted by industry.

This second phase investment in the CEI will provide an additional 290m<sup>2</sup> of newly refurbished CEI floorspace to include an industrially-relevant bio-recycling development centre. In addition, an innovation suite will be created within this second phase of CEI development to provide a focus point for interactions with and support to industry.

This document is the Full Business Case which supports investment in the CEI Expansion - Industrial Engagement Hub project. 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 University has selected the choice of investment that best meets existing and future needs and optimises 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.

## 2. Strategic Case

### 2.1 The need for change in tackling plastic pollution

We use plastic in almost every area of our lives – as packaging, in electronics, clothing and building materials. Plastic is inexpensive and easy to make. It's unmatched in its cost-effective durability and resistance to degradation. But this attractive resilience has created a global plastic crisis. Some plastics take more than 400 years to break down, and around 8 million tons of plastic ends up in our oceans every year, impacting wildlife, our food chain and, potentially, our health. Cleaning up the plastics from our oceans is vital, but that will not stop the tide of plastics entering it; we need to move upstream to the source of the flow. By 2040 it is forecast that plastic generation will double, plastic leakage into the ocean will increase by three times and plastic stock will increase in the ocean by four times. Half of all plastic becomes waste within a year of being made, yet most isn't recycled. In addition, only 21% plastics are currently economically recyclable, and only 15% were actually recycled globally in 2016. In short, our planet is suffocating in plastic. We need radical action to halt this dire trend and limit the damaging consequences of plastic pollution on our health and the environment. This need for change is recognised worldwide and, with organisations such as the Ellen MacArthur Foundation (EMF) and Knowledge Transfer Network (KTN), facilitating communication and collaboration between academic researchers and the multinational organisations that produce and supply plastic products, we are in position to address the problem.

In collaboration with the UN Environment, the EMF leads the New Plastics Economy Global Commitment, a pledge with a vision of a circular economy of plastic that never becomes waste. The need for change has been recognised on a global scale, through the signing of the pledge by 250 organisations including many of the world's largest packaging producers, brands, retailers and recyclers, as well as governments and NGOs. The Global Commitment and its vision for a circular economy for plastic are supported by the World Wide Fund for Nature (WWF), and have been endorsed by the World Economic Forum, The Consumer Goods Forum (a CEO-led organisation representing some 400 retailers and manufacturers from 70 countries), and 40 universities (including UoP), institutions and academics. More than 15 financial institutions with in excess of \$2.5 trillion in assets under management have also endorsed the Global Commitment, and over \$200 million has been pledged by five venture capital funds to create a circular economy for plastic. The Global Commitment aims to create 'a new normal' for plastic packaging. Targets will be reviewed every 18 months, and become increasingly ambitious over the coming years. Businesses that sign the commitment will publish annual data on their progress to help drive momentum and ensure transparency.

The scale and urgency of the plastic pollution problem is reflected in the creation of the UN Global Plastics Platform and the issue has featured heavily at the World Economic Forum in 2018, at which the pioneering UoP research into plastic-degrading enzymes was highlighted. The EU has adopted a pioneering strategy to promote a Circular Economy of Plastics, while the UK has set out multiple new strategies (identified in section 2.6) to address these challenges. With increasing expert and public pressure driving legislation, the UK has ambitious targets for recycling/composting of plastic packaging (70%) and for new plastic to contain 30% recycled material by 2022. However, a global step-change in recycling science and technologies is needed to achieve these ambitious goals, and the CEI is key to delivering this transformation.



## 2.2 The opportunity for the CEI to lead in solving the challenge of problem plastics

The UK as a whole is well placed to lead on the development of transformative technologies to tackle the problem of plastic pollution, with the positioning of the CEI to empower and accelerate the national drive to tackle the challenge.

Industry is currently incentivised through both legislation and lucrative emerging markets in recycled materials: the CEI is in a prime position to deliver innovative solutions to this high-growth sector: the global market for PET alone is expected to reach \$38m by 2023 (Allied Market Research). Crucially, aside from enzymes, no other technology currently exists that has the potential to produce high value commodity chemicals from mixed plastics waste. While PET is one of the most common single use plastics, the CEI will develop enzymes that can break down some of the other most commonly polluting plastics, creating the possibility of huge positive environmental and commercial impacts.

A scale-up of collection, sorting and recycling infrastructure, coupled with design for recycling, is forecast to reduce 2040 plastics leakage into the ocean by 38% (Breaking the Wave, Pews Trust, 2020). The expansion of the CEI would accelerate the scaling of cutting-edge recycling technology, coupled with increased industrial exploitation, enabling the global drive to tackle plastic waste in the ocean.

The UK's Industrial Strategy, 2017, recognises the UK's ability to innovate (create and deploy new technologies) as a core historic strength. The UK Research and Development Roadmap, 2020, also recognises the challenges inherent in this and that more needs to be done to encourage and facilitate this activity to ensure that technology transfers from the lab to industrial use.

To realise this opportunity, the CEI will deliver commercially viable products and processes through its policy-aligned programme and industry-engaged pipeline structure. The inclusion of sector experts in its activities - enabled by the expansion of the CEI sought through this project - will ensure that industry-relevant commercial and technical design criteria are included at key stages of the CEI's scientific and technical development processes to deliver maximum potential for economic and jobs growth.

A surge of interest to develop green recovery processes for all plastics has been fuelled by a raft of ambitious industrial sustainability goals coupled with increasing legislation for extended producer responsibility. Most multinationals now have strong and prominent corporate social responsibility (CSR) campaigns, coupled with increasing Extended Supplier Responsibility (ESR), but are struggling to find solutions in the timescales they are proposing. This offers huge opportunities for SMEs and UK companies to work with us to develop UK-based solutions. Crucially, the interest from companies spans the whole supply chain, from plastic producers, users and consumers, through to recyclers. Through the securing of a grant from the Solent LEP, the expansion of the CEI will enable us to deliver new innovative technologies, systems and processes to a variety of industrial sectors. Crucially, its work will be directed by the industries that will be responsible for exploiting the new technologies, thereby ensuring a route to adoption is identified and in place. It will lead to economic growth within these companies, both within the region and nationally, and create inward investment opportunities as it responds to global demands.

## 2.3 Research and Innovation at the Centre for Enzyme Innovation

A global audience of over 200 million was captivated by the University of Portsmouth's timely development of an enzyme that breaks down one of the most common single-use plastics (PET) into its constituent building blocks. PET is used to make 20,000 single-use plastic bottles every second worldwide, and our discovery is paving the way for a more efficient method of recycling and helping solve the global plastic pollution problem. This has the potential to transform discarded plastic from an environmental menace into a sustainable waste feedstock, which can be processed into commodity chemicals and infinitely re-used to make new plastics as part of a circular economy. However, for this vision to become a reality within the recycling industry, different enzymes are needed to break down each different type of plastic and the enzymes must be efficient, robust, and affordable. This has informed the mission and aims of the CEI; to provide transformative enzyme-enabled solutions for circular recycling of plastics through discovering naturally-occurring enzymes with industrial potential, engineering into them enhanced activity against plastics, optimising the conditions for their use, and finally delivering them into industry.

The research excellence of the CEI members is evidenced by the results of the most recent UK research audit, REF2014, in which they were submitted to Units of Assessment (UoAs) 3 and 7. Notably, 90% of the research in the UoA 3 submission was assessed as world-leading or internationally excellent (4\*/3\*) and the panel commended the particularly strong molecular biophysics research, which forms the CEI's Engineer theme (see below). Equally, the ICS (UoA 7) on work underpinning the Discover theme was given the top ranking. Since that audit, the CEI researchers have continued to excel:

- External income from sources including: Research England, BBSRC, NERC, EPSRC, Leverhulme Trust, Innovate UK, Diamond Light Source, NREL, NSF, Dstl, and the European Commission.
- Multiple publications in high impact journals, e.g. Nature, Nature Communications, Proceedings of the National Academy of Sciences USA.
- Completion of 14 doctoral students, hosted a Daphne Jackson Fellowship and supported a PDRA through the Innovate UK Innovation-to-Commercialisation (ICURE) programme.
- 5 granted or filed patents to underpin exploitation and commercialisation.
- Research informing policy development and government strategy, most recently featuring in the UKRI Strategy.
- Held in high esteem through a wide range of prestigious positions, including visiting professorships, editorial roles, panel and committee leadership and memberships.

Further recognition of the CEI's excellence came in November 2019 when the PETase engineering project, led by Prof McGeehan, was awarded the Times Higher Education STEM Research Project of the Year. In 2019, in recognition of its excellence in sustainability teaching and research, exemplified by the work of the CEI, UoP was selected by the Ellen MacArthur Foundation (EMF) to join its Profiled University programme which has a select membership of only 38 institutions from around the globe. The programme seeks to enable collaborative ventures and knowledge exchange across academia, policy makers, and business around the world. Indeed, the CEI is perfectly positioned to support the EMF in meeting their targets which include: through innovation, ensuring that 100% of plastic packaging can be easily and safely reused, recycled, or composted by 2025; and significantly increasing the amounts of plastics reused or recycled and made into new packaging or products. This is coupled with their "new plastics economy" vision to "radically improve recycling" through pursuing technological innovation and stimulating demand for recycled materials.

Using our established research and innovation platform, the timing is perfect to expand the CEI

facility to capitalise on industrial engagement. Working with local industries will allow us to better define our research directions to maximise their industrial applicability, while offering opportunities for companies to embed our technologies into their processes.

## 2.4 Overview of the University, its Faculty of Science and Health, and the CEI

The University of Portsmouth is a progressive and dynamic university with an outstanding reputation for innovative teaching and globally significant research and innovation. It was rated 'Gold' in the UK government's Teaching Excellence Framework (TEF) and was ranked in the top 150 under 50 in the world according to the Times Higher Education rankings. The University is also 21st in the Guardian's 2020 league table and was ranked number one in the UK for boosting graduate salaries according to The Economist.

The University's research and innovation culture is impacting lives today and in the future and addressing local, national and global challenges across science, technology, humanities, business and creative industries. The investment and support it has provided to date in the CEI is a demonstration of that commitment in practice. By 2030, the University of Portsmouth strategy is driving us to “deliver globally-recognised research and innovative solution that improve society” and to “lead in environmental sustainability and become climate positive”.

The CEI is the premiere research centre within the Faculty of Science and Health at the University. It comprises leading researchers and academics from both the School of Biological Sciences, and the School of Pharmacy and Biomedical Sciences, and this interdisciplinary approach provides additional value to its work.

## 2.5 Investment in the CEI to Date, and Next Steps

Prior to June 2019, the CEI's research expertise had grown organically and whilst it had achieved significant success, investment was needed at a scale not possible via the usual levels of institutional and external funding (e.g. project grants) in order to capitalise on the opportunity to take a world leading position in the research into and application of plastic- degrading enzymes. With the investment in the CEI from the combined resource of the £5.8m Expanding Excellence in England (E3) grant from Research England coupled with significant UoP investment, not only were we able to achieve our ambition of establishing a pipeline (see Discover, Engineer, Deploy in Figure 2) for the delivery of transformative enzyme-enabled solutions for circular economy of plastics, but also to become one of the world leaders in equipping the next generation of biotechnologists/enzymologists with the highly technical skills needed to support the growing UK bioscience sector (set to double in size by 2030, UK Bioeconomy Strategy).

The UoP/Research England E3 investment which created the original CEI will be used to support the operation of the centre. Following the expiry of the current funding, the research and innovation income received by the CEI, which the Solent LEP funding is forecast to accelerate, will be used to support the centre's continued operating costs. A letter from UoP dated 02/09/2020 confirmed commitment to providing the revenue funding required to support the work of the CEI is provided as appendix 1.

The CEI research pipeline (Figure 3), enabled by the E3/UoP investment, was designed to provide

optimised enzymes for subsequent application in a bio-based recycling industry, a design informed through consultation with the number stakeholders. It is divided into 3 arenas:

- Discover – finding new enzymes from the environment that break down plastics
- Engineer – developing efficient and stable enzymes to break down plastics, and the control systems needed for their efficient production
- Deploy – optimising the conditions for production and activity of the engineered enzymes at an industrially-relevant scale

Our intention was for our engineered enzymes to be taken up by commercial partners for subsequent development and application. The investment from the Solent LEP creates an environment that both accelerates and supports this work. The Expansion project will enable us to expand our “Discover-Engineer-Deploy” pipeline with the “Apply” arena (Figure 3.). The feedback loops between these arena, all to be housed in adjacent laboratories, will provide a rapid acceleration of our capabilities and outputs, bringing together a unique integrated facility combining scientists with industrial experts that does not currently exist within the UK. The scale of the challenge requires true inter-disciplinary research, which is precisely what this expansion will deliver.

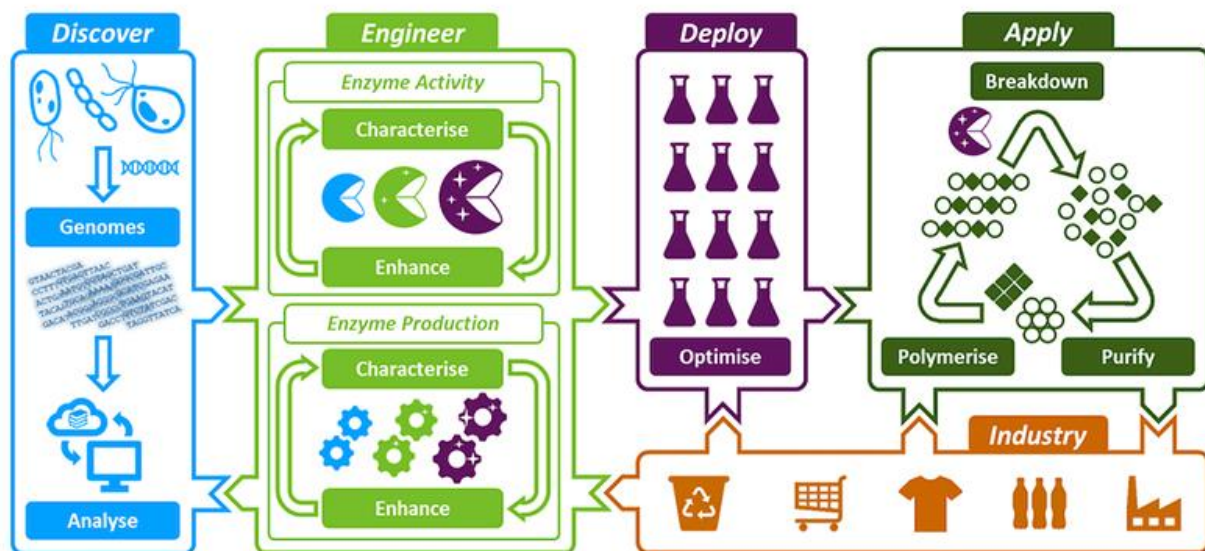


Figure 3 The proposed expansion of the CEI arena that enhances the centre’s industrial engagement

This project creates new opportunities to engage with industry, which will ultimately provide the mechanism to bridge our fundamental research with innovations that can be rapidly taken to market. With industrial interest and several formal agreements already in place, we can ensure that our research developments are robustly informed and targeted for real-world application.

The fourth arena - Apply - will provide the environment, equipment, expertise and capacity for the translation of research and development. This will enable (1) the application of engineered enzymes to plastic breakdown at pilot scale; (2) the release and recovery of plastic components (including both monomers and additives); and (3) the re-polymerisation of the monomers into new plastic materials. We will work with commercial partners to deliver these solutions at an industrially-relevant scale in an efficient, robust and affordable manner.

The model demonstrates how the CEI Expansion project ensures a pipeline of activity from Technology Readiness Level (TRL) 1 (observation of principles) through to TRL 9 (adoption by industry) can be supported delivering on the key tenant of the UK Industrial Strategy. The challenges of exploitation of university research are understood within the sector and have informed the current direction of the Government's policies on knowledge exchange including the creation of the Knowledge Exchange Framework. This project addresses these challenges by creating mechanisms for industrial and academic experts to work together to solve real-world problems. The University has in place the commercialisation skills and expertise required to support the exploitation of intellectual property which will be generated by the collaborators.

## 2.6 CEI Expansion - Industrial Engagement Hub Project

Investment in the CEI Expansion - Industrial Engagement Hub project will enable the new laboratories and associated office and meeting spaces to create the necessary environment for the research and development in the application of engineered enzymes to the recycling of plastic materials. Research and development of the breakdown process will take place in the Biorecycling Laboratory (60 m<sup>2</sup>) (figure 5), which will house equipment for cutting and milling waste plastic materials down to a powder for subsequent treatment with our engineered enzymes in environmentally-controlled bioreactors. This entire process will be observable from the neighbouring Engagement Hub (18 m<sup>2</sup>) by way of a floor-to-ceiling glazed partition (figure 4). The Hub will facilitate interaction between researchers and industry collaborators so that, together, they can drive the translation of the applied research towards viable industrial processes.



Figure 4 Architect's impression of the potential Innovation Suite in the CEI Industrial Engagement Hub expansion





Figure 5 Architect's impression of the bio recycling laboratory, part of the CEI Industrial Engagement Hub expansion

## 2.7 Strategic Alignment of the CEI Industrial Engagement Hub

Funding for the CEI Industrial Engagement Hub aligns to the Solent LEP strategic priority of building on the region's 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. This highly deliverable capital project enables investment in the UK's innovation ecosystem, including through improvements to research and development facilities driving up business productivity and also supports the Government's desire to stimulate the economy over the next 18 months by enabling capital projects. This project aligns to the UK Government's stated overarching objectives for this investment of driving up economic growth and jobs and supporting green recovery as the UK economy recovers from the impacts of the coronavirus pandemic. It also supports the delivery of the Industrial Strategy's aim of achieving R&D investment to 2.4% of GDP by 2027.

In addition, the CEI expansion will support the UK Government to meet goals for recycling, net zero and sustainability across many different strategies and ambitions, as outlined below:

- **Clean Growth Strategy**  
 "Enhancing the benefits and value of our natural resource" - "to work towards our ambition for zero avoidable waste by 2050, maximising the value we extract from our resources, and minimising the negative environmental and carbon impacts associated with their extraction, use and disposal.". The CEI would support this through the development of low energy and low GHG releasing bio-recycling technologies that enable the continued use of plastic resources extracted from fossil fuels, with an industrial engagement hub that is able to accelerate their adoption by industry.
- **Net Zero Ambition** - Plastic-recycling enzymes developed by the CEI offer a low green-house-gas (GHG) and energy solution for a circular economy of plastics

- **Resources and Waste Strategy 2018** -The expanded CEI would provide a solution for the stimulated demand for recycled plastics, as a result of the UK HMG planned tax on plastic packaging. The expanded CEI and provision of novel bio-recycling enzymes would accelerate the movement towards the 2025 goal of “all plastic packaging placed on the market being recyclable, reusable or compostable by 2025”, in particular for a number of the key priority areas (textiles, vehicle tyres and fishing gear) and difficult to recycle plastics by conventional recycling technology, the area of focus for the centre
- **Plastic packaging tax**  
The scaling of plastic recycling enzymes, through the expanded centre, will enable the UK recycled plastic market to better respond to the expected demand increase for recycled plastic material through the plastic packaging import tax, which is due to be implemented in April 2022
- **UK 25 year environmental plan**  
Part of the strategy aims to maximize resource efficiency and minimise environmental impacts at end of life, partly through achieving zero avoidable plastic waste by end of 2042. This CEI would support this through the development of bio-recycling technologies that enable the continued use of plastic resources.
- **UK Industrial Strategy grand challenge** - The aim of the strategy to “maximise the advantages for UK industry from the global shift to clean growth” would be supported through the CEI Industrial Engagement Hub, by enabling the rapid scaling of bio-recycling technologies to support clean growth and providing a space to accelerate their adoption by industry.
- **Growing the Bioeconomy strategy:**  
Through the CEI Industrial Engagement Hub, the CEI would actively look to engage with partners from the biotechnology industry to:
  - Produce smarter, cheaper materials such as bio-based plastics and composites for everyday items as part of a more circular, low-carbon economy

The CEI is aligned to the Solent LEP and University’s shared priority for clean economic growth as it develops green recovery solutions for the breakdown of plastics, enabling their reuse and therefore tackles one of the world’s greatest pollution challenges. The Engagement Hub will create a physical environment for companies to engage with the science, access facilities and to become a testbed for growing local and national partnerships.

## 2.8 Industry engagement at the Centre for Enzyme Innovation

Following John McGeehan’s internationally acclaimed research journal article in PNAS in 2018, publishing the enhanced engineering of PETase, the CEI were contacted by nearly 200 businesses (both local and international), interested in the opportunities posed by the further development of the PETase technology. This prompted the funding request for creation of the centre through the Research England E3 scheme, which - along with UoP match - secured resource funding for the first five years of the centre. In order to meet the demand for engagement, part of the Research England E3 funding included the creation of an Innovation Fellow post over the five years of the centre

creation project, to engage with industry and promote innovation successes from the centre. Since appointment in April 2020, the Innovation Fellow has been working to prioritise and start the engagement with relevant companies and industries. The nature of this work is such that letters of support are not sought from businesses wishing to engage. Owing to the potential impact of any engagement at this early stage in technological development and future competitive advantage confidentiality is a key requirement

The University has a strong track record of developing links with key stakeholders and recognises the importance of strategic partnerships in achieving its ambitions to 2030 and strategy to 2025. The University's diverse resources (including Collaboration Managers, Commercialisation Manager and investment in a new CRM system) will be made available to support the CEI to engage with the pipeline of potential collaborators.

The CEI will work with government and industrial partners to identify the costs associated with uptake of these technologies and will work in collaboration and partnership where possible to facilitate the uptake. IP rights for collaborative projects and licensing terms for patents from the CEI are to be determined on a project-by-project basis by the University of Portsmouth Commercialisation Manager.

## 2.9 Key benefits of CEI Industrial Engagement Hub

This investment in the region's innovation ecosystem, through improvements to research and development facilities, will ultimately contribute to driving up business productivity. It will do this by creating mechanisms for industrial and academic experts to work together to solve real-world problems. The University has in place the commercialisation skills and expertise required to support the exploitation of intellectual property which will be generated by the collaborators. The Industrial Engagement Hub will facilitate interaction between researchers and industry collaborators so that, together, they can drive the translation of the applied research towards viable industrial processes and position the Solent economy to capitalise on the global market opportunity for plastic recycling in a circular economy.

Specifically, the following outputs will be delivered by the CEI Expansion project:

- 5 new jobs created
- 290 m<sup>2</sup> R&D facilities floorspace
- 20 businesses assisted

Through the expansion, the CEI will become the first committed element of the Portsmouth Clean Growth Innovation Quarter. This is a key objective of the Portsmouth Economic Development and Regeneration Strategy 2019-2036.

## 2.10 Strategic direction of CEI Industrial Focus

Due to the low maturity (assessed through the TRL) of the bio-recycling enzymes produced by the CEI, uptake of the technology has not yet been possible. The expansion of the CEI with an Industrial Engagement Hub will create a unique environment for industry and academia to work together to shape, refine, develop and test the new technologies emerging from this ground-breaking research



into commercial solutions with a ready exploitation route, enabling the centre to accelerate the adoption of the technologies by industry.

Through the CEI Industrial Engagement Hub and facilitated by the CEI Innovation Fellow, the CEI would look to engage with industry from across the plastics value chain, in order to create a circular economy from plastic waste. In addition, the CEI would partner with local biotechnology innovators to accelerate the exploitation of their technology in collaborative research and innovation projects. These could include:

- Plastic users - consumer packaged goods companies, consumer goods and textiles retailers, aerospace, automotive, consumer electronics, white goods manufacturers, textile manufacturers
- Plastic makers - producers of plastic materials
- Plastic miners - Petrochemicals industry and chemicals industry
- Plastic recyclers
- Biotechnology - innovators in the bioplastics/enzyme/plastics market space

The CEI focuses on the research and development of bio-recycling technologies and is unique as a research and innovation centre in terms of the skills and facilities that it brings together. The main competitors for the CEI are focused on the commercialisation of chemical recycling technologies (including enzyme-based recycling technologies), though their principal focus is on the commercialisation of processes for specific plastics and/or industries, whereas the CEI looks to offer research and innovation support across the plastics value chain in multiple industries, led by the specific challenges of each business.

These current main competitors are:

- Carbios - France
- Zymergen - USA
- Ioniqa - The Netherlands
- Worn Again - London, UK
- Scindo - London, UK
- Loop Industries, USA

There is currently no direct competitor to the CEI in the Solent region. There are small pockets of research into alternative recycling technologies, such as pyrolysis, at other institutes but CEI research indicates that biological/enzyme-based recycling technology offers significant advantages over these.

In terms of the market for input material, plastic packaging and textile waste is not currently routinely recycled across the Solent region. There is a significant amount of plastic waste, which the CEI has the potential to create value from, as the technology further develops. Businesses providing alternative recycling technologies exist: GHS Recycling and Plastic Expert offer mechanical recycling services across the Solent Region. Enabled by its expansion, the CEI would look to engage with the businesses to identify challenges which plastic-recycling enzymes could resolve.

In terms of the life sciences/biotechnology industry, that any CEI associated spin-out companies would operate in, a report from University of Southampton from 2012 - 2013 indicated that there were 97 life sciences companies operating in the [Solent region](#). The [Solent Innovation Strategy](#) highlighted that the Solent falls behind the national average, at 17th for employment in the life sciences industry, though it is classed as an emergent market area with growth potential. In terms

of the wider southern England region, an Innovation South study commissioned as part of the [BEIS Science & Innovation audit](#) in 2017 highlighted the South of England as having outstanding strength in the biological sciences, with significant activity in high-tech enabling technologies.

The CEI would look to engage with industry in the area with relevant technology to a) support the development of plastic-recycling technology and b) support the development of industry technology with relevant expertise/facilities/equipment.

## 2.11 The CEI supporting “Building Back Better” from COVID-19

Throughout the COVID-19 pandemic, the CEI has continued to receive enquiries from companies interested in exploring collaborations. In addition, the local need for the project has accelerated during the COVID-19 pandemic and the associated lockdown. There has been considerable evidence of local improper disposal of single-use plastic PPE, particularly in public open spaces. In addition, due to Portsmouth's role as a popular day-trip site for coastal access and the increase in UK tourist travel associated with COVID limitations on international travel and closure of local entertainment services, there has been a significant increase in improper disposal of waste (most notably of single-use plastics) in the local area. This has been evidenced through the identification of more than double the amount of litter in Portsmouth's open public spaces compared to May 2019 and an increase in waste collection by Portsmouth City Council from 11 tonnes in May 2019 to 24 tonnes in 2020. In response, Portsmouth City Council have increased recycling provision with 33 new recycling bins on Southsea Common. Though this response is welcomed, Portsmouth City Council is still unable to collect and recycle problem plastics, in particular single-use plastics (including plastic packaging).

The expansion of the CEI will accelerate the development of the bio-recycling technologies to a point-of-scale up, to support local councils to collect and recycle problem plastics. Revolution Plastics at University of Portsmouth, of which the CEI are members, already has strong links with local stakeholders and a presence on the Portsmouth City Council Climate Board, with an aim to transform the way that Portsmouth makes, uses and disposes of plastic.

During the COVID pandemic, public interest in reducing plastic utilisation has also accelerated, as evidenced in Portsmouth by the opening of the "Plastic Free Larder" and successful crowd funding of the "SQUIDMOO" reusable packaging. Consumers are demanding less plastic waste and more sustainable provisions of products.

More widely, since the beginning of the COVID-19 pandemic, consumers have been demanding less plastic waste and more sustainable provision of products. Industry is struggling to respond to this, due to significantly reduced virgin plastic prices, in comparison with non-competitive current recycled plastic prices. Increased consumer awareness of the environmental impact of plastic packaging has accelerated during COVID, as has the demand for safe and hygienic packaging. Industry needs sustainable solutions for end-of-life packaging to sustain their competitiveness with consumers, whilst achieving environmental protection goals.

The responsiveness of industry to consumer desires has been limited by the global crash of oil prices during the COVID-19 outbreak to less than \$20 per barrel, associated with reduced manufacturing/industrial activity and the following recession. This reduced the price

competitiveness of non-fossil fuel based alternatives for plastic and also recycled PET. The demand for PET has decreased by 1.1% due to the reduced industrial activity, further enhancing the non-price competitiveness of the recycled plastic market. This has hugely impacted the movement of industry towards a circular economy of plastics and there have been reports of financial difficulties from major plastic recycling companies, due to reduced demand for their products. Solent LEP's investment in the CEI Expansion - Industrial Engagement Hub project offers an opportunity to accelerate the development of more cost-competitive recycling technologies.

In terms of the wider market, the British Plastic Federation have reported that confidence among plastic recyclers, polymer producers and recyclers is low for 2021, following the closure of 85% business sites during April 2020 with 22% of staff furloughed under the government scheme. Coupled with the business closures, in a survey on the impact of COVID-19, 50% of those surveyed expected a large decrease in exports sales in 2021 and were facing critical issues of cashflow, market closure and falling demand. The only market area which saw an increase in demand was in packaging supply. Sustainability of packaging was of limited interest at the beginning of the outbreak as packaging manufacturers and suppliers rapidly increased supply from fossil fuel, but sustainability is now seen as an essential part of their future strategy, due to the increasingly limited margins for their consumer goods industry customers.

The consumer goods industry has seen a significant change in demand related to COVID-19, leading to their rapid changing of business priorities. The closure of store environments led to a huge increase in demand for safe and hygienic packaging provision, associated with increased plastic demand. Due to supply challenges, consumers have significantly adapted their behaviour and have become increasingly less loyal to brands and due to the outlined above, increasingly valued sustainability as a key factor in their brand loyalty decisions. To return to growth, it is expected that CPG companies will need to focus their attention on improving and achieving their sustainability targets, particularly in regards to plastic packaging.

As a highly deliverable capital refurbishment project with confirmed local match funding, the CEI Expansion project will provide a stimulus to the local economy during the construction phase. Through expanding the CEI and creating an Industrial Engagement Hub, this project will directly support the government's ambition for a green recovery.

The CEI focuses on developing low green-house gas and low energy biological recycling solutions for plastic waste, reducing reliance on fossil fuels. The Industrial Engagement Hub will enable the CEI to accelerate support to industries involved in the green economy in the Solent, along with enabling wider industry partners to achieve their extended supplier responsibility and corporate sustainability objectives. This would support the Solent region to "build back better" from the COVID-19 lockdown.

Following the award of the Research England E3 funding and recruitment of a dedicated Innovation Fellow, the CEI are building a network of local, national, international and multinational industry partners. Investment from Solent LEP to expand the CEI and establish an Industrial Engagement Hub will create a unique environment for industry and academia to work together to shape, refine, develop and test the new technologies emerging from this ground-breaking research into commercial solutions with a ready exploitation route, attracting investment to the Solent area.

During the COVID-19 lockdown, the CEI has received interest from a number of new biotechnology start-ups who are interested in benefiting from the equipment, facilities and expertise that the CEI

offer. Through the expanded Industrial Engagement Hub, the CEI would look to expand this support to other emerging businesses and SMEs in the biotechnology sector to accelerate the commercialisation and exploitation of their technology and incorporating them into our support network where appropriate. The South East region has the second largest foreign direct investment (FDI) outside of London: with Portsmouth at the south eastern edge of the Solent region the CEI could expand FDI activity further across the Solent area, bringing together local and international companies. The expected impact is to further increase employment opportunities and economic development in the Solent region. The University of Portsmouth is currently conducting a study to identify the [impact of COVID on the local economy](#), including Hampshire and the Isle of Wight. The analysis of the results are not due to be completed until October 2020. The CEI will utilise this data on release to inform the areas of the economy requiring support from the expanded CEI.

## **2.12 Risks, issues, constraints, dependencies and mitigations to the Strategic case**

The Full Business Case has been written and the risks identified in the context of the COVID-19 situation and the University's experience of meeting challenges and continuing operations throughout the pandemic. The risk register will continue to be closely monitored as the University emerges from lockdown and adjusts to operating in a new "normal". This project will be able to draw on the experiences of the University in delivering similar projects, procuring goods and service and supporting stakeholders during the pandemic. The lessons learned (including the University's provision of on-site COVID testing of staff and students, deputisation charts to ensure continuity in the event of illness, adaptations to enable remote working, investment in software to facilitate medium- to long-term remote working) will be incorporated into the project management for the benefit of the CEI Expansion project.

Proceeding with the CEI Expansion - Industrial Engagement Hub project is dependent on securing the funding from Solent LEP and entering into contractual arrangements with our suppliers is contingent on our receiving the GFA from Solent LEP. The University routinely schedules capital refurbishment projects to be executed during non-teaching times, and the Estates department are skilled in planning, monitoring and managing projects to ensure minimal disruption to the University's core functions around the constraints of the academic timetable. Procurement constraints will be identified and routes to market mapped as the Procurement Plan is fully developed.

The project's progress against milestones/deadlines and its risk register will be routinely monitored as part of robust project management. The project governance arrangements set out clear reporting structures to allow for the Board to take oversight of the delivery of the project and its objectives, and to authorise resources to mitigate any issues that arise.

The CEI team are experienced in delivering projects of this nature, having recently successfully delivered the Research England E3 funded project which created the CEI. The CEI Delivery Group will include stakeholders from across the University bringing their expertise in disciplines such as Estates, Procurement, Finance, and Research and Innovation Services. This reflects the University's commitment to providing the necessary resources to enable the successful delivery of this project.

### 3. Economic Case

Plastic pollution remains a huge global issue and the UK is well placed to lead the development of technologies to tackle the problem. Recently published Government and industry-led strategies seek to address environmental issues surrounding plastics and to exploit the clear commercial opportunities for economic and jobs growth (25 Year Environment Plan, the Clean Growth Strategy, and DEFRA's blueprint for Resource and Waste Management). The CEI aligns with and supports this strategic direction-of-travel. The scale of the opportunity is demonstrated by the REBus project (WRAP), estimating that widespread roll-out of resource-efficient business models across the UK economy could increase the national Gross Value Added (GVA by £75bn by 2030).

Specific to the CEI, the global plastics market is enormous (\$654bn estimate by 2020, Grand View Research), with the UK a global leader in production (£23bn annually; 6,200 businesses; 170,000 jobs; 2<sup>nd</sup> largest employer in UK manufacturing). With companies incentivised through both legislation and lucrative emerging markets in recycled materials, the CEI is in a prime position to deliver innovative solutions to this high-growth sector: the global market for PET alone is expected to reach \$38m by 2023 (Allied Market Research). Crucially, aside from enzymes, no other technology currently exists that has the potential to produce high value commodity chemicals from mixed plastics waste.

While PET is one of the most common single use plastics, the CEI will develop enzymes that can break down some of the other most commonly polluting plastics, creating the possibility of huge positive environmental and commercial impacts. To realise this opportunity, the CEI will deliver commercially viable products and processes through its policy-aligned programme and industry-engaged pipeline structure. The inclusion of sector experts in its activities will ensure that industry-relevant commercial and technical design criteria are included at key stages of the CEI's scientific and technical development processes to deliver maximum potential for economic and jobs growth. The University considers that their additional investment into the CEI to support the development of the hub will deliver significant economic and societal benefits and clearly delivers its ambitions for research with impact and sustainability as set out in its Strategy 2025 and vision for 2030.

#### 3.1 Economic Impact and Value for Money

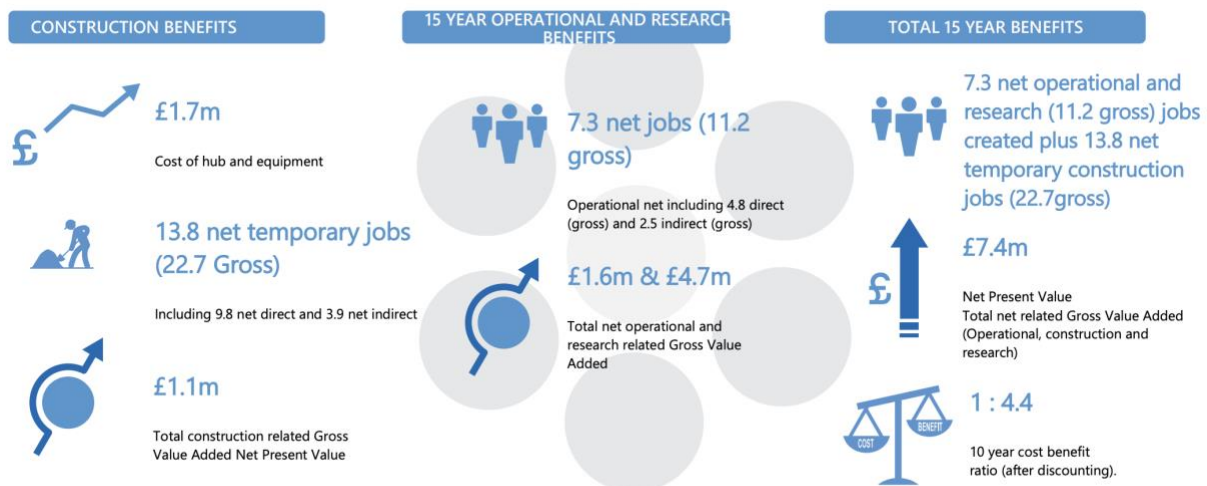
Kada Research were commissioned to undertake an Economic Impact Assessment for the University of Portsmouth (UoP) of an expansion for the Centre for Enzyme Innovation (CEI). The full economic impact assessment is included as appendix 2. Summaries of the project employment and GVA impacts are presented in Table 1. The EIA indicates that the project will result in the following impacts:

- 13.8 total net construction jobs (temporary) generating a total NPV GVA of £1.07m. There are 22.7 gross temporary construction jobs.
- 4.7 total net operational net jobs generating a total net NPV GVA of £1.6m. There are 7.6 gross operational jobs.
- 2.6 total net research net jobs and a total operational net NPV GVA of £4.7m. There are 3.6 gross research jobs.
- 15 year combined economic impacts (Total NPV GVA) of £7.4m. This gives a benefit cost ratio of 4.4 (i.e. for every £1 invested £4.40 is generated for the local economy).

**Table 1 Forecast impact of the Centre for Enzyme Innovation Industrial Engagement Hub. GVA – Gross Value Added. NPV – Net Present Value (Kada Research, 2020)**

	Gross Jobs	Net Jobs	Gross GVA over 15 years	NPV over 15 years
Operations (FTE)	7.6	4.7	£6,152,518	£1,630,285
Direct Jobs	5.0	3.1	£4,613,094	£1,222,371
Indirect and Induced	2.6	1.6	£1,539,424	£407,914
Construction (Temp)	22.7	13.8	£1,749,400	£1,073,813
Direct Jobs	16.2	9.8	£1,249,571	£767,009
Indirect and Induced Jobs	6.5	3.9	£499,829	£306,804
Research Impacts	3.6	2.6	£12,566,917	£4,691,740
Direct Jobs	2.4	1.7	£8,322,461	£4,321,006
Indirect and Induced	1.2	0.9	£4,244,455	£370,735
<b>Total GVA</b>			<b>£20,468,834</b>	<b>£7,395,839</b>
Direct Economic Impacts			£14,185,127	£6,310,386
Indirect & Induced Impacts			£6,283,708	£1,085,453

The Economic Impact Assessment (summarised In Figure 6) undertaken by Kada Research includes benefits related to construction jobs. If these construction benefits are removed and an Optimism Bias of 30% is applied, in line with HMT Green Book guidance, the resulting BCR value is circa 2.9 without including a number of wider benefits such as Knowledge Transfer Partnerships, new business R&D investment, low carbon, resource and energy efficiency and environmental benefits. Given the focus of this project on early stage technology readiness levels, this is a positive indication for the return on investment.



**Figure 6 Economic impact summary of the Centre for Enzyme Innovation Industrial Engagement Hub (Kada Research, 2020)**

### 3.2 Sensitivity and optimism bias

Several scenarios were tested to assess the effect of unfavourable events or circumstances and theoretical 'worst-case scenarios'. The UK Government has issued [guidance](#) on the treatment of optimism bias. The Green Book suggests a range for non-standard buildings of between 51% and 4% (a midpoint of 25-30% would seem reasonable). Even though some financial contingency is built in a pessimistic stress test on costs was conducted – a 30% increase comprised of. A less extreme cost increase of 15% was also tested.

As one of the biggest drivers of impacts is research, so a large decline in research income of 25% was explored. In reality such a large decrease over such as sustained period (i.e. 15 years) would be extremely unlikely given what we know about comparator facilities internationally and other UK R&D projects. Persistence is also one of the largest drivers of change. Again, given the life span of the proposed capital equipment (25 years plus) a lower persistence is probably an unlikely scenario but the effect of a 10-year horizon has been assessed. These scenarios might be useful for looking at lost income from economic shocks such as major recessions, earthquakes, terrorism or pandemics. The results for the suggested stress tests for the project were as follows:

- A 15% capital expenditure increase would modestly reduce the net return on investment from 1:4.4 to 1:3.8 (A substantial 30% increase would decrease the Benefit-Cost Ratio (BCR) to 3.3)
- The effects of a substantial decline in research expenditure by 25% would reduced the BCR from 4.4 to 3.3.
- Reducing the persistence to 10 years reduces the BCR to 3.0.



Table 2 Summary of financial costs, gross value added (GVA) and Benefit-Cost Ratio (BCR) across 5 different scenarios

Lifetime cost benefit (original 15 years)	Financial costs	GVA	BCR
Gross	£1,700,000	£20,468,834	12.0
NPC/NPV	£1,700,000	£7,395,839	4.4
<b>15% capex increase</b>			
Gross	£1,955,000	£20,468,834	10.5
NPC/NPV	£1,955,000	£7,395,839	3.8
<b>30% capex increase</b>			
Gross	£2,210,000	£20,468,834	9.3
NPC/NPV	£2,210,000	£7,395,839	3.3
<b>25% reduction in research income</b>			
Gross	£1,700,000	£15,351,626	9.0
NPC/NPV	£1,700,000	£5,546,879	3.3
<b>10 year persistence</b>			
Gross	£1,700,000	£12,287,418	7.2
NPC/NPV	£1,700,000	£5,117,472	3.0

### 3.4 Options Appraisal

In line with HMT Green Book Guidance we have considered a shortlist of credible options:

- a. Do nothing - CEI remains at minimal capacity created by Research England E3 funding.
- b. Expand CEI to include polymer analysis and synthesis laboratories only - (cost £1,699,800).
- c. Expand CEI to include bio-recycling laboratory and industrial engagement hub only - (cost £1,000,200).
- d. Expand centre to include polymer analysis and synthesis laboratories, bio-recycling laboratory and innovation suite (large expansion) - (cost £1.7m).
- e. Expand centre to include three laboratories as in option d, with additional specialist capital equipment for the three laboratories and improved postgraduate activity - (cost £2.7m).

The impact model was used to assess the short-list of credible options Option D was selected as the most preferential in terms of the benefit cost ratio and in terms of the wider industrial benefits achieved.



The preferred option (d) was presented to the University's Executive Planning Group and approved on 14th May 2020 because of its strong alignment to the University's Strategy 2025, confidence about deliverability, long term return on investment and impact on the region.

The options list was reviewed in light of the impacts of COVID-19 in increasing the use of problem plastics and decreasing the desirability of recyclable/recycled alternatives for single-use plastics, as demonstrated in our previous responses. The expansion of the centre to include all three new laboratories and the Industrial Engagement Hub was seen as the best way to rapidly accelerate the adoption of the bio-recycling enzymes in a feasible timescale to tackle current industry sustainability challenges and to facilitate a green recovery from COVID-19.

**Table 3 Options Appraisal of five different options for expansion of the Centre for Enzyme Innovation (see section 3.4 for details of the options)**

	Option A	Option B	Option C	Option D (Preferred)	Option E
	NPV over 15 years	NPV over 15 years	NPV over 15 years	NPV over 15 years	NPV over 15 years
Operations (FTE)	£0	£0	£815,143	<b>£1,630,285</b>	£1,630,285
Direct Jobs	£0	£0	£611,185	<b>£1,222,371</b>	£1,222,371
Indirect and Induced	£0	£0	£203,957	<b>£407,914</b>	£407,914
Construction (Temp)	£0	£1,073,813	£631,781	<b>£1,073,813</b>	£1,705,468
Direct Jobs	£0	£767,009	£451,272	<b>£767,009</b>	£1,218,191
Indirect & Induced Jobs	£0	£306,804	£180,509	<b>£306,804</b>	£487,277
Research Impacts	£0	£2,815,044	£1,407,522	<b>£4,691,740</b>	£7,037,611
Direct Jobs	£0	£2,592,604	£1,296,302	<b>£4,321,006</b>	£6,481,509
Indirect and Induced	£0	£222,441	£111,220	<b>£370,735</b>	£556,102
<b>Total GVA</b>	<b>£0</b>	<b>£3,888,857</b>	<b>£2,854,446</b>	<b>£7,395,839</b>	<b>£10,373,364</b>
<b>Direct Economic</b>	<b>£0</b>	<b>£3,359,613</b>	<b>£2,358,759</b>	<b>£6,310,386</b>	<b>£8,922,071</b>
<b>Indirect &amp; Induced</b>	<b>£0</b>	<b>£529,244</b>	<b>£495,686</b>	<b>£1,085,453</b>	<b>£1,451,293</b>
<b>BCR</b>		<b>2.3</b>	<b>2.9</b>	<b>4.4</b>	<b>3.8</b>

### 3.5 Risks, Dependencies and Constraints to the Economic Case

The Economic Impact Assessment included a stress test of the BCR with increased capex costs of up to 30% and decreased research income of up to 25%. However, the risks associated with capex and research income for this project have not yet been increased. The risk register and FBC were developed in the context of the pandemic, incorporating our current learning from continuation of operations during the pandemic. We have seen an increase in research funding activity and success rates related to projects responding to the challenges faced by society because of COVID-19. The

risk register will be regularly updated, informed by our experience of delivering similar capital projects during the pandemic.

The dependencies and constraints will be updated as the project progresses.

## 4. Commercial Case

### 4.1 Project Description

This project will double the current size of the CEI and deliver three additional laboratory facilities specialising in polymer analysis, polymer synthesis, and biorecycling. In addition, this project will create an Industrial Engagement Hub as a focal point to facilitate interaction between researchers and industry collaborators. The total cost of the project is £1.7m comprising the following:

- Estates refurbishment, including Industrial Engagement Hub: £1.20m
- Specialist equipment for Polymer Synthesis Laboratory: £0.22m
- Specialist equipment for Biorecycling Facility: £0.28m

The total project cost: £1.70m

### 4.2 Market exploration and testing

Following the securing of the Research England E3 grant which funded the creation of the CEI, the University of Portsmouth Advancement & Marketing department commissioned Graham Pelton Consulting to perform a philanthropic study of the future potential for research in plastics at University of Portsmouth. The findings of this with 24 local and international industry stakeholders identified that:

- Enzymes research at Portsmouth was of significant interest to the consulted stakeholders
- Most of the consulted stakeholders were interested in establishing a commercial relationship with the CEI. Securing these relationships was seen as opening up the potential to philanthropic funding. Establishing an innovation hub should accelerate the CEI ability to sustain relationships and secure funding
- Industrially-funded PhD studentships and research funding through contract research was of highest interest. The Solent LEP funding would expand CEI capacity to conduct this type of work with industrial partners
- Other feedback indicated the requirement for the CEI to expand to include solutions for novel bioplastics. The expansion including a polymer analysis laboratory would enable early-stage research into solutions for that area
- It was noted that particular interest in funding the centre would be through a focus on specialist equipment that is unique and distinct, as demonstrated in the expansion plan for the bio-recycling laboratory
- Another stakeholder queried if the University of Portsmouth aspired to develop infrastructure where it is currently lacking against competitors, or grow areas of strength to influence collaboration. The expansion of the centre would enable the CEI to bring together world-class facilities, not seen together elsewhere, coupled with an Industrial Engagement

## Hub to accelerate the capacity for collaborative projects

In late 2019, the CEI partnered through a Research Collaboration with a company. The company was interested in small-scale fermentation solutions. An expansion of the bio-recycling laboratory would enable experimentation with different solutions for scaling to industry, expanding the offer available for future partners. In addition, other project scoping activity has indicated the willingness of large consumer goods companies to consider altering the compositions of chemical polymers in their packaging to support bio-recycling. The polymer analysis and synthesis suite, coupled with the bio-recycling suite for experimentation with scaling, would enable the CEI to support industry to improve the recyclability of their packaging, in a way that it is currently unable to.

### 4.3 Breakdown of project costs

The £1.7m total project cost consists of £1.2m capital refurbishment of an existing University building (St Michaels Old Building) which will effectively double the floorspace of the existing CEI, plus £0.5m of specialist capital equipment for the laboratories created through the refurbishment.

A full breakdown of the estimated £1.2m refurbishment costs has been provided by Gleeds, a global property and construction consultancy, in April 2020 (see appendix 3).

The specification for the specialist capital equipment for each of the labs will be refined as a work stream of the Delivery Group, according to the project timescale. The detailed cost breakdown of the capital equipment will then inform the procurement plan for the equipment.

### 4.4 The University's Experience Delivering Capital Projects

The University of Portsmouth has expertise and experience in managing diverse and complex projects as evidenced by the successful completion of a number of projects delivered on time and on budget. Three specific examples include:

- The University of Portsmouth's Eye Clinic estates project was delivered successfully two weeks ahead of schedule, and under budget.
- The original Centre for Enzyme Innovation (CEI) project was delivered on time and on budget in January 2020, evidencing our ability to direct appropriate resources in a timely manner to deliver a project involving £1.2m refurbishment to construct laboratory space and procurement of £1.6m state-of-the-art capital equipment.
- As an example of delivering business support, the University successfully delivered the Wave 2 Growth Hub project funded by the RGF programme. It was allocated additional funding in recognition of its achievement of existing targets and ability to disburse additional funding and increase engagement. At the end, the project exceeded its targets, including creation of new jobs in local businesses supported. The Managing Authority for this programme commended UoP for its governance of the project.

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. 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.

#### 4.5 Procurement Plan for this Project

Importantly, a stakeholder from the University's Procurement department will be part of the CEI Expansion project's Delivery Group to ensure that all contracts are procured in line with University procedures. The Procurement Officer for this project will guide the project team in developing a procurement plan for each element of the project. The procurement plan will map the timing of procurement activities to align with overall project milestones to ensure that the specialist equipment is ready to be delivered, installed and commissioned as soon as the capital refurbishment is complete and the building is handed over.

The detailed procurement plan will be developed as a work stream within the CEI Expansion Delivery Group. The development of this procurement plan will be led by the Procurement representative on the Delivery Group to ensure that this project maintains the University's compliance with the Public Contracts Regulations 2015 (PCR 2015) and that procurement activity is conducted in accordance with the EU Treaty Principles of transparency; mutual recognition; proportionality; equal treatment and non-discrimination.

The requirements of PCR 2015 underpin the University's financial regulations, as expressed in the Procurement Manual. To ensure we comply with the regulations we use either existing frameworks that have been established by bona fide providers and that have been set up specifically to provide a route to market that complies with PCR 2015, or if there isn't one available we conduct a compliant tender exercise for the requirement.

The timeline for each purchase of capital equipment will be determined taking into account the product, market size, value, complexity of the equipment, site survey requirements, and potential demonstration requirements. Each item of equipment will be assessed to determine the most appropriate route to market, which will then be mapped to create an order of purchase for the CEI Expansion project. The project team are skilled in procuring this type of equipment, having successfully procured the capital equipment for the creation of the CEI which opened earlier this year.

In all procurement activities, the project team will adhere to the following from the University of Portsmouth Purchasing Manual.

*"The Procurement Manager has delegated authority from the Director of Finance for delivering the UoP's Procurement processes, which are commensurate with the value of the project or purchase. For projects <£24,999 (incl VAT), a minimum of three written quotes is required; >£25,000 (incl VAT), projects are advertised on Contracts Finder/Intend; if the Official Journal of the European Union (OJEU) threshold is exceeded, full OJEU process applies. For building projects between £100,000 - £500,000 and equipment over OJEU levels, competitive bids are normally required from at least five contractors. Award of a contract is completed via In-Tend and also utilising the University authorising*

*structures. Formal Purchasing Procedures forbid the pre-selection of suppliers and any conflict of interest must be declared. For all tenders, the Procurement team assesses the winning bidder based on the overall 'Most economically advantageous tender', taking into account all criteria, not just price. The Procurement Manager may approve the use of purchasing consortium-negotiated agreements and other national agreements under specific circumstances. Scientific equipment <£15,000 is written off in the year of acquisition. All other equipment is capitalised, stated at cost and depreciated over its expected useful life (5 or 10 years)'".*

The procurement plan, once developed, will identify and map the appropriate method of procurement for each element that makes up the £1.7m total project costs. For each item of capital equipment, the most appropriate route for procurement will be determined, including advertising through OJEU for those items which meet the OJEU threshold and identification of the most appropriate purchasing framework for sub-OJEU equipment. Appropriate milestones will be built into the project delivery plan for each route to market identified.

Procurement for the goods/services related to the £1.2m refurbishment will follow the UoP standard Estates protocols for procuring. 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 the Finance Committee for monitoring purposes, including the final costs of completed projects.

This project involves the refurbishment of an existing building which is owned by the University. Procurement will therefore be for goods/services required for refurbishment of the existing building and new specialist capital equipment for the laboratories created. The detailed procurement requirements for each element will be developed as part of the procurement plan. The University has experience of procuring specialist equipment to exacting timescales, having recently procured specialist equipment for the CEI and currently on track to procure specialist equipment for its new Centre for Creative and Immersive XR, the latter occurring in the midst of the COVID pandemic.

There is a developed market for the goods and services which we need to procure for this project, and the University has experience of procuring from these markets through its ongoing extensive estates refurbishment plan (for capital refurbishment of buildings) and through the creation of the CEI which opened in Jan 2020 (for specialist capital equipment for the laboratories).

## 4.6 Monitoring and evaluation of the CEI Industrial Engagement Hub

The CEI Management Group will undertake continuous monitoring and evaluation of the performance of the CEI Expansion project against its implementation plan. Progress toward achieving the specific deliverables will be reported to the CEI Board which reviews and approves financial reports and KPI performance and can allocate resources to mitigate risks.

The named contact responsible for this ongoing monitoring and evaluation will be the CEI Operations Director, Professor Andrew Pickford, who will chair both the CEI Delivery Group and CEI Management Group. Support will also be provided by the University's Research and Innovation Services (RIS) which has experience of ongoing monitoring and reporting for RGF, LGD and ERDF funded projects. These are existing University posts.

Further analysis of specific business/research impacts, created by the research and innovation outputs of the CEI will be reported on PURE, the University's research information system, for submission into the Research Excellence Framework (REF). The CEI Innovation Fellow, Rory Miles, works to track & facilitate the creation of impact of all outputs from the CEI, accelerating this through their membership of the Faculty for Science & Health impact working group. In addition, the University of Portsmouth is assessed annually in the Knowledge Exchange Framework (KEF). This is coordinated by the Deputy Director Business & Commercialisation in Research and Innovation Services, who also sits on the CEI Board. Through the CEI submission into the KEF, Research England, will assess the performance of the University of Portsmouth against seven perspectives of social, economic, community and cultural impact. The results of the KEF and the required action plan will support the continual improvement and understanding of the CEI offer to accelerate the impact of the Solent LEP funded expansion.

The CEI Innovation Fellow is a new post initially funded through the successful Research England investment in the CEI. The CEI will be subject to the University of Portsmouth's rolling programme of external auditing.

## 4.7 Risks, issues, contingencies, dependencies and mitigations to the Commercial Case

Specific monetary contingencies have not been allocated to the risks, in accordance with the UoP's standard operating procedures for projects of this type. However detailed estimates commissioned through external consultants use a 15% contingency and 3.3% works inflation rate. Financial planning and associated cash flows estimates will include these contingent elements.

Furthermore the UoP is a diverse and large institution that manages risk through risk registers, and has a level of autonomy that allows us to manage our cashflow. Therefore, specific monetary contingencies do not need to be allocated to specific risks associated with a project of this scale. Ultimately, the University has confirmed that any additional costs will be borne by the University.

There is a developed market for the goods and services which we need to procure for this project, and the University has experience of procuring from these markets through its ongoing extensive estates refurbishment plan (for capital refurbishment of buildings) and through the creation of the

CEI which opened in Jan 2020 (for specialist capital equipment for the laboratories). No statutory obligations or dependencies have been identified which need to be met before procurement can commence. However, the GFA from Solent LEP needs to be in place before contracts can be awarded to suppliers.

Throughout the COVID-19 pandemic, the University has maintained continuity of operations, including continuity of Procurement and Contracting Departments. The lessons learned from maintaining continuity during this pandemic will be incorporated into the University's standard operating procedures to ensure continuity in future.

The University has a number of other capital refurbishment projects which have been undertaken throughout the COVID-19 pandemic, and the learning from these projects (including experience of procuring from various markets and suppliers) will inform the ongoing assessment of supply chain risks and stresses.



## 5. Financial Case

### 5.1 CEI Expansion - Industry Engagement Hub costs

Investment in the CEI Expansion - Industrial Engagement Hub project will double the current size of the CEI, through further refurbishment of floor two of the Old St Michael's building, and deliver three additional laboratory facilities specialising in polymer analysis, polymer synthesis, and biorecycling. In addition, this project will create an Industrial Engagement Hub as a focal point to facilitate interaction between researchers and industry collaborators. The total cost of the project is £1.7m comprising the following:

Estates refurbishment, including Industrial Engagement Hub: £1.20m

Specialist equipment for Polymer Synthesis Laboratory: £0.22m

Specialist equipment for Biorecycling Facility: £0.28m

The total project cost: £1.70m

The capital refurbishment estimates were provided by Gleeds, a global property and construction consultancy, in April 2020. This cost breakdown has been provided as an appendix 3. The project costs have been based on list prices and likely discounts based on previous procurement of similar equipment. UoP is required to secure value for money through procurement exercises. Specialist equipment cost estimates are based on published list prices less discount margins similar to discounts we have achieved previously during competitive procurement exercises for similar equipment. The University already owns the extensive specialist equipment for the Polymer Analysis Laboratory, and this will be moved into the newly refurbished space and recommissioned once the refurbishment is completed.

The University is seeking investment of £1m from Solent LEP towards the expansion of the CEI. The University's funding is confirmed in the letter of support dated 02.09.2020.

The University is in discussion with additional interested philanthropic donors who may wish to invest in the project, and the University is committed to providing the remaining funding to enable the CEI expansion project. To develop a philanthropic strategy for Plastics at University of Portsmouth, Graham Pelton Consulting, were commissioned to conduct an assessment. This assessment was coupled with the establishment of an Advancement & Alumni team for seeking and supporting philanthropic activity. The CEI are working closely with the newly appointed Associate Director of Alumni & Advancement to develop a philanthropy strategy and secure opportunities. This strategy will inform our approach to potential donors, details of which cannot be shared at this point for confidentiality reasons. If the University are successful in securing additional investment, the match funding is likely to be a mix of public and private funding.

### 5.2 Overall Affordability to the University of Portsmouth

The University is committed to providing match funding for this project and has considered to its satisfaction that the impact of the CEI Expansion - Industrial Engagement Hub 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. The University will be responsible for any cost overruns, as confirmed the letter of support dated 02/09/2020.



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

### 5.3 Risks, issues, dependencies and mitigations of the Financial Case

Table 4 Financial Risk Matrix

Risk	Likelihood	Impact	Risk Rating	Mitigation	Risk owner	Date reviewed /closed
<b>Financial Risks</b>						
Lack of financial resources to complete project	low	high	medium	Availability of required resource established prior to commencing project.	CEI Director	31.7.2020
Failure of sub-contractors resulting in increased time and cost	Low	medium	low	Financial checks undertaken as part of the due diligence on key suppliers as part of the procurement process. Strong project management from an experienced Estates team.	Estates	31.7.2020
Building costs exceed budget	Low	medium	low	Standard University allowance for cost contingency to cover unexpected additional costs. The considerable experience of the Estates team will be used to ensure work is completed on time and to project budget.	Estates	31.7.2020
Equipment not purchased or supplied in time for spend deadline as a result of a delay in decisions, approvals, tendering or delivery	Low	medium	Low	Procurement Officer to sit on Delivery Group to ensure realistic procurement plan timelines and identify procurement milestones are identified. Monitor installation times closely to achieve target delivery dates. Close project management.	CEI Director	31.7.2020

The University has sought independent legal advice to confirm that there are no state aid issues to address, extract below:

*“ It is considered that there are robust arguments to the effect that the funding will not raise state aid issues based on UoP amounting to a research organisation and the activities to which the funding is applied being non-economic in nature where undertaken by a research organisation (and thus outside of the ambit of the State aid regime) or purely ancillary economic activity (when looking at the overall capacity of UoP in terms of it engaging in both non-economic and economic activities) and thus also outside of the ambit of the State aid regime. “*

It is common practice for the University to cash flow some externally funded projects with the requirement to evidence defrayed expenditure before the funding is claimed. The University has assessed to its satisfaction that this project will not negatively impact the University's cash flow.

Costs forecasts will be monitored on an ongoing basis throughout the delivery of this project, as part of UoP's robust project management approach. The University is required by statutory provision to set a sustainable annual budget which includes assessment of borrowing requirements. No specific borrowing is being sought to support this investment.

As part of the initial project review a risk register and risk assessment has been conducted. This includes additional financial risks associated with cost overruns, procurement failure and commissioning issues. The University can confidently meet the assessed financial risks highlighted as part of this work.

## 6. Management Case

### 6.1 The University's Approach to Management

The University of Portsmouth has a successful track record of delivering projects on time, within budget and in accordance contract management arrangements in ensure the delivery of benefits. The University is investing in this project to further the strategic ambitions of the University. In addition to providing management expertise and support to delivery of the project.

The University's Executive Planning Group approved investment in the CEI expansion on 14th May 2020 because of its strong alignment to the University's Strategy 2025, confidence about deliverability, long term return on investment and impact on the region. The Acting Vice-Chancellor has confirmed the University's support in his letter dated 02.09.2020.

### 6.2 CEI Governance and Reporting Arrangements

The CEI Board is accountable to the Faculty Research and Innovation Committee (FR&IC) for the Faculty of Science and Health and reports annually to the Pro-Vice Chancellor Research and Innovation (PVC R&I) on its knowledge exchange and impact activities, the quality of its research outputs, and its evolving strategic direction. The CEI Director, Prof John McGeehan, provides academic and strategic leadership to deliver sustained growth of research excellence in the CEI and develops it's inter/national profile. The Operations Director, Prof Andy Pickford, is responsible for overseeing the academic and scientific management of the CEI and for ensuring maximum benefit from, and alignment with, the wider UoP resources and support. Dedicated administration and project management is provided by the CEI Centre Manager, and the Finance Officer provides financial management support.

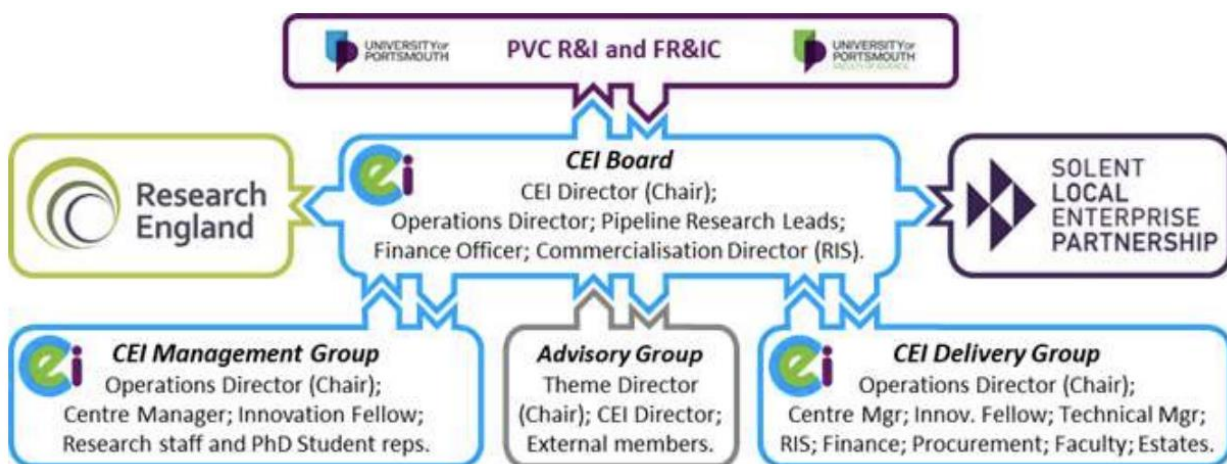


Figure 7 The proposed governance structure of the Centre for Enzyme Innovation

The proposed governance structure for the CEI is depicted in figure 7. In brief, it comprises:

- The CEI Board is responsible for the strategic direction of the CEI and oversees the milestones, financial performance and overall project delivery. It reviews and endorses scientific progress, sets research, innovation and exploitation strategy and priorities, as well as reviews and endorses grant submissions, partnerships and collaboration proposals. It reviews and approves financial reports, resource and risk mitigation plans, and also monitors and reports on the CEI's KPIs and performance in general.
- The CEI Management Group meets to: review the delivery of the project plan and milestones; manage financial, resources, projects and risks; monitor innovation/exploitation opportunities and relationships with collaborators/partners; and ensure website/marketing and communications are fit for purpose.
- The CEI Advisory Group provides an external perspective and guidance to the CEI, independently reviewing its performance, as well as advising on the CEI research, engagement, income and impact generation strategies and priorities. The group is chaired by Prof Adrian Hopgood, Director of the UoP's Future Emerging Technologies theme.
- The CEI Delivery Group will be chaired by the CEI Operations Director, Prof Andy Pickford, and will be tasked with ensuring the progress of the project through all project milestones. The CEI Operations Director has extensive experience of delivering similar projects, having project-managed the successful delivery of the first phase of investment to create the CEI, including design of the £1.2m Enzyme Engineering laboratories and the procurement of £1.5m in capital equipment. The Operations Director will be assisted by various stakeholders in the Delivery Group, including colleagues from Faculty, Finance, Procurement, Estates, and Research and Innovation Services (RIS). The Innovation Fellow with a responsibility for Industry Engagement will also serve on the Delivery Group to ensure that industry needs are considered throughout the planning and delivery of the CEI expansion project.

The CEI Board will take overall responsibility for delivery of the CEI Expansion project and achievement of its KPIs. The CEI Delivery Group will be tasked with planning and executing the various work packages involved in delivering this project. The Delivery Group will closely monitor all aspects of progress and expenditure and report into the CEI Board. The CEI Board will authorise any necessary mitigations to assure the project is delivered within scope and on time.

A project timeline outlining key milestones to ensure deliverability by March 2022 is provided as appendix 4.

## 6.4 Risks, issues, dependencies and mitigations of the management case

Robust project management will be undertaken at all times to monitor progress, identify risks, and implement mitigations where necessary. The operational and strategic risks that have been identified, along with mitigating measures put in place, are detailed below. Note that the financial risks are shown in the Financial Case section.



Table 5 Management Case Risk Matrix

Risk	Likelihood	Impact	Risk Rating	Mitigation	Risk owner	Date reviewed /closed
<b>Operational Risks</b>						
Planning risk - Risk that implementation of CEI fails to meet planning permission conditions, or requires greater costs to meet conditions	low	low	low	Not applicable, as planning permission is not required as this is a refurbishment of an existing University building.	n/a	31.7.2020
Environmental risk - Risk that nature of the project has a major impact on an adjacent area and there is an objection from the public	low	medium	low	All work will be within the University building, so impact on the surrounding environment will be minimised. Environmental impact of increased visitors to the site will be minimised through the University's commitment to becoming carbon positive, and by following University policies when advising visitors to choose environmentally responsible methods of travel to the University.	Estates	31.7.2020
Construction risk - delays in construction and handover	low	medium	low	Estates will appoint a project manager to oversee the construction and handover.	Estates	31.7.2020
Delays to operations while staff are waiting to be trained to use specialist equipment	low	medium	low	Training of staff to be built into the supply and commissioning contracts and scheduled into the project milestones.	CEI Director	31.7.2020
Contractual risk - clawback of all or part of LEP funding due to breach of grant agreement terms and conditions	low	high	medium	Project Manager will ensure project is delivered in a manner that is compliant with the terms of the GFA. Implementation Plan will provide blueprint for delivering contractual obligations. The CEI Board will closely monitor KPIS against contractual terms and conditions, and authorise mitigations actions if needed.	CEI Director	31.7.2020
Contractual risk - clawback of all or part of LEP funding due to failure to comply with publicity regulations	low	high	medium	Project team will ensure publicity and logo requirements from Solent LEP are forwarded to Estates and Marketing to ensure publicity requirements from the outset.	CEI Director	31.7.2020
Catastrophe Risk - Unpredictable risks such as natural disasters, technological disruption, unexpected policy changes and other unforeseen occurrences, cyber security attacks	low	medium	low	UoP has an institutional approach to mitigations and responses to a variety of risks, including catastrophes. The CEI will follow institutional guidelines in responding to catastrophe and ensuring continuity of operations as much as is possible. Adhere to institutional cyber security procedures at all times. Incorporate learning from previous catastrophes into procedures for future responses.	CEI Director	31.7.2020
Pandemic risk - Unpredictable risk such as global/national/regional pandemic/epidemic causing disruption to operations through lockdown or mitigation measures	high	medium	high	Follow institutional guidelines for responding to pandemic. Lessons learned from COVID-19 pandemic will inform and be incorporated into planning for operational continuity, including remote working.	CEI Director	31.7.2020
<b>Strategic Risks</b>						
Loss of key strategic staff	low	medium	low	Strong professional development and career advancement prospects for CEI personnel.	CEI Director	31.7.2020
Failure to develop key strategic partnerships with industry	low	medium	low	Implement a stakeholder engagement plan focusing on relationship management to ensure partners are engaged and valued. Appointment of Innovation Fellow to drive industry engagement.	CEI Director	31.7.2020
UoP/CEI fails to deliver its commitments and cannot meet objectives, resulting in reputational risk with funder(s)	low	high	medium	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 remedial action will be taken should it be required.	CEI Director	31.7.2020
Regulatory Risk - Risk a change in the law or regulations will affect the costs or benefits of the project	low	low	low	Strong strategic alignment of continuing operations of CEI, feedback from industry to inform future direction, positions of key CEI personnel on policy influencing organisations.	CEI Director	31.7.2020

The robust project management approach adopted by the University requires close monitoring to mitigate project overruns, particularly as the University routinely delivers its capital refurbishment projects within the constraints of the academic timetable in order to minimise disruption to its students and core activities. There have been no risks identified to date in the project timescale that would jeopardise completion of this project by March 2022. The risks will be closely monitored and mitigated throughout delivery of this project.

The CEI labs were closed for almost 5 months (March 23rd to August 17th) as the University entered

lockdown in line with government guidelines. Although this impacted the ability to do bench-based research, staff and students continued with manuscript and grant writing activities remotely. Governance for the CEI and indeed the University as a whole was unaffected, with board meetings taking place as scheduled, by video conference rather than in person.

The University has implemented a robust COVID-19 Programme Management Team which considers all operational implications and resolutions for Covid-19 impacts on all aspects of University activity and takes a risk-based approach which is regularly reviewed at a senior level within the organisation.

The risk register for this project has been developed during the COVID-19 pandemic, in the context of the University's experience of continuing operations throughout lockdown. The University's commitment to expanding the CEI has remained firm throughout the pandemic, as evidenced by the letter confirming match funding dated 02/09/2020. The interest expressed by potential industrial partners has continued throughout the pandemic, and the potential for the CEI to contribute to a green recovery has, if anything, been heightened by COVID-19, as previously explained in depth.

The UoP Estates department has confirmed that there will not be a need for planning applications or other consents for this project. The University owns and is the sole occupier of the building therefore landlord consent is not required, and works do not involve a change of use. There are no material changes within the proposal to the appearance of the buildings therefore planning approval is not required. The works will require sign off from an independent building control advisor which will be part of the contractor's package of works to arrange.

*Appendices 1-4 have been redacted, due to commercial sensitivity*