

STATE OF THE RELATIONSHIP

REPORT 2018

GROWING COLLABORATION:
STATE, SHAPE, SUSTAIN

The National Centre for Universities and Business

*Promoting business-university collaboration for
a prosperous and inclusive economy and society*

The National Centre for Universities and Business (NCUB) is an independent and not-for-profit membership organisation that promotes, develops and supports university-business collaboration across the UK.

Compiled and edited by:
Sarah Cowan

Introduction



This is the National Centre's fifth annual assessment of the health of the partnerships between business, higher education institutions, UK government, devolved administrations, and their agencies. Much has changed since last year, with the establishment of UK Research and Innovation (UKRI) to oversee a substantial increase in funding and integration of purpose, and, in England, the launch of the Office for Students (OfS), a new regulator dedicated to ensuring that students have a rich experience from their university and college education.

The broader context is also changing, with a new emphasis on industrial strategy, grand challenges, devolution at city-region level, the patient capital review, and preparing for Brexit. Across the UK, policy makers have focussed on knowledge-exchange between universities and businesses, and the UK Government has committed itself to growing R&D to 2.4% of GDP by 2027.

There are persistent concerns among businesses about skills (including skilled migrants) and long-run productivity and competitiveness that require the kinds of relationships documented in this report. Our members and funders are responding to these challenges with a range of exciting, strategic, focussed, and transformational projects, collaborations, funding calls, fresh thinking on pedagogy and student support, as well as a stronger focus on place-based research and innovation.

Growing Collaboration is at the heart of the NCUB's mission, and its members continue to show how to do it best.

Handwritten signature of Sam Laidlaw in black ink.

Sam Laidlaw
Chairman

Handwritten signature of David Docherty in black ink.

David Docherty
Chief Executive

01. STATE OF THE RELATIONSHIP	06
Ten years of problems, conundrums and solutions in business-university collaboration	07
Collaboration Progress Monitor - 2018 update	10
02. SHAPE OF THE RELATIONSHIP - The changing state of higher education	14
Closing the skills and talent gap to deliver on the industrial strategy	16
Pearson College London	18
New College Durham	19
Coventry University	20
BT	21
Bangor University	22
Imperial College London	23
Falmouth University	24
Linklaters	25
University of Chester	26
Capgemini	27
Manchester Metropolitan University	28
Provider, employer and learner: the changing dynamic	29
03. SHAPE OF THE RELATIONSHIP - Local business impact	30
Strengthening Places – supporting local excellence	32
Leeds Beckett University	34
Aston Business School	35
Canterbury Christ Church University	36
University of Nottingham	37
Keele University	38
SETsquared	39
University of Exeter	40
Anglia Ruskin University	41
Nottingham Trent University	42
Sheffield Hallam University	43
University of Sussex	44
HSBC	45
Ørsted	46
The University of Sheffield	47
Sensor City	48
University of Hertfordshire	49
University of Gloucestershire	50
University of Glasgow	51
Making the Connection – a new national innovation compact for Wales	52
04. SHAPE OF THE RELATIONSHIP - Driving solutions	54
Accelerating Patient Capital	56
Cardiff Metropolitan University	58
Abertay University	59
EDF Energy	60

Queen Mary University of London	61
GSK	62
The Institute of Cancer Research	63
Heriot-Watt University	64
Cardiff University	65
Ulster University	66
University of St Andrews	67
University of Surrey	68
University of Leicester	69
University of Southampton	70
Cisco	71
Value in a Knowledge Exchange Framework	72

05. SUSTAINING THE RELATIONSHIP - Safeguarding the future 74

Shaping and sustaining the future: a new chapter for research, innovation and collaboration in the UK	76
Design Council	77
University of York	78
London South Bank University	79
University of Warwick	80
Interface	81
Cranfield University	82
University of Hull	83
University of Brighton	84
University of Bath	85
UCL	86
Jisc	87
Loughborough University	88
University of Birmingham	89
LSE	90
AON	91

06. SUSTAINING THE RELATIONSHIP - People and wellbeing 92

University of Portsmouth	94
City, University of London	95
Sage	96
KPMG	97
Royal Academy of Engineering	98
University of Dundee	99
AstraZeneca	100
University of South Wales	101
University of Oxford	102
University of Plymouth	103
University of Huddersfield	104
Bournemouth University	105

NCUB Members 106



01

STATE OF THE
RELATIONSHIP



Putting Humpty together? Ten years of problems, conundrums and solutions in business-university collaboration

ARTICLE BY DAVID DOCHERTY

**The fault, dear Brutus, is not in our stars,
But in ourselves...**

Julius Caesar, Act I, Scene III

In spring 2009, I was appointed CEO of the Council for Industry and Higher Education, the NCUB's precursor, and spent the subsequent nine years working through the implications of The Lambert Challenge and The Laidlaw Conundrum. I named these after the authors and Chairs of early Task Forces on University-Business collaboration: Richard Lambert's 2003 government review, and 2008-9's CBI report, chaired by Sam Laidlaw (both subsequently board members of the NCUB).

Over the years, we ran our own Task Forces on the creative and technology industries, manufacturing and engineering, food, digital health, and the innovation systems across the UK. And time and again we returned to the same set of issues, albeit with new answers and recommendations.

The problem at the heart of The Lambert Challenge is increasing innovation capacity in business. As he notes in his review:

The biggest challenge...lies on the demand side. Compared with other countries, British business is not research intensive, and its record of investment in R&D in recent years has been unimpressive. UK business research is concentrated in a narrow range of industrial sectors, and in a small number of large companies. All this helps to explain the productivity gap between the UK and other comparable economies.

This has yet fundamentally to change, despite good policy work across multiple sectors¹.

The Laidlaw Conundrum poses a higher-order question, namely how do you align all of the actors, institutions, processes, and funders to create strategic, structural and effective collaboration.

¹ Richard Lambert, Lambert Review on Business-University Collaboration, 2003.

² Sam Laidlaw and CBI, Stronger Together: Business and Universities in Turbulent Times, 2009.

The UK has a world class higher education sector. But it faces some urgent challenges including the changing needs of business, intensifying international competition and constrained public-sector funding. Effective collaboration between the higher education sector business and government will be critical to the UK's economic recovery and sustainable international competitiveness².

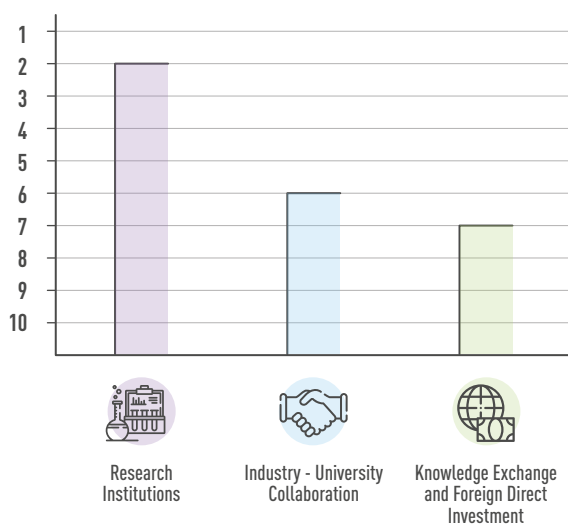
This is a conundrum, because, like Humpty, it is incredibly hard to put all the pieces together to make a functioning and organic whole, capable of evolving. It is easy to become shell-shocked, as it were. Over the past nine years, governments and devolved administrations have continued to pour over this problem like a 19th century classicist with the Rosetta Stone. The roll call includes: Perkins on engineering skills, Shadbolt on computing, Sainsbury on technical education, Scotland's enterprise and skills, Wales essential skills, Northern Ireland's skills barometer, Nurse on the Research Councils and Innovate UK, Wilson on business-university collaboration (which set up the NCUB), Witty on universities and growth, Dowling on research, Coutu on scale-ups, Young on Business Schools, Reid on Scotland's innovation centres, Diamond on Welsh university funding, Reid on Welsh research and innovation, Hauser on catapults, the various industrial strategy reviews, and England's forthcoming post-18 skills review.

institutions, 6th for industry-university collaboration, and 7th for knowledge exchange and foreign direct investment. However, the country tails substantially on some other pillars of the Laidlaw Conundrum: it stands 22nd for quality of education, a dismal 41st for math and science education, and 24th for government procurement of advanced technology products³.

Nonetheless, despite austerity, there have been substantial increases in research, technology-development, knowledge exchange, teaching value, and student focus. So much so, that at the launch of UK Research and Innovation, Sam Gyimah, the Minister for Universities, Science, Research and Innovation spoke of a "once-in-a-generation opportunity" to push back the boundaries of knowledge and put it to practical use. The UK Government is seeking to boost R&D by over £80bn over the ten years from 2018; devolve skills and innovation to city-regional level actors; implement a Knowledge Exchange Framework (KEF); back the patient capital review to fund long-term innovation.

All this is under the aegis of the Government's commitment to grow national R&D to 2.4% of GDP. It is important to remind ourselves that only a third of R&D comes from the public sector, and the remainder will have to come from private investment, and therefore that the Laidlaw Conundrum and Lambert Challenge will always be with us.

THE UK'S RANKING ACCORDING TO THE WORLD ECONOMIC FORUM



These efforts have paid dividends. The UK is, according to the World Economic Forum, 2nd in the world for research

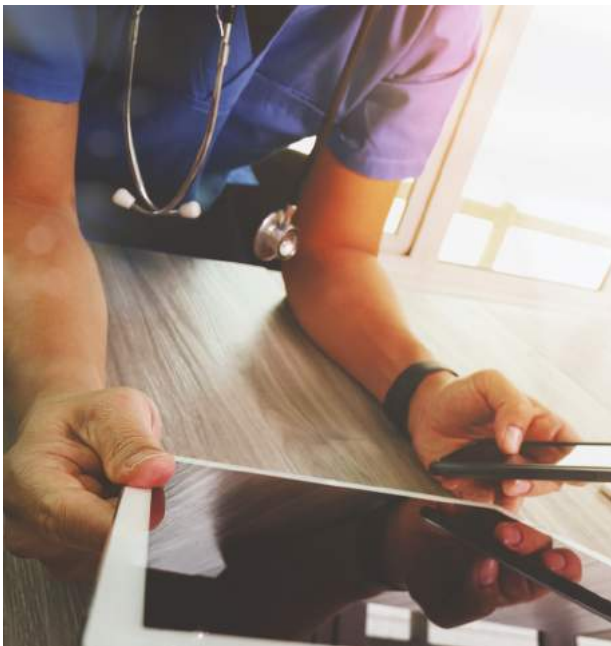
Even in this highly laudable collaborative environment there are still areas of tension such as the relationship between place and excellence, academic discipline and industry challenges, short-term profit, long-term investment, responsive and strategic funding, curiosity and priority.

There is almost a law of business thermodynamics that firms will only put effort in where they can benefit. Unfortunately, countervailing forces are at work, namely entropy - the tendency towards market disorder driven by technology and science - and occlusion, quite simply, no one can see the future, despite the fact that we must place bets on it.

Twenty-first century capitalism is a difficult beast to understand, let alone control. It simultaneously tends towards destruction and disorder and monopoly power: witness the rise of the Silicon Valley giants. The moral and economic challenge for government and universities, therefore, is to work with incumbents who

³ www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf
⁴ NCUB, The Human Factor: Driving Digital Solutions for 21st Century Health and Care, 2018.

seek to retain competitive advantage and insurgents either seeking to replace them or to reinvent the very sectors in which they previously existed. For example, in the NCUB's 2018 report on digital health and care, we noted the challenge to existing UK-based life-science firms (who heavily invest in UK R&D) from US-based technology firms, such as Amazon and Apple⁴. The 2.4% R&D target is, in some ways, dependent on backing a small number of big firms looking to stay that way, and a myriad of small companies driving for growth.



As collaborative success in the UK spirals upwards in ever increasing circles of knowledge, understanding, policy and practice, the countering competitive cyclones become ever stronger. The key questions before us today, unlike ten years' ago is not that we lack great success stories, this State of Relationship report has documented hundreds over the years, nor that government is unwilling to fund collaborative

mechanisms: it does and it will. No, the biggest issues are speed, scale, impact, leverage and collaborative culture and these must be at the heart of university-business partnerships for the 21st Century.

The biggest issues are speed, scale, impact, leverage and collaborative culture and these must be at the heart of university-business partnerships for the 21st Century.

Collaboration problems endure for small and mid-sized firms, and, as our Task Forces demonstrated over the years, they are different sector-by-sector. But there are two underlying Lambert and Laidlaw challenges that have persisted throughout the last ten years, namely, the lack of knowledge about where to find anything in a university, or a scaled-up UK-wide innovation community, where academics are willing partners in sharing knowledge and practice. And secondly, we lack a platform for offering the kinds of work experience that will give employers access to new (not necessarily) young talent that will flourish in the uncertain future ahead of us all.

After almost ten years as CEO at the NCUB, I intend to work on scaling-up digital solutions to these through a UKRI-backed innovation brokerage platform, *Konfer.online*, which already has contact details for over 130,000 academics, and Placer, a unique work experience start up, alongside JISC and Unite Students. And I have begun a research programme at the School of Advanced Study at the University of London called Knowing and Doing – the Once and Future University. I am starting with a review of the impact of the 12th century University of Bologna on early municipal markets. The problems never go away, the solutions never last, but we should never stop trying.



Collaboration Progress Monitor 2018

ARTICLE BY NCUB

The National Centre tracks progress in UK university-business collaboration using a bespoke tool. It identifies emerging trends through:

- Publicly available data released annually ²,
- 15 metrics across four dimensions: resources for collaboration, knowledge flows between universities and business, partnerships and commercialisation activity,
- Comparison with the five year average,
- Detecting trends for early warnings of changing indicators.

The progress in university business collaborations is monitored using the latest available data at the National Centre, covering the 2015/16 academic year¹. Forthcoming iterations of the Monitor will begin to surface both the practical and perceptual impacts of Brexit, and structural shifts in the innovation ecosystem, on these trends.

This edition of the Collaboration Progress Monitor has surfaced some interesting emergent trends, and a series of longer-term indicative landscape shifts over the five year tracking. Principally, the quantity of interactions between universities and businesses has increased, but in general terms value has contracted.

- Foreign investment in business collaborations with UK universities grew healthily between 2015 and 2016; but domestic businesses decreased their investment in the same period.
- And while domestic businesses became more cautious with investments, they increased their interactions with universities. The number of deals both with large businesses and SMEs rose – but average deal size fell.
- Graduate and post-graduate employment in innovative sectors fell.

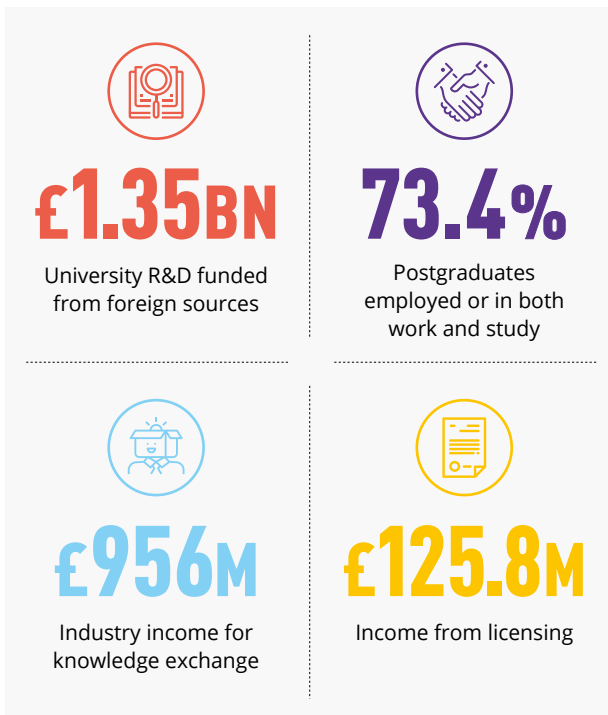
University and business partnerships 2016

Universities registered an increase of interactions with SMEs of 11.4% from the previous year - but the size of the average deal fell 1.5%. Interactions with large businesses grew by 6.5% from 2015. However, the size of the average deal decreased by 3.7%. The size of the average deal with a large business remains consistently above a 5-year average, but it will be interesting to observe how this trend develops post-Brexit.

The number of Innovate UK grants awarded to universities in collaborative projects with industry fell by 21.9% from the previous year, but the average size of the grants awarded to universities in such projects increased by 13.5%. Whilst this pushed the 5-year average up to £136,121, the 2016 average grant size exceeded it, which suggests that the performance progress in collaborative university business projects focused on the quality rather than the quantity of projects, potentially making them more strategic, selective and impactful.

¹ Whilst data for most of the indicators is available for 2017, in order to present a consistent economic overview, 2016 data is employed, for which statistical availability was complete for all indicators considered. Full methodological outline available from the NCUB website.

² Data sources include: Higher Education-Business and Community Interaction (HE-BCI) Survey; (ONS) UK Gross Domestic Expenditure on Research and Development (GERD); Destinations of Leavers in the United Kingdom (DLHE); gov.uk database on Innovate UK funded projects.



Whilst the performance reported in the 2015 was below that 5-year average, it is important to note that fluctuations in patent data are partially a consequence of the time lag between application date and when the patent is granted. The numbers of spin-off companies that survived at least 3 years increased by 1.7% to 1031 in 2016, adding to the stock of high technology firms in the UK.

Resources for university business collaboration 2016

Industry income for knowledge exchange activities (excluding licensing) received by universities contracted by 0.2% in real terms, - from £958m, in 2015 to £956m - and the gross expenditure on R&D performed by universities fell by 1.8% (in real terms) from 2015. The share of investment in R&D performed by universities from foreign sources increased slightly, from £1.3bn to 1.35bn.

Commercialisation in UK universities 2016

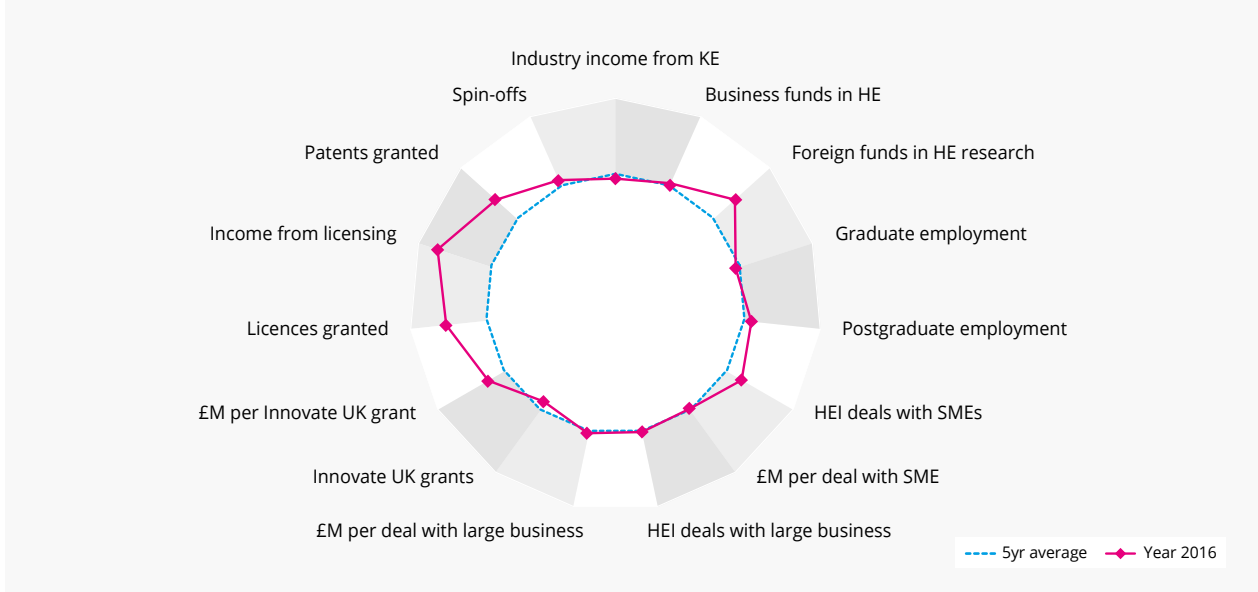
In 2016 universities issued 25.5% more licences to businesses compared with the previous year. This was followed by growth in income from licensing activity (with the exclusion of IP income pertaining to the sale of spin-offs) of 38.2% from 2015 to £125.8m.

Universities reported an increase of 27.9% in granted patents from 2015, exceeding the 5-year average.

Knowledge flows between universities and business 2016

The share of graduates employed in innovative sectors fell to 38.6%, 0.5% lower than in 2015, and below the 5-year average. However, in terms of the numbers of graduates employed in the innovative sectors (which is a fairly tight definition) and all graduates in employment, the falls decelerated in 2016 to 2.6% and 1.8%, respectively. The share of postgraduates in employment (in work or in work and study) was 73.4% in 2016, 0.5% lower than in the previous year, but above the 5-year average.

Figure 1 The Collaboration Progress Monitor: covering resources for collaboration, knowledge flows, partnerships and commercialisation.



Progress over time in 2016

As previously noted, the data collected for this version of the Monitor may represent the last to be unaffected by Brexit. The overall trend suggests that UK universities improved in the knowledge exchange activities that enabled them to capture underlying IP.

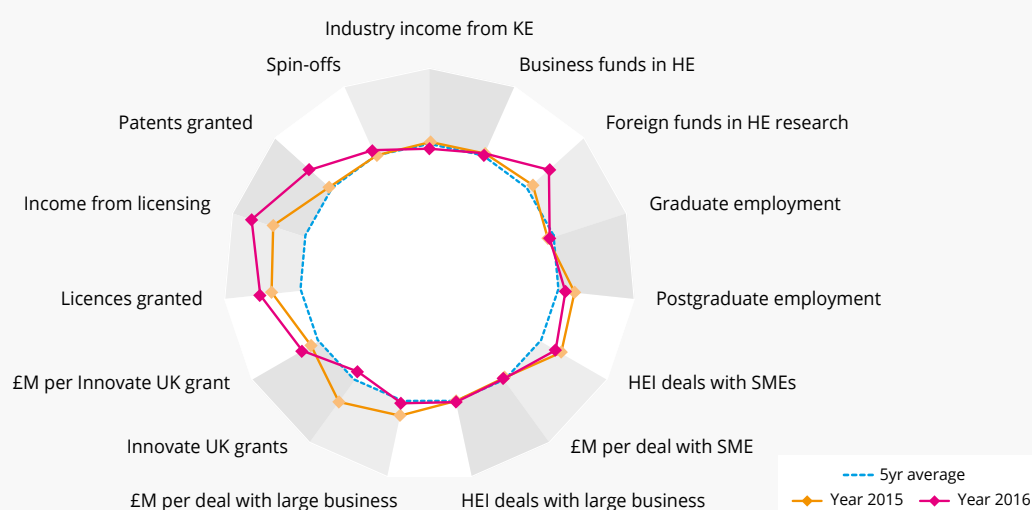
Interactions between universities and businesses clearly intensified, although with reduced financing devoted to consultancy, contract research, facilities and equipment. Gross expenditure on R&D from domestic business and foreign sources performed by universities decreased in relation to their 5-year average values.

Whilst postgraduate employment in 2016 in comparison to its 5-year average fell over the 2015 record, there was a modest improvement in performance of graduate employment in innovative sectors; however, this is mostly related to the reduced 5-year average for 2012-16.

The number of Innovate UK grants in 2016 fell below its 5-year average, although it performed significantly above its 5-year average in 2015. On the other hand, more consistently, the average size of Innovate UK grants per university continued to increase against its 5-year average.

Figure 2

Collaboration Progress Monitor for the UK in two successive years, including 5-year average, showing acceleration and deceleration in indicators.



Devolved monitors

Devolved monitors display 12 indicators tracking collaboration in England, Scotland, Wales and Northern Ireland. For consistency with previous reporting a 4-year average is used.

English universities experienced a decrease in industry income for knowledge exchange activities, as well as graduate employment in innovative sectors. However, English universities increased their numbers of interactions with both small and medium enterprises (7.0%) and large businesses (3.1%). Whilst average deal size with SMEs grew by nearly 3% from 2015, it shrunk by 0.5% with large businesses.

The number of Innovate UK grants awarded to English universities participating in collaborative projects decreased by nearly 24% from 2015; at the same time the value of such grants increased in line with the UK trends. The commercialisation activities of English

universities improved considerably, along with a modest growth in the stock of living spin-off companies.

Northern Irish universities observed a decrease in industry income from knowledge exchange activities and a minimal change in graduate employment in innovative sectors compared to 2015.

Universities in Northern Ireland reported a considerable fall in interactions with business of all sizes since 2015 with a 1.7% decrease in the average size of the deals with large businesses. However, the average size of the deals with SMEs increased by a striking 71.4% from 2015.

The commercialisation efforts of Northern Irish universities decreased (licenses granted to businesses fell by more than 50%, whilst patents granted were 32.3% down from 2015) or stayed unchanged.

Scottish universities saw a fall in industry income from knowledge exchange activities in 2016; however they also reported a modest increase in terms of share of graduates employed in innovative sectors of the economy to 39.4%.

Scottish universities reported increases in interactions with all business sizes (43.0% with SMEs and 28.3% with large businesses) since 2015, but falls in average deal sizes (15.4% with small and medium enterprises, and 18.6% with large businesses).

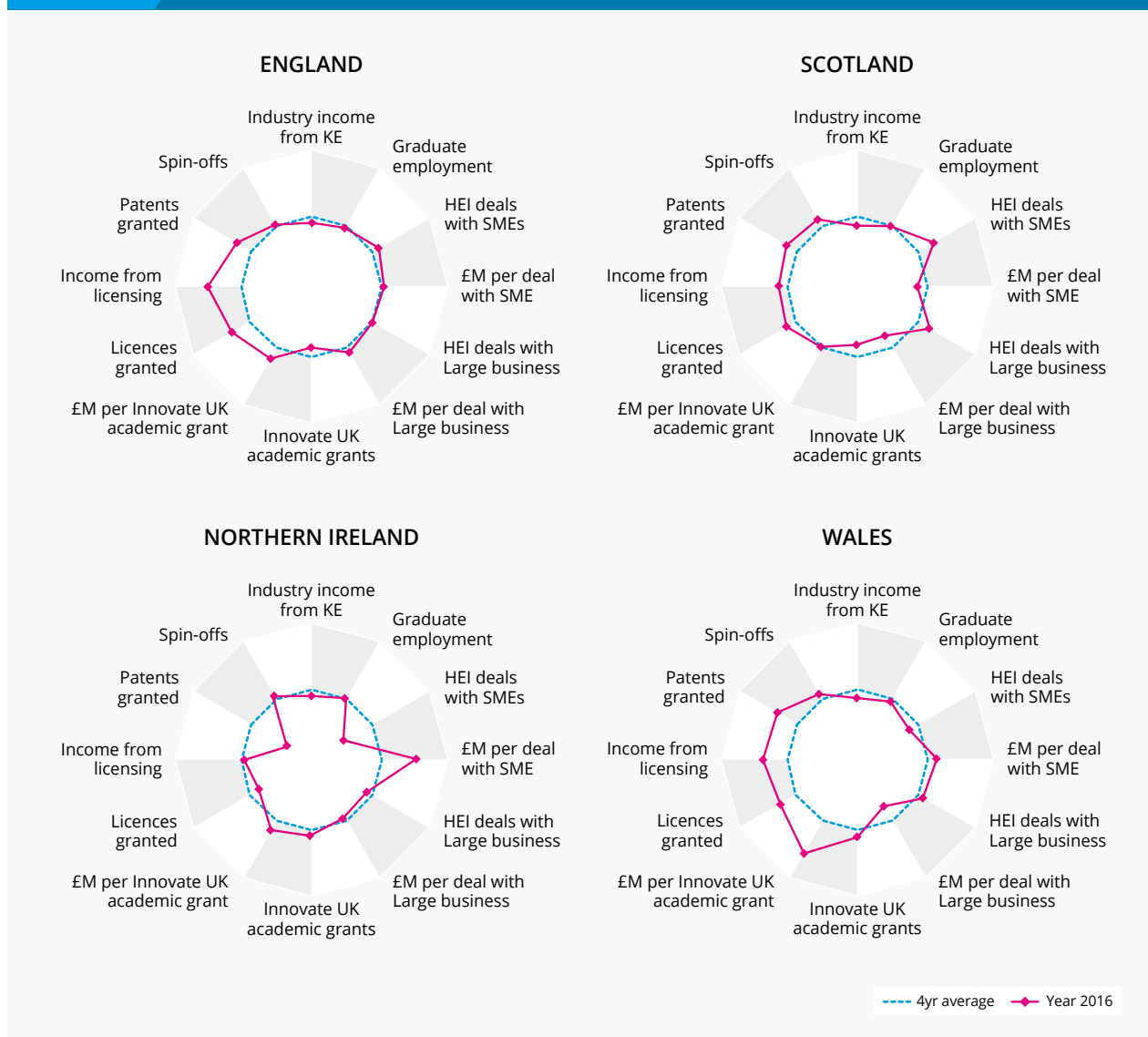
Universities in Scotland saw a decrease in Innovate UK grants by a third from 2015, with a fall in the average value of such grants – contrary to the performance observed in England, Northern Ireland and Wales. The commercialisation activities of Scottish universities improved in terms of patents granted, live spin-offs, and the income from licensing but the number of licenses granted to business fell by 3.6% since 2015.

Welsh universities reported a decreased share of income from large and small businesses from 2015, and a decrease in the share of graduates employed in innovative sectors.

Whilst interactions with SMEs decreased by 16.7% since 2015, interactions with large businesses increased by 7.0%. Interestingly, Welsh universities reported an 18.2% increase in the average size of a deal with small and medium enterprises, yet a 10.9% fall in the average size of a deal with large businesses.

The greatest change can be observed in Innovate UK metrics: although Welsh universities reported a modest increase in number of grants (3.6%), the average Innovate UK grant value they received doubled compared to 2015. Further improvements were observed with regards to licensing, patenting and spin-off data.

Figure 3 England, Northern Ireland, Scotland and Wales against 4 year average.





02

SHAPE OF THE
RELATIONSHIP

The changing state of higher education

Clearly we have much to celebrate of the Higher Education Institutions of the UK: from their role in regional and national economies to the strength of their reputation on an international stage.

But the Industrial Strategy white paper also demonstrated a number of challenges around skills and talent, from technical to sectoral, which remain counter-productive to the success of the UK economy. For a higher education system of international repute, there is a clear role to be played in tackling these; universities have to ensure that graduates emerge from degree programmes not just ready, but able to work.

Employability is not a simply defined term. The rhetoric has and continues to evolve from academic discipline to critical thinking, work experience, leadership ability, and communication skills etc. The list goes on, and so the burden on universities grows.

Yet it is evident in this section that universities have stepped up to the plate. From the advent of new forces in degree apprenticeships, to the role of institutions in life-long learning and the upskilling of the workforce; higher education is in a changing state. There is evidence of the growing importance of interdisciplinarity, as more institutions merge the arts and sciences together to embed creativity and critical thinking in their students. Both universities and businesses are also investing heavily in institutes solely for the evolution of graduate talent, and embedding the practice of work-experience across both small and large companies.

Not all changes for higher education have been easy, and rarely have they been straightforward. It is in the complicated spaces that we see the most innovative solutions, brought about by collaboration. The role of industry demonstrated here is strong; using innovative technology to extend the offer of work experience, co-creating new and varied degree programmes, using competitive enterprise to motivate and mentor students. All these initiatives, and more, are crucial to the development of graduates capable of meeting the exceptional skills demands of the current and future economy.



Closing the skills and talent gap to deliver on the industrial strategy



There is much to celebrate in both our university and business sectors, as the Government's industrial strategy white paper highlights. We have a Higher Education system of international repute which continues to produce higher-level skills and to deliver a graduate earning premium and, set alongside this, a labour market that continues to create new graduate-level jobs.

And at the intersection, as the State of the Relationship captures so well, our universities and businesses are collaborating in innovative ways and in greater frequency to target skills needs in particular sectors and regions. The success of these collaborations will generate a highly skilled workforce that can achieve a highly productive economy and public services - the virtuous goal at the heart of the industrial strategy.

The Office for Students, the new Higher Education regulator in England, is named in the industrial strategy and will be expecting universities to build yet more sustained and in-depth collaboration with employers not just to equip students with what they need to succeed in the labour market, but also to create opportunities for mature students, and to help employers capitalise on graduate talent and skills to improve their productivity. It's clear from the industrial strategy that there are multiple challenges we need to address if we are going to achieve that virtuous goal and many of them about skills and talent.



Skills challenges

The industrial strategy highlights that technical education is an underused and undervalued part of our skills system – perhaps our missing link to greater productivity. With reforms to the apprenticeship system ongoing and T-levels set to be introduced from 2020, the OfS aims to enable a genuinely informed choice of academic and technical routes into HE for students from all backgrounds and at different points in their lives.

Despite many targeted interventions over several years, some STEM skills remain an acute challenge for businesses to recruit. The Wakeham and Shadbolt reviews, commissioned by the Government in 2015 to examine graduate employability in STEM subjects, highlighted how graduates from those disciplines associated with the fastest rate of technological change face the greatest obstacles to employment.

Demand for STEM-related occupations is projected to grow at double the rate of other sectors, and a lack

of diversity throughout the STEM talent pipeline risks exacerbating skills shortages. This is an issue that the HE sector as employers also needs to confront. The OfS will be working with UKRI throughout this year to determine the priorities for the research talent pipeline and how we improve equality and diversity in the research workforce today, and in the future.

Add to this a fundamental shift in the world of work and the nature of the labour market, driven by the fourth industrial revolution and influenced by Britain's imminent exit from the EU, and there is clearly more to understand and more to do.



Talent solutions

These challenges – spanning provision, sector and place – increasingly call upon collaborative solutions, with universities, businesses and others working in partnership to create effective talent pipelines.

The post-18 education and funding review is shining a light on the importance of flexibility and choice for both learners and employers. There are good examples of provision that is more responsive to learner needs and employer requirements with the expansion of higher and degree apprenticeships, accelerated degrees, new models of placement provision and work-based learning. This close collaborative working between HE providers and employers also has positive effects on mainstream teaching provision and knowledge exchange.

Other sector-specific collaborations focus on bringing together established providers and employers. The Institute of Coding launched this year – a national consortium of more than 25 universities, 60 national and international businesses, SMEs and others led by the University of Bath – aiming to use innovative, industry-focused higher education models to rapidly drive up digital skills for upskillers, apprentices and traditional students.

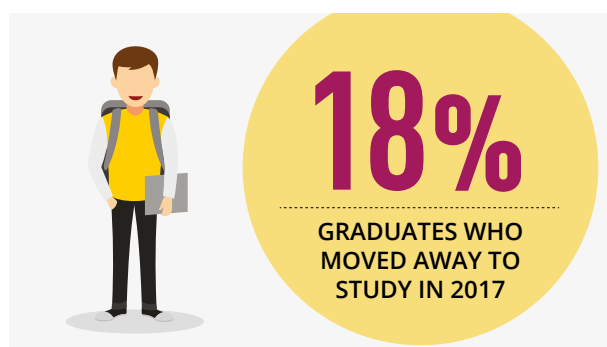


Positive outcomes

The first objective for OfS, as set out in the Regulatory Framework, is that all students from all backgrounds should be supported to access, succeed in and progress from HE, particularly the most disadvantaged.

Students value their experience of higher education in its own terms, but they also want it to be a route into highly skilled and rewarding jobs.

In practice we have some distance to go if we are to achieve this. Employment prospects are affected by where and what you study and how you perform, but they are also affected by the time, resources and contacts needed to gain the experience and know-how you need to navigate the jobs market. For students from the most underrepresented group, the proportion of graduates entering professional jobs is five percentage points lower than expected given their qualifications.



Everyone should have the opportunity to build a good life for themselves and unlock their potential, regardless of their background or where they live. We are paying close attention to regional disparities in education and skills levels and we want a clearer picture of the interplay between regional employer demand for graduates, graduate mobility and graduate outcomes. Graduate mobility is often far more limited than many people perceive. Only 18% of 2017's graduates moved away to study and then moved again for their first employment and this challenges the perception that most graduates are highly mobile. The brunt of this is being felt by employers with unfilled graduate vacancies in certain locations.

The OfS business plan acknowledges all of these challenges and identifies the areas for immediate action. We are looking to meet these challenges with solutions based on provision, sector and place, and the industrial strategy calls for the OfS to encourage even greater collaboration between universities and business. Whether you are an employer or part of the higher education system, it seems clear that combining our efforts on skills and talent challenges is the right step forward – and not just to achieve our respective ambitions, but also, to make a positive move towards closing the skills gap and national prosperity.

Delivering students fit for 21st century industry

Pearson Business School, part of Pearson College London, is the only Higher Education institution to offer a Rotational Degree Apprenticeship (RDA) programme in the UK. Together with industry partners we are designing a new innovative degree apprenticeship scheme, creating an unparalleled learning experience and supporting businesses to expand their apprenticeship provision in the context of the Apprenticeship Levy.

Our partners to date have included: Unilever, IBM, Direct Line Group, Tesco, Kantar Added-Value, WPP's Ogilvy and Pearson Plc.

We launched this programme to tackle a problem put to us by employers: graduates are lacking the skills needed to succeed in the world of work. Yet when surveyed by the Confederation of British Industry (CBI), 89% of employers said that they value graduate hires with the right attitudes for work, as well as aptitude¹. Our priority is to fully integrate the industry voice, so our apprentices do not step out of the corporate environment when they step into the classroom; as such, they study a degree co-designed with industry partners to learn what makes the commercial world tick.

“At Ogilvy we are constantly looking for new ways to bring diverse talent into our business. We are delighted to be taking part in helping make this degree happen in such a modern, business relevant way.”

Annette King, Former CEO of WPP's Ogilvy and Mather UK

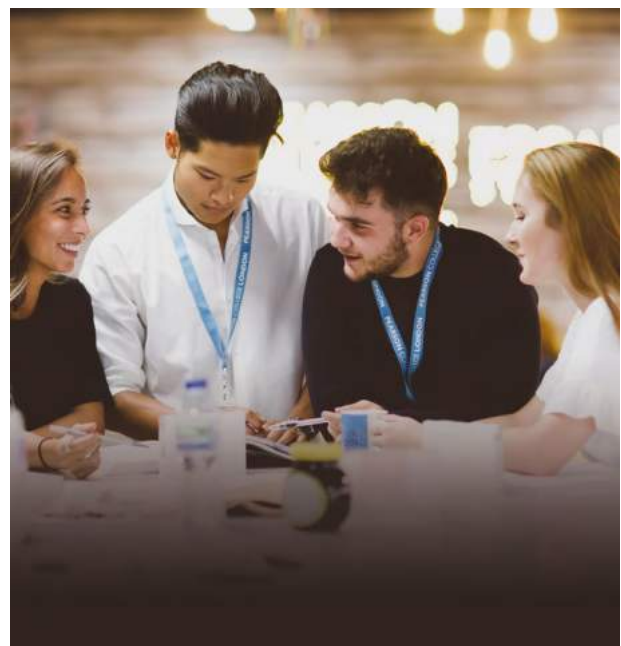
To meet this need, our innovative course strives to balance the offerings of traditional academia and the needs of 21st century employers whilst providing an unrivalled opportunity to earn and learn simultaneously. All our academics are well-versed in their professional disciplines and workshops with guest industry speakers are a regular feature, in which all students can participate. Throughout the programme, apprentices enjoy the support of a company mentor and an academic personal tutor - both of whom offer support for apprentices navigating both the academic and corporate world.

Numerous studies show that students who gain professional experience such as internships or

apprenticeships, achieve more academically; this is not just about employment, but intellectual development too.

Each apprentice graduates with contextualised academic and working knowledge of a relevant business environment, and no student debt! They'll also have built a CV packed with experience collected in three different companies; a BA (Hons) Business Management degree validated by the University of Kent; and Chartered Manager status.

In little over eighteen months following the programme launch, RDA apprentice Christopher Achiampong was awarded London Regional Higher/Degree Apprentice of the Year at the 2017 National Apprenticeship Awards, in recognition of his achievements to-date. Many other students have similarly blazed a trail through their work in our partner organisations, whilst satisfying the academic requirements of the programme. Building on this remarkable success, we've expanded our range of partner companies and are exploring ways in which we can create similar rotational schemes in the future: exciting times.



¹ Confederation of British Industry and Pearson, The Right Combination, July 2016.

Innovation in the Curriculum

The need to develop Higher Education graduates with the skills and knowledge required by employers is an essential component of regional economic growth. One of the current high profile needs, is the skills and knowledge set of innovation.

In preparation for the development of a national innovation plan, the Department for Business, Energy and Industrial Strategy state: "Innovation can transform lives. It can help us face some of our biggest challenges, from energy supply and food security, to demographic change and the delivery of public services. It enables business to develop new ideas, products and services, and create new jobs and export opportunities." (Department for Business, Energy and Industrial Strategy Consultation: 2016).

New College Durham was approached by Business Durham in 2015 to support the development of Durham County Council's strategy to attract innovative businesses and organisations to the County. New College Durham and Business Durham worked in partnership to identify a knowledge and skill set which would enable graduates of higher education programmes to be equipped as potential employee innovators.

This was achieved through the development of a new level 5 module titled, *Innovation, Idea Generation and Enterprise*, which has been integrated into Foundation Degree provision at the College. (New College Durham has held Foundation Degree Awarding Powers since 2011).

For Sean King, College Staff Innovation Champion, the impact has been clear. "The Foundation Degree students are really enjoying their studies of innovation this academic year, gathering the skills and knowledge to develop them to be innovative thinkers and practitioners." Sean added "The support from Business Durham for the delivery of the learning has been fantastic, and has enabled students to see innovation

in action at the North East Technology Part (NETPark). It has also opened up the opportunity to work on projects with global innovators across the county."

The delivery of this new module is being supported by Business Durham through the supplying of specialist speakers from industry and visits to innovative business organisations in the County, including NETPark. As part of the project, the College have designated College Innovation Staff Champions.

"The innovation module has made me think in a different way about solving problems and I feel like it is an integral part of my learning and experience. The trip to NETPark was an inspiration for my future projects and business ideas because of the way it expanded and nurtured my ability to think differently and creatively."

Rhiannon Hardy, Computing and Networking Foundation Degree student

As an approved Institute of Enterprise and Entrepreneurs (IOEE), the College was interested to see if the new module developed with Business Durham could be accredited as an award. Following a joint mapping exercise with IOEE, it was established that students who complete the Foundation Degree module in Innovation, Idea Generation and Enterprise could be awarded the IOEE Level 4 Award in Creativity and Innovation.

Collaborate to innovate - the development of MIRA Technology Institute

Delivering 2,500 student places per year when fully operational, MTI is the creation of an alliance between HORIBA MIRA and the Midlands's top education institutes, with funding from the Leicester and Leicestershire EP Growth Deal Fund, and is backed by the Department for Business, Energy & Industrial Strategy (BEIS). North Warwickshire and South Leicestershire College is the lead partner for this collaboration.

2018 is set to be a transformational year for the automotive sector in the Midlands as the new MIRA Technology Institute (MTI) opens its doors to students from September.

Born out of an urgent need to close the widening gap between the demand for specialist technical skills and the current labour force, this unique partnership will address this skills gap across the automotive sector by providing expertise and qualifications relevant to the industry now and in the future. The strength of MTI is the employer-led curriculum; each member can offer the right level of qualification and deliver industry-linked training and education across all levels, providing the skills that the industry needs to thrive.

"This project will help us to meet the demand for engineers regionally, nationally and globally by building a core skill set that will help to create future growth, employment and wealth. It is a leading model that could easily be extended to other sectors."

Marion Plant OBE, North Warwickshire and South Leicestershire College Chief Executive

Qualifications, skills and opportunities on offer through the partner members include:

- Inspiring 700 students through our STEM ambassador programme and a range of employability activities taking place within schools and colleges
- Technical and non-technical training MSc-level courses delivered by HORIBA MIRA
- Specialist courses in advanced structural dynamics by the University of Leicester, using their MIRA Technology Park-based ASDEC facility: specialist

software for reliable 'real time' embedded systems and advanced engineering management courses up to MSc level

- BTEC and EAL accredited qualifications and apprenticeship standards, delivered by North Warwickshire and South Leicestershire College, providing robust skills for entry-level engineers
- Masters-level delivery of specialist technical modules, delivered by Coventry University. Additionally, the University will offer Automotive Degree Apprenticeships at Level 6+, as well as the world's first foundation degree in Metrology
- Masters-level programmes delivered by Loughborough University, focused on Powertrain Simulation and Test; Intelligent Vehicle Systems; and Body Engineering and Test
- A Doctoral school operating from MTI, working with the university partners to deliver research programmes leading to PhDs

In particular, MTI will help to create specialist skills in some of the new disruptive technology areas such as electrification and driverless car technologies, ensuring a sustainable supply of future technical specialists and engineers.

Dr George Gillespie OBE, CEO at HORIBA MIRA, said: "MIRA Technology Institute is a unique solution that has been created to address a very real problem the UK automotive sector is facing. Importantly, it is well aligned with the government's new Industrial Strategy. It will be a huge asset to MIRA Technology Park but we hope its benefits will be felt throughout the UK auto sector and beyond."

With 40 companies on site, poised to do business with the rich variety of supply chain businesses within the area, MIRA Technology Institute is set to place the Midlands at the heart of automotive excellence.

The Tommy Flowers Institute - developing future research leaders

The UK's ICT industry needs researchers who can collaborate confidently across multiple academic disciplines - and work seamlessly between academia and industry. That's why BT, along with partners from across the ICT sector, launched the Tommy Flowers Institute in 2016. The Institute aims to improve the links between academic research and commercial opportunities in the industry, driving research to produce new product innovations for consumers and business.

The Institute brings the ICT industry and UK academia together to develop the skills and knowledge of our future research leaders. BT are delighted to be supported by professors from the universities of; Cambridge, East Anglia, Essex, Imperial, Lancaster, Oxford, Southampton and Surrey, along with major technology companies, to launch the initiative. Based at Adastral Park in Suffolk and bigger than any one company or any one university, **the Institute will be a source of well-rounded ICT research leaders with a thorough commercial and operational perspective to complement their technical excellence.**

Through targeted lectures, conferences and workshops, the researchers embedded at the institute will be equipped to take on the complex challenges facing the ICT sector and help the UK to grow its world-leading knowledge economy. After all, the institute is named after computing pioneer Tommy Flowers who created Colossus, the world's first electronic, programmable computer capable of breaking complex codes, and is credited with shortening the Second World War by many years. Flowers himself owes part of his legacy to a combination of great minds from diverse backgrounds, demonstrating the far-reaching potential of collaboration. As such, the institute is witness to ICT industry partners engaging with UK academia on specific industrial and societal challenges, to produce both excellent research solutions and the excellent research leaders able to drive implementation.

"This institute will bridge the gap between industrial research and the fantastic talent that exists in the academic sector."

Dr Tim Whitley, BT MD Research & Innovation

The Institute includes the Innovation Martlesham cluster, a collaborative eco-system for high-tech companies whose global players include NPL, Cisco, Intel, Huawei, Ericsson and Nokia. All our industry-sponsored postgraduates and their academic supervisors are invited to participate. The institute also convenes several major conferences each year, providing students with exposure to sector challenges with industrial practitioners at the leading-edge of operations, technology and innovation. Our focus is on the challenges that the technology is being used to address, and on what is needed from the researchers to meet those challenges.

The Tommy Flowers Institute supports both the UK Research Councils' *Research Innovate Grow* ambition to ensure the UK remains the best place in the world to do research, innovate and grow business, and the Engineering and Physical Sciences Research Council's *Accelerating Impact* strategy to maximise academic excellence and impact through building wider and stronger research and training partnerships.



Enterprise by design

Bangor University has cut through traditional academic boundaries to bring students from different subjects together to compete in multi-disciplinary teams for an ‘Enterprise by Design’ challenge with a winning prize of £2,500.

Now in its eighth year, Enterprise by Design (EbD) combines students drawn from Business studies, Arts, Science and Engineering and aims to deliver projects that are feasible (using current available technology), viable (financially) and desirable (meeting a human need).

Professor Oliver Turnbull, Pro Vice-Chancellor for Teaching and Learning at Bangor University who was on the judging panel said of Enterprise by Design: “This is one of the most innovative and inspirational programmes that I’ve seen in higher education, and I’m delighted that it was developed in Bangor University”.

The projects at Bangor run in 12 teams of four students, one from each discipline (Business, Art, Science and Engineering). Every year, teams address a real business challenge given to them by a company to allow for collaboration across disciplines through the University, with a focus on delivering commercially viable business options. The process culminates with teams pitching their new ideas to an expert panel composed of local business leaders and innovation experts.

“I think it is essential that academics and entrepreneurs promote multidisciplinary based working. The problem we have in Higher Education is that we don’t work outside of our disciplines, and this doesn’t reflect how companies actually function.”

Dr Andy Goodman, Academic Lead for Enterprise by Design

In 2017 the design challenge came from Zip World, one of Wales’ leading adventure tourism companies, which has a range of adventure sites locally, boasting the world’s fastest zip line and a unique network of underground trampolines in slate caverns. In keeping with the Zip World vision of constantly innovating around the core activities and developing new and unique offers to clients, the brief was focussed on delivering an improved visitor experience for

their diverse customer base. Participating students identified problems and explored solutions relating to a range of target Zip World clients.

MD of Zip World David Stacey presented the £2,500 prize to the winning team for their ‘Slate VR’ concept; a package of VR related benefits to enhance the customer experience at Zip World sites. “There were several ideas with real potential” said David, “the final choice was influenced by the credibility of the presenters, the superb content and professional delivery. We want to work with credible people who fit our culture and brand and this team did that brilliantly. We also wanted an innovative solution that challenged the norm and at the same time delivered commercially across a multi-site operation. We felt this group was extremely professional, understood our brand and delivered significant potential for future value”. Additionally, the winning team were all offered paid employment by Zip World, so impressed were they by their professionalism and innovative thinking.

EbD has been highlighted as best practice case study in Wales by Be The Spark, and Zip World are participating again in the 2018 Challenge along with another leading Adventure Tourism Company, RibRide.



2017 Enterprise by Design winners with David Stacey, Managing Director Zip World

Fusing creative thinking with the fundamentals of science

Global tech giant Dyson and Imperial are collaborating to train the next generation of problem solvers, technology leaders, and innovative engineers.

Imperial's Dyson School of Design Engineering, launched in March 2015 following a £12m grant from the James Dyson Foundation, fuses creative design thinking with engineering within a culture of innovation and enterprise. It houses a unique community of students and researchers who are creating innovative solutions to modern global challenges.

The school's flagship undergraduate programme – Design Engineering (MEng) - was developed in collaboration with Dyson, as well as scores of other industrial stakeholders, specifically to train the next generation of design engineers. The result is an education grounded in the fundamentals of engineering science, with an accompanying emphasis on design thinking, creative problem-solving, and management and communication skills. Students gain experience in the workplace, with undergraduates undertaking a six-month industrial placement and developing entrepreneurial skills through a bespoke module.

Speaking at the launch, Sir James Dyson said: "We want to create engineers who are bold and commercially astute. They will use their skills, nurtured in the Dyson School, to develop future technology that will catalyse Britain's economic growth."

The School's first students are already making their mark on the world. Undergraduate students Josephine Latreille and Leah Pattison, together with Mechanical Engineering student Camille Morand-Duval, worked with International Wheelchair and Ambulatory Sports Federation to develop a low-cost, open-source design for a wheelchair fencing frame. Designed to be built using readily available materials, the team are providing their design free-of-charge in the hope of opening up the sport to the developing world.

In addition to undergraduate provision, the School also offers the Innovation Design Engineering (IDE) and Global Innovation Design (GID) double Masters courses, which have been run jointly with the Royal College of Art for the past three decades.

Many game-changing start-ups have emerged from the programme, including Aeropowder – founded by Elena Dieckmann as an IDE student. Now a PhD student in

the School, Elena and her colleagues are turning waste feathers from the poultry industry into new sustainable products and materials. Elena is featured in Forbes' 30 Under 30 - Europe - Social Entrepreneurs 2017 and was one of 15 recipients of the Innovate UK Women in Innovation Awards. Aeropowder also won the Mayor of London's Low Carbon Entrepreneurs 2016.

"The course's emphasis on fast-paced prototyping and testing new ideas meant that by the time I'd finished, I had 4 or 5 potential business ideas ready to go. The course helps you to ground your design in the real world – focussing your mind on finding design and engineering solutions that will have a real impact on people's lives."

Elena Dieckmann, IDE alumnus and Aeropowder founder

Malav Sanghavi, another IDE alumnus, has already founded two businesses and features in Forbes' 30 Under 30 - Europe – Science & Healthcare. He was selected as one of two winners at the Vatican Youth Symposium, and took home third prize for LifeCradle, a low-cost baby incubator, at Pitch@Palace, a start-up competition hosted by the Duke of York.

The School has a fast-growing population of both staff and students, including fractional staff actively working in industry. The School expects to grow by 100 people each year for the next few years.





Futureproofing careers in fashion and retail

To address both a talent shortage and a perceived lack of premium career opportunities within the fashion retail industry, the Fashion Retail Academy (FRA) was established in 2005 as a private-public partnership with investment from the retail industry matched by government.



In 2017, the FRA partnered with Falmouth University to develop brand new degree-level provision. All the courses are delivered in 2-year, accelerated format to enable students to complete their studies more quickly and graduate with less debt. The courses are delivered by the FRA in Central London, with the degrees awarded by Falmouth University; the university has been ranked gold in the Teaching Excellence Framework, the new classification of degree teaching standards.

“Our partnership with the Fashion Retail Academy is the embodiment of Falmouth’s commitment to ‘Doing it for Real’. This principle, we believe, is both a powerful antidote to applicants’ growing concerns around value for money and indebtedness but also the best way of equipping graduates with the skills and capabilities they are going to need to thrive in the future economy.”

Professor Geoff Smith, Senior Deputy Vice-Chancellor of Falmouth University

Lee Lucas, Principal of the FRA said that the partnership between the Fashion Retail Academy

and Falmouth University has “brought to fruition undergraduate and postgraduate courses to solve the skills gaps anticipated and identified by the retail industry.” Lee added: “Our courses are conceived and developed ‘with industry, by industry and for industry’ to provide a talent pipeline which serves the needs of contemporary retail and ensures our graduates are equipped with the skills and knowledge to futureproof a career in a sector that is transforming at a fast pace.”

Over fifty fashion retail companies were involved in the development and detailed design of the new courses. As a result, students acquire the very latest skills, knowledge and insights that industry demands. They also benefit from industry mentoring, masterclasses, live projects, exclusive Head Office placements with high street fashion brands and a guaranteed job interview.

Ezra Brown, BA (Hons) Buying and Merchandising said: “The chance to network with industry professionals is an opportunity that I wouldn’t get otherwise. Dean Cook, the Buying Director of Browns Menswear, is my mentor and I am amazed - I would never have had the opportunity to even meet him! I am really enjoying how interactive the course is. We don’t know what each day will have in store for us, as we are working on tasks with live fashion retail research as it happens.”

Falmouth and the FRA have also collaborated closely with industry on the development of a new degree apprenticeship standard in Buying & Merchandising. The trailblazer group, chaired by Lord Stuart Rose, includes representatives from the breadth of the retail industry – from retail giants, to SMEs and digital disrupters.

Forging a partnership between business and law

Linklaters has provided its trainees with a boost to their career through collaboration with the University of Law. Alongside their Legal Practice Course, all Linklaters trainees now have the opportunity to achieve an MSc in Law, Business and Management, embedding business knowledge into their traditional legal education.

In this changing global environment, where it is no longer sufficient for lawyers only to be legal experts, the carefully designed MSc includes business topics tailored specifically for lawyers. The programme expands students' commercial and business knowledge to help them to understand their clients' business and sector and equipping them to provide more holistic and tailored advice. At the same time, the students are expected to gain business acumen, build initiative and independence, and to appreciate that law firms themselves are a business with their own challenges and markets.

“The collaboration with the University of Law on the design of this programme has been essential to ensure that future generations of Linklaters trainees have all the key competencies to meet the outcomes required in a highly competitive and rapidly evolving market.”

Patrick McCann, Linklaters Global Head of Learning

To build these competencies, and to allow the students to interact with experts from both Linklaters and the wider business world, the programme is delivered through interactive lectures and workshops. In these, the students participate in group study, practice giving presentations and even have the opportunity to pitch to a panel of experts.

During the programme, students study a variety of business subjects. They explore the environment within which businesses operate, discuss the competitive position of companies, interpret financial statements and analyse company performance, define strategy and its role in organisations, explore valuation models for stocks, bonds and financial derivatives, review the functionality of the financial system, discover the issues of ethics and regulation in the financial sector, analyse customers and markets and review marketing strategies for different companies. Mastering these subjects allows a Linklaters trainee to qualify with the ability to thrive in a competitive legal environment; they have heightened their ability to understand and deliver exactly what their client needs.

To be awarded the MSc, students complete a case study on a topic reflecting areas of interest related to Linklaters strategy. The top three case studies are then judged by a panel of Linklaters senior leaders and University of Law tutors. Linklaters have been enormously impressed with the ideas that students have developed for these case studies; in addition to the financial prize for the winner, the top three students meet with a variety of teams and leaders across Linklaters to discuss their ideas and build connections for their future.

The successful programme is now in its third year, following a five-year commitment made between Linklaters and the University of Law. The MSc continues to be developed in collaboration to ensure it meets the needs of the students, developing their knowledge and skills and equipping them with the business acumen to deliver success for future clients.

Standing out for enterprise

In one of the few partnerships of its kind, the University of Chester and Shropshire Council established University Centre Shrewsbury (UCS) in one of the Higher Education ‘cold spots’ identified by the Government in 2014, with the ultimate aim of it becoming an independent university.

Since its launch, UCS has established itself as a stand-out institution, embracing enterprising approaches to support students and the region to realise their potential. From the beginning, innovation has been set firmly in its foundations and the institution is focused on high-quality teaching and research, fostering entrepreneurship and making a positive impact that reaches as far as possible.

Students can choose from a range of programmes, from BA Business Management and the Master of Business Administration to BA Events and Festivals Management to Master of Rural Health. These courses and the wider opportunities on offer at UCS have been designed to offer a range of practice-based experiences, alongside academic rigour, and in turn support students to become extremely employable graduates.

The curriculum has been developed and is delivered in collaboration with businesses, and instead of following a traditional structure, learning and research is aligned to local, regional and national needs.

Mandy Thorn MBE, Chair of the Shropshire Business Board, said: “The commitment of UCS towards engaging with the diverse local business communities, and towards addressing identified skills gaps within those communities, has been central to its formative years. Furthermore, through its exciting ongoing plans,

the institution is primed to play a key role in future business creation, growth and prosperity in Shropshire and in the wider Marches region.”

It is the shared vision of the University of Chester and Shropshire Council to create a Higher Education Institution that acts as a significant and sustainable force for regional and societal transformation. As part of this, UCS is focusing on establishing two new specialist centres that will position UCS as a test bed for transformational research.

Paul Kirkbright, Deputy Provost at UCS said: “Through these areas of excellence we will address local demographic, business and skills challenges, with the long-term goal of improving Shropshire’s skills, productivity and levels of innovation. Successful solutions and models will then be shared and rolled out across the country. **This will help to deliver the ambitions and the targets of the Government’s Industrial Strategy: to realise inclusive, sustainable economic growth across the UK.**”

Alongside the development of the Centres, UCS has launched a Community Innovation Fund with the Furrows Group, a family-owned Shropshire business, to support initiatives that offer long-term benefits to the community through grants and the input of UCS students and staff.



Centre for Research in Environmental Science and Technology (CREST)

Funded by **£1.9M** ERDF award

To develop and increase the productivity of environmental science and technology businesses in Shropshire



Centre for Digital Innovation in Medicine and Health

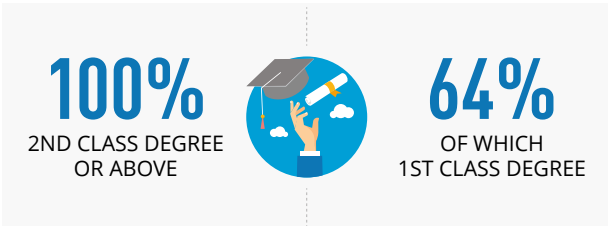
Funded by **£1.7M** MHCLG grant

To foster connections between innovators and health partners and develop new ideas in digital health and care

Creating the first degree apprenticeship in digital and technology solutions

In 2011 Capgemini took action to address the impact the digital skills gap was having on the business by investing in their talent strategy at a junior level and reviewing the opportunities available for those looking for an alternative to university.

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. The creation of a market-leading apprenticeship programme, to grow the firm's technologists of the future, includes a higher apprenticeship programme with the option to step straight on to a sponsored degree following its completion. To deliver this, Capgemini partnered with Aston University in 2012, working together with government to create **the very first Degree Apprenticeship in Digital and Technology Solutions.**



Seven years on from the first action taken, Capgemini has invested considerably in this area with 300 apprentices currently on the programme, of which 279 are enrolled in a degree apprenticeship and will qualify with a degree and a suite of employable skills.

In 2017 Capgemini met a significant milestone, as the cohort became the country's first degree apprentices to graduate with a degree in Digital & Technology Solutions. The results achieved were outstanding; 100% passed with a 2nd class degree or above, and 64% achieved a 1st class degree, which is more than double the Aston-on-campus average. Capgemini also crossed a gender milestone with 3 of their women becoming the first female degree apprentices to complete their degree in October, achieving 2:1's and 1st class results.

Amy Grange, one of the latest cohort to complete, shares her experience of being an apprentice and the opportunities it provided: "Capgemini has enabled

me to grow from both a personal and professional perspective by providing fantastic support with my career progression. Working as an Oracle Applications Consultant I received 5 promotions in 5 years, having achieved a first class honours degree in Digital & Technology Solutions from Aston University. **The skills that I acquired during my degree apprenticeship have allowed me to provide profound support to clients and provided me with the opportunity to take on more challenging roles with higher levels of responsibility, including managing a team."**

With the exceptional results achieved, the graduates from Capgemini's degree apprenticeship programme have demonstrated the success that the blend of academic and workplace learning can have and also challenge the view that degree apprenticeships are a second class option to pure university routes.

As a result of the investment in the degree apprenticeship programmes, Capgemini is seeing high performing and skilled junior talent who are actively engaged with customers from early on in their career. In turn, Aston has seen excellent academic results coming from the course and recognises the value of blending academic and on the job / practical experience in achieving outstanding results. Based on the successes achieved and the ongoing digital skills gap, Capgemini is committed to continue their investment in apprenticeships with a further 90 starts planned for 2018.



Joining the work-experience revolution

Manchester Metropolitan University, (MMU) is working with Placer, a unique work experience platform and app developed by the National Centre for Universities and Business (NCUB) and launched in partnership with Jisc and Unite Students. As the first university to support Placer, MMU is a trailblazer university in the endeavour to revolutionise the way that students can access work experience.



For many students, work experience opportunities can be instrumental when it comes to improving graduate outcomes. Such opportunities challenge students' perceptions of the workplace and build a sense of what is possible for

their future careers. It exposes undergraduates to a workplace culture, which may be very different to the educational setting they have experienced.

Not all students seek the more established 'year in industry' model characterised by four-year sandwich degree programmes. Many universities are looking at alternative models that offer the same high quality experience sought, but which are also more accessible to the wider student body who seek such opportunities in parallel to their studies.

This has particular significance to those students who may have the potential and talent to succeed in an increasingly competitive labour market, but who lack the insight and connections that exposure to the world of work offers.



Innovation

The development of Placer recognises that something has to change. Schools, colleges and universities broadly acknowledge the value of work experience. Many employers recognise that work experience is not just about talent spotting, it is also about investing in the development of the skills required by the Industrial Strategy. Manchester Metropolitan University recognised that Placer offers a vehicle that can transform how we connect students with work experience opportunities.



Additionality

Against this background, demand is likely to exceed current supply. Through Placer, NCUB have the potential

to leverage their membership and the supply chain to stimulate the increase in opportunities required. This additionality we considered essential to the success of Placer and we were encouraged that NCUB recognised that this would be sensitive to our sense of place within the regional economy and the needs of our students.



Engagement

It is critical that students feel engaged with employability initiatives that are taken. At Manchester Metropolitan University, we ensured that our students contributed at concept stage and were able to provide feedback through development.

Everyone has a role to play in improving access to work experience; universities, employers and most importantly students. It is therefore crucial that the offer of work experience is made in such a way that captures the interest of students via a medium that will inspire and encourage their engagement. Bringing work experience directly to the student is how we see real change and progress being made.

Work experience helps students develop confidence and a positive attitude to the workplace, giving students a clearer picture of where their studies can take them.

NCUB are committed through Placer to help achieve this and we believe that Placer will allow universities to work more closely with a wider range of employers to bring a greater volume of work experience opportunities, directly to the student.

Manchester Metropolitan University are dedicated to the ongoing employability of our students and are pleased to partner with NCUB and Placer to help achieve our strategic goals and ensure the success of our students.

Provider, employer and learner: the changing dynamic

As the Government embarks on a major review of funding across tertiary education, it brings into focus once more an array of debates and discussions about accessibility to post-18 education, value for money, choice and competition, and the nurturing and developing of skills that business and the country needs.

While these debates are not new in themselves, the Review will put a spotlight onto whether the balance is right between the needs of learners, employers and providers in Higher Education.

Drawing on experiences at a national and institutional level, the National Centre approached me to reflect on this changing dynamic between provider, employer and learner. Back in 2012 when I supported the Wilson Review we grappled with the tension between employer-needs and student-demands¹. We were acutely aware that the perception of universities' ability to provide employers with graduates with the skills they sought was not strong. There was an impression that universities were not attuned to business needs, but rather were internally focussed, running degrees that the institutions wanted instead. Universities were often regarded as out of touch with business, unable to speak their language.

At the heart of the recommendations made in the Wilson Review was a real desire to change the dynamic. Rather than focusing on the tensions between learners, employers and providers, the recommendations focussed on where there were mutual partnerships and mutual benefits. Collaborations and partnerships saw the co-design of degrees, integrated work experience on all degrees, work shadowing for university staff, encouraging more students to undertake outward mobility overseas, promoting graduate internships, more opportunities to reflect on employability skills, and a new focus on the employability of postgraduate taught and research students.

All of these were already happening in many institutions five years ago. Looking at the landscape today it is clear that the situation is even stronger. Great leadership

and strategic approaches to employability from both universities and businesses have ensured that business-university collaboration is more central than ever before, supporting individuals, the economy and UK plc.

At my own institution we live and breathe partnership with our students and employers. Aston University was created by the employers of Birmingham in 1895 because they could not find enough employees with the right skills to work for them. This close relationship between our institution and local, national and international employers, both large and small, has stood the test of time and has remained the touchstone for all we have done since.

Today Aston continues to be at the forefront of yet another business-university collaborative initiative. We were the first university to graduate a cohort of degree apprentices and we have matured our ability to provide employers with what they need, when they need it. We now have over 350 apprentices studying with us, which is expected to increase to over 700 next year. In this innovation we draw strongly on our track record, our deep partnerships with business, and our legacy built via previous initiatives, including foundation degrees, CPD, KTPs, and above all the sandwich placement year. We are proud that nearly 80% of our students now undertake a year of integrated work-based learning, and that in 2017/18 we have 2,000 students out on placement, more than ever before. At universities like ours the collaboration with employers is strong and as important as ever.

As Ministers and senior officials grapple with the complexities and interdependencies of tertiary education, especially funding, they would be wise to learn lessons from previous reviews. In such a diverse and vibrant sector there will, of course, be areas for improvement. But a brave course would be to use the Review recommendations to encourage more institutions to learn from each other and promote the sharing of good practice across the practice. The dynamic between providers, employers and learners does not need to be one of tension but one of partnership and collaboration.



03

SHAPE OF THE
RELATIONSHIP

Local business impact

Growing the economy is no easy task, and growing it evenly is almost impossible. Yet there is a clear need to carefully balance the needs of the country with local capability, regional ecosystems. And place-based strategy.

Across the country there are the hot spots, and the 'not spots'. World-class excellence is, of course, more prevalent and likely to succeed in economically advantaged areas. There are many examples of local players investing in local collaborations to encourage innovation to flourish, which is evident here; from well-known Gloucestershire events harnessing local expertise, to universities working to understand and match local skills need in Sheffield, to technology hubs in Kent, Cambridgeshire, and Liverpool welcoming SME participants.

There are examples of large national issues, such as the ever present STEM skills shortages, being tackled on a local level for local growth. And there are examples of place-based issues, niche threats to regional economies, being challenged by the combined efforts of universities and businesses, both the large and the small.

It's clear from the case-studies in this section that both universities and businesses are taking their role in local eco-systems seriously, and as a result, clear identities and specialisations are starting to emerge. The case-studies in the section alone have helped more than 3000 local businesses, levied over £2.25bn in funding and investment, created 1000 jobs, 371 apprenticeships and added hundreds of millions to local economies.

Introducing Strength in Places

UK Research and Innovation

REPORT BY RACHEL TYRRELL
PROGRAMME DIRECTOR, STRENGTH IN
PLACES FUND, UKRI

UK Research and Innovation launches a new competitive fund to drive productivity and economic growth throughout the regions and nations of the UK.

Funded activities should bring significant, relative economic impact and regional growth relative to the baseline economic activity for the defined geographic area. Consortia are now invited to develop and submit Expression of Interest bids to the first wave, led by research organisations or business and involving both, with strong engagement from local leadership.

UKRI Strength in Places Fund is a new place-based approach to competitive funding of research and innovation, driven by business need that can be met by existing research strengths.

The issue SIPF aims to address

The UK Government announced the Strength in Places Fund in the Industrial Strategy White Paper, published in November 2017, recognising that there are large regional disparities in economic activity leading to social inequities.

The UKRI Strength in Places Fund (SIPF) is an opportunity for UKRI to play its part in strengthening existing research excellence and high quality innovation capability, given the important role science, research and innovation play in driving productivity and economic growth throughout the regions and nations of the UK.

It forms part of the activity undertaken as part of the National Productivity Investment Fund (NPIF) that will be contributing to the UK Government's commitment to reach 2.4% of GDP investment in R&D by 2027.

Economic geography

Consortia bidding to SIPF will self-define the economic geography of their proposal –the realistic local scale for the cluster being supported, not constrained, by local authority or political boundaries. The size and scope of the area must match the economic geography of the supply chain or local industry that the proposal focuses on, with robust evidence provided to justify the choice of area, range of partners involved and activities proposed, aligned to appropriate local plans and strategies.



Design process

Over the last few months, detailed design work has been underway in order that the high level aims of SIPF complement existing UK programmes, delivered by UKRI & other funders. An example is the Industrial Strategy Challenge Fund (ISCF) which looks to address grand challenges at a national level, compared to SIPF's focus on local economic growth, where activities are likely to bring significant, relative economic impact and regional growth.

The design of SIPF, a research and innovation fund, also takes into account that there are other funding streams in development, including the UK Shared Prosperity Fund, a domestic programme of investment which will boost productivity and reduce economic inequality across the country following departure from the European Union.

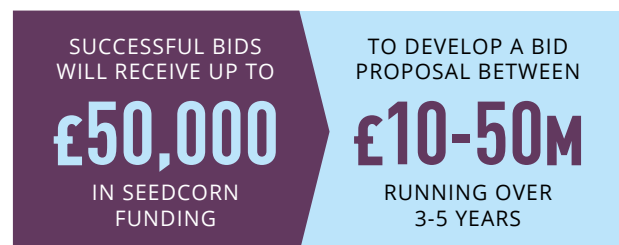
This first wave of SIPF has been deliberately designed to be flexible, open across all sectors and disciplines. We will support existing research excellence and high-quality innovation capability that focus on creating opportunities for economic growth, in line with the needs of local industry. We also expect proposals to consider the essential skills provision that would support the application of research and innovation activities.

Partnership approach

SIPF is a cross-Council UKRI programme, in partnership with the higher education funding bodies of Wales, Scotland and Northern Ireland and with the Office for Students. Delivery of the fund is being led by Research England and Innovate UK.

First wave as pathfinder

In this first wave, we are running a two-stage programme - firstly an expression of interest stage, where consortia will set out plans for large collaborative proposals. Following assessment, successful bids will be selected for stage two, receiving up to £50,000 in seedcorn funding to further develop a full bid proposal of between £10 million and £50 million, running over 3 to 5 years. UKRI plan to support between 4 and 8 full stage awards in this first pathfinder wave.



We have held events throughout May and June 2018, challenging universities and research organisations to partner with businesses and produce proposals that demonstrate and evidence strong engagement with local leadership. We look forward to working with the successful SIPF awards in the first wave, for the benefit of people right across the UK.

Placing locality at the heart of engagement

Leeds Beckett University has a strong reputation for proactive and positive engagement with local businesses, business representative bodies and statutory authorities, and is developing new business centres in the Leeds City Region. Leeds Beckett University's Business Centres are currently home to 240 SMEs in Leeds and Wakefield and with the University's new Halifax UBC opening in the spring of 2018, over 400 businesses will soon be based at LBU's sites.

Simon Baldwin Head of Enterprise and Operations at Leeds Beckett defines the success of these centres in terms of their "positive impact on local economies, and through the creation and growth of innovative new businesses, employing highly skilled local people."

"Leeds Beckett is committed to supporting growth and prosperity in our region. This initiative will accelerate growth in new and developing businesses by providing them with direct access to vital knowledge and resources."

Peter Slee, Leeds Beckett University Vice-Chancellor

Wakefield and Calderdale are "cold spots" of higher education. Neither have a university within their local authority area. Local political leaders believe this leads to lower levels of graduate employment and slower and less inclusive growth when compared to cities with established universities. Through formal Memoranda of Understanding the University and local authorities are able to explore how they can work together to address these issues.

Leeds Beckett University has operated a very successful (and financially self-sustaining) business centre for 15 years from multiple sites in Leeds. Each site provides flexible office accommodation for new

and growing businesses and offers them access to a range of supporting infrastructure and advice. The Centre creates an environment in which entrepreneurs and businesses can thrive. This approach underpins the establishment of two new University Business Centres (UBC) in Wakefield and Halifax.

In Wakefield, where the UBC was launched in January 2018, the city's college is the base of the new business hub. Sam Wright, Chief Executive and Principal of Wakefield College, has ring-fenced hot desks in the Centre to enable former students to access the support and guidance they need to facilitate businesses growth.

"Through the relationships between the university and the college, we will create opportunities for the businesses based in our UBC to access our student talent, through placements, projects and employment, giving our best students direct opportunities with great local employers."

Simon Baldwin, Leeds Beckett University Head of Enterprise and Operations

Councillor Denise Jeffery, Deputy Leader of Wakefield Council, said the new business hub was a "great step forward in supporting business and bringing jobs and prosperity into our district".

Gamification prompts regional SME growth

Researchers in the Advanced Services Group at Aston Business School are delivering a project which focuses on transforming SMEs to improve their revenues through the adoption of advanced services.

The TRAN-SIP project was funded using European Regional Development Funds and it has been designed to support manufacturers to help improve revenues through the development and provision of 'advanced services'. In essence, the project helps technology-innovating firms to understand their customers' pains - in relation to the use of their product or service - and to find novel ways of addressing these pains by providing basic, intermediate or advanced services to make the customer more successful.

services. An ERDF-funded pilot project delivered by the ASG team (2012-2015) was able to evidence £11.6m Gross Value add (GVA). The new TRAN-SIP project (2016-18) has achieved £13.2m GVA and created 19 jobs to date, with 1-year of the project still to run.

The main obstacles were addressed early on in the process by designing-in new knowledge (legal and finance) which allowed the TRAN-SIP project team to focus on building relationships with the firms, taking time

The new TRAN-SIP project (2016-18) in numbers



£13.2M
GVA



19x
JOBS



1 YEAR
TO RUN

Basic services might include spares and consumables, intermediate could include maintenance contracts, and, ultimately, advanced might cover a fully-managed service to ensure the customer receives the maximum capability from the product.

The Advanced Services Group (ASG) at Aston Business School recruited suitable firms and carried out a series of web-enabled 'gamified' diagnostics to understand the strategic positioning of each firm viz-a-viz their dominant strategy. The innovation came in the combined recruitment/diagnostic phase; by using 'gamification' tools (serious games) to gauge a firm's readiness to transform, ASG were able to help the firms envisage how the transformation might help them become more sustainable, improve revenues and recruit more staff. This is a unique project and the model does not exist elsewhere in the UK.

ASG partnered with Lloyds Bank plc and Trowers & Hamblins LLP to ensure that professional support was on hand to help the firms change their financial model and legal contracts to match the opportunities offered by new

to understand the core business, assess the opportunities and to create a community of like-minded executives (circa 62 firms). This community can come together to share best practice of business transformation and to work with the academic research community to identify new areas of business research to be explored.

Danny Harrison, Head of Business Development at Nicklin Transit Packaging, has been a beneficiary of both projects and their firm has grown 66% as a result of the changes to their business model, being innovative in the design of their products and understanding their customers better.

As a result, they have moved from being a Tier 2 supplier to a Tier 1 with an automotive original Equipment Manufacturer (OEM) as a result of demonstrating a much higher level of innovation. Danny said "without the ASG team, we would still be trying to sell pallets and cardboard boxes on a price basis, which was becoming a much commoditised sector, but now we are co-creating new value with our customers and improving both revenues and margins".

Growing the regional economy: a new vision for engineering and technology

Exciting changes are on the horizon that will reinvigorate the Kent and Medway economy and transform its graduate Engineering and Technology talent pool.

Canterbury Christ Church University is working in partnership with local businesses to develop and deliver innovative degree-level, professionally accredited qualifications, provided as major new full-time, part-time and apprenticeship-based courses that are designed collaboratively to fulfil the needs of the engineering and technology sectors.

These newly developed professional qualifications will be delivered and supported through the new Kent and Medway Engineering, Design, Growth and Enterprise (EDGE) Hub, funded through £6.12m from the South East Local Enterprise Partnership and a further £7m from the Higher Education Funding Council for England's Catalyst Fund.

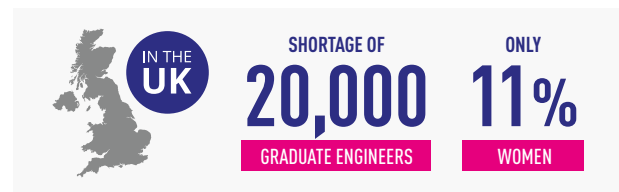
The EDGE Hub will be established by 2020 to deliver work-ready graduates for local SMEs, alongside new innovation services, technologies and facilities, and will be a multimillion-pound facility in Canterbury with distributed centres of excellence across Kent and Medway. This hub-and-spoke model will enable the centres of excellence to be easily accessible by regional SMEs, and will become instrumental in improving regional access to engineering and technology graduates while retaining them in Kent and Medway to ensure future economic success.

"The University is a major contributor to the regional economy and we want to ensure the region continues to prosper by working hand-in-hand with the business community. Our development of engineering presents a clear opportunity to provide highly skilled graduates and facilities, supporting SMEs to succeed."

Professor Rama Thirunamachandran,
Vice-Chancellor and Principal, Canterbury Christ Church University

Services will be delivered flexibly, built around companies' needs, including work-based learning routes for people in work that can be funded under the Government's new Apprenticeship Levy scheme. The EDGE Hub will also be made accessible to businesses, with a local presence through satellite centres in business parks, key research sites and near major concentrations of engineering and technology companies.

Phil Hart, Managing Director of MEP Ltd, said: "The Kent and Medway EDGE Hub is an exciting and significant partnership response to the region's challenges and opportunities, which has brought together businesses, industry and Canterbury Christ Church University to design a powerful and long-term solution."



As well as working with some of the big names in engineering and technology, the EDGE Hub will work collaboratively with SMEs. Christ Church will work with businesses to respond quickly to the latest sector developments, with a programme of continuing professional development, short courses and guest speaker events. Companies will also benefit from industry-led research and development projects, focused on real-world business needs.

Nationally, there is an annual shortage of over 20,000 graduate engineers (Engineering UK, 2017) and women make up only 11% of the engineering workforce (WISE, 2017). To challenge the gender and national skills gap, the University aims to attract 35% women and 40% of new learners from less advantaged communities to its courses, strongly promoting equality and diversity in education and industry. Christ Church is also removing barriers to success by taking away the need for A-level physics – designing the engineering knowledge required as students learn.



Engaging businesses with arts at the University of Nottingham

The University of Nottingham has a distinguished track record of science and engineering partnerships with industry. Large industrial partners including Rolls Royce, Unilever and Siemens collaborate across the breadth of the University's services to businesses.

Academics in the Faculty of Arts recognised the need to increase their business engagement and make a difference outside of academia. Led by Professor Paul Grainge and Dr Cathy Johnson from our Department of Culture, Film and Media, they worked with our small business network, Ingenuity, to deliver a workshop on 'Spreadable Marketing'. They used the platform to talk about how their research findings could be applied to business.

"We have a wealth of expertise and knowledge within arts which can be applied to businesses. The challenge is demystifying what we offer and encouraging businesses to take action. The Ingenuity Network has been really successful in opening doors for member businesses into further services at the University," said Gemma Morgan-Jones, University of Nottingham SME Engagement Manager.

With a membership of over 1,800 and a series of events and workshops held throughout the year, the network helps the University to build connections with the business community. One local company, Verve Garden Design, attended the workshop and could see the potential of the research to help develop their business.

Working with the Ingenuity Network team, Verve Garden Design successfully applied for our Innovation Voucher scheme, part of a three-year ERDF-funded programme of support called Enabling Innovation.

Lorraine Young, Managing Director of Verve Garden Design, began to work with the academics to translate

the thinking behind spreadable marketing into her business. The vouchers helped to pay for a PhD student to work as a research assistant. Working together with the PhD student and academics, the impact has been transformative. Based on the research findings, Verve Garden Design changed their business model and identified 14 steps to take their business forward including content creation and distribution strategies.

Lorraine said: "I found our discussions with the University academics very fruitful and they challenged my thinking. I feel incredibly fortunate to have had this opportunity from the University of Nottingham to take my business to a new level."

The project shows the potential of engaging with businesses beyond the traditional areas of science and engineering. The academics took back their learnings from the project and now deliver spreadable marketing as part of their taught module content to students. The project will also support a REF impact case study and helped to develop a PhD graduate with practical business experience.

Smaller businesses are often unaware how they can access or benefit from the University's facilities and expertise within arts. The University's award-winning 'Arts into Business' initiative has developed a series of programmes to transfer research-based knowledge into contemporary cultural, political and business life. The initial suite of programmes offered to business include; Language Profiling for Professionals; Languages for Business; and Digital Tools for New Audiences.

The New Keele Deal - supporting Staffordshire's business community

Dr Mark Bacon, Director of Research, Innovation and Engagement explains how the past few years have been significant for Keele University and its support of the business community in Stoke-on-Trent and Staffordshire.

Highlights include the launch of the New Keele Deal, our collaborative programme aiming to create 700 high-value jobs and support 1,000 businesses across the local area, and the introduction of our Business Gateway portal as a 'one stop shop' for local SMEs to access the University's resources and expertise. Regionally, we've also become part of the Midlands Innovation partnership, a network of eight research-intensive universities working together to drive and support innovation and growth across the Midlands.

The New Keele Deal, officially announced in January 2017, sees Keele University working in partnership with key local partners – Staffordshire County Council, Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council, the Stoke-on-Trent and Staffordshire Local Enterprise Partnership and University Hospitals of North Midlands NHS Trust – to deliver a unique programme of business support, development and growth within the local area.

The collaboration is supporting businesses to access the University's world-class research and facilities, providing training in innovation leadership and facilitating supply chain development across a range of sectors. **Collectively, the New Keele Deal will assist businesses to become more competitive, produce better products and improve their overall services to their customers.**

Through a range of innovative business support programmes, the New Keele Deal will enable the University to extend its already considerable impact on the local economy by contributing an extra £210m into the local area. Coupled with our involvement in the Midlands Innovation partnership, this economic impact will increase even further over the coming years.

In addition to providing enhanced local business support opportunities, the New Keele Deal aims to improve health care in Stoke-on-Trent and Staffordshire through the development of new health innovations and research designed to improve the diagnosis, treatment and management of health conditions.

The Deal will also position the area at the heart of the country's transition towards a lower carbon economy through the establishment of the Smart Energy Network Demonstrator - Europe's only at-scale living laboratory that will be used to trial and test new energy technologies.

These programmes will have an impact throughout Stoke-on-Trent and Staffordshire for the next 20 years and beyond. They are an investment in the growth of the local economy, helping our local businesses to develop, grow and prosper.



The New Keele Deal

Working together to create jobs and growth

£70m investment will...

- Create at least **700** high value jobs
- support **1,000** Staffordshire and Stoke-on-Trent businesses...
- Inject **£0.21 billion** into the local area
- improve local health and care for **EVERYONE**
- save around **4,000 tonnes** of CO₂ per year



A number of programmes available through the New Keele Deal and Business Gateway are part-funded through the European Regional Development Fund (ERDF) as part of the England 2014 to 2020 European Structural and Investment Funds (ESIF) Growth Programme.

Digital business programme boosts tech businesses in the M3 region

SETsquared Surrey's Digital Business Acceleration Hubs (DBAH) programme is proving to be an invaluable springboard for entrepreneurs and start-ups, accelerating their path to investment, growth and product launch.

It's a major £2.4m, three-year business acceleration initiative funded by the European Regional Development Funding (ERDF) to set up a network of four business acceleration hubs in Guildford, Woking, Basingstoke and Farnborough and linking SMEs to the region's first class digital research centres such as 5G Innovation Centre and Centre of the Digital Economy (CoDE) at Surrey University.

"I would urge anyone thinking of starting a tech-based business to go on this course, as it will set you on track to develop a viable business."

Steve Johnson, HOLM

SETsquared is the enterprise partnership between the universities of Bath, Bristol, Exeter, Southampton and Surrey and the global no. 1 university business incubator. Over the last 15 years SETsquared has helped more than 1,500 businesses raise over £1.25bn in investment. This programme is being run by SETsquared Surrey.



What does it offer?

Through the DBAH programme digital SMEs can receive funded access to two key stages of support:

- Two-day Entrepreneur's Programme
- A fast-track, interactive programme designed for entrepreneurs with an idea for a new digital enabling technology product or service or founders of existing high-tech companies needing a boost to the next level. Alex Cowan of RazorSecure said "The Entrepreneur's Programme really was the springboard for RazorSecure"
- 12-months fully-funded business incubation support
- Funded virtual membership of SETsquared's business acceleration support services, delivered through one of the four hubs



Delivering value and economic impact

Since the beginning of the programme 212 entrepreneurs have taken part in the Entrepreneur's Programme (over the course of the three-year programme 360 entrepreneurs are expected to take part). Since the programme:

- 38% have already launched their product/service
- 41% have recruited between 1 and 20 new staff over the last 12 months
- 63 were awarded a 12-month membership of SETsquared's business incubation programme

Companies taking part in the programme are seeing considerable investment success:

- whatCharity.com – £200k investment in seven months from private investors
- ScreenLimit – £150k funding in four months
- BotsAndUs – £100k Innovate UK grant and £40k SME Instruments Grant from the European Commission
- Streeva – secured a £264k Seed investment round
- Inovo Robotics – won an Innovate UK grant worth £225k in Sept 2017



Using Big Data to grow small businesses

The University of Exeter collaborates with the Met Office and other producers of environmental data and R&D to drive the business applications of complex data, boosting the development of a new innovation ecosystem and encouraging local growth.

The potential business impact of meta-trends such as urbanisation, digitisation and decarbonisation is huge. The University of Exeter and its partners are driving real meaning and future regional economic growth out of big environmental data.

Working with the Met Office and other producers of environmental data and R&D, the University of Exeter is helping businesses find new ways to use complex data to create new products and services, in sectors such as environmental resilience, agriculture, marine, smart cities, health and social care, and advanced engineering.

The £6.3 million Environmental Futures and Big Data Impact Lab (£3.8 million from the European Regional Development Fund) is a partnership between the University of Exeter, Met Office, Exeter City Futures, University of Plymouth, Plymouth Marine Laboratory, Plymouth College of Art and Rothamsted Research.

The Lab lets SME innovators respond to growing demand for innovation and opportunities using environmental data and sophisticated analytics and visualization tools held by the partners. The project will open up access to knowledge, expertise and data assets held by the partners and use these unique strengths to drive forward regional economic growth.

“Our region has great potential to become a recognised cluster for Environmental Futures and the capability to exploit the big data that underpins it.”

Robert Kathro, Programme Director

Met Office Head of the Informatics Lab Alberto Arribas said: “We all live on the same planet and we all get affected by weather, pollution, flooding, etc. That means that environmental data and science have great value for a large number of economic sectors. However, using environmental data and science to create useful applications is not easy: science is complex, and data volumes are huge and change rapidly. The Impact Lab changes the situation completely by creating a

unique place where all the different elements (science, technology, business) are combined. This will make it much easier to develop useful applications from environmental science and data.”

By linking SMEs with environmental scientists, data owners, and business support services, the Impact Lab is helping to create an innovation ecosystem which encourages local growth through the creation of new products and services. The Lab will provide the ongoing guidance and resources required to see these innovations through to market success, connecting with the global number one university business incubation service, SETsquared.

Support available to SMEs includes access to new data sets, new technology and data analytics tools, business and innovation support and joint projects working with statisticians, scientists, designers and academics in a shared working space. There will also be a Challenge Fund to further develop business solutions.

Programme Director Robert Kathro said: “Our region has great potential to become a recognised cluster for Environmental Futures and the capability to exploit the big data that underpins it. The building blocks are in place. We can now compete globally using our core strengths to create value as the world becomes ever more digital, urbanisation continues and we all decarbonise.”



Design. Develop. Publish.

Harnessing the power of games to create innovative solutions for human problems.



REACTOR is a regional development project led by Anglia Ruskin University (ARU) and co-funded by the European Regional Development Fund. Designed to support small and medium sized enterprises (SMEs), the project helps businesses based in the Cambridgeshire/Peterborough region grow through the use of applied gaming techniques.

Since 2017, the project has been helping over 100 organisations from a range of sectors by providing funding grant support, access to academic expertise, networking opportunities through an events programme that includes the Big Gamification Challenge, and more recently access to gaming software and high spec technology through the launch of a new Incubator Space.

Our community of networked organisations now stands at over 100 and some of these people are receiving tangible benefits from being involved in the project. Take YoYoLet'sGo for example. The company was keen to take their idea forward by creating a family friendly app which enabled users to be their own tour guide, discovering the most inspiring and interesting spots on a city visit with children.

The REACTOR project connected the company to game designers with experience of working with mobile games development. By connecting the two together, YoYoLet'sGo were able to avail expertise that let them build in a map and GPS into the app and explore gamification as an enhancement technique for the product.

The project has not been without its challenges though. One of the biggest the project has faced relates to translation. The world of business and academia

often speak different languages and innovation is a complex entity that can mean many different things to different audiences. In the beginning, there was a misunderstanding amongst the community as to what we were offering. We're not making games, but applying those techniques from the games industry to other areas. We discovered that the naming of events, support and the incubation space was critical to how people understood what they were. The Big Games Challenge became the Big Gamification Challenge. The REACTOR innovation space became the REACTOR Incubation Space. These subtle changes meant the difference between an event being fully booked or not, or enquiries coming forward to join our community network.

"We as designers know that if a design doesn't work, you change it. The same can be said for a project such as REACTOR. So our advice would be to be open-minded and be willing to make changes to a project as it progresses. This is a typical start-up problem which even universities can experience" said Dr Jan Storgards, REACTOR Director and Sector Lead for Digital and Creative Industries at ARU. "The early stage technology cluster in Cambridge is curious and support from the community superb. The next challenge for us is to harness this support to create a world-class cluster that grows beyond the Cambridgeshire enclave.

"Our aim is to be the global thought-leaders in gamification and the SMEs participating in the project best in their class."

Dr Jan Storgards, REACTOR Director and ARU Sector Lead for Digital and Creative Industries

ARU already plays a vital role in the games ecosystem in Cambridge. Along with industry partners, we run Brains Eden, the largest student games festival in Europe, bringing talented students to Cambridge for an annual games jam.



Nurturing graduate talent to introduce innovation into businesses

Over the last year, 96 small businesses have been helped by Nottingham Trent University (NTU) to bring forward their plans for innovation in the workplace.

Many SMEs would like to innovate by developing new products and services, but lack the necessary skills and capacity to do so. Through the £7.6m ERDF Enabling Innovation Programme, NTU has launched the pioneering Innovation Community Lab (ICL) which uses graduate talent to introduce an innovative culture into business.

Designed and tailored to meet the needs of SMEs in Nottinghamshire and Derbyshire, the ICL is a six month programme delivered to the graduate “intrapreneurs” and also supporting the management teams in the businesses. Monthly workshops ensure that participants are equipped with the tools to develop, pitch and implement new processes, products and services within their organisation.

The programme is creating a new community of young innovators in the local area that shares good practice and fosters a supportive network across a range of business sectors.

The ICL programme blends university knowledge with industry expertise. The feedback from businesses following the first two programmes has been universally positive. Businesses reported that the programme has also helped to change the mindset of senior managers, who see the benefits of their employees attending the ICL. They have also reported a stronger appetite for growth as the programme has contributed to the business’ awareness and desire to be more productive and competitive.

Jordan Daniel, Lead Motion Graphic Designer at Affari Media, a Nottingham based creative marketing agency, attended the first series of ICL, said, “Throughout the course, I was able to identify areas of improvement that could be made to my team’s approach to knowledge sharing that would, in turn, enhance our productivity. I began to create a structure, which I slowly started to implement and test. By the end, this

enhanced our productivity levels ten-fold. On the back of this, I started to mentor other colleagues to help them structure their own innovative ideas”.

As an anchor institution located in a core city, Nottingham Trent University is committed to playing a leading role in the social, cultural, economic and environmental development of the City and wider economic area. Michael Carr, Pro-Vice Chancellor for Employer and Economic Engagement explained, “The ICL project represents a further evolution of Nottingham Trent University’s innovative employer support initiatives. We are looking to support recruited graduates in their early stage-careers such that they make maximum impact within their employers. The programme has been well supported by businesses, many of whom are seeing significant benefit from this initiative.”

The University also believes that initiatives such as ICL can help extend local opportunities for student employment, which is a key strategic priority. The third series of the programme began in January and NTU is already looking to recruit the next cohort of participants which will begin in July as the programme continues to boost the innovation effort of SMEs in Derbyshire and Nottinghamshire.



European Union

European Regional
Development Fund

Using degree apprenticeships to meet regional need

The economy of the Sheffield City Region (SCR) faces a significant challenge, being ranked 38th in terms of GVA per head in the UK. The Local Enterprise Partnership (LEP) identified a key reason for this has been a “failure to grow a serious system of respected employer-led professional and technical qualifications”. With higher level skills shortages projected across key industry sectors it was clear a strategic regional response was needed to meet this challenge.

The emergence of employer-led higher and degree apprenticeships as a result of new government policy ambitions, coupled with an announcement by the Higher Education and Funding Council for England (HEFCE) of a Degree Apprenticeship Development Fund (DADF), provided a new opportunity for Sheffield Hallam University (SHU) to lead the response.

It was imperative to unite the business and education sectors, along with key partners and regional stakeholders.

SHU secured commitment and support for a successful collaborative bid to the DADF fund, articulating how higher and degree apprenticeship programs could be developed to help meet regional higher level skills needs and tabling a plan of ‘action to achieve’.

This resulted in SHU setting up a Degree Apprenticeship Regional Steering Group to provide oversight of the project, bringing together the LEP, Further Education Colleges, Chambers of Commerce and economically important employer representation, for example the regional NHS Trusts. The group collectively, utilising their own data sources and insights, created a regional economic skills map to further define the challenge, clearly identifying where higher level skills interventions were needed.

To enable SHU to align development of degree apprenticeship provision to these needs and ensure sustainability, further granular research was required, identifying the occupations which needed high-level skills acquisition, and which regional employers were most likely to have a demand for the relevant degree apprenticeships as a result.

SHU commissioned economic modelling experts, EMSI, to undertake this within the regional priority sectors and skills areas informed and defined by the group.

The short, data-rich reports revealed a number of things which continue to help SHU inform new degree

apprenticeships development; for example reflecting rapid growth of computer programming, with an expected 3,955 openings for programmers and software development professionals within the region by 2022.

Since forming the regional board



13

new higher and degree programmes have been developed and launched



216

new apprentices have started



371

apprentices are projected by the end of the 2017/18 academic year

Mark Rayner, Degree Apprenticeship Development Manager at Sheffield Hallam University said: “The data in these reports has revealed to us a number of opportunities for growing our degree apprenticeships over the next few years. We believed that there might be potential in each sector, and now we have hard evidence to support this. We can also see more clearly the occupational areas within each sector where opportunities lie.”

The initiative has seen great success, particularly since taking a proactive approach to talent matching; we now have free Apprenticeship Recruitment events to meet the needs of employers and the aspirations of new talent from our region’s schools and colleges.

Brighton: the seaside town that fuses the arts with technology

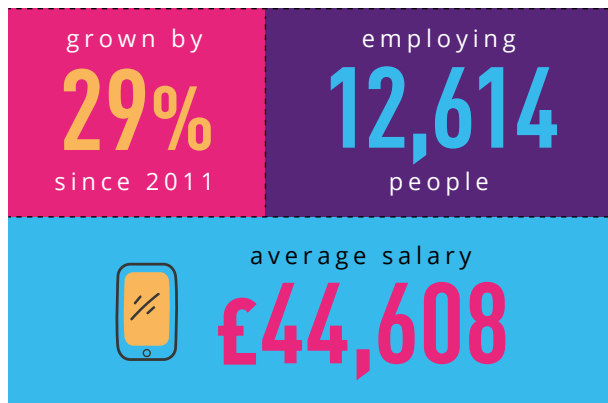
When Black Rock, a video game development studio in Brighton with 144 staff closed down in 2011, former employees formed the Brighton Indie collective, meeting regularly to form smaller businesses out of the ashes.

Four former staff joined forces to start Studio Gobo. Best known for its work on popular Disney Infinity playsets, including Pirates of the Caribbean, it launched a second studio in 2015 and is now partnered with Microsoft Studios.

The number of digital tech businesses in Brighton has grown by 29% since 2011, employing 12,614 people with an average salary of £44,608.



DIGITAL TECH BUSINESSES IN BRIGHTON



18.5% of Brighton's digital tech businesses are classified as high growth – more than Cambridge and Oxford¹. So, what is the secret to its growth? Many people were originally attracted to Brighton's seaside location, lifestyle and close proximity to London and Gatwick. The University of Sussex and the University of Brighton also help attract digital entrepreneurs who network, collaborate and provide peer support to each other through membership organisations like Wired Sussex. The city's Brighton Festival, the largest arts festival in England, and tech events, such as Brighton Digital, which drew 60,000 participants in 2017, also encourage openness and connectivity.

In fact, 74.5% of Brighton's creative and digital industry firms interviewed believe its digital cluster is important for creating opportunities and collaboration, according to the Brighton Fuse². This two-year project led by the University of Sussex and the University of Brighton and overseen by Wired Sussex and the NCUB analysed the growth of Brighton's creative and digital cluster and ran pilot schemes to promote innovation.

Brighton's fusion of technology with the arts is another ingredient to Brighton's success. 'Fused' businesses, which combine creative art and design skills with science and technology expertise, grew faster than their 'non-fused' equivalents (18% versus 7% growth) and were more likely to innovate³. "It's got a strong arts and bohemian scene," said Phil Jones, Managing Director of Wired Sussex. "Bringing that together with a digital scene is what gives Brighton its edge."

A £170m Greater Brighton City deal, signed in 2014, aimed to drive "tech cluster" growth and said that Brighton Fuse research was critical for highlighting the area's 'outstanding performance' and 'superfused' businesses. The independent review behind the £45m Creative Industries Clusters programme, which aims to build collaboration between creative industries and UK universities, also cites the research⁴. The Review's recommendations feed into the 2017 Industrial Strategy White Paper.

The University of Sussex, a City Deal partner, is helping firms understand and explore the potential of new technologies. For example, entrepreneurs on Brighton's Digital Catapult Centre's residency programme will soon visit the University to find out about its haptic technology research. Only conceptualised in 2011, the technology uses ultrasound to stimulate our sense of touch and could fundamentally change the way we interact with technology. Helping firms understand and exploit new technologies like this will be key to maintaining Brighton's future tech growth.

¹ Tech Nation 2017 report.

² Sapsed, J, Nightingale, P. The Brighton Fuse, 2013.

³ Sapsed, J, Nightingale, P. The Brighton Fuse, 2013.

⁴ Independent Review of the Creative Industries, Sir Peter Bazalgette, 2017.

New home, new alliances

HSBC is preparing to open the headquarters of its new ring-fenced bank, HSBC UK, in Birmingham in 2018. This is a major investment for HSBC and is the largest property deal in Birmingham for more than a decade. As part of the relocation process, they have been forging closer links with universities and other important stakeholders in the Midlands.



HSBC values its relationships with UK universities and understands the important role that they play in civic leadership, regeneration, skills development, supporting business growth, exporting and innovation - as well as being a major employer. While HSBC's relationships with universities vary widely, our place-based presence across the Midlands has led to strong regional partnerships and is key to developing local skills for growth.

Future talent pipeline

HSBC supports student employability by providing expertise, advice and guidance on topics such as 'careers in banking' as well as running events aimed at helping more women consider and develop their careers in banking. HSBC has a strong presence at careers fairs at universities such as Aston, Birmingham, Coventry, Newman and Warwick allows HSBC to work with students from a range of mission group universities, through networking sessions and strength-based recruitment presentations.

But it's not all talk; this year HSBC has worked with Aston University to introduce 'A Year in Industry', a programme offering students an intensive banking experience. The first two student participants have now been recruited and started their placements with HSBC in Birmingham in January. If successful, the bank aims to expand the partnership to more universities in the Midlands and potentially nationwide.

HSBC has also collaborated with Aston University to help develop its MSc in Financial Regulation and Compliance. In addition, the bank has created a number

of employability modules to encourage students to engage in self-reflection as well as providing practical advice to help graduates prepare for the future world of work. HSBC's internship and graduate programmes have seen 75 candidates from the Midlands attend assessment centres this year alone.

Financial wellbeing

It's important that students have the insight and education they need to help them plan for significant life stages. HSBC works with universities to offer a Financial Wellbeing Programme, supporting students by developing knowledge such as; how a bank account works, budgeting, understanding credit and keeping finances safe, along with hints, tips and best practices to prepare them financially for what lies ahead.

HSBC also offers employees and students the opportunity to undertake a financial 'health check' with a specialist so that individuals can ask questions and seek guidance in a confidential environment on all aspects of their financial situation. Where appropriate, HSBC will also help ensure that the appropriate solution or specialist support is provided.

The importance of relationships

At HSBC, relationships are important. The Birmingham move is a real opportunity to build lasting relationships that benefit not only the bank, its customers and its partner universities, but the wider community and the entire region.

HSBC's ambition is to find new ways to boost economic growth by supporting the supply of a diverse, talented graduate pool to local businesses.

Through these and other activities, HSBC hopes to support further work by Midlands' universities this year - in particular, working to close the skills gap and support the Government's Industrial Strategy.

Ørsted nurture the foundations of an affordable future

In 2011, Ørsted (formerly DONG Energy) began a strategic relationship with Durham University to sponsor renewable energy research at the University's Durham Energy Institute (DEI).

As a market leader in the development and operation of offshore wind, Ørsted recognises the importance of developing strong links with academia in order to cement the UK's position as world leader in the offshore wind industry.

The DEI as a global centre of excellence has proved a perfect match for Ørsted's world leading experience in the renewables sector. Addressing energy challenges collaboratively through strong partnerships with industry ensures exciting research initiatives with real world applications that achieve maximum impact in the energy sector.

The real-world data and knowledge gathered from Ørsted's offshore wind operations provides a unique resource for academics to study, whilst research undertaken will help make the UK wind industry even more economically competitive and a play a key role in the UK and European energy mix.

Each year, the company has provided three MSc scholarships at Durham University, as well as funding the Chair in Renewable Energy position at DEI. Ørsted is also now supporting the work of two PhD students through the DEI. The PhD research programmes focus on the operation of wind turbines and predicting of technical faults before they happen.

The programmes are a perfect example of how strong relationships between industry and academia can make a tangible contribution to the energy sector.

The two PhDs bring together turbine maintenance data and Supervisory Control and Data Acquisition (SCADA) data, with a view to developing algorithms for predicting turbine malfunction. One will focus on developing a method for analysing and categorising relevant maintenance issues from the maintenance database. This will feed into the work of the second student, who will focus on developing advanced data methods to positively identify turbines that are developing faults before they become critical and require the turbine to be taken off line.

This research which will be undertaken both in Durham and on site at Ørsted offices, could prove vital in improving the availability of offshore wind turbines, ultimately helping to further drive down the cost of energy. By including the students as part of the Ørsted team, they will be able to rapidly gain deep understanding of the company's key challenges and priorities. This will ensure that research remains highly relevant to the company, as well as enabling knowledge transfer between Ørsted and Durham University.

With the sponsorship and supervision of MSc and PhD students at Durham University, Ørsted is looking ahead to the future of the company and the industry as a whole.

The company is committed to fulfilling its vision of a world that runs entirely on green energy and firmly believes that strong links with academia are a key component in achieving this goal.



A renaissance in UK manufacturing

The research and innovation assets and expertise based at the University of Sheffield's Advanced Manufacturing Research Centre (AMRC) are driving regional economic growth and cementing the Sheffield City Region as a place of innovation.

Since its foundation in 2001, the University of Sheffield's Advanced Manufacturing Research Centre (AMRC) has grown a global reputation as a model for successful collaborative research involving universities and industry to accelerate the adoption of new technology.

Located on a once brownfield site, the global success of the AMRC and the partnership approach of the University with key economic anchors such as the Sheffield City Region Local Enterprise Partnership and Sheffield and Rotherham councils, has led to global aerospace and automotive brands choosing to locate key aspects of their production processes here in the region.

Supercar manufacturer, McLaren Automotive, is on-shoring its carbon body production from Eastern Europe to Rotherham on to land which more than a decade ago developers would have dismissed. Today the same land tells a different story as the area attracts not just international organisations like McLaren but the SMEs and supply chain companies who complete the innovation ecosystem.

The purpose-built £100m production plant will bring an additional 200 jobs to an area which is fast becoming the hub of the region's Advanced Manufacturing Innovation District.

For McLaren Automotive's Chief Executive Officer, Mike Flewitt, it is the research and innovation assets in the AMRC that were key to their decision to on-shore. "We

evaluated several options, but the opportunity created by the AMRC at the University of Sheffield was compelling. We will have access to some of the world's finest composites and materials research capabilities, and I look forward to building a world-class facility and talented team at the new McLaren Composites Technology Centre."

Within months of the McLaren announcement it was the turn of Boeing – a founding partner of the AMRC – to announce that it too would be building a production plant close to the researchers who were revolutionising the production of key components of its latest generation of aircraft. The new 6,200-square metre Boeing Sheffield facility, the first of its kind in Europe, will manufacture actuation system components for Boeing's Next-Generation 737, 737 MAX and 777 aeroplanes – enhancing production efficiency and reducing costs whilst maintaining quality.

Like McLaren, Boeing is also using the AMRC's Training Centre to build a new workforce of highly skilled apprentices for the new facilities. "These developments mark a step change in the perception of the Sheffield City Region as the go-to-place for the world's most advanced manufacturing companies," said Keith Ridgway, Executive Dean and co-founder of the AMRC. "We are proving that we have the research and innovation assets, combined with skilled and talented young apprentices committed to careers in engineering, to bring the very best manufacturing companies in the world to the Sheffield City Region. The transformation of what was once a post-industrial wasteland into a global hub of research and innovation is a model for how to create a renaissance in UK manufacturing."



Sensor technologies to put Liverpool on the map

Sensors play an important role in day-to-day life and their usage is set to increase as technology advances even further. Sensor City presents an exciting opportunity for both universities and SME businesses to work together and share knowledge in this cutting-edge sector.

Sensor City is a Liverpool city region based innovation centre and University Enterprise Zone funded through the European Regional Development Fund and the Department for Business, Energy and Industrial Strategy with co-investment from Liverpool John Moores University and the University of Liverpool. It aims to foster the creation, development, production and promotion of cutting edge sensor technologies for use in a wide range of sectors and to become a global hub for sensor technologies.

From its purpose-built base in Liverpool, Sensor City offers existing companies and budding entrepreneurs the technical expertise, business support and international platform needed to collaborate, fund and promote sensor solutions to a global market. Positioned at the intersection of industry and academia, Sensor City facilitates connectivity and fosters progress, helping partners to capitalise on the growing sensor revolution and aiming to make Liverpool City Region a world-recognised hub for sensor technologies.

The state of the art engineering workshops provide everything needed to support rapid prototyping of new developments. Entrepreneurs and companies can choose from a range of hot desk packages or dedicated office space and can access hands-on expert engineering technical support for new developments alongside business support, mentoring and networking opportunities, direct access to university talent including interested academics and student placements, pump-priming support, and help with accessing funds.

All of this is delivered in a supportive environment that aims to de-risk the development process.

Since opening in June 2017, the centre has welcomed 11 new tenant companies and the intention is to welcome student entrepreneurs from both partner Universities to help build the community either through their own companies or support of the tenants. Tenants have been able to access support from engineers and academics via the ERDF-funded LCR 4.0 project, of which Sensor City is a partner. This has enabled early stage developments to be fast tracked through to prototyping.

Pulse Systems has become the latest addition to the Sensor City community. The innovative SME designs, builds and deploys complete building management solutions (BMS) and smart sensor devices to allow their customers make critical business decisions based upon real-time data, achieving substantial energy savings due to improved understanding and control of their building environment.

Kevin Davies, Managing Director of Pulse Systems said: "The move into Sensor City was a simple choice for us. The facility enables rapid prototyping capabilities, a vast support network of highly skilled engineering and business professionals and an ultra-modern, cool working environment. The branding and status of Sensor City enables us to stand out and with the level of support and engineering potential, it puts us into a strong position to grow and succeed with our vision."

Hertfordshire Science Partnership

Hertfordshire Science Partnership (HSP) is the University of Hertfordshire's pioneering scheme that offers cutting edge facilities and research talent in a state-of-the-art science building for the benefit of local and regional businesses. There are three ways that businesses can utilise the resources that the HSP offers.

Bespoke research

Hertfordshire lies in the centre of the UK life sciences industry's 'Golden Triangle', between Oxford, Cambridge and London. In 2016 there were 330 enterprises in Hertfordshire that focussed on pharmaceutical and life sciences research. While the sector is dominated by large enterprises, there has been a remarkable growth in SMEs.

"SMEs operating in the life sciences field often struggle to fund the research required to ensure a continual stream of innovative products is in development."

Professor Darrah Murnane, Hertfordshire Science Partnership Director

To help businesses overcome this challenge the HSP, through its Hertfordshire Knowledge Exchange Partnership (HKEP), gives any organisation access to a dedicated PhD researcher who will, uniquely, spend their first year embedded in the organisation. In conjunction with their academic supervisor and the host company, the researcher spends their first year gaining an in-depth understanding of the particular challenges facing that business and deciding how their three year research project should be focused for the benefit of the company.

Current HKEP projects include: investigating resistance to crop disease affecting oilseed rape for RSK ADAS Ltd; researching new ways of administering drugs to older patients who have difficulty swallowing for Fluid Pharma Ltd; exploring more efficient modelling for testing the effect of drugs on organs for CN Bio Innovations Ltd; and investigating growing food locally for Letchworth Garden City Heritage Foundation.

Help bringing products to market

To encourage life sciences research collaborations and to help new start-ups or academic research centres to bring products to market quicker, the HSP also includes a Therapy Accelerator Competition which considers applications for grants totalling £700,000. One such collaboration with the University of Cambridge is driving research to prevent the spread of a lethal form of pancreatic cancer. The new partnership will allow researchers to make rapid progress in designing and screening more potent drugs, generating the evidence required to attract translational funding and commercial partners.

"This funding enables research groups with different expertise to join their forces to explore the druggability of a novel protein target that is driving pancreatic cancer and to facilitate the development of new generation of cancer drugs," said Dr Marko Hyvönen, Department of Biochemistry, University of Cambridge.

A science hub for local use

A central consideration in the development of the HSP was to provide ways in which the University's science building could benefit local businesses on a practical, day-to-day level. The 'Research Hotel and Concierge Service' is a first for businesses, especially SMEs, and is based on the shared use of specialist research facilities.

"We've made our brand new Life Science Laboratories available to businesses on a walk-in, pay-as-you-use, basis and a number of companies have taken advantage of this so far", said Professor Murnane. "Additionally, we're offering subsidised, specialist research-for-fee projects; the company only pays for equipment and laboratory running costs and a contribution to the costed researcher's time."



Showcasing place-based value

Working closely with The Jockey Club and Cheltenham Racecourse, the University of Gloucestershire embarked on a project to put a cash figure on the value of the Cheltenham Festival, underlining its pivotal role in driving future growth in the local economy.

Every March Cheltenham businesses eagerly await the Festival. More than 248,000 race goers snap up any spare rooms, pack the cafes, restaurants and bars to bursting, and taxi drivers look forward to a long and lucrative night. It's never been in any doubt that that this internationally-renowned horse racing festival helps drive the local economy - the big question was by how much.

The challenge for Cheltenham Racecourse was to establish a figure for its contribution to the local economy and encourage visitors coming from the UK and abroad to support this important research.

The solution was a collaboration with staff at the Centre for Contemporary Accounting Research (CenCAR) at the University of Gloucestershire to deliver an Economic Impact Analysis of the four-day Cheltenham Festival.

The categorisation of expenditure was gained from an online survey managed by Cheltenham Racecourse using a questionnaire developed to achieve the project goal. A survey was distributed to each party that attended the event asking about their expenditure, with a total of 4,356 responses. This included days attended and what, and where, they spent their money during their visit to the area.

Taken from information gathered at the event in 2015, the analysis revealed that it brings more than £100 million to the Gloucestershire economy. Professor Neil Towers, who oversaw the project on behalf of the University of Gloucestershire, added;

"The Cheltenham Festival is a major contributor to the Gloucestershire economy and we were pleased to be invited to undertake the Economic Impact Analysis. **From our analysis we were able to show where the money was spent over the four days which in turn helps Cheltenham Racecourse better target its activities to meet the customers' requirements in future events.**"

Published in March 2016, the Economic Impact Analysis generated widespread coverage across the print and broadcast media for Cheltenham Racecourse, boosting its local reputation and building the place brand of Cheltenham. Insight into where money was spent also allows Cheltenham Racecourse to make robust business decisions about how it meets future customer needs.

Ian Renton, Regional Director for The Jockey Club, South-West, said, "The University of Gloucestershire have produced a comprehensive report which has revealed a staggering figure of what the four day Festival brings to the Gloucestershire economy. We have known for many years that many of the local business have a significant turnover during the four days of The Festival but we are delighted that we have been able to put a figure on this impact and thank the team at the University for all their hard work in bringing this report to life."

Through this research, the University was able to shine a light on the invaluable contribution of The Festival and its pivotal role in driving growth and business spend in Cheltenham and beyond.



Beyond borders: the Glasgow University innovation district

The University of Glasgow's £1bn campus redevelopment is its single biggest estates project in more than 150 years. But its ambitions stretch beyond its borders: its vision is to use the revitalised campus to connect its world class research with industry, the public sector, City Council, and local community to drive innovation in the West End and wider city - transforming some of its most economically-deprived neighbouring communities.

At the heart of this vision is the creation of the Glasgow University Innovation District: encompassing the city's bustling West End and Waterfront region, taking in the University campus in the north, the Queen Elizabeth University Hospital to the West, and the Creative Clyde Media Cluster in the South. It's also an area rich with culture, offering the Kelvingrove, Riverside and Science museums, the all-new Kelvin Hall cultural hub, and the Scottish Events Campus, one of Europe's leading conference venues.

"The Innovation District is an outstanding opportunity for the city. It's the University of Glasgow at its very best: world-class researchers and students working in partnership with industry to create world-changing breakthroughs and innovations. I am confident that the development of the District will help drive the Glasgow region's continuing growth and prosperity."

Sir Anton Muscatelli, Principal and Vice-Chancellor of the University of Glasgow

The District will connect and leverage local strengths to transform the area into a vibrant focus of entrepreneurial activity where the best of industry and academia

will live, work and thrive alongside one another, generating new avenues of exploration, partnerships and educational and employment opportunities in the surrounding neighbourhoods – which include some of the city's most economically undeveloped areas.

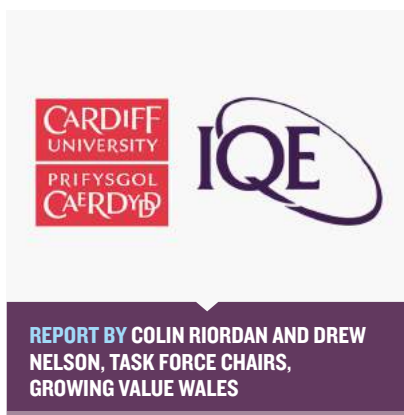
As the anchor institution for the District, the University will lead development of a new Interdisciplinary Innovation Zone on its redeveloped campus. It is working to attract and partner with industry to deliver innovation in four priority areas: Precision Medicine and Chronic Disease, the Nano and Quantum World, Creative and Cultural Economies, and Smart City Technologies. The new Zone will complement the University's existing Clinical Innovation at the Queen Elizabeth University Hospital, another key anchor of the District.

Both Zones will provide the space and facilities needed to accelerate innovation in the area, offering space for start-ups, spin-outs, and corporate partners to work alongside their academic counterparts, while also providing the tools and training that the University's students need to succeed in tomorrow's digital economy.

What's more, the new Interdisciplinary Innovation Zone will sit alongside the University's forthcoming Research Hub (pictured) – a cutting-edge, internationally leading facility that will bring the University's best researchers together in large interdisciplinary teams in order to tackle some of global society's most pressing challenges.



Making the connection – a new national innovation compact for Wales



In 2016, the National Centre launched the Growing Value Wales Task Force that brought together senior leaders from multiple sectors and agencies to review ways of increasing more effective partnerships and collaborations. The work, supported by the Higher Education Funding Council for Wales (HEFCW) shines an important spotlight on the opportunities for Wales by harnessing the talent being developed in Welsh universities and strengthening research and development for the benefit of the nation's economy.

Since embarking on this Task Force at the beginning of 2016 much has changed. The landscape has radically shifted particularly in the context of Brexit but also with structural changes in the global economy, driven by data analytics, quantum computing, AI, and deep-seated shifts in energy production and consumption. In Wales, a new Economic Prosperity plan has been launched, City Deals are being agreed and a major review of Tertiary education has recently been announced.

Post-Brexit Britain faces daunting challenges. More specifically, post-Brexit Wales faces daunting challenges. And this is the point; the issues in Scotland, Northern Ireland and even the English regions differ both dramatically and subtly. Wales can and should act decisively to determine its own future. It is important that stakeholders work together in a spirit of co-production to promote self-reliance as a proud nation, to find ways of taking advantage of the opportunities this new world offers. In particular, it is vital to ensure that the key actors in the Welsh Government, the City Regions, the Local Authorities, in Westminster, in business and industry and in our universities and colleges take a

coordinated and strategic view of the opportunities that will exist. Funding streams such as the Industrial Strategy Challenge Fund, Strength in Places Fund, City/Region Deals, the pledged UK Shared Prosperity Fund and Welsh Government innovation initiatives would be more powerful, transformational and effective for the Welsh economy if the various agencies and actors involved co-ordinated their efforts.

But the issues go beyond funding: the supply side of knowledge generation must be better aligned with the demand side of knowledge exploitation. Prosperity for All has “5 priority areas – early years, housing, social care, mental health and skills, which have the potential to make the greatest contributions to long-term prosperity and well-being”. To deliver on these priorities, and to supercharge Welsh industries of the future and empower the regions to become more productive, Welsh Government must work closely with universities, industry, stakeholders and civil society to take full advantage of the Quadruple Helix approach shown to work so well in other parts of the world. A new compact between Government, both national

Prosperity for All: the national strategy

5 priority areas



HOUSING



MENTAL HEALTH



SKILLS



SOCIAL CARE



EARLY YEARS

and regional, and their stakeholders is required to help deliver this ambitious plan. Relationships need to be warm and open and communication should flow freely. Government, academics, entrepreneurs, industrialists and business people have to understand each others' dynamics, capabilities and constraints much more comprehensively. And information exchange and relationship-building should be established and strongly developed.

The excellent products of our research expertise – recognising that economically viable innovation depends on a solid base of well-funded, curiosity-driven, blue-skies research across the whole academic range – must be complemented by an excellent skills base in which young people at the start of their working lives, as well as those who wish to change direction or increase their skill level, are equally well served. And in which the needs of employers are seriously catered for. Above all, there must be a sense of common purpose.

The whole of Wales deserves a modern, forward-looking knowledge economy that takes account of the nation's economic traditions and adapts them for a new world outside the EU.

We should be at the forefront of a growing economy in which Wales becomes a byword for prosperity in all in regions. We need, in short, to grow value in all senses: economically, socially and culturally. But that success will only come about if all involved are prepared to play their part.

The final Task Force called for a New National Innovation Compact to be formed. The aim of the compact is simple: to promote prosperity and wellbeing for the people of Wales. Universities have convening power and the capacity to offer a neutral space for debate.

This must be a distinctively Welsh response to this increasingly confused global world, where technology is hollowing out industries, whilst at the same time creating a vibrant entrepreneurial environment for those able to take advantage of the possibilities. Short and medium-term initiatives are understandable responses to a rapidly-changing environment, but agreeing, aligning and applying an innovation compact, with clear give and take on all sides, is a fundamental pre-requisite of Welsh success and the economic action plan.

The elements of The National Innovation Compact must be enduring (at least five years), be grounded in actionable reciprocity, be a strong balance of rights and responsibilities, and report back to an Innovation Compact Commission, composed of leaders drawn from across the Welsh spectrum of government, business, public and third sector, as well as vice-chancellors and heads of schools and colleges.

To take this forward Cardiff University has expressed a willingness to work with other interested parties to organise and host a summit on the concept of a National Innovation Compact. We look to work with colleagues and stakeholders in Wales and beyond to make this happen to bring benefit and impact for Wales.





04

SHAPE OF THE
RELATIONSHIP

Driving solutions

The UK has a strong reputation for global innovation excellence, being 2nd in the world for research, 6th for industry-university collaboration and 7th for knowledge exchange.

This section showcases this reputation at its best, and makes evident the goals that can be achieved, and the obstacles overcome, when universities and businesses truly collaborate. There is reduction of food waste for SMEs in Scotland, robotics changing the face of space exploration, Virtual Reality in the mining industry, and new medicines to fight cancer and neurodegenerative diseases. We're seeing truly open innovation from GSK, the championing of entrepreneurship from Cisco and UCL, and local, meaningful growth from universities across Wales.

Innovation based on collaboration will always involve a degree of knowledge exchange, and participants are required to put excellence ahead of their own goals. In a world where a significant proportion of the public fail to understand what universities do, shining a light on this, the 'third leg of the HE stool', is crucial. As we develop the Knowledge Exchange Framework, it is imperative that this section showcase the diversity of knowledge exchange taking place in university-business collaboration, and highlight the wealth of both outputs and outcomes which ensue.

The benefits for both universities and business are evident, both financial and reputational, but it is the benefits for the UK as whole which are outstanding. As seen in the Collaboration Progress Monitor at the beginning of this report, the quantity of interactions between universities and business has increased, but in general terms the value has contracted. The outcomes of these interactions are substantial, and this year we have recorded increases in the number of licenses issued to businesses; a growth in income from licensing activity; an increase in the granting of patents; and a great number of spin-off companies surviving the initial 3 years. We look forward to the impact of efforts to raise R&D investment to 2.4% GDP by 2027, bringing us closer to our OECD competitors.



Accelerating Patient Capital

Innovate UK

REPORT BY TIM SAWYER
INVESTMENT DIRECTOR, INNOVATE UK

The mix of funding that underpins our innovative firms is key to ensuring they receive the investment required to thrive and grow; this, in turn, has a profound impact on growth in the wider economy. As the Industrial Strategy observes, we must empower our innovative companies with the confidence they need to plan for the long term. In this context, the right finance is critical.

The Patient Capital consultation, published August 2017, made interesting distinctions when it set out to understand the current UK landscape for financing growth in innovative firms. As you would expect, it looked into the economic factors which impact the supply and demand for ambitious long-term investment in innovative companies. But critically, it also looked into the factors that determine successful deployment of patient capital, and in particular the challenges of matching patient capital to companies with the highest growth potential.



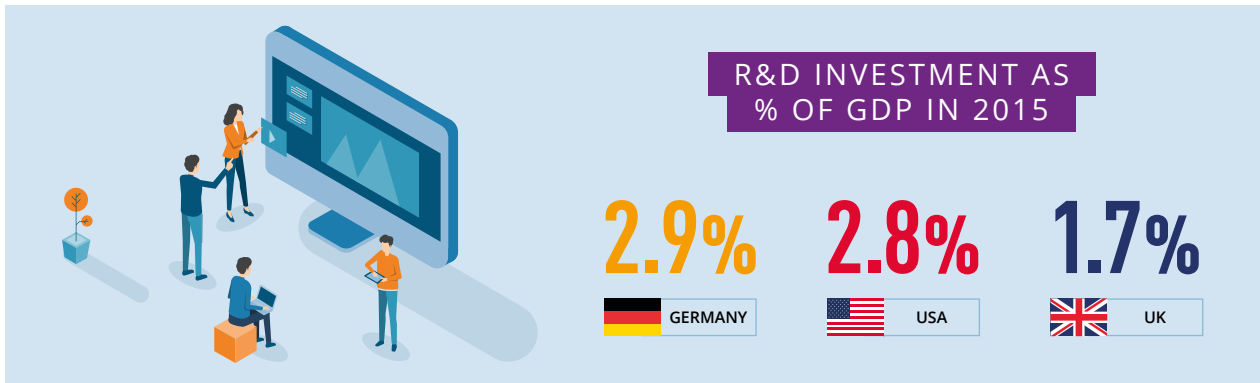
The key weakness identified - level of business R&D

The Patient Capital consultation also put its finger on a key weakness; the low level of business R&D investment going into young UK companies compared to the United States, despite the UK having a higher quality research base than the US upon which to attract that investment.

The difference is stark. In the US, 45% of business R&D investment goes into young companies whilst in the UK it is only 15%. Three times as much of the R&D investment is going into young companies in the US, compared to their counterparts here in Britain.

Finding new solutions for accelerating patient capital deployment

The challenge for young companies in the UK is further compounded by the low level of our total R&D investment, which has plateaued at around 1.7% of GDP for the last 20 years, whilst our global competitors



such as the US and Germany have increased their investment to 2.8% and 2.9% respectively. Whilst Government's commitment to increase investment to 2.4% of GDP is important, finding new solutions to accelerating patient capital deployment is going to be critical if we are to compete more effectively globally. To grow the industries of the future, we must harness the capabilities of innovative young companies.

75% of R&D is carried out by just 400 businesses

The foundations for tackling this challenge have been set out by the Government in its Industrial Strategy, and attendant ambition for the UK economy to lift its total investment in R&D over the next ten years much closer to the OECD average.

This is a challenge which is more about breadth than depth. The UK has excellent examples of R&D intensive industries - e.g. in automotive, aerospace and pharmaceuticals, but as the Industrial Strategy points out, 75% of our private sector R&D is carried out by just 400 businesses.

We need a way to accelerate patient capital more broadly into young agile companies, which can drive growth and prosperity right across our economy.

The demand is there but what is missing?

The demand is there; we see it every day in the number of high quality applications received for our funding competitions. The long-term supply of finance has also been strengthened, with an additional £20bn available for innovative and high potential business.

What is missing are new ways to bring supply and demand for business R&D together, in order to drive new patterns of capital deployment right across the UK economy.

Our first of a kind Investment Accelerator took on that challenge by bringing together:

- Innovate UK expertise identifying high potential businesses
- Venture capital expertise identifying the teams and business plans capable of realising that potential
- Innovate UK grant funding to create a risk profile that crowds-forward private sector investment into early-stage R&D
- Venture capital equity funding increasing the occurrence of follow-on private sector growth funding
- 100% project funding combining grant funding from Innovate UK with matched equity funding from venture capitalist for successful companies

Investment Accelerator pilot success

The pilot competition received over 750 registrations, the majority of which were from businesses who had never approached Innovate UK before. This led to over 220 applications with more than 50 in the strand for Infrastructure and over 170 in the strand for Health & Life Sciences. From these applications, we are on course to securing in excess of 40 joint investments by Innovate UK and our Venture Capital partners.

Create a step change in growth

The UK government has set itself the ambition to become the world's most innovative economy. We already have the high potential companies, and plans are in place to drive up the supply of patient capital. If we now align the core strengths of our public and private funding communities, through solutions such as the Investment Accelerator, we can break out of our historic investment bias and create a step change in growth across our economy.

Triggering innovation in new markets through partnership

From window cleaning to waterless aircraft cleaning, a top rated Knowledge Transfer Partnership between Vale of Glamorgan based business 'Window Cleaning Warehouse' and Cardiff Metropolitan University sparks innovation in new markets and wins the Partnership Category at the Insider Media Ltd Business and Education Partnerships Awards 2017.



The Business and Education Partnership Awards celebrate the best examples of collaborative work between Welsh business and education. The Award, which was presented in November 2017, was in recognition of Cardiff Met's successful two year Knowledge Transfer Partnership (KTP) with Vale of Glamorgan-based manufacturer of professional window cleaning systems, Window Cleaning Warehouse (WCW). This KTP had previously been recognised for its excellence by receiving a Grade A from Innovate UK making it a top rated UK KTP.

Matthew Taylor, Director of Innovation at Cardiff Met said: "We are delighted that this partnership has been recognised as a top rated KTP and a model of best practice at the Insider Business and Education Partnership Awards.

"Our partnership with Window Cleaning Warehouse is an excellent example of how the expertise within Cardiff Met can be applied directly to influence business growth. We were able to apply research-led solutions in a real-world setting to deliver tangible financial benefits to the company."

The partnership capitalised on years of knowledge within the company and the expertise of Cardiff Met academics from the Cardiff School of Art and Design to develop, perfect, and test an innovative waterless cleaning process appropriate for the external surface of aircraft. The KTP achieved the overarching aim of embedding research and development capabilities in Window

Cleaning Warehouse in order for the company to offer new services and access new markets. It resulted in a Boeing-certified product solution for Window Cleaning Warehouse to sell to airlines.

"We have formed a good relationship between ourselves and Window Cleaning Warehouse. The company has prospered and we have gained much better insights into the issues faced by the UK's SMEs. The results have been both satisfying and rewarding."

Bethan Gordon, Cardiff School of Art and Design Deputy Dean

Stephen Fox from WCW said: "We identified a market need for innovative aircraft cleaning services, and a potential solution - however successfully developing this solution would involve gaining access to aircrafts for on-going user testing - which is understandably restricted.

"Through the KTP, we were able to utilise a facility called the Perceptual Experience Laboratory (PEL) at Cardiff Metropolitan University. PEL is a mixed-reality facility that allows product testing contexts to be simulated very realistically within hours" Stephen added. "We used PEL as a vehicle for practical, fast and low cost user testing. We worked closely with the project team at Cardiff Met throughout the course of the project and believe it has been a hugely beneficial experience for all involved."

Award winning KTP opens doors for the food industry

A Scottish fruit and vegetable wholesaler who had a “eureka moment” in the middle of the night picked up the coveted Innovation of the Year award at the Scottish Knowledge Exchange Awards 2017. Connected by Interface, Ivan Wood and Sons and Abertay University transformed new regulation into a business opportunity.



Ivan Wood and Sons is a family run business with 30 employees located in Ballingry, Fife. As a company which prepares and supplies fresh and pre-prepared fruit and vegetables to the catering trade, they faced the same challenge as many others in the industry - the Waste Regulations (Scotland) prevent non-rural businesses from depositing food and starch waste in a public drain or sewer. Malcolm's idea, combined with Abertay University expertise and government backed KTP funding, has resulted in the creation of an affordable, compact starch filtration system, known as PeelTech.

PeelTech offers significant savings to chip shop owners, the catering trade and food and fish processing businesses. If the average Chip Shop peels around 10 bags of main crop potatoes a week, they produce approximately 420kg of waste micropeel and potato starch which previously went down the drain. Smelly, messy and blocked drains need expensive jet clearing every few weeks and companies risk fines of up to £10,000. Early adopters of the PeelTech system are reporting savings of over £1500 per year.

In order to develop the concept of the filtering system into a saleable product, the collaboration appointed

Knowledge Transfer Associate Lee-Anne McGee to the project. Lee-Anne redesigned and validated the filtration system, reduced waste materials and generated sales within the UK and Europe. She also implemented a Food Quality Management System, which resulted in significant cost savings to both the company wages and packaging. In a final flourish, Lee-Anne developed a high quality vegetable stock from the recovered starch to be sold as a new product to the food service industry.

“Working with Abertay has allowed the company to open many doors that once were normally closed to industry. We have our Knowledge Transfer Associate working alongside the company and the University to establish new products and help with the developments of the new filtration system.”

Malcolm Wood, Malcolm Wood & Sons

Based on site at Ivan Wood and Sons Ltd but jointly supervised by the University and company, Lee-Anne triumphed in the Building Skills through Knowledge Exchange category at the Scottish Knowledge Exchange Awards 2017, to complement the project's Innovation of the Year Award.

With its interdisciplinary approach, the University was ideally placed to help conduct this research by bringing together the expertise of its teams working in food technology and water treatment for maximum research capability. Abertay's £3.5 million food innovation facilities are exceptional and the only ones of their type in Scotland. Business partners can access a fully food standard production / pilot plant to develop new products and refine production processes to get to market faster and a world leading sensory and consumer science laboratory to iterate and refine.

EDF Energy embeds employees at University of Manchester to drive nuclear progress

EDF Energy and the EDF group have been working in partnership with the University of Manchester for many years to support resilient and cost effective nuclear energy. Over the last five years we have directly invested half a million pounds each year to drive collaborative research projects. In 2011, the Modelling and Simulation Centre was established as a joint initiative to strengthen this partnership, and in 2017 we were delighted to welcome the National Nuclear Laboratory (NNL) as the third member of the partnership.

EDF Energy has based 10 employees at the centre; doing their daily work alongside the university researchers and students, this co-location enables the teams to easily collaborate with one another on existing projects, and to explore new opportunities.

“None of this work can be done in isolation. We need both ‘blue skies’ knowledge, and knowledge focused on the needs of industry and society. We need to train new scientists in relevant skills and assist them in finding places in which they can use those skills.”

Professor Mike Smith, Director of the Modelling and Simulation Centre

For Professor Mike Smith this proximity supports the objective of the centre, which has three dimensions:

- Generating new knowledge
- Developing skills for the next generation of scientists and engineers
- Achieving impact – both economic and societal

To date, the MaSC has been the centre of many innovative collaborations; one such project, involving large-scale simulations, has improved the understanding of graphite moderator bricks and acted as a comprehensive validation for information earlier obtained by numerical simulation on supercomputers. This is a key part of the activity of the team in Manchester, who have access to data measured on our nuclear plants and are able to perform ad-hoc experiments commissioned in the labs of the university. R&D UK Centre Director Xavier Mamo says that it is clear the collaboration delivers measurable impacts. “By

combining the understanding of the industrial context of our research engineers and the world-leading expertise in modelling at Manchester, we can develop cutting-edge tools to predict the behaviour of elements fundamental to the operation of our nuclear plants.”

EDF Energy extends these benefits beyond the immediate team at Manchester by offering opportunities to young scientists and engineers to work more closely with the industry through MaSC. Skills shortages and replacing an ageing workforce are a real problem for the nuclear industry, particularly in the UK, and EDF is tackling this by welcoming final-year undergraduates onto projects. This benefits all the partners involved at MaSC, and connections that begin at an early stage can often turn into rewarding careers.

The unique business model of MaSC continues to go from strength to strength, as evidenced by its extension in 2017 to include the National Nuclear Laboratory (NNL) as the third member of the partnership. NNL brings extensive modelling and simulation experience, which will complement the skills already present in MaSC. Looking forward to the next five years, the ambition is for the increased capacity and breadth of expertise to enable the centre to lead on innovations in digital and new technologies for the nuclear sector and its future challenges.



Pushing the boundaries at Queen Mary University of London

Research, innovation and accelerated translation to market applications, together with education and skills development, are fundamental to supporting economic growth, health and wellbeing, and social inclusion.

At Queen Mary University of London, we work with business partners on research and innovation, curriculum development, public engagement, social responsibility and CPD/executive education. We are a global and leading university, pushing the boundaries of knowledge and innovation and providing world-class education to a diverse student body where our undergraduates comprise 60% BAME, 42% first from their family into Higher Education and 27% from households where the annual taxable income is under £10k. Our relationship with partners across all sectors is critical to ensuring that our graduates obtain the jobs that they deserve, allowing future companies to create the required diversity throughout their workforce which is critical to their success. Below are a few examples showing the breadth of our engagement.



Degree apprenticeships

We were the first Russell Group institution to adopt degree apprenticeships, which can empower future generations with the skills they need for success. We have delivered the Digital and Technology Solutions Degree Apprenticeship with Goldman Sachs, IBM, GSK and the BBC. In 2017, we began providing training to non-levy paying employers as part of our growing engagement with SMEs.



Spinouts

Actual Experience is a QMUL spinout, which was listed on the London Stock Exchange in 2013, with a current market capitalisation of £135m and which employs 80 people. Actual Experience provides customers like Accenture, Verizon and Vodafone with 'Analytics-as-a-Service', managing digital supply chains to optimise and improve efficiency, delivery and experience.



Incubators and job creation

Queen Mary Bio-enterprises (QMB) hosts a range of startups and spinouts, including major companies like Spirogen and hViVo. These companies have created more than 450 jobs in the region and QMB has a queue of additional companies seeking space.



Creative and Digital

A unique Media and Arts Technology Doctoral Training Centre with multiple industry partners. A recent Data Science partnership agreement with BBC will enable them to rapidly expand the promotion and use of their media content worldwide, increasing revenue growth and influence.



Genomics and precision medicine

Our researchers are working with partners applying the latest advances in genomics research to the development of new precision medicines and personalised treatments. Partners include AstraZeneca, Genentech-Roche, Astellas, Abbvie, Bristol-Myers Squibb, Pfizer and Medimmune. Our research benefits from co-location with Genomics England and access to clinical expertise through co-location with Barts Health Trust.



Student entrepreneurship

We foster a student entrepreneurial environment, through funding, boot-camps, training and mentoring. An example of success is Sam Armani. Before he graduated in 2012 he started the company KACE, then Tamoco in 2012, providing proximity marketing solutions with big data. A serial entrepreneur, Sam has since become a founder of CrowdIt after seeing an opportunity to launch a nightlife app in the UK.

GSK take open innovation to the next level

GSK have more academic collaborations than any other UK headquartered company. We are constantly exploring innovative models to engage with top academics who might help to identify new medicines. Many of the collaborative programmes we have pioneered involve sharing propriety data and resources with trusted academics; this model has been amplified with the development of the Immunology Network.

Initiated in 2015 by Paul-Peter Tak - Chief Immunology Officer and Senior Vice President of the R&D Pipeline at GSK - the network incorporates a vision to combine the best academic science with the powerful drug discovery engine of pharma. Dr Tak assembled an External Immunology Board to propose academic immunologists who might benefit from a sabbatical as "Professor-in-residence" at the Immunology Catalyst at GSK's campus in Stevenage. Seven leading academics from around the world were identified and embedded in the company for up to three years.

For GSK this is not about recruitment but innovation; we are asking them to challenge the thinking of our scientists, help to develop blue skies thinking and test basic scientific hypotheses.

The embedded academics have access to proprietary GSK platforms, compound libraries, data and internal meetings. Crucially, the academics also own any biology IP that they bring or develop whilst at GSK, provided that the IP is not based on existing proprietary GSK molecules. Joint publications are supported as a means of promoting leading edge science, and if an academic identifies translational work with commercial potential then they may access additional funding for "killer experiments" from an Immunology Innovation fund. This is a crucial component of the company philosophy: to be transparent with the external world when seeking to identify and validate new drug targets.

This open approach to science has already yielded tangible results and has enabled GSK to capitalise on emerging areas of science over the last three years.

For example, R&D business development divisions have been guided by the Immunology Network to re-purpose some GSK assets as potential treatments for specific diseases. In close collaboration with Dr Tak, Professor in Residence John Hamilton (University of Melbourne) made a scientific case to underpin the use of a monoclonal antibody to treat osteoarthritis in addition to rheumatoid arthritis. The antibody has now progressed to Phase 2 clinical trials and results are expected in 2018.

The information exchange between the visiting academics and the GSK scientists is very much a two way process. The academics gain an in-depth understanding of the drug development process and see, first hand, the quality of the research undertaken in the industrial laboratory. Whereas the industrial scientist gains access to new thinking from the academic which helps to shape their internal programmes. In sharing best practice, GSK aim to increase the rate at which translational research accelerates through to a commercial opportunity. The programme has been so successful in such a relatively short time period that the company are now considering this innovative model in other areas of science, such as in chemistry.



Partnership rapidly progresses new cancer drugs

A new multi-project collaboration and licensing deal between The Institute of Cancer Research, London – an independent research institute and a college of the University of London – science and technology company Merck, and charity Cancer Research UK is set to discover and develop new cancer drugs.

The Institute of Cancer Research (ICR) is the most successful higher education institution in the UK at earning invention income from its research, with intellectual property income of more than £64 million for the academic year 2015/16.

The ICR's business engagement strategy – led by its sector-leading Enterprise Unit – is centred on bringing the benefits of its discoveries to patients, by partnering strategically with the organisations most likely to take new treatments into the clinic as quickly as possible.

“Teaming up with the ICR on cutting-edge drug discovery provides us with enhanced capability to rapidly progress our collaborative projects into clinical development.”

Andree Blaukat, Merck Healthcare Senior Vice President and Head of TIP Oncology

The new agreement is the culmination of a prior sequence of successful collaborations between the partners and represents a deeper, more strategic partnership based on shared principles and objectives. These earlier projects showed that scientists at the ICR and Merck were able to form a productive and efficient project team, demonstrating a willingness to share information, good communication and shared high quality expertise and interests. The projects demonstrated the mutual benefit in agreeing an overarching strategic collaboration.

This new collaboration aims to progress the discovery and development of potential cancer drugs, from target discovery to preclinical drug candidate nomination, as well as to develop biomarkers for target engagement and patient selection.

Director of the Cancer Research UK Cancer Therapeutics Unit at the ICR, Professor Rajesh Chopra, explains “We hope that through the diverse projects in this collaboration, we can identify molecules that are effective against a number of different tumour types. Together we can create innovative new treatments for the benefit of patients.”

Under the terms of the partnership, which will bring together three independent research programmes, Merck has worldwide rights to take molecules discovered through the collaboration into clinical development. Cancer Research UK and the ICR will receive milestone payments based on research and development achievements, regulatory and sales goals, and royalty payments on net sales of future products discovered or developed under the agreement. Any payments made to Cancer Research UK and the ICR will be invested into future lifesaving research.

The ICR passionately believes in the importance of innovation, designing and developing novel techniques and cancer treatments that work in completely new ways. It is also a strong proponent for knowledge exchange between universities, companies and the public to maximise economic and societal benefit.

Anchor for growth

Heriot-Watt University's Robotics evolution is an exemplar of local and global collaboration, combining research and industry partnerships with skills development to drive innovative products and processes and innovation-ready graduates, and it's already looking forward to an exciting new phase.

The establishment of the Edinburgh Centre for Robotics (ECR) in 2014, harnessed the potential of 30 world-leading investigators from 12 cross-disciplinary groups, supported by more than 40 industrial partners. From offshore robotic solutions to conversational AI, from the bottom of the sea to the final of the Amazon Alexa Prize, its voyage has been ambitious.

Jointly run by Heriot-Watt University and the University of Edinburgh, it is a remarkable investment; now in the region of £100M into research and advanced facilities that has already enabled successful spin-outs including Seebyte, Hydrason and Robotical.

In its ROBOTARIUM, some of the world's most advanced robots are being developed in Robotics and Artificial Intelligence (RAI), Robotics and Autonomous Systems (RAS), and Human-Robot Interaction (HRI). The evolution from past achievement to future ambition now enters a new phase as it becomes the UK's National ROBOTARIUM, part of the Edinburgh and South East Scotland City Region Deal.

The most recent success, in November 2017, was the awarding of £14.6M by the Engineering and Physical Sciences Research Council (EPSRC) for the Offshore Robotics for Certification of Assets Hub or 'ORCA Hub', to develop robotics technologies for use in extreme and hazardous offshore environments. Heriot-Watt Professor and Director of ECR, David Lane is leading the £36M consortium including the University of Edinburgh, Imperial College London, the University of Oxford and the University of Liverpool, together with 31 industry partners.

An integral part of ECR is its Centre for Doctoral Training (CDT) which focuses on innovation-ready postgraduates, equipped with scientific, creative, ethical and enterprise skills. The programmes include technical preparation and cohort-wide training, supported by User Partners operating in crucial market sectors for RAS including oil and gas, defence, renewable energy, healthcare, assisted living, transport, space, automotive, manufacturing, nuclear, digital media and education.

Postgraduate research training includes an innovation fund for prototyping, connection to Enterprise Fellowships from the Royal Academy of Engineering and Royal Society of Edinburgh, and the Converge Challenge business plan competition.

This challenge-based approach to innovation, adopted in ORCA, involves spiral development of industrial-use cases and regular technology demonstrations, and is now an integral part of the Industrial Strategy Challenge Fund (ISCF) at the heart of the UK Government's 2017 Industrial Strategy.

RAI/RAS is recognised as a disruptive force where new businesses lead to the next generation of wealth creation and Robotics has been identified by both the Scottish and UK Governments as a key growth area.

Through this robotics concentration, ECR has provided active policy leadership in the 2014 RAS 2020 Strategy and the RAS Sector Deal in the Industrial Strategy. Around this anchor of research innovation and enterprise training, Heriot-Watt is able to nurture the next generation of experts in the field and to reach out to future generations.



Students Siobhan Duncan and Sabina Jedrzejczyk representing Heriot-Watt University and Edinburgh Centre for Robotics at the Scottish Parliament

Semiconductors: unsung heroes of the modern world

If you're reading this on your smartphone, you're relying on technology that would not exist without compound semiconductors (CS). Performing up to 100 times faster than silicon chips, they're at the heart of the 'Internet of Things' – from healthcare devices and autonomous vehicles to a host of unimagined breakthroughs.

Cardiff-headquartered IQE holds the lion's share of the global CS materials market and has worked with Cardiff University for decades. But the collaboration intensified recently as they joined forces to find ways of bridging the so-called 'Valley of Death' between R&D and commercial reality.

Based in South Wales, the partners have developed the world's first CS cluster - CS Connected - with the potential to lever £375m of private sector investment and create up to 2,000 high skilled jobs.

The collaboration has attracted game-changing investment: the UK Government's decision to establish £50m Compound Semiconductor Applications Catapult, making the latest technology available to small and medium-sized businesses; £38m from the Cardiff Capital Region for a Compound Semiconductor Foundry, and £12m from EPSRC for the Future Compound Semiconductor Manufacturing Hub which applies 'Silicon Valley' techniques to drive a pipeline of innovation in the cluster.

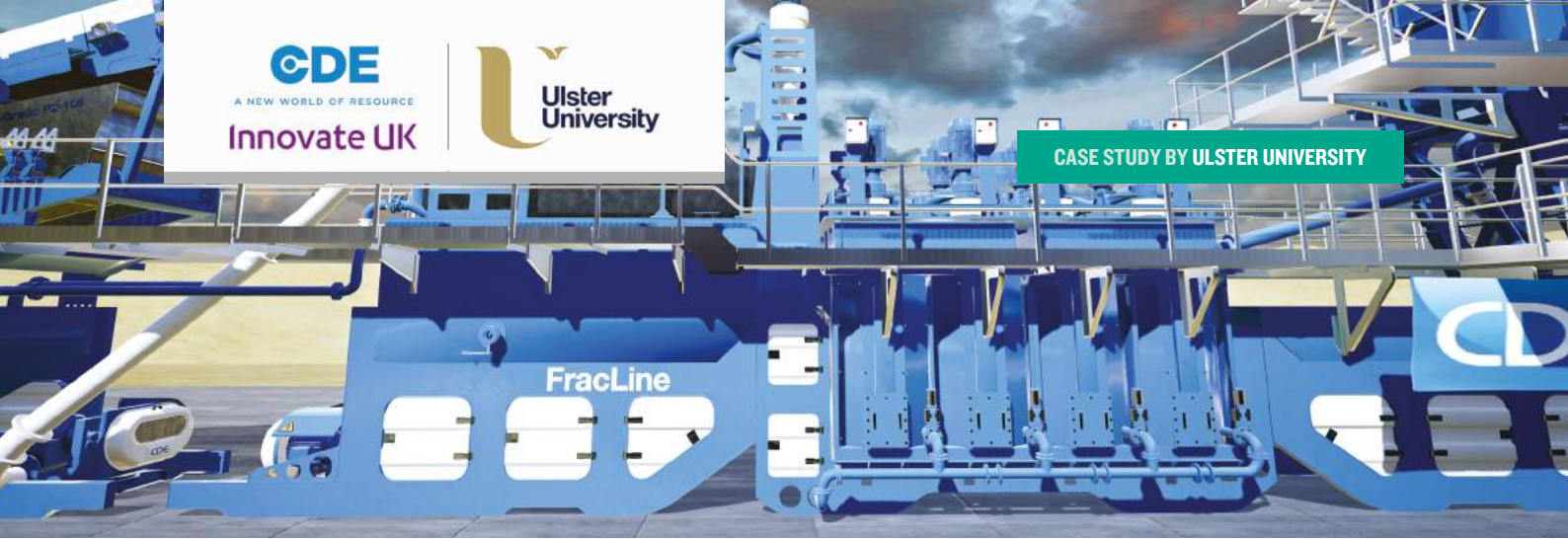
A spirit of co-operation also underpins Compound Semiconductor Centre (CSC) Ltd. The for-profit joint-venture between the University and IQE overcomes decades-long obstacles to getting research into society, using the expertise of the Institute for the pilot production of new compound semiconductor technology. CSC secured nine collaborative R&D projects worth £5.4m throughout 2017 to develop new CS solutions ranging from ultra-high speed data communications to consumer cosmetic products and wearable healthcare.

The Centre works alongside the Institute for Compound Semiconductors (ICS). State-of-the-art equipment, facilities and international experts support world-class research that helps industry partners. The Institute received funding from the Welsh Government, the UK Research Partnership Investment Fund and Welsh European Funding Office (WEFO). Building on Cardiff's expertise in CS technologies, ICS focuses on device fabrication and the development of innovative growth methods, materials technologies, and small scale pilot production.

As part of ICS, a Knowledge Transfer Partnership (KTP) has been established, placing research associate Dr Lewis Kastein within IQE's developing eco-system. Using knowledge and techniques developed at Cardiff University, Dr Kastein will help IQE develop and embed new characterisation capabilities, strengthening their leading role in manufacturing CS materials.

More R&D programme wins are expected in the years ahead as CS technologies continue to shape our lives in the 21st century.





Immersive Virtual Reality (VR) in the mining industry

CDE Global (CDE) are the world's leading wet-processing equipment company for the four sectors of sand and aggregates, mining, C&D waste recycling and industrial sands.

In order to improve product communication, increase sales efficiency and enter new markets, it was essential to embed digital literacy and a Creative Industries capability into the company. To achieve this, CDE secured a KTP with Ulster University to apply its cutting-edge Design research into the Engineering sector (KTP009750).

Art & Design Research Director, Dr Justin Magee, led a multidisciplinary team bridging expertise from product, experience, games and graphic design with film and animation. They integrated design-led methodologies and digital content workflows into the company, enabling larger global tenders in the £5M-£15M range. The KTP Associate, Peter McGroarty, was an experienced product visualisation and games designer.

CDE produce machines that range in size - from that of a van, to a house - with modular structures being much larger. The cost and logistics of physical installation at tradeshows is significant and sometimes non-viable. A digital approach to communicate technical, maintenance and customer experiences was required.

Dr Joanne Hayden, Director of Marketing, explained: "When you consider the cost of bringing even a small wash plant to an exhibition can run into tens of thousands the benefits are obvious. Virtual Reality is a great alternative that is quickly gaining credibility not only at exhibitions but also for conveying concepts to customers on inward visits".

An adapted workflow from games and animation, tailored to the company's engineering workflow was embedded. An extensive digital library of full-scale machines was produced, each incorporating realistic physical behaviour. For instance, a loaded conveyor

belt or water treatment process were rigged and animated to capture the realistic machine behaviour.

This led to a more immersive approach, using the HTC Vive with the 'Unreal4 games engine' providing a digitally immersive experience for customers, with life-sized presence. The audience reach extended beyond primary customers, to people of all ages, within a safe virtual environment during international tradeshows.

"This KTP enabled a heavy engineering company to strategically embed design thinking, 'trial and error' innovation with visualisation technologies and work flows, which otherwise would not have been explored", Dr Justin Magee said. "The KTP acted as a catalyst for an innovation culture that emerged between R&D and marketing, where more ambitious ideas were explored on a strategic level. This led the company to make a technological and strategic leap."

The KTP allowed a level of risk-free experimentation for CDE to develop new technologies and ideas into the delivery of significant future business benefits.

CDE acknowledged that the KTP helped to increase sales from £21.1M to £46.3M (2015-2017) and expects that the new tools and resources embedded by the KTP will contribute to the company achieving its original objective of £15M additional turnover over the next 3 years.

The research was assessed by Innovate UK as 'Outstanding' and received Ulster University's Knowledge Exchange Impact Award (2016). It was showcased at Belfast Design Week 2017, Digital DNA2017 Finalist and THELMA Finalist for Knowledge Exchange/Transfer initiative of the year (2018).

The light touch

Major strides have been made in our understanding of light and its applications in bioscience and healthcare through the development of novel lasers, microscopes, imaging systems, specialized software and complex opto-mechanical designs.

Engineering and Physical Sciences Research Council funding has played an important part in the internationally recognised success of the Optical Manipulation Group (OMG) at the University of St Andrews. Their research has led to innovations in light beam shaping, and novel applications for optical tweezing and sorting. Among these innovations is the Airy Beam Light Sheet Microscope, a wide field of view imaging modality that uses light beam shaping so that optical exposure is kept to a minimum. This allows imaging over long periods of time, and is able to achieve high-contrast 3D images up to 500 times faster than conventional confocal microscopy techniques, with minimal damage to tissue.

Since 2006, M Squared Lasers Limited has worked closely with the OMG to develop commercial instrumentation. The long-standing business-university interaction includes letters of support, joint research grants, staff training, knowledge transfer and intellectual property licensing resulting in the company engineering and marketing a range of commercial laser and millimetre-wave products based on University innovations.

In 2015 M Squared opened its specialised biophotonics division 'M Squared Life' at the Surrey Research Park, and in 2017 launched the 'Aurora' Airy Beam Light Sheet Microscope. This microscope, based on underpinning research at St Andrews, is the first transformative imaging technology to be commercialised by the company.

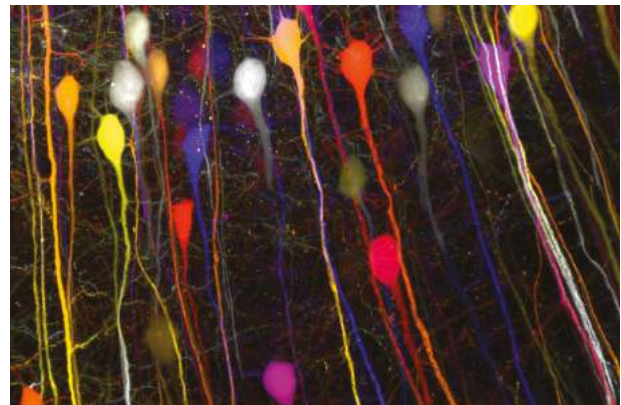
"Biophotonics and laser-based innovations can have a huge impact in medicine. Our work with research partners, and in particular the University of St Andrews, brings our technology much closer to the sectors – importantly healthcare – where we hope our work will have a major impact on people's lives." Dr Graeme Malcolm OBE, CEO and Founder of M Squared.

'Aurora' microscopy overcomes many technological obstacles to produce accurate images at cellular level. 'Aurora' is now in use at a range of international research institutes (including the Maurice Wohl Clinical Neurosciences Institute at Kings College London, the National Physical Laboratory, and the Niels Bohr Institute).

The 'Aurora' Microscope is a step change in light-sheet imaging technology, and has already allowed researchers to gain unprecedented insight into key scientific questions. It has produced 3D images fine enough to capture neural connections, support 3D volumetric imaging, leading to increased understanding of neuro degenerative diseases and organ regeneration. 'Aurora' is enabling new discoveries in neuroscience research, shedding new light on neurodevelopmental and neuropsychiatric disorders including autism spectrum disorders, schizophrenia and intellectual disability.

This technology could also lead to breakthroughs in understanding neurodegenerative disorders including dementia, Motor Neuron Disease and Parkinson's Disease. Alongside neuroscience research, Airy Light-Sheet technology is also being used in research on neural organoids, stem cells, and how the pancreas develops in Zebrafish.

In 2017 the commercial success and quality of the images provided by the 'Aurora' Airy Beam Sheet Microscope resulted in M Squared being awarded the Institute of Physics Business Innovation Award at the Houses of Parliament. M Squared was also granted a Prosperity Partnership fund with the University of St Andrews, from the Engineering and Physical Sciences Research Council and the Industrial Strategy Challenge Fund, a part of which supports work in the diagnosis and treatment of dementia and cancer.



AI and robotics: the future of space exploration

Building on 40 years at the forefront of small satellite engineering, the University of Surrey is leading a new multi-million pound hub which will develop AI and robotics that could change the face of future space missions.



Space is a hazardous environment for humans, with extreme temperatures, radiation and other dangers making exploration highly problematic. Aimed at providing solutions to these technical challenges, the Future AI and Robotics for Space (FAIR-SPACE) Hub will develop space robots that can act as 'proxies' for humans, performing complex tasks with minimal dependency on a human ground crew.

Launched in November 2017, FAIR-SPACE is being funded through a £6.9m grant from the Engineering and Physical Sciences Research Council (EPSRC) and the UK Space Agency (UKSA), boosted by a further £7.5m from the space sector and £15m from a business development fund. The Hub will see the University of Surrey working with Imperial College London and the Universities of Edinburgh, Liverpool, Salford and Warwick, in addition to partners from government and industry including Airbus Defence and Space and Thales Alenia Space UK Ltd.

"Airbus Defence and Space has enjoyed a long and successful partnership in space research with the University of Surrey" said Matt Perren, Head of Future Programmes at Airbus. "This relationship relies on the open sharing of innovative concepts, a good understanding of industry needs and excellence in research project execution. I am confident that this working mode will deliver again with our other partners within the FAIR-SPACE Hub."

Surrey draws on four decades of experience to lead the Hub. Home to the Surrey Space Centre, the University pioneered the small satellite industry in the 1970s, launching the world's first university microsatellite to demonstrate commercial 'off-the-shelf' technologies. More recently, its STAR (Surrey Technology for Autonomous systems and Robotics) Lab has contributed to ground breaking missions including MoonLITE, Moonraker, Proba-3 and ExoMars 2020.

"FAIR-SPACE is an incredible opportunity for the University and the whole country to play a pivotal role in how humankind explores space, our moon and beyond."

Professor Yang Gao, University of Surrey Associate Dean, Professor of Space Autonomous Systems and Hub Director of FAIR-SPACE

The FAIR-SPACE Hub will focus on three areas of research: developing robots that can performing tasks such as repairing satellites, assembling large space telescopes and removing space debris; creating planetary vehicles which can survey, extract resources and prepare for human habitation on alien planets; and investigating interoperability between astronauts and robots, for example through wearable technologies. Work is already underway in each of these areas, with the first prototypes due to be developed by mid-2019.

FAIR-SPACE directly addresses two key priorities in the government's recent Industrial Strategy Green Paper: robotics and artificial intelligence, and satellite/space technologies. In addition to offering significant market opportunities within the UK space industry, these technologies have applications in other sectors where there is a need to navigate a hostile or challenging environment – such as nuclear, off-shore, mining, healthcare and agriculture. Using robotics-based products and services in these industries is expected to deliver economic benefits of at least \$1.9 trillion globally by 2025.

Boosting sales through best practice insight

The Sytner Group represents prestigious car manufacturers in over 140 dealerships across the UK including Jaguar Land Rover, Bentley, Mercedes Benz, Audi, Volkswagen, BMW, Mini, Lamborghini, and Porsche. They are one of the UK's largest motor retail groups, employing over 7,500 people and retailing over 135,000 cars per annum. With the company Head Office in Leicester, they contacted the University of Leicester's School of Business to develop a new training and development programme to enhance their sales performance.



Through a collaborative partnership starting in 2014, Professor James Fitchett, published Professor of Marketing and Consumer Research, designed and developed a workshop session. Underpinned by theories developed in his research, Professor Fitchett's designed a workshop to facilitate and fuse together new ideas, new knowledge and best practice in customer insight and sales excellence.

"James has been an incredible success with our Senior Management, Sales Executives and Service Consultants. He is crucial to the start of our Sales and Service Pathways workshops. His sessions challenge the thinking and open the minds of our teams using knowledge, data and questioning."

Sue Sansome, Sytner Group Head of Learning and Development

The workshop formed part of an innovative training programme for sales executives, introducing the latest theories and concepts for understanding consumers. Supported professionals delivered value and outstanding customer experience which led to an increase in sales performance and meeting the Organisations customer

expectation levels and create long term customer relationships. The partnership continued to develop and led to 'Best Advice' seminars being delivered to After Sales teams in BMW, MINI and Jaguar Land Rover. This focused on customer value, service quality and service innovation.

"The partnership has developed over a number of years and has progressed across several key business areas. Utilising research with real world application is proving to have real impact and benefit for Sytner."

Professor James Fitchett, University of Leicester School of Business Professor of Marketing and Consumer Research

A research collaboration has been created to looking into developing new innovations to continually improve services. The research is exploring how video and film based 'service evidencing techniques' can be enhanced so that they become devices of added benefit articulation and customer value rather than simply cost justification devices. In order to evaluate these issues, a research programme involving a multi-site qualitative research design is being conducted in collaboration with Sytner UK to evaluate, assess and test insights from a range of different stakeholders and involved with the development and implementation of radical service technologies.

Photonics – impacting our daily lives

The Optoelectronics Research Centre at the University of Southampton expands its long term collaboration with industry to keep the £12.9bn UK photonics industry growing at 5% annually.

The World Wide Web and the Internet would not operate on a global scale at their capacity and speed were it not for innovations in photonics. Mobile phones, laptop computers, large data centres, medical procedures and devices, automobiles, and many other products and services we all use daily are critically dependent on photonics.

The UK is a world leader in photonics technology, being home to the largest cluster of photonics companies and research organisations. Over 65,000 people are employed in UK photonics manufacturing and over 75% of its output is exported. The Optoelectronics Research Centre (ORC) at the University of Southampton has significantly contributed to the UK's photonics development for six decades and collaborates with high tech companies, ranging from aerospace (BAE Systems) to IT and data storage (Microsoft, Seagate), communications (Huawei, Rockley Photonics) and manufacturing (SPI Lasers).

“We wanted to work with ORC researchers because of their formidable track record in fibre laser development, the world-class facilities they have at their fingertips and their pioneering attitude to problem solving.”

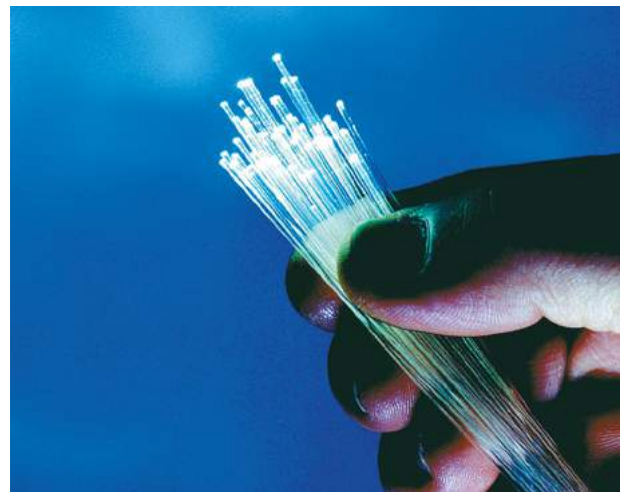
Professor Gérard Mourou, International Centre for Zetta-Exawatt Science and Technology Director

Photonics at the University of Southampton goes back to the early 1960s when our researchers worked on ground-breaking developments in fabricating optical fibres and understanding the fundamentals of how to generate laser light. The ORC is the largest and longest-established research centre for photonics in the UK. It has over 200 staff and PhD students and a research portfolio of over £50m. The ORC continues to develop its commercial partnerships with large and small businesses resulting in industrial funding of over £3m each year. An average of 10 patents annually are generated and are licensed to collaborators for commercialisation.

The ORC has recently received HEFCE Catalyst funding to develop a much-needed skills programme for the photonics industry in support of the Industrial Strategy. The ORC has for many years been very active in STEM outreach to future students in photonics and broader science and engineering subjects.

ORC research has led to the formation of more than 10 successful spin-out companies including SPI Lasers, Lumenity, Covesion and Fibercore. Most of these spin-outs continue to have substantial operations in Southampton's 'photonics valley', forming a photonics cluster which continues to look to the ORC for innovations. Consequently there are more specialty fibre drawing towers in this cluster of companies than anywhere else in the world.

The University's £120m cleanroom facilities make the ORC highly distinctive on the world stage, as does its encouragement of enterprise. ORC scientists have a unique ability to turn their research into practical, commercial uses, delivering benefits to society and the economy in areas including communications, manufacturing and medicine. They can see their work go all the way from the lab to the assembly line, making new fibres, emitters, and circuits, developing new devices based on those components, testing these in a system and starting a company to produce it. Very few universities have this vertically-integrated capability: from photonics to production.



IDEALondon: a blueprint for business university collaboration

Nestled in the heart of London's Tech City, IDEALondon is an innovation centre with a difference. Now in its fifth year, the centre is run by founding partners Cisco and UCL, and were joined last year by EDF Energy, and aims to provide a space in which tech start-ups can grow faster, stronger and further than they could on their own.



Since opening its doors in 2013 more than 50 start-ups have passed through the

centre, creating 500 jobs, celebrating upwards of £60m in investment and running more than 400 pilots in the process.

None of this could happen without the partnership that lies at IDEALondon's foundation. The University's mission is to change the world for the better. Cisco, in turn, has an approach to innovation that is based on co-creation. IDEALondon is the melting pot in which these ideologies combine, and today the centre stands as an example of best-in-class university business collaboration.

"Innovation can happen anywhere. What's important is that it's given the space to do so."

Scot Gardner, Cisco UK and Ireland Chief Executive

Katherine Hannah, Cisco's Head of Innovation Engagement said: "The real sweet spot of the whole programme is that all the partners are there to help each other, and support all of the resident start-ups towards their goals."

Many of the centre's start-up success stories – such as Hoxton Analytics and MishiPay which operate within the retail sector – are UCL alumni, and the university plays a key role in bringing innovative entrepreneurs to the table. Innovative global payments company, Curve, is yet another example of a successful UCL spin-out that has called IDEALondon home.

Indeed, Jane Butler, UCL's Engineering Vice Dean and one of the founding members of IDEALondon, says that "highly talented graduates are increasingly choosing to start their own businesses rather than pursuing traditional graduate schemes with big corporations. Much more than a co-working space, IDEALondon comprises all parts of the entrepreneurial

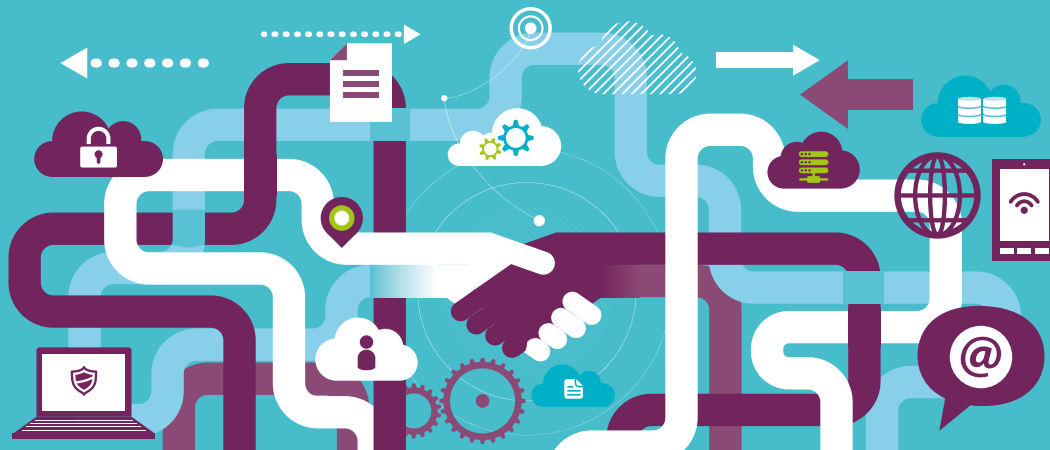
ecosystem onsite and is the first of its kind in the UK to offer such a programme to aspiring students."

Far from being an isolated innovation hub, though, IDEALondon start-ups are given the opportunity to get involved in other innovation projects happening outside of the centre. The centre has close ties with the government's innovation agency, Innovate UK, and start-ups are regularly brought on board to tackle problem statements – along with other organisations from across business, government and academia. They've contributed their expertise and agility to projects covering everything from superfast Wi-Fi for trains on Project SWIFT, to building the CityVerve smart city demonstrator in Manchester and CONSERVE technology that supports first responders in disaster situations.

"That's why we commit our resources to developing innovation hubs throughout the UK and beyond," says Cisco's UK and Ireland Chief Executive, Scot Gardner, "whether that be with dedicated spaces like our Mi-IDEA innovation centre in Manchester, or via our connections with other academic institutions and government organisations in the regions as part of our Country Digital Acceleration strategy."

Cisco has 12 innovation centres globally, with the concept of co-innovation as their foundation. After all, you won't change the world by staying in one place.





Value in a Knowledge Exchange Framework

 **National Centre**
for Universities and Business

REPORT BY JOE MARSHALL AND
GRAEME REID, NATIONAL CENTRE FOR
UNIVERSITIES AND BUSINESS

The proposed creation of a Knowledge Exchange Framework (KEF) in the autumn of 2017 has provoked much debate and discussion, especially inside universities. It has the potential to raise the profile of knowledge exchange; it creates a similar accountability for universities to Teaching (TEF) and Research (REF); and provides a mechanism for comparing or benchmarking performance between universities.

But knowledge exchange is by its very name and nature a two-way activity. It is not just about the value and benefit for one side - the universities. There are beneficiaries on the other side of the exchange: Businesses, public sector organisations, charities and third sector organisations can and do derive benefit from the interactions, collaborations and partnerships with universities.

The creation of a Knowledge Exchange Framework has the opportunity to celebrate, recognise and - most importantly - advance this area of activity to the benefit of everyone. The UK has a strong tradition and international reputation already in this area. But as the piece earlier in this section from Innovate UK sets out, we need to encourage more businesses to invest in, undertake and drive research and development across the UK.

We need, therefore, more and better information to help inform the decision-making process that business and other 'users' of University knowledge go through to decide who to collaborate with. At the heart of the proposed Framework is a commitment to bring

together a comprehensive range of measures to determine how well Universities exploit their assets and capabilities for the benefit of the economy and society, but also to ensure fair comparison, recognising there is no 'one size fits all' approach to knowledge exchange, and that we have a very diverse university sector in the UK.

To inform and feed into the development of the Knowledge Exchange Framework, the National Centre engaged with its membership base - in particular its business membership - to better understand what information or data would be useful to inform/ influence their interactions with universities.

Despite a strong steer in the initial briefings around KEF to use any information or data on knowledge exchange performance to benchmark universities (and ultimately create league tables) - from a choice perspective the businesses we spoke with saw little added value to the choice of collaboration. Easily accessible, high level data - analogous to TripAdvisor - appealed to some. Detailed data on interactions a University might have had in the past appealed to none.

The broad themes that did merge from businesses can be grouped into the following areas:



Individuals versus institutions

Businesses seek individual experts with whom to collaborate. It is the knowledge of individual academics that most interests them. But institutions set the tone of collaboration and provide communities of individuals.

While both individual and institutional performance and reputation are of interest to businesses, it is the individual academic's willingness and ability to engage that is of greatest importance.



Beyond commercialisation

Knowledge Exchange covers a broad range of activities including sponsoring academic chairs, contributing to the running cost of facilities, sponsoring higher apprenticeships as well as 'in kind' contributions such as donations of equipment and staff time. Intellectual property and spinout companies are small components of business relationships with universities and should not be given undue prominence in the KEF.



Strategic partnerships

Strategic partnerships between businesses and universities are costly and time-consuming to develop but are valued highly by businesses. Such partnerships can cover some or all of: recruitment, use of research facilities, continuing professional development, short-term problem solving and longer-term research collaborations.

Strategic partnerships are often based on mutual trust and familiarity that grows over time, rather than contractual agreements (although contractual agreements may be in place). Large research universities with a broad span of excellence are particularly valuable as partners to business because partnerships can evolve over time to engage new research disciplines and combinations of discipline without the cost and risk of building new relationships with new university partners. Arguably, these strategic partnerships are not well captured in existing data collections such as the HE-BCI survey, so we welcome the news that HESA will review this dataset later in the year.



Transactional costs

Similarly, the risk and transactional cost of working with a new partner can be much greater than that of continuing to work with an existing partner so expanding existing collaboration is often preferred to creating a new one.



Reputation

Universities with large scale and high reputation, for example in the REF, are interpreted by some businesses as less risky places with which to forge partnerships. This is particularly evident if a business is considering the relocation of its research activities or a major investment in a research campus. However, a strong local reputation for a university is of value to local firms.



Geographic location

Universities in close proximity are more attractive to businesses for many types of collaboration, including apprenticeships, teacher training, medical training, engineering, short-term problem solving or access to facilities and equipment. There is also some evidence that proximity is a particularly important factor for SMEs. A nearby university of lesser-perceived prestige may rank more highly as a partner than a traditionally more prestigious but more distant university. This is particularly true if one views Universities as producers of not just knowledge, but of skilled people.

The introduction of a Knowledge Exchange Framework could be a powerful instrument that both celebrates the great work already being done, but also encourages new ground to be broken and, as set out above, encourages more businesses to innovate, which is essential if government is to meet its target of 2.4% of GDP spending on R&D. The answer to this doesn't lie with government, universities or businesses in isolation. Effective university-business interactions are an important way of meeting this challenge.





05

SUSTAINING THE
RELATIONSHIP

Safeguarding the future

This year's State of the Relationship report witnessed an impressive number of case studies concerning the role that both universities and businesses can play in safeguarding the future of the UK and the wider world.

But while sustainability isn't perhaps the first thought that comes to mind when considering university business collaboration, it's clear from the pieces in this section that both universities and businesses can have a deep impact on the way the world will look in the near and distant future.

The Safeguarding the Future collection also has a clear overlap with the skills, place and innovation sections, where those agendas are forming bigger pictures around what we need for a future, and what that future could look like in real, practical terms. You'll find pieces concerning the future of specific areas, such as the role of the University of Hull and the Energy Estuary. The University of Warwick are embedding student internships in recycling technology firms to ensuring skills development. And the 'lean and green' R&D taking place between Loughborough and Rolls-Royce works towards meeting international emissions targets.

There are impressive examples of collaboration specifically aimed at ensuring sustainable resources, whether that's energy for the future by Jisc, London South Bank University and the University of York; water access and quality by the University of Brighton and Cranfield University; or sustainable products from the collaborations of Interface and the University of Bath.

But we can also see the application of existing sector-specific knowledge for a purpose other than which it was intended: Aon are using their insurance expertise to increase resilience to the risks of climate change: UCL are working with IBM technology to secure and protect knowledge for future benefit: the University of Birmingham are transforming business practices to embed responsibility into the industry: and LSE are exploring the decision making process of the financial market system to determine how to safeguard it from reoccurring issues.

Shaping and sustaining the future: a new chapter for research, innovation and collaboration in the UK

The UK leads the world in research and innovation. With just 0.9% of the world's entire population, 2.7% of global research and development (R&D) expenditure, and 4.1% of researchers, the UK accounts for a whopping 10.7% of global citations and 15.2% of the world's most highly-cited articles¹.

Creating UK Research and Innovation provides a landmark moment to strengthen the UK's world-leading position. The Government has put research and innovation at the heart of its modern Industrial Strategy, committing additional funding of £7bn by 2021/22 and setting out an ambition to increase total R&D expenditure to 2.4% of GDP by 2027.

As the Chief Executive of UK Research and Innovation recently announced at the launch of our new organisation: *"UK Research and Innovation builds on the excellence of our individual councils. We will work collaboratively with researchers, innovators and entrepreneurs to develop the most exciting ideas and innovative technologies and bring these to fruition. Delivering this success will take commitment, a collective effort and new, ambitious ways of working"*².

UKRI will work in partnership with government, businesses, universities, and other research organisations to create the best possible environment for research and innovation to flourish. One of the most important of these partnerships is the connectivity, collaborations and embedded relationships between our universities and business. Forming and building strong partnerships locally, nationally and globally delivers substantial economic and social impact.

At Research England, we are committed to continuing to support universities strengthen and build partnerships with significant growth in Higher

Education Innovation Funding (HEIF)³ in 2018-19 and new support for world-class commercialisation projects through the Connecting Capability Fund⁴.

Generating £95bn annually in gross economic output for the country, universities are key influencers in their local and regional contexts as well as major players on the national and world stage.

These funds enable universities to build the capability and capacity to strengthen their interactions with business and the wider world, generating real-world impact from their research, teaching and knowledge exchange activities. The forthcoming Knowledge Exchange Framework, once implemented, will help further increase the efficiency and effectiveness of these investments.

Knowledge exchange is a key area where we plan to build a deeper understanding of how our investments create diverse benefits to research, to innovation and enterprise, and to students.

Working with NCUB and its members, we are keen to explore new ideas and approaches that support the connections between universities and businesses. This plays into the heart of the Government's proposed Industrial Strategy which seeks to extend our strengths in the areas of science, research and innovation.

A framework for knowledge exchange we know has already raised much debate and discussion within the HE sector. We believe it is important milestone in the journey in further raising the profile of this activity within universities. But we are keen to engage with industry to understand how we further unlock the sector's potential and create genuine impact and value.

¹ www.elsevier.com/research-intelligence/research-initiatives/beis2016

² www.ukri.org/news/ukri-will-ensure-everyone-in-society-benefits-from-world-leading-research-and-innovation

³ <https://re.ukri.org/news-events-publications/news/research-england-to-invest-2bn-into-universities-in-2018-19>

⁴ <https://re.ukri.org/news-events-publications/news/research-england-invests-67-million-in-collaborative-projects-to-drive-university-commercialisation>



Design expertise strengthens UK markets

In our experience, scientists, researchers and entrepreneurs are too frequently unaware of the value of design to their work. Design enables innovation. Evidence repeatedly shows that firms who invest in R&D, marketing and design are more likely to create change that leads to economic benefit. Organisations who commit to using design are much more likely to make other innovation investments as a result. Integrating design into the culture of an organisation helps to stimulate greater collaboration and is key to translating ideas into transformative products and services.

Design Council's latest research *Designing a Future Economy* evidences how workers using design skills are more likely to be in innovation-intensive jobs, with 43% carrying out activities requiring creativity and alternative thinking to develop new ideas for, and answers to, work-related problems, compared with the UK average of 6%. These workers contributed £209bn GVA to the UK economy in 2015, and are 47% more productive (equivalent to £10 extra per hour compared to the average UK worker).

The absence of innovation drivers at scale is one of the reasons the UK has such a low conversion rate of ideas to market.

Design Council has coached approximately 30% of the UK's technology transfer offices and 5-10% of technology transfer practitioners.

However, entrepreneurs often find the journey from idea to commercialisation stalls after a concept has been developed, tested and initially seen as commercially viable. Obstacles can include failures to attract collaborative partners, investors or customers to fund further development. Often the reason for this lies in the failure to develop and communicate a benefit-driven proposition, based on evidence of market need.

Through the Industrial Strategy, the government can help to scale up the availability of design support and raise

awareness of the benefits of design across the country. This requires strategic action at both a national level and the right alliances between different stakeholders at a local level. Design Council's Spark Programme, a product-design accelerator start-up initiative, champions this by making a significant difference in offering support for skills development. The Spark Programme delivery team signposts and links businesses or entrepreneurs to the right type of design support in UK universities.

In addition, our Design Academy project links design expertise with the 'real world'. A four-day course, Design Academy supports students from second to post-graduate year to foster greater collaboration between the faculty disciplines. Each year Design Academy works with a selection of design and business schools within UK universities, actively bridging a gap between design thinking skills needed in the market and practical, "real world design briefs".

However, more needs to be done to scale up design support for business and students if the UK is to reap the full economic and growth benefit of applying design to the commercialisation process. In our experience, scientists, researchers and entrepreneurs are too frequently unaware of the value of design to their work. Our research shows that there is a clear call to action for UK universities to review curriculum development, and for government to build an environment where there is the same ability to commercialize design expertise as legal or financial.

A triple helix partnership

The Government has an ambitious target to double the size of the UK bioeconomy to £440 billion by 2030. The University of York is a research leader in this area and has helped establish two organisations that successfully address the challenges facing the growth of a biobased economy.

The bioeconomy uses renewable, biological resources such as plants and wastes to create the greener products of the future - reducing our reliance on fossil resources and minimising waste. In 2012, the **Biorenewables Development Centre (BDC)** was set-up to help ideas for turning plants and wastes into products navigate the valley of death. Since then, the team have delivered more than 450 projects for around 300 clients.

Their work is varied, starting with providing market insights, new contacts and funding proposals; all the way through to sophisticated research, development and demonstration projects.

Ultimately, the team believe that a multidisciplinary approach to biorefining will be key to biorenewable materials replacing their fossil counterparts and have put together the team and facilities to help partners all along the bio-based supply chain.

is to build new connections between bioeconomy stakeholders that do not usually interact. This enables the transfer of discoveries, technology and innovation between sectors in the bioeconomy and the building of new supply chains based on biobased resources. BioVale also brokers collaborative research, development and demonstration as well as promoting the region's bioeconomy to encourage trade & inward investment.

78



BDC project highlights

- Collaborating in an H2020 consortium to turn potato starch into batteries for electric vehicles
- Helping Drax get added value from wood pellets
- Using recycled plastic 'planks' to grow plants through hydroponics with SME, HydroBlox
- Working with GSK to make pharmaceuticals from food waste

"We are really impressed with the ideas and support available at the BDC and believe they are uniquely equipped to help companies looking to enter the emerging biorefining sector." GSK

Since 2014, the University has been leading development of **BioVale**, an innovation cluster that promotes and develops the bioeconomy across Yorkshire and the Humber. BioVale acts as a 'one-stop shop' for businesses in the bioeconomy, creating links from initial R&D through to commercial products. One of its key roles



BioVale highlights

Building effective networks for the regional bioeconomy:

- 300 members from 200 companies and 18 academic institutions
- 400 participants in workshops and networking events every year

Raising international recognition of the region's bioeconomy:

- Links to 400 biobased SMEs across Europe
- Research collaborations with 30 organisations from 19 countries

Supporting economic development:

- A network of over 30 bioeconomy investors
- Entrepreneurship training delivered to 17 SMEs and start-ups

With the help of the BDC and BioVale's activities, recognition for the region's bioeconomy innovation is growing. In 2016, a Government delegation, including the Chief Scientific Adviser, Mark Walport, visited the two organisations, as part of a fact-finding mission on the waste based bioeconomy. In 2017, Innovate UK held their Chemistry and IB Showcase 2017 in York - the first time it has been held outside London - because of the breath and importance of bioeconomy research in the area.

BioVale and the BDC receive funding support from HEFCE and the European Regional Development Fund.

Keeping commuters cool and communities warm

A new partnership between London South Bank University (LSBU), London Underground Ltd (LUL), and Islington Council is pioneering the use of waste heat generated by the Underground system to cut carbon emissions while keeping the capital's commuters cool and the people of Islington warm.

Underpinning this innovative project is the highly productive long term relationship between LSBU and LUL. This provides the reservoir of experience and trust needed to tackle such a complex project: a resource which would not have existed 10 years ago.

“We realised that there was both a big heat demand in the area and a means of distributing heat via Islington’s district heating scheme.”

Nick Boot, London Underground Senior Project Manager

There are two key issues affecting London’s Underground tube system: the fact that it generates a lot of heat that is not currently recovered; and the fact that this waste heat can contribute to the overheating of tube carriages, making travel uncomfortable for passengers. The Metropolitan Integrated Cooling and Heating (MICAH) project was established to determine the feasibility of transferring waste heat from London Underground to Islington Borough Council’s district heating network, providing a low carbon heating and cooling solution. It involves the transfer of the heat generated in the Underground to where there is demand for heat, and in doing so provides cooling for LUL.

“We’ve been working on cooling London Underground for a number of years and one recent study involved working at York Road Station near Islington. The heat removed by cooling the Underground is usually

exhausted to the outside air and wasted,” explains Dr Gareth Davies, Senior Research Fellow in the Centre for Refrigeration and Air Conditioning. Dr Graeme Maidment, Professor of Refrigeration and Air Conditioning adds: “Currently, heat constitutes 47 percent of all end use energy demand, while cooling accounts for 19 percent of all electricity use. Alongside other global environmental challenges, reducing heating and cooling energy use is therefore a high priority for LUL”.

As recently as 10 years ago, the focus of these kinds of research collaborations was almost entirely on generating technical solutions. However, this project exemplifies how much things have moved on. Whilst the technical issues are critical the project is as much about addressing the many technical, commercial and behavioural questions involved, not only to identify its feasibility for LUL and Islington Council, but also to explore the potential for utilising other sources of waste heat in the future, such as data centres and supermarkets.

MICAH provides an excellent example of how by working over an extended period, universities and businesses can address together not only technical solutions but also the complex commercial and deliverability issues that are often the most critical aspect of today’s research challenges.

Recycling Technologies - a scalable solution to the problem of plastic waste

The consumption of plastic worldwide has created a global rubbish problem requiring an urgent solution. Today only 10% of plastic waste is recycled globally; the rest is landfilled, incinerated or, worse still, lost into the environment. This represents a huge loss to the economy and a disaster for our oceans. The World Economic Forum and Ellen MacArthur Foundation predict that unless action is taken, there will be more plastic than fish in our oceans by 2050.

One of the companies joining the environmental crusade against plastic waste is Recycling Technologies Ltd, established in 2011 to develop an idea originating at the University of Warwick to convert mixed waste plastic into a chemical feedstock using pyrolysis. The idea started as a research project led by Professor Jan Baeyens, a Visiting Professor at Warwick, along with the School of Engineering, and an early test rig was designed and developed.

Founder and CEO of Recycling Technologies, Adrian Griffiths, is passionate about transforming waste to resources and was instantly attracted to commercialise a technical solution that could turn the tide on the problem plastic creates when it becomes waste. The Warwick concept and research was transferred to Recycling Technologies and the development of a plastic waste recycling process continued at the company's Research Centre in Swindon. The development was supported by leading engineering partners and backed by grant and angel funding from the team and private investors, including from the Minerva Business Angel Network run by the University of Warwick Science Park.

Building on the original university research foundations, Recycling Technologies has now developed a modular machine, the RT7000, which recycles a wide range of household and commercial plastic waste back into a petrochemical raw material called Plaxx®. Plaxx® is used in a number of applications, including as industrial waxes, marine and process fuels and as the chemical feedstock from which new plastics are made.

The RT7000 not only offers a solution for plastic waste disposed of in landfills and our oceans, but by turning waste plastic back to oil to be made into new plastics, the value chain is entirely circular.

The modular design of the RT7000 machine enables it to be mass produced and easily transported to waste sites across the UK and globally, taking the solution to the problem of plastic waste wherever it occurs.

Recycling Technologies' connections to the University of Warwick continue, extending beyond the technical foundations of the company. The business maintains educational relationships with Warwick, welcoming students on internships. One student, Ravish Jain, joined Recycling Technologies as Commercial Operations Manager following his internship as part of his MBA programme with Warwick Business School, and has since been promoted to Commercial Operations Director and joined the company's Board.

This year, having completed extensive engineering trials on its beta plant based at Swindon's recycling centre, the company opens its first commercial plant in Scotland, part-funded by Zero Waste Scotland. Each plant has the capacity to recycle 7,000 tonnes of plastic a year with an 85% energy efficiency. Within a decade, the company's goal is to have installed 1,300 machines worldwide, producing an annual recycling capacity of 10 million tonnes of plastic waste – three times the EU's total recycling capacity today – and giving Warwick's early research a truly global impact.



Interface connects innovation partners for sustainability

Sunamp Ltd, based in a former mining community near Tranent in East Lothian, was founded in 2005 by successful technology entrepreneur, Andrew Bissell.

Andrew wanted to create heat storage systems using Phase Change Materials (PCMs) capable of storing and releasing heat as they change phase - similar to hand warmers, and yet powerful enough to provide heat and hot water for a household. The company developed a heat battery that was more efficient than hot water tanks and cheaper than gas.

However, the issue Sunamp faced with PCMs was incongruent melting, which affected the PCMs ability to store and release heat over a long lifetime.

Through Interface, Sunamp was matched with Colin Pulham, Professor of High-Pressure Chemistry and Head of the School of Chemistry at the University of Edinburgh, to analyse the PCMs to develop systems that stored renewable energy as heat. The partners did this by developing additives, reducing the effects of any incongruent melting and significantly improving the heat storage properties.

Andrew said: "Professor Colin Pulham is extremely good at understanding a problem from the perspective of the company and then applying his own intellect, that of his students, the wider resources of the university and its' academic networks to solving the problem. Colin and his colleagues have been pragmatic and creative in developing the commercial relationship in such a way that it optimises the benefits for all parties."

The partnership was funded through a Scottish Funding Council Innovation Voucher.

The company developed a heat battery that was more efficient than hot water tanks and cheaper than gas. Sunamp batteries are now installed in 650 homes in East Lothian.

Resident, Jean Maclean, said: "It saves a lot of money - you're getting your hot water for free. Before that, this house was a really cold, cold house."

The partners have since worked together on several projects, helping Sunamp engage with companies all over the world and access facilities such as the Diamond Light Source UK facility and leading to a new area of research for the university. In 2017 a consortia, including Professor Pulham and Sunamp, was awarded £250,000 from Innovate UK for a project to develop a thermal heating solution for hybrid electric bus cabins.

Sunamp have also gone to work with the University of Glasgow on a £2 million project linked to clean power and heat generation from the China-UK Research and Innovation Bridges programme, and have a KTP with Heriot Watt University, which was also set-up through Interface.

Sunamp's material science team now consists of four of Prof. Pulham's former students, including material scientist Dr David Oliver who worked on the initial research project. Under an Energy Technology Partnership one of the PhD students made two significant discoveries in relation to Sunamp which have been published. Professor Pulham now has a Sunamp-focussed team working within the university and some of the collaborative projects have secured EPSRC Impact accelerator and Innovate UK funding.

The university aims to submit an impact case study to the Research Excellence Framework (REF) 2021, highlighting the significant benefits of the collaboration to both partners.





Wastewater innovation for a sustainable future

Cranfield's strategic partnership with Severn Trent has been in place for over seven years, and covers multiple challenges.

Cranfield is a specialist university, focused on technology and management, with over 40 years' experience in the water sector. Its Water Science Institute works with government and industry – from helping to ensure safe, clean supplies for domestic consumption, to assessing agricultural needs for food production and improving process engineering for manufacturing and industry.

Severn Trent is responsible for water management and supply, and waste water treatment and disposal, in the catchment areas of two of Britain's largest rivers – the Severn and the Trent. It supplies water to over eight million people in a water supply area of 19,000 square kilometres.

Severn Trent's vision is to be the most trusted water company by 2020 and to deliver a lasting legacy for its customers and its stakeholders. In practice, this means driving continuous innovation and being an environmental leader.

Keiron Maher, one of Severn Trent's Innovation Managers, explains: "We have a number of key challenges – delivering safe drinking water, treating wastewater to excellent environmental standards, and reducing our carbon footprint - which is both more environmentally friendly and economic for our customers.

"Cranfield's technical know-how and depth of understanding is impressive. It's not just about science, however; it's their translation of science that is so beneficial for us."

Keiron Maher, Severn Trent Innovation Manager

At Packington sewage treatment works in Leicestershire, the two partners are working together to address the issue of phosphorous removal from wastewater. Such a move is necessary to meet stricter legislation and is important for wider society as phosphorus is a non-renewable resource, required by all living organisms for cell growth.

Five technologies were trialled at Packington, including two world firsts, to help Severn Trent identify the most suitable systems which, ultimately, could lead to a more sustainable way of treating wastewater. The benefits are environmental protection and potentially lower prices for customers, if the wastewater can be treated in a more sustainable way.

Cranfield is also supporting Severn Trent in developing its rural strategy. The ambition is to transform small wastewater treatment plants so they become a net provider of societal value. One of the technologies is being tested at Hulland Ward in Derbyshire, where full treatment of the wastewater is done by vertical flow constructed wetlands. The potential for this environmentally-friendly approach for sewage treatment is enormous – wastewater treatment plants could represent an active society asset and become educational and recreational areas for local communities.

Professor Paul Jeffrey, Director of Water at Cranfield, said: "Our activities are underpinned by our world-class facilities but the real benefit comes in the application of our research and thinking to benefit society. We are proud of the work that our academics and PhD students are doing to support Severn Trent and its important role in protecting and sustaining water as a natural resource and the environment as a whole."

The Energy Estuary: shaping the future of offshore wind

The UK has been the world leader in offshore wind since October 2008, with more installed capacity than any other country. Three of the largest wind farms are located off the North East Coast of the UK, making the Humber - the Energy Estuary - a prime location to become the country's offshore wind hub. Innovation in technology has fuelled this rapid growth.

The presence of the recently opened Siemens Gamesa Renewable Energy blade factory in Hull and Ørsted's presence in Grimsby is evidence that the Humber region is the place for this new, rapidly growing sector to develop and thrive. To seize the opportunity provided by the offshore wind industry, a project bringing together excellence, knowledge and innovation called Aura, has been established to consolidate the UK's position as a world leader in the offshore wind sector, supporting the Government's Industrial Strategy.

Alongside Ørsted, Siemens Gamesa Renewable Energy and the University of Hull, Aura unites the expertise of Durham University, the University of Sheffield, the Offshore Renewable Energy Catapult [ORE], Green Port Hull, CATCH the National Oceanography Centre and the Humber Local Enterprise Partnership.

“Research and innovation in operations and maintenance is essential to maintaining the UK's position as a global leader in offshore wind and this new Centre of Excellence will be key to establishing an anchor for the industry as a whole.”

Dr David Richards, University of Hull Pro Vice Chancellor for Research and Enterprise

Centred in the Humber, Aura aims to help establish a vibrant offshore wind industry with global reach and influence. To deliver this vision, we are engaging with academia, industry, NGOs, and national and local government to focus on three key areas:

- **Research, development and innovation** - identifying and solving the technical challenges and problems facing the sector.
- **Industry engagement and enterprise** - creating an international centre to stimulate the growth of offshore wind in the Humber region.

- **The talent pipeline** - developing and delivering a national framework to meet the skill needs of the sector by matching demand to knowledge and training.

In October 2017, the University of Hull and the Offshore Renewable Energy (ORE) Catapult further consolidated the Energy Estuary's position as a global hub for offshore wind by joining forces to launch a £2 million Operations and Maintenance (O&M) Centre of Excellence. The five-year partnership will develop a series of research and innovation projects to improve the way offshore wind farms are operated and maintained.

Chris Hill, ORE Catapult's Operational Performance Director, said: "The offshore wind industry is committed to working with Government to secure a transformational Sector Deal, and initiatives like this play a key role. The East Coast has extensive experience of servicing offshore wind farms and that experience is invaluable as we look to build expertise and a local supply chain, establishing the region as a real centre of excellence that can service UK offshore wind farms as well exporting to the fast growing international market."

Aura allows the University of Hull to align with the Government's Clean Growth Strategy, which provides a blueprint for Britain's low carbon future. This in turn enables the University and the Energy Estuary to research and pilot the emerging area of integrated energy; and forge links with the chemical industry.





Improving water quality in the River Medway

The University of Brighton and Southern Water collaborated on a research project to tackle the levels of chemical contaminants in the River Medway catchment to produce higher water quality standards.

Since 2000, the EU Water Framework Directive (WFD) has been fostering a new holistic approach to river basin management. The approach seeks to achieve good ecological and chemical status in water courses by managing a range of chemical contaminants, including pesticides. Metaldehyde, a synthetic aldehyde pesticide used globally in agriculture and particularly in slug pellets, is a particular problem because it is highly stable in water and is not effectively removed by drinking water treatment processes.

“Metaldehyde is an increasing concern for us and we needed a low-cost solution that we could bring in-house and use on an ongoing basis within the catchment team.”

Rebecca Kennedy, Southern Water Research and Development Planner

Southern Water needed to develop capability in advanced catchment modelling, and through its relationship with the University of Brighton’s Green Growth Platform, developed a collaborative research project to investigate how computer modelling approaches could help to predict where and when water quality issues are most likely to arise. The project was led by Dr Sarah Purnell at the University of Brighton, and was funded by Southern Water using the River Medway catchment as a pilot.

An important aim of the project was knowledge transfer into the company. Rebecca Kennedy, Research and Development Planner at Southern Water said: “The model will help Southern Water to make important business decisions around the company’s investment in catchment management processes. It will help us determine where the risk hotspots are, and better target our mitigation measures through catchment-specific solutions, to address some of the biggest risks to our raw waters.”

Rebecca added that “The new modelling approach will give a visual view of what’s going on in the catchment

and provide enhanced opportunities for engagement with our stakeholders including the National Farmers Union, local users and the Drinking Water Inspectorate.”

The project ran between 2016 and 2017 to develop a Soil and Water Assessment Tool for the River Medway Catchment using data from the UK Met office, Southern Water, the University of Brighton and Sutton and East Surrey Water, which is responsible for part of the catchment area.

The team produced hazard maps to show in-stream metaldehyde levels using simulated data from the model. These maps identified locations in the catchment at risk from the highest peaks in metaldehyde concentrations. Results suggested that up to 58% of in-stream metaldehyde could potentially be removed at specific points with effective management.

During the final six months of the project, university experts worked closely with the catchment team at Southern Water to establish a transferable protocol for future river basin mapping and predicting emerging pollutants. A series of knowledge transfer videos were produced to facilitate this long term.

This project supports the government’s clean growth challenge, one of the first four Grand Challenges announced as part of the Industrial Strategy Challenge Fund, and will provide the water sector with much needed resilience to future climate change.



Towards a sustainable alternative to palm oil for food, fuels and beyond

University of Bath's Centre for Sustainable Chemical Technologies brings together multidisciplinary expertise of scientists and engineers working with industry for a sustainable future.

Bath's Centre for Sustainable Chemical Technologies (CSCT) has rapidly become an important hub for sustainable chemistry in the UK since its establishment in 2008. Currently there are 110 academics involved, 23 industrial partners, and the EPSRC Centre for Doctoral Training has supported 132 PhD Students. CSCT develops new molecules, materials, processes and systems from the lab right through to industrial application, with an emphasis on practical sustainability. CSCT's scientists and engineers work together with industry to meet the needs of current and future generations around four main themes: Energy and Water, Renewable Feedstocks and Biotechnology, Processes and Manufacturing, and Healthcare Technologies.

In 2011, CSCT and Airbus began a partnership to investigate renewable jet fuels, this led to the development of a novel biotechnological organism that has spurred multiple further collaborative ventures in other applications from food production to the pharmaceutical industry. The lead academic, Dr. Chris Chuck, established his independent career as a Whorrod Research Fellow within the CSCT and is now a Reader in the Department of Chemical Engineering. CSCT and Airbus started collaborating through two PhD studentships, with the aim to develop a yeast platform for bio jet fuels.

Dr. Chuck's group discovered a little known yeast, found in wine cultures, which can produce a composition similar to palm oil, with the potential to be converted into a bio-fuel and an array of other higher value compounds. Further funding from the Biotechnology and Biological Sciences Research Council (BBSRC) followed to develop the concept further with Croda Europe, including scale up at the Croda site. At this point, the team determined that while a palm oil substitute was plausible it would need further development of the yeast and work from across the supply chain. To this end a larger consortium was built including three departments from the University of Bath, Croda, AB Agri, C-Tech and the University of York. The consortia were awarded an Industrial Biotechnology (IB) catalyst early stage translation project worth £4m. The project is ongoing and now includes Accenture management

consultants, who are working on supply chain analysis, a private equity firm aiding in the financing for a scaled up enterprise and a number of end-users willing to test the oils and proteins in their products.

"We are close to realising the true potential of this work, right the way through from an idea to a potential process. None of this would have been possible without a whole range of UK industries being willing to collaborate with us in speculative research projects, sharing their expertise and guidance or just helping us meet the right people along the way."

Dr. Chris Chuck, University of Bath Department of Chemical Engineering Reader

This case study represents just one of many projects that are taking place in the CSCT, which has received over £34.1m in research funding from several partners including UK Research Councils, Innovate UK, European Commission and Private Companies. Our partners greatly value participation in the Centre through partnership in collaborative research projects, hosting of internships, participation in postgraduate training and involvement in an industrial forum.



Transcribe Bentham hackathon

UCL and IBM collaborated for a hackathon that brought computer scientists together with digital humanitarians, delivering new meaning to the works of philosopher and social reformer, Jeremy Bentham.

Transcribe Bentham is part of the wider *Bentham Project* bringing together a new edition of the works and correspondence of Jeremy Bentham (1748-1832). Bentham was a philosopher, jurist, social reformer, the initiator of modern utilitarianism and seen by many as a founding father of UCL. Producing a new edition of Bentham's works is particularly important given the significant influence of his thought. The incomplete way in which his works have been previously published gives the project added urgency; his work holds relevance today, yet a vast majority of it has not been properly accessible to date.

Transcribe Bentham involved transcribing, analysing and unpicking some 100,000 pages of Bentham's manuscripts. However, a digital element to this work was desperately needed if Bentham's works were to become tangibly useful and digitally searchable. A research project that spanned disciplines from humanities to computer science, creating digital value from Bentham's work was an ideal project for UCL and IBM to collaborate on. UCL and IBM have a long-standing strategic partnership, but this was the first initiative of its kind for the university and the technology company.

"Prior to the hackathon, the UCL research team had been trying to find a solution for four years. Yet over a single weekend, amazing progress was made. Collaborations like this – done properly – can be very convincing."

Simon Baker, IBM Developer Advocate

As a result, the *Transcribe Bentham* hackathon came into fruition. Stakeholders from both UCL and IBM planned the event together, defining the business problem and objectives. Essentially, there was a huge amount of data available from the UCL research team, which required digital platforms to interpret it. In turn, this would give the data opportunities for real-life usage, meaning and value. UCL academics and students from a broad range of disciplines came together for the two-day event. 'How

to' guides were produced in advance, so participants could get the most out of the session. IBM supplied the technology, mentors, judges and prize money.

Hackathon participants were divided into competing teams to come up with solutions to the problem. "Every idea presented at the end of the hackathon had great merit," said Simon Baker, Developer Advocate at IBM. "The winning team in particular found a way to make the data more accessible."

Each partner involved in the hackathon got genuine value from the collaboration. Students and academics had exposure to technology and experts they wouldn't normally have access to. IBM could apply its technology to a real-world problem and mentor the next generation of developers and computer scientists. All the while, the *Bentham Project* team received a solution to making Jeremy Bentham's important works accessible to the wide audience it deserves.

"The collaboration across disciplines can be really powerful," said Oli Pinch, Project Manager for UCL Innovation & Enterprise. "We had participants with law, philosophy, history and computer science backgrounds coming together. IBM provided experts to guide them through the hackathon so they could get the best out of the technology. The *Transcribe Bentham* hackathon is a great example of a university and a big corporation collaborating on something that delivered real value."



Iceland's energy powers cheaper and greener scientific research

Science is often data and power hungry – a collaboration between Jisc and Verne Global to provide access to data centres in Iceland is delivering many benefits to the research community.

Research leading to cures for diseases and other important scientific discoveries now often relies on analysing data in a way that was previously not possible. Powerful computers are needed to process huge volumes of data at a speed that allows important work, particularly in bio and life sciences, to be carried out effectively.

Jisc, the provider of digital technology and resources to UK education and research, aids the processing of this data by providing the world-leading Janet network, which is capable of supporting clusters of academic High Performance Computing (HPC) users. The data involved in this type of research is vast – for example researchers at Earlham Institute, a leading bioscience research facility in the UK, deploy some of the largest shared memory computing resources dedicated to life sciences in Europe.

This includes the assembly of some of the largest and most complex genomes, including the 17GB wheat genome, which can take between six and eleven terabytes of memory per run. For an idea of the scale, it would take on average around seven years to play eleven terabytes of music on mp3 files.

But the demand for HPC on this scale is increasing pressure on the capacity and operational costs for data centre services, especially in locations like the UK where energy prices are high and power supply is low and insecure. HPC clusters consume a great deal of energy to power them and to keep them cool so they can operate efficiently and continuously. Spencer Lamb, director of research at Verne Global, said: "Our Icelandic location provides ultra-low cost HPC which is 100% green, and this enables research institutions in the UK to massively scale their deployments without increasing their carbon footprints."

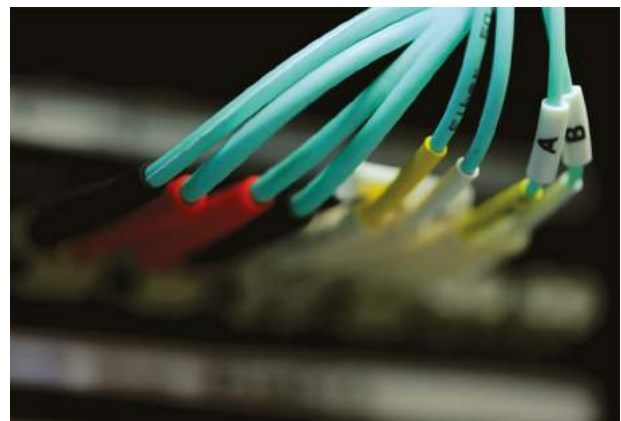
Through an agreement with Verne Global, Janet Network users can benefit from a secure predictable path to HPC via its data centres in Iceland. The agreement enables the UK's academic and enterprise research community to have access to data centres with abundant, reliable power, in locations where

ambient temperatures provide free cooling to keep the servers operating at optimal levels. This allows Jisc's members in the academic research community to do more with less energy and fewer resources, with access to a power supply that is 100% green.

"Our agreement with Verne Global to connect to their facilities in Iceland could offer customers more predictable costs for HPC, powered by renewable geothermal energy. While this venture is embryonic, we are very excited about the potential opportunities this arrangement will create for Jisc's members."

Jon Tucker, Jisc Executive Director Members and Customers

Verne Global's Icelandic data centre provides the ability to process, analyse, and store large amounts of data and optimise computing capacity, while reducing carbon footprints. This ensures long-term, sustainable computing and connectivity for Jisc members. Additionally, this power supply can help lower the total cost of ownership on power by more than 70% when compared to UK energy pricing.



Loughborough University and Rolls-Royce – a powerful partnership

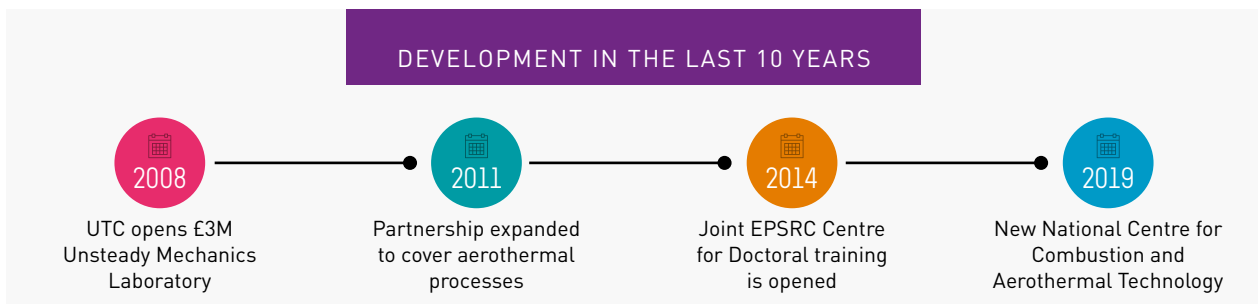
The Loughborough based Rolls-Royce University Technology Centre (UTC) in Aerothermal Processes is an innovative partnership which brings together a leading UK University with one of the world's foremost aerospace companies.

Built on a decades-long history of collaboration, the partnership provides a unique infrastructure in which Rolls-Royce and University staff work together to advance understanding and provide design capability in the field of combustion aerodynamics and aerothermal technology. This cutting-edge research is driven by real industrial challenges and generates innovative technologies for current and next generation low emission gas turbine engines.

For continued sustainable growth of the UK aerospace industry, propulsion systems require the development of low emission, 'leaner and greener', gas turbines. The Loughborough UTC grew from a need to reduce emissions and meet future emissions targets, and now represents a long-standing strategic partnership with Rolls-Royce that was formally established in 1991. Over the last 25 years the UTC has evolved into a mature collaboration with a global and interdisciplinary research staff. This growth has been achieved by successfully adapting and consistently producing innovative results for the industry.

an opportunity for students to gain an appreciation of what it means to study in higher education.

Building on the expertise of the Loughborough Rolls-Royce partnership, the Government announced plans for a new £15m National Centre in Combustion and Aerothermal Technology (NCCAT) to be based at Loughborough. Set to open in early 2019, NCCAT will act as the UK's primary hub for research and development of future low-emission aero gas turbine combustion technologies, with opportunities for wider exploitation beyond aerospace (e.g. energy). Funded through a partnership comprising the Department for Business, Energy and Industrial Strategy, the Aerospace Technology Institute and Innovate UK, with support from Rolls-Royce and Loughborough University, the Centre will support activities over a range of Technology Readiness Levels (TRL 1-6) through the alignment of early research activities with future commercial goals. This will promote multi-disciplinary and integrated design methodologies which will ensure the fast pull through of new technologies.



And it's not just about science and engineering. The scale and success of the partnership has allowed staff and students to gain exposure in managing complex projects, work with people from other universities and industries, and engage in STEM outreach activities with local schools. UTC Business Manager, Emma Callaghan, who recently completed her MBA at Loughborough whilst helping to manage the Rolls-Royce partnership, has worked with a local school to engage children through a time capsule event and practical STEM challenge, providing

Mark Jefferies, Chief of University Research Liaison at Rolls-Royce said "I am delighted that we are able to further strengthen our existing strategic partnership with Loughborough University through this investment. The new Centre will help train the next generation of highly skilled engineers and scientists who will play a key role in helping the UK develop the advanced technologies needed by the aerospace industry to meet international environmental performance targets".

Transforming responsible business practice

In late 2017, one of the University of Birmingham's most impressive business collaborations was announced. A leading financial institution provided five years' worth of funding to establish a £2.5m research centre within the University's Business School.

The Lloyds Banking Group Centre for Responsible Business is a unique partnership that actively engages with businesses, NGOs and policy makers who are at the frontier of responsible business education and practice to develop and share research findings and best practice in responsible business practice and translate into workable solutions. The Centre has twelve research challenge areas, ranging from building sustainable business models, through to embedding United Nations Sustainable Development Goals within governance.

“This partnership is already contributing to the process of transforming responsible business practice in the banking industry and beyond: through engaged research, agenda setting thought leadership and innovative and accessible responsible business education”

Fiona Cannon OBE, Director, Diversity & Inclusion, Head of Responsible Business, Lloyds Banking Group

Professor Ian Thomson, the Centre Director, focuses his research on sustainable accounting and using evidence to influence organisational decision making. The Centre will also explore the obstacles blocking responsible business transformation and propose solutions based on quality evidence and evaluation.

In 2017, the University of Birmingham was the higher education sponsor of the Confederation of British Industry Annual Conference, solidifying its approach to working proactively with business to solve industry's challenges. The University used the opportunity to launch its '10 Ways We're Transforming Business' campaign, which touched on tangible research strengths from across our five Colleges that are having a direct impact on business; the first in the collection of ten was 'We're making business responsible.' Professor Ian Thomson was also asked during the Conference to sit on a panel discussing how to grow trust within business.

At the Centre's announcement, Martin Dodd, Lloyds Banking Group's Ambassador for the Midlands, said: 'It's Lloyds Banking Group's belief that restoring trust with the public remains a critical task for us as a bank and for the industry as a whole; and we believe it is in our own hands to rebuild this trust. This can only be achieved through a healthy corporate culture in which every individual is valued for the skills, enthusiasm and dedication they bring to the business. Engraining a healthy corporate culture across the industry and beyond should be a priority.

The University of Birmingham is accelerating industry and academic research collaborations, with the ultimate goal of providing academics with greater impact for their research and more diversified income, whilst supporting industry as it grows and innovates. As a research-intensive institution it is vital that the University maximises all opportunities to generate industry research awards and create impact through the transformative work of its academics.

In the past five years, the University has more than doubled its awards from industry, helped 350 academics to engage with business, and collaborated with over 300 organisations. The University continues to set ambitious targets for its level of engagement with business, and is aiming to double its research income by 2026.



Supporting a resilient financial market system

LSE has a formal partnership with Swiss Re, one of the world's largest reinsurers, to support a research programme on monetary policy and long-term investment.

The project is led by Simeon Djankov, Executive Director of LSE's Financial Markets Group, who is the former Deputy Prime Minister and Minister of Finance of Bulgaria. Jerome Haegeli, Swiss Re's Head of Investment Strategy at Group Asset Management, is collaborating on the project with the aim to support a resilient financial market system.

The LSE Financial Markets Group (FMG) is a leading centre in Europe for policy research into financial markets, working alongside the LSE Department of Finance to understand problems in financial markets and in the decision-making processes of corporations, banks and regulators.

The programme examines two key questions:

01 The first project has looked at the structure of central bank balance sheets in the future and the corresponding implications regarding their contribution to a well-functioning financial market. The structure of central bank balance sheet has changed substantially since the Global Financial Crisis, both in terms of the composition and the size of assets and liabilities.

During the crisis, many major central banks expanded their asset holdings in efforts to supply monetary accommodation and support economic activity. Some central banks continue in this direction. Looking ahead, population trends and low levels of productivity growth are raising questions as to whether the equilibrium, or natural, real interest rate is lower. In a persistently low interest rate environment, central banks may turn more frequently to their balance sheet as an instrument of policy, raising questions both about the type of assets to hold and structure of liabilities.

“Central banks’ dominant role in financial markets is not sustainable. The costs are outweighing the benefits. Low interest rates are a “tax” on savers and long-term investors alike.”

Jerome Haegeli, Swiss Re Head of Investment Strategy



02 The second project has looked at the effect of loose monetary policy on structural reforms across Europe. The Eurozone crisis has shown significant vulnerabilities in the European social model. Europe is home to only 8% of the world's population, yet it produces 50% of all social payments (public pensions, healthcare benefits, maternity leave and associated benefits, public education) globally. These social benefits come at a large cost, typically covered by high taxation and chronic budget deficits. The latter have increased public debt in some Southern and Western European countries to dangerously high levels, even prior to the Eurozone crisis. The resulting fiscal tightening has gone along with pursuing structural reforms in public finances and social sectors across Europe.

More recently, loose monetary policy has allowed government to borrow at essentially no cost, reducing their incentive to modernise the social sectors. There are some differences across Europe, especially among Eurozone and non-Eurozone countries. These differences can be exploited to conduct comparative analysis on the effects of loose monetary policy on structural reforms.

Simeon Djankov commented: “The preliminary research clearly shows that governments opt for the easy path out when offered a choice between structural reforms and cheap additional debt. This result holds both in advanced and in developing economies. **Europe after 2012 is a striking example of how loose monetary policy can slow down reforms”.**

A networked partnership to tackle climate risk

For over ten years Aon have been part of a unique university collaboration called ClimateWise, the insurance industry's climate risk and societal resilience group, which brings together organisations from across the insurance industry with academics from various universities.

Many academic partnerships with business are discrete and client driven. Aon has leveraged these partnerships successfully through Aon Benfield Research. Facilitated by the University of Cambridge's Institute for Sustainability Leadership (CISL), ClimateWise offers Cambridge connectivity and expertise to ClimateWise members, giving organisations and academics from a range of institutions access they might not have otherwise. Over the past 18 months Aon has been deeply involved in two initiatives that have brought together the university, academics, and our own Aon experts.

“Across Aon, we take the findings of ClimateWise action research to develop and deliver client solutions on the critical issue of climate risk.”

Greg Lowe, Aon Global Head of Resilience and Sustainability

The first initiative, the Investing in Resilience research project, explored how the insurance industry can use its expertise in risk quantification, its sizeable balance sheets and its key stakeholder partnerships to enable cities and communities to become more resilient to the physical risks of climate change. The research project involved a year-long series of roundtables facilitated by CISL, also involving academics from the London School of Economics, and civil society organisation.

Aon offered its own experience and ideas, while providing feedback to the academics and report authors. The final report was widely circulated within the insurance industry and has allowed Aon to develop deeper dialogues about the opportunities: both internally and with clients. The output of this report - the harnessing of academic expertise and its merger with industry experience - has strongly shaped Aon's city infrastructure and resilience strategy. We are now having new dialogues with our clients and connecting them with the academics involved in the report where beneficial.

Projects are overseen by the ClimateWise Advisory Council, made up of senior industry leaders and regulators, and the Council is currently running two further schemes. Aon has been deeply involved in one of these schemes, the Physical Risk Initiative. Similar to Investing in Resilience, the scheme involves independent academics working as consultants, along with ClimateWise members and wider involvement of CISL's sustainable finance initiatives.

Involvement with the Physical Risk Initiative has brought key reinsurance colleagues into direct contact with CISL, allowing Aon to model products and strategies on the issue of physical risk in the banking system. When the report is completed, Aon and other ClimateWise members will have deeper insight to address physical climate risk in the banking system with insurance products and tools, such as modelling expertise.

This pre-competitive research requires a neutrality that only a university such as Cambridge can bring as convener. 'Access to ClimateWise's insights and connections with academics and regulators is what provides the leverage to engage colleagues and the wider insurance industry on this topic, and allows us to work together to address real issues' says Aon Global Head of Resilience and Sustainability Greg Lowe. As ClimateWise enters its second decade, this networked partnership will continue to lead the way in bringing the range of academic, commercial, and policy expertise required to ask the difficult questions of the industry, and to facilitate impact on insurance and global societal resilience.





06

SUSTAINING THE
RELATIONSHIP

People and wellbeing

At the heart of any successful collaboration lies people. Teams, colleagues, clients and partners, working together to exchange knowledge, ideas and skills, playing a role in a piece bigger than themselves or their organisations. Yet while the value of people as a resource is long-established, there is growing awareness in the role of well-being, and the value that people can bring to productivity and innovation.

In much the same way as the place agenda, a section on people is hard to determine; all collaborations occur in a place, and all collaborations involve some people. Instead, this section concerns the more specific focus on the role of people and their mental well-being to the organisations they exist within, and the wider concern of the physical well-being of whole populations.

Plymouth University are tackling the fight against anti-biotic resistance: a collaboration with global impact, while the University of South Wales explore the innovative technology developed to safeguard the vision of children. The University of Dundee, AstraZeneca, the University of Oxford, the University of Huddersfield and Bournemouth University are all doing exceptional work in the advancement of specific medical treatments which have the capability to revolutionise the lives and life-expectancies of patients.

Concerning mental-wellbeing, we aren't solely concerned with mental health, but also confidence built through skills and training, involvement in community outreach, and mobility and progression in the work place. These aspects are covered in the collaborations of Sage and KPMG, who are looking at the concept of life-long learning and the benefits of upskilling. The University of Portsmouth is working with the British Army to develop a degree apprenticeship to promote values and expertise in leadership. Similarly, the Royal Academy of Engineering explores the role of mobility in progressing expertise and careers, while City, the University of London, consider the role of social enterprise in fostering community relationships.

An army of apprentices

The British Army is offering its soldiers the chance to study for a university degree in management and leadership. The new initiative is part of the national degree apprenticeship scheme and delivered by the University of Portsmouth.

Experienced in the delivery of apprenticeships at Levels 2-4, this is the first time that the Army has offered an apprenticeship at degree level. Soldiers working towards the management and leadership degree apprenticeship will be able to apply their learning and bring real value into the Army. As part of CGS' Maximising Talent Portfolio, this scheme represents the continued investment by the Army in developing talented soldiers to meet management and leadership challenges - now and in the future.

Degree apprenticeships were introduced in 2015 as a way of increasing the number of people with specific knowledge, skills and behaviour required by UK employers. Students gain a degree, as well as developing skills valuable to the organisation. All fees are entirely paid from the employer's Apprenticeship Levy - the only investment needed is the time commitment required by students and their organisation mentors.

"This is a really exciting development. The programme aims to provide a genuine learning and development opportunity to upskill our workforce" said Major Rachel Lamont. "It's targeted at our senior soldiers as they are often in key leadership appointments and will add considerable value to those they command, inspiring, educating and better managing the future talent of our organisation."

"It's a wonderful opportunity for the individuals and the Army as we continue to grow and develop as a learning organisation."

Rachel Lamont, British Army Major

Building on existing knowledge and experience gained on the job, the programme supports the development of leadership and management skills, applying academic studies to real work challenges. Upon completion of the programme, soldiers will graduate with an Honours Degree in Leadership and Management, as well as gaining the prestigious Chartered Manager status - awarded by the Chartered Management Institute (CMI).

The University of Portsmouth's challenge was to develop competence as well as intelligence, and a teaching style to suit geographically dispersed students on varying work patterns who could not rely on access to the Internet. The course has been designed so soldiers can study wherever they are based in the world. There is an intensive residential period at the start of each academic year where topics are introduced and explored using a variety of teaching methodologies that is followed by lecturers facilitating online discussions and host group online video conference sessions once a week to support soldiers' progress. Each soldier has an allocated Army Employer mentor, who will closely support their learning and development.

Nick Capon, Course Developer, said that the course will allow soldiers to "develop an in-depth knowledge of strategic management and leadership that will bring greater understanding and allow them to bring new ideas to their role in the Army" Nick added "It's a fantastic opportunity for talented Army personnel who may not yet have a formal, degree-level qualification but have years' worth of on-the-job practical experience in leadership and management."

The Army had an overwhelming response from soldiers wishing to participate in this programme. Individuals were chosen from across the Army representing a wide cross-section of 'cap badges' and trades from those who serve in the infantry to communication and logistic specialists, medics, engineers and equipment technicians.



City's Social Enterprise Festival: Meet people. Solve problems. Change lives.

City's Social Enterprise Festival (SEF) was a public, seven-day platform focused on making an impact through highly innovative workshops, debates and competitions across two institutions, seeing it named as the first collaborative SEF of its kind in London.



The festival was also supported by Santander Universities who took on a proactive role in promoting it to their businesses.

There are 70,000 social enterprises in the UK, contributing £24billion to the economy, SEF provided a platform for City to break into this sector and begin creating new relationships with local social entrepreneurs and their companies, as well as enabling engagement with communities to progress social enterprise ideas.

The outcome was discovering 116 social enterprises in our neighbourhood, that until now were not engaged with us.

The SEF targeted London's community interested in the learning and development associated with social change and those businesses and people at earlier stages of development. SEF provided a platform to launch new strategic community projects and offered an ideal setting to give existing social enterprises and social entrepreneurs the opportunity to promote their products and services, and to debate and discuss current issues.

Speeches, hackathons, panels, workshops and networking all featured at this SEF and attracted more

than 1,000 guests including staff, local businesses, students from local, national and international universities, and members of the public. Attendees gained expert insight, skills and met several business founders making a difference and 96% said they would recommend this event to a friend.

The extent of the community reach was national with the leading journal, Pioneers Post, featuring the SEF as well as Guardian's own social pages. Google placed our SEF as the second most popular searched item and it featured on many community channels such as CAN and the Knowledge Quarter.

There were three advocacy clinics helping the community with their legal, financial and marketing strategies. As well as social enterprises, the SEF attracted large corporates such as PwC, Natwest and Wates Group as part of their commitment to Corporate Social Responsibility. The team also collaborated with Queen Mary University of London and held some sessions at their Mile End campus, bringing together the East London community with City's central London location.

The programme concluded with the Big Social Debate which critically looked at whether social enterprise can truly deliver social impact and financial return? Debaters included: June O'Sullivan, MBE, CEO of award-winning childcare charity and social enterprise (London Early Years Foundation – LEYF), Vanessa Sanyauke, Founder and CEO of Girls Talk London, recognised as a Changemaker at 2015's World of Love Festival, Guy Battle, experienced business leader and founder of The Sustainable Business Partnership and Rob Wolfe, an award-winning leader in the construction field, and senior executive of Construction & Housing: Yorkshire, promoting responsible business practice in the industry.

The week showcased that social enterprise can be a viable solution to the current economic crisis, and that we can generate wealth sustainably, create meaningful and well-paid jobs and tackle some of society's most intractable problems.

Digital skills education for the 4th Industrial Revolution

Statistics from BIS in 2016 state that more than 99% of UK companies are classed as SMEs, and they account for 60% per cent of private sector employment and 47% per cent of private sector turnover. Most of these businesses need to be able to do internal accounting better and Sage is the No 1 Accounting Software used by the SME sector.

Sage CEO Stephen is clear on why, "It's about ensuring access to digital skills education for all as we approach the 4th Industrial revolution."

Sage have collaborated with many accounting and bookkeeping awarding bodies, and several regional universities to develop a series of nationally recognised and regulated qualifications in computerised accounting and payroll. Working closely with universities such as Ulster and Hertfordshire, we now have over 25,000 learners with a Sage qualification, ensuring access to digital skills education as we approach the 4th Industrial Revolution.

This work supports learners and businesses by giving practical skills and demonstrating how, when used proficiently, computerised software adds real value to a business. It also increases a learner's employability, encourages self-employment and enhances business confidence in critical decision making formed on the basis of accurate data management.

"For the students, achievement of the certificate immediately improves their employability, giving them a differentiating factor from their peers."

Ulster University

This collaboration is driven by a unique and interactive e-Learning portal which provides downloadable software for every learner, is easy to use, has simple explanations and examples with a plethora of pictures, videos, quizzes and activities. Providers have found that with this portal, the project enables learners to collect and collate financial data which they can analyse, synthesising it into information which supports better decision making. It also allows for learners to gain added value with up to date and practical skills, such as sending the mandatory returns required by HMRC when running a business, and explains the importance of timely data submission as well as simplifying the processes.

"I have found the SAGE module interesting as I am learning a system which I may be using for the majority of my life and gaining experience, as well as a professional qualification (Sage), which will benefit me greatly."

Student in SAGE training

To ensure that qualifications translate to employability, Sage works with awarding bodies such as IAB, Skillsfirst, ICB, City & Guilds, OCR, ICAEW and CIMA. These qualifications and courses mean that for the first time, a person's skill at using Sage Accounting and Payroll software can be officially benchmarked, with an accredited Sage UK certification which proves competency. The qualifications begin at Level 1, then progress through the Further Education levels 2 and 3, and extend into Higher Education at Level 4 and 5. Most of the current partnership qualifications are on the RQF and attract SFA funding.

We know that this certification makes the learners more employable because they have practical skills that are of immediate use to an employer who will recognise the Sage brand - backed with awarding body accreditation.



Building a Civil Service fit for the 21st Century

In early 2016, Civil Service Learning (CSL) commissioned the KPMG consortium to design and deliver a Learning and Development (L&D) curriculum to meet the needs of a Civil Service fit for the 21st century. Less than a year later KPMG delivered the largest L&D project in UK Government history.

The sheer scale of the project – the design and delivery of a curriculum fit for 400,000 civil servants - required a sizable consortium of L&D suppliers. The Open University and thirty top-class suppliers joined the consortium, including leading industry names such as LEO, Mind Gym, Unspun, Lane 4 and QA.

This collaboration took place against a backdrop of rapid change within the Civil Service, who were challenged to reimagine the provision of public services, make use of new technologies, delivery mechanisms and management approaches in an efficient, innovative and cost-effective manner.

The curriculum needed to be wide-ranging, covering everything from finance and policy-making through to leadership and customer service, and applicable to an incredibly diverse audience. It also needed to represent a considerable departure from what went before; previously the Civil Service learning catalogue had over 2,600 separate courses, many of which had overlapping content and typically lacked any alignment to the Government's overarching objectives.

“It is vital we have the right people, with the right capabilities, in the right place at the right time. Developing the skills we need – and delivered in an accessible, convenient and digitally-enabled way – this is a curriculum designed very much with tomorrow's Civil Service in mind.”

Deborah McKenzie, Civil Service Director of Learning & Leadership

In designing the curriculum, thirteen Task and Finish groups worked to identify, prioritise and validate the desired learner outcomes. Over 6,000 civil servants, representing numerous government departments and professions, were involved with reviewing and agreeing

the curriculum content. A blended learning model synthesizing digital with social learning was deployed, and as the topics went into production a further 600 civil servants were involved with testing them.

From this, a new curriculum emerged covering 138 topics all clearly aligned with government business priorities. It featured over 1,500 learning assets: including 50 video case studies, 180 online tutorials, 32 live animations, eight online drama scenarios and over 320 guides and planning tools.

Since its launch, there have been over 157,000 bookings onto CSL topics, spread across 110 government departments and agencies. The new curriculum has received an 87% success rating from learners who believe it has changed how they do their job. Feedback has also confirmed the merits of how the blended learning approach addresses prior barriers to learning such as time constraints and accessibility.

For the first time in its history, the UK Government now owns its own coherent L&D curriculum. It can develop the skills and competencies it needs to equip a more effective, modern Civil Service, capable of providing high quality services to the public.



Enhancing relationships and enabling mobility between universities and business

In 2015, the President of the Royal Academy of Engineering, Professor Dame Ann Dowling OM DBE FEng FRS, led a government review of how businesses of all sizes could be encouraged to connect with UK universities through strategic research partnerships. The Academy is now continuing on this mission.

Collaboration between universities and businesses offers innumerable benefits to everyone involved, from individual researchers, to companies' productivity, and ultimately the competitiveness of the UK as a whole. Through our schemes industry partners have access to the UK's foremost engineering expertise.

Over the last 30 years the Academy has worked collaboratively with industry partners to fund 129 exceptional academic engineers to pursue research that directly benefits industry, through the Research Chairs and Senior Research Fellowships programme. We currently have 50 active Research Chairs and Senior Research Fellows collaborating with 43 industry partners based at 23 universities, covering the full range of engineering disciplines.

Our schemes have impact. In 2016/17, for every £1 the Academy contributed to Research Chairs and Senior Research Fellows, they received more than £18 in funding from others. During the same period they also published 316 papers in journals. Looking beyond these numbers, our awardees tell us that our schemes benefit both their professional and research careers.

"My RAEng Chair has led to the establishment of many new research relationships and activities with people and in areas of the company that I had previously not known. These connections and other experiences in the nuclear sector have led to my membership of the MOD's Reactor Programmes Group."

Professor Fionn Dunne, Rolls-Royce/Royal Academy of Engineering Research Chair

Similarly, since 2014 the Royal Academy's Industrial Fellowships Scheme, which is aimed at early to mid-career academic engineers, has enabled 38

researchers to undertake collaborative research projects in industrial environments. Being embedded in industry gives them an opportunity to work on challenges that may have a more immediate impact. One such awardee was Dr Gillian Ragsdell, Reader in Knowledge Management at Loughborough University. Between 2015-16 Dr Ragsdell worked with the Energy Technologies Institute (ETI) to embed a more rigorous approach to knowledge management within the organisation. Speaking of this, she said: "The fellowship has accelerated both my personal and professional development – it has invigorated my teaching and my research. I wanted to refresh my understanding of engineering management and be in a better position to support both qualified engineers and business students to become leaders."

The Academy's programmes are continually evolving to meet current needs; this year we launched a series of Regional Engagement Awards, enabling six Research Chairs and Senior Research Fellows to engage with SMEs and other organisations. As a result, a broader spectrum of businesses are now able to gain access to the exceptional engineering expertise and networks of our awardees.

The Academy will continue to be at the forefront of promoting these collaborations and leading the drive towards excellence in engineering.



A new class of medicine

Boehringer Ingelheim and the University of Dundee are engaged in a collaboration to develop a new class of medicine, opening up possibilities for drug development in areas of high medical need.

Boehringer Ingelheim is one of the world's 20 leading pharmaceutical companies with a focus on researching, developing, manufacturing and marketing new medications of high therapeutic value for humans and animals. The collaboration with the University of Dundee brings together the expertise of Professor Alessio Ciulli, one of the pioneers in the field of drug design for targeting protein degradation, based in the School of Life Sciences, with Boehringer Ingelheim's expertise in drug discovery and development of new therapeutic agents.

“We believe our approach has the potential to fundamentally transform how we tackle protein targets to fight disease. This is a prime example of university-business collaboration establishing a disruptive new approach to drug discovery, initially developed in academia, and to enable its translation all the way to benefit patients.”

Professor Alessio Ciulli, University of Dundee
Professor of Chemical and Structural Biology

The team is working to develop PROteolysis TArgeting Chimeric molecules (PROTACs) designed to harness the cell's natural disposal system (the ubiquitin-proteasome) to specifically remove disease causing proteins. They do this by triggering the process of labelling such proteins as “expired” proteins, which the proteasome then removes. PROTACs are anticipated to be broadly applicable to therapeutic areas as diverse as oncology, immunology and respiratory diseases. It opens up

opportunities to target disease mechanisms that have been difficult to reach with existing chemical modalities.

To trigger the degradation of target proteins, PROTACs are made of a moiety that binds the target molecule on one end and a moiety that binds a ubiquitin ligase enzyme on the other, which is a key component of the ubiquitin-proteasome system. As a result, they are likely to exceed the molecular size of conventional oral drug molecules. The design of such “medium sized” drug molecules represents a considerable challenge and is one of the frontiers of modern drug discovery.

Clive R. Wood, Ph.D., Senior Corporate Vice President, Discovery Research at Boehringer Ingelheim, said “Working closely with the researchers at the University of Dundee, one of the top research centres in the UK for life sciences and early-stage drug discovery, we benefit from a unique platform that can generate PROTAC-based drug candidates for multiple areas of unmet medical need.”

Boehringer Ingelheim's overall focus is on developing innovative new treatment approaches providing outstanding value for patients. To achieve this, the company is increasing its commitment to external innovation, and is working with top partners from academia and industry worldwide. A growing network of academic collaborations reflects the company's focus on emerging science that could open new avenues leading to the breakthrough medications of the future.

The collaboration not only builds on recent ground-breaking work of Professor Ciulli and his team, but also benefits from top facilities and expertise available within the School of Life Sciences at the University of Dundee, renowned for innovative industry-collaborations.

Delivering innovation in healthcare through creative collaboration models

AstraZeneca and its global biologics R&D arm, MedImmune, have built a collaborative alliance with the University of Cambridge upon foundations developed over MedImmune's 25-year presence in Cambridge.

From 2014, as AstraZeneca moved R&D expertise into Cambridge, broader opportunities were created, and in 2016, it relocated its global headquarters to the city. The partnership capitalises on the world-leading, cross-disciplinary scientific expertise in Cambridge, and combines it with AstraZeneca's extensive drug discovery capabilities to deliver synergistic project-based ideas and capabilities.

This close partnership with a world-leading university exemplifies AstraZeneca's science-led approach. Direct engagement in early science by the IMED Biotech Unit at AstraZeneca and MedImmune underpins the company's research-focused culture, and ultimately yields results by providing detailed insights into disease mechanisms. Nurturing the next generation of scientific talent demonstrates the company's investment in the future of knowledge-led drug development, and support of the wider life-science ecosystem in the UK.

"Working alongside colleagues in academia has built an open, collaborative culture of knowledge and capability sharing in which science thrives, and enables our researchers to help solve unmet patient needs. These types of partnerships create wider interdisciplinary links, encouraging further basic science understanding for the benefit of society."

Mene Pangalos, IMED Biotech Unit Executive Vice President

The number of collaborations between the university and AstraZeneca has increased from 34 in 2015 to over 130 at present; these encompass areas from disease biology to biopharmaceutical process engineering. The Experimental Medicine Initiative for 2016–2022 is one example of such a project, and is designed to train scientists in early clinical trials using novel

therapeutics. As part of the initiative, AstraZeneca co-funds 8 academic clinical lecturers and 4 PhD students; this investment is complemented by funding from the Cambridge Biomedical Research Centre and Cambridge University Hospital Foundation Trust.

Other initiatives include the Cambridge MedImmune Programme in Biomedical Research and the AZ and MedImmune PhD programmes, which currently fund 34 students. Further studentships will be created annually for 10 years across the departments of Chemistry, Pharmacology and Biochemistry. The programmes support research from structural biology to translational science, and objectives are jointly agreed to ensure cross-organisational mentoring.

Helena Rannikmae, a PhD student who is jointly funded by AstraZeneca and the university, said: "I work with world-class scientists, and am part of a vibrant academic community. Collaborating with a pharmaceutical company is extremely satisfying; my work will contribute to medical science and potentially change patients' lives."

AstraZeneca and the university also have resource- and expertise-sharing arrangements to increase access to equipment and compounds. For example, they are part of the cryo-electron Microscopy (Cryo-EM) Consortium, the MRC LMB and several other partners. CryoEM gained public attention in 2017, when consortium member Richard Henderson was awarded a Nobel Prize for his work in its development.

The consortium shares a state-of-the-art facility at the university – one of only 100 of its kind in the world – providing multi-user access to this specialised equipment. CryoEM can reveal subatomic structures of drug targets, guiding the development of new medicines. As a recent output, IMED Biotech Unit scientists together with Cambridge researchers published the structure of a prime drug target, ATM (a key trigger protein in the DNA damage response that can lead to cancer), in *Science Advances*.

Using gaming to check vision

Two eye specialists are developing an iPad-based game that can check children's sight at home, without youngsters having to attend medical appointments.

With support from CEMET (Centre of Excellence in Mobile and Emerging Technologies), Dr Stephanie Campbell and Dr Luke Anderson have established Vision Game Labs, based at the University of South Wales (USW).

The company is developing technology which will allow parents to monitor their children's vision from home, helping to avoid what can be long visits to the hospital/optometrist.

Stephanie, who has a PhD in vision science and is an NHS optometrist, and Luke, a consultant eye surgeon at Cwm Taf University Health Board, came up with the idea for the app when analysing youngsters' sight.

"Through testing children's vision, I realised that they were being misdiagnosed because of their short attention span," Stephanie said. "Watching how long that children could play on computer games, I turned to technology to help."

The iPad game tests different aspects of vision, acuity (black on white), contrast (differentiation of greys), colour, and motion.

After the game is completed, parents can track their child's vision and identify any decline. The results are also made available to a specialist to decide whether a further hospital appointment is needed. This can be done remotely if necessary.

"Different diseases affect different aspects of vision and by collecting the data and training our neural

network we will be able to not only use this as a screening tool but as a way of indicating the underlying cause of vision loss in the future," Stephanie added. "It's a particularly exciting development for us as eye specialists, because we can also use the app to collect vital information that can further improve the results – meaning that we won't just have data from maybe 20 or 30 people, but up to thousands of subjects who are tested in their own homes."

The app development is just the latest piece of research Luke has carried out. He previously worked with USW's Centre of Excellence in Mobile Applications and Services (CEMAS) to design an app to teach trainee eye professionals how to identify sight-threatening diseases.

"The serious game Space Vision has the capability to revolutionise how vision is measured," Luke added. "It should also be able to contribute huge efficiencies to the health service by allowing patients to be monitored at home; and to pick up eye problems earlier in life, enabling a healthier population of young children in Wales."

Mark Griffiths, Co-Director of CEMET, said: "The technology that Stephanie and Luke are developing is exactly what CEMET is here to support. Small business often have great ideas, but they don't have the expertise in emerging technologies needed to turn that inspiration into reality, and that's what we provide here.

CEMET is based at USW, and has £4.2m of backing from the European Regional Development Fund (ERDF) through the Welsh Government. Its purpose is to provide R&D support to SMEs in the Valleys, West and North Wales, and we'd love to hear from more business owners who think they could benefit from our help."

Improving the lives of people with diabetes

The University of Oxford partners with Novo Nordisk to pioneer innovative research into type 2 diabetes.



Diabetes affects around 3.5 million people in Britain, with type 2 diabetes accounting for between 85 and 95 per cent of all cases. The condition, which occurs when the pancreas does not produce enough insulin or when the body's cells do not react to insulin, can cause serious long-term health problems, including vision impairment, blindness and kidney failure. Worse, diabetes – fuelled by the global obesity epidemic – is the world's fastest-growing chronic disease.

To help combat this, in January 2017 the University of Oxford entered into a landmark research partnership with Novo Nordisk, a global healthcare company with 95 years' experience of innovation in diabetes care. A key part of the new strategic alliance is the establishment of a dedicated research centre within the University of Oxford, known as the Novo Nordisk Research Centre Oxford (NNRCO). The centre focuses on innovation within early stage research that has the potential to substantially impact future treatment of type 2 diabetes and its complications.

“Our vision is that the unique combination of industrial and academic know-how will eventually lead to a new generation of treatments to improve the lives of people with type 2 diabetes.”

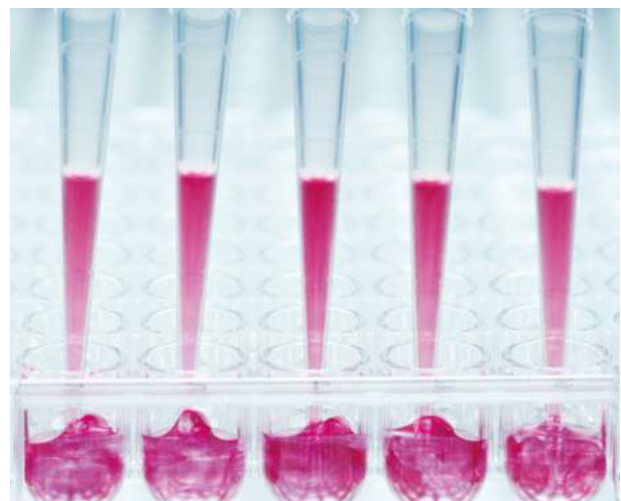
Mads Krosgaard Thomsen, Chief Science Officer and Executive Vice President of Novo Nordisk

The total investment from Novo Nordisk is expected to be around GBP115 million over a period of 10 years. Up to 100 Novo Nordisk scientists and researchers will be employed by the NNRCO, in an alliance that has bold aims: to incorporate the best practices of pharma with cutting edge research being undertaken at Oxford University. A multi-disciplinary team of scientists will work in a brand-new facility to combine industry expertise with Oxford's existing strength in diabetes and metabolism research to explore new therapeutic targets for type 2 diabetes. It is hoped that new discoveries will be made that will one day make a difference to the lives of patients with diabetes.

The NNRCO is well-placed to achieve its aims, in building on more than 20 years of fruitful cross-fertilisation between Oxford and Novo Nordisk. In 1999, funding from Novo Nordisk contributed to the establishment of the Oxford Centre for Diabetes, Endocrinology and Metabolism and in 2013 the Novo Nordisk Fellowship Programme was launched – one of the company's largest external fellowship programmes, which will fund a total of 32 postdoctoral and clinical research training fellows in Oxford.

There's more. To kick-start initiatives between the university and Novo Nordisk researchers, funds will be available to support pump priming applications. These funds are for bespoke 12-month projects to fuel creation of collaborative ideas and projects. Better yet, applicants will find they don't have to hang around for decisions: the partnership aims not only to discover new and exciting avenues of research, but also to initiate work on collaborative ideas as soon as they are approved.

Professor Sir John Bell, Regius Professor of Medicine, University of Oxford, sums up the sense of excitement and optimism around the partnership: “We see the collaboration with Novo Nordisk as an outstanding opportunity to mix competence embedded at our campus with Novo Nordisk's ground-breaking research and results in diabetes.” Professor Bell added “this collaboration underlines the importance of shared research and cutting edge science across boundaries.”



At the forefront of fighting antibiotic resistance

Described by the WHO as “one of the biggest threats to global health, food security and development today”, antibiotic resistance has been largely driven by the over-use and misuse of antibiotics.

The recent O'Neill Review on Antimicrobial Resistance estimates that by 2050 the global cost of antibiotic resistance will rise to \$100 trillion and account for 10 million deaths a year, with drug resistant infections killing more people than cancer. There is now a global effort to find new families of antibiotics.

At the forefront of this fight against antibiotic resistance is a partnership between the UK's premier industrial biotechnology company, Ingenza Ltd, and Dr Mathew Upton, Associate Professor in Medical Microbiology at Plymouth University Faculty of Medicine and Dentistry.

The partnership between Plymouth University and Ingenza Ltd has been crucial to solving a major hurdle that has previously prevented progression of other new antibiotics. Building on recent success, the project has now received a £933,000 funding boost from Innovate UK – and in the words of Dr Upton, has taken his research “to a new level”.

“Working with Ingenza has progressed our research to a new level. Ingenza has an excellent and highly collaborative approach. We feel this cooperation has been more productive than the kind of relationship we could have realised with other companies, who might have attempted this work as a service contract”.

Dr Mathew Upton, Plymouth University Associate Professor in Medical Microbiology

Through the collaboration, which began in 2015, the researchers have developed a new antimicrobial agent, epidermicin, which has unique and potent activity against MRSA, a leading pathogen causing infections in the community and in hospital patients. Between 2015 and 2017, the team developed new ways of producing epidermicin, which could be used as a nasal spray to treat a number of infectious diseases,

including those caused by MRSA. High yield production of these antibiotics has only been possible using Ingenza's unique, innovative biotechnology solutions.

“Ingenza has really engaged with our research and its endorsement has meant we have been able to escalate the work” Dr Upton said. “It has also meant we have been able to start exploring new avenues. Our success and reputation for working together productively has opened up new research opportunities, with recent funding for two PhD students investigating novel antibiotics from bacteria living in deep sea sponges”.

Mat Upton continued: “Our collaboration with Ingenza and the National Physical Laboratory could deliver globally significant health benefits, tackling antibiotic resistance. Ours is a unique consortium and extremely well-placed to take forward joined-up discovery, development and manufacture in ways which have not been done before.”

With the funding, over the next three years, the team will work with experts at the National Physical Laboratory (NPL) and IBM, using artificial intelligence methods to design in silico novel antibiotics related to epidermicin. They will then investigate their activity against key pathogens, including those listed by the World Health Organisation (WHO) as ‘priority threats’. Ingenza will engineer systems for the production of promising candidate antibiotics that can be progressed into clinical trials.





Innovation vouchers kick-start global cancer initiative

Chemotherapy-induced hair loss is widely recognised as one of the most traumatic side effects associated with cancer treatment. Paxman Coolers, a SME based in Huddersfield, manufacture scalp cooling devices to reduce hair loss in cancer patients during chemotherapy.

The origins of the partnership between Paxman and the University of Huddersfield are in a 2012 Kirklees Innovation Voucher - a joint initiative between the University and Kirklees Metropolitan Council. This project supported the initial investigation of the fundamental biology underpinning the selectively protective effect of cooling. Dr Nik Georgopoulos and Dr Andrew Collett, from the University of Huddersfield Department of Biological Sciences, have subsequently established the scientific basis for the 'empirical' clinically-observed success of scalp cooling in a high proportion of cases. These extensive and on-going scientific studies have played a pivotal role in securing regulatory and medical acceptance of the Paxman systems.

These studies have been funded by a variety of routes including a KTP which completed in 2015 and was judged as "Outstanding" by Innovate UK.

Expanding the relationship, Paxman worked with Product Design expert Dr Ertu Unvier, and colleagues within the School of Art, Design and Architecture utilised their expertise in computer aided design and 3D printing technology to develop a hugely-improved, silicon cooling cap. The cooling cap is the critical patient - device interface where excellent fit and comfort to drive efficacy and compliance must be managed within strict manufacturing-cost parameters. The improved cap, developed under a second KTP project which commenced in 2015, has yielded a more comfortable, more economical to manufacture

cap. This has been recognised in various awards and accolades including Medilink Innovation Award (January 2016), and Medtec Innovation Accolade (December 2015).

The deep and interdisciplinary relationship between the University and Paxman continued to flourish. In the spring of 2017 it was announced that Paxman had been given official clearance by the Food and Drug Administration to enter the U.S. healthcare market - the largest in the world - after undergoing rigorous trials of its scalp cooling systems. The U.S. market breakthrough, with its potential for exponential growth at the company, was supported by the research developed by the well-established, multi-disciplinary research partnership with the University of Huddersfield.

This has earned regional awards, including the Yorkshire & Humber Healthcare Business Awards 2016 'Partnership with Academia Award'. More recently, Paxman Coolers has listed on the NASDAQ First North exchange at a value of in excess of £13M.

The research collaboration has helped Paxman to establish itself as the leader in its field. More than 2,500 cooling systems are installed in treatment centres around the world, with the prospect of huge expansion in the USA still to come.



Orthopaedic care prospers under Bournemouth University

Bournemouth University's Orthopaedic Research Institute (ORI) launched in 2015, with the aim of working together with health organisations, businesses and researchers to improve orthopaedic practice and care locally, nationally and globally.

Living well in older age is increasingly becoming a concern for our society and a key priority for health services is to enable older people to stay healthy and independent for as long as possible. Orthopaedics will become a critical issue as our population ages, as longer and more active lives will increase the risk that joints will wear out and replacements or treatments will be needed. ORI is addressing this need by carrying out research to improve orthopaedic practices and patient care, thus supporting people to maintain their activity levels and mobility as they age.

Deputy Head of ORI Associate Professor Tom Wainwright explains: "Knee and hip problems are going to become more prevalent, so we're going to need better solutions to manage that; whether it's better surgical procedures or better nonsurgical interventions. We have some very effective treatments in orthopaedics, but they're not 100% effective, so part of our role is to work out how to make them better – improve them, through developing better surgical techniques, testing new medical technology or developing better rehabilitation processes."

Between them, Associate Professor Wainwright and Head of ORI Professor Rob Middleton have a wealth of clinical and research expertise. Professor Rob Middleton is a practising orthopaedic surgeon, specialising in hip replacement, while Associate Professor Wainwright is a physiotherapist and clinical researcher. They carried out research alongside their clinical practice before joining BU and have a national and international reputation for their work to date. One of their biggest successes so far is speeding up the recovery process after hip and knee surgery, which has led to their work being cited in best practice health guidelines

around the world. This approach, called Enhanced Recovery after Surgery, seeks to minimise the impact of surgery and accelerate recovery by employing strategies throughout the patient pathway, to improve outcomes and reduce the need for medical interventions. Their research into this area was a first in the UK for orthopaedics and demonstrated its value to patient care, as well as showing an improvement in patient and staff satisfaction and leading to significant cost savings to hospitals.

"As well as developing interventions to help patients recover from surgery and manage their conditions, we also work with a number of national and international medical device companies to test and run clinical trials on the latest orthopaedic technology," says Associate Professor Wainwright.

"We are working with companies such as ZimmerBiomet, Stryker, Lima Corporate, and Firstkind Ltd to ensure that their technology is delivering the best possible outcomes for patients."

Associate Professor Wainwright, Deputy Head of ORI

One example of their work with ZimmerBiomet was to explore ways to improve the technology used in hip replacements. The hip joint is a ball and socket joint and one of the risks of hip replacement is dislocation; where the new ball comes out of the socket. ORI's research has shown that a larger ball reduces the risk of dislocation, and does not adversely affect the rate of wear.

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