STATE OF THE RELATIONSHIP 2023

Analysing trends in UK business university collaboration
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As the new Minister for Science, Research & Innovation, I have the privilege of supporting the excellent research and innovation undertaken by universities and businesses across the UK.

This government recognises the importance of research and innovation to our nation’s long-term prosperity. University-business partnerships are one of the bedrocks of our economic growth. I am glad to see in this report that business-university collaboration increased 5% over 2021-22.

This report’s themes of resilience, reaction and reform mirror the government’s agenda. On resilience we’re delivering a substantial increase in R&D funding from £15 billion annually to £20 billion by 2024-25, and our association to Horizon Europe ensures important continuity in our access to international collaborations. We have set up government to be able to react to a world of fast-changing technology, through creating the Department for Science, Innovation, and Technology, with a dedicated cabinet minister for science and technology.

Finally, our response to Paul Nurse’s review of the R&D organisational landscape sets out the direction we are moving on reform of the R&D system, and the launch of the Advanced Research and Invention Agency (ARIA) demonstrates our commitment to developing new models of funding R&D that support bold risks in research.

As a country we possess the potential to become the world’s most innovative economy, driving innovation and adopting groundbreaking technologies to address the challenges of the future. The United Kingdom boasts exceptional strengths, with excellent universities, robust venture capital markets, and a wealth of talented researchers and entrepreneurs. While we should rightfully take pride in these achievements, we must recognise the need for constant improvement in an intensely competitive global landscape.

The next crucial step is using our additional public investment to unlock substantial industrial and private sector funding to accelerate the development of the UK’s clusters of innovation excellence. To facilitate this, I am delighted that we were able to fund a new £60 million Regional Innovation Fund, designed to enhance local research and development innovation and investment and ‘level up’ across the UK.

The case studies and insights featured within this report bear testimony to our shared commitment to advancing knowledge, nurturing creativity, and shaping the future. As we confront the societal challenges before us and harness the economic benefits of innovative solutions, collaborations between universities and businesses have become a proactive response to these challenges.
Introduction

NCUB’s annual State of the Relationship report monitors connections between universities and businesses, identifying patterns and trends over time. This annual review is developed to inform the priorities of policy makers and the collaborative practices of universities and businesses.

We believe a fundamental rebalance of the economy is needed to accelerate growth, build resilience and seize the benefits of the dual transition to a green and digital economy. This rebalance requires a seismic structural, industrial and cultural shift towards greater research and innovation, underpinned by an adaptable, highly skilled and collaborative workforce. Growing collaboration between universities and businesses is essential to not only enhance the scale of UK research and innovation, but also its application and impact.

This report, the tenth edition of the State of the Relationship, presents trend analysis of data on university-business interaction, coupled with reflections from thought leaders and practical case studies. Together, this aims to capture the latest state of play and identify emerging trends. 2023 has challenged policy makers, businesses and universities to reimagine the future, whilst simultaneously battling the immediate headwinds of financial pressure and pandemic recovery. This report is therefore structured into three distinct sections: resilience, reaction and reform.

Resilience. Our analysis shows that university and business interaction demonstrated remarkable resilience in a difficult climate. Universities and businesses have each faced sizeable challenges in recent years that could have profoundly affected collaboration, including the Covid-19 pandemic, widespread economic disruption and changes following Brexit. Nonetheless, our analysis in this section shows that generally growth in collaboration continued, except for at the height of the Covid-19 pandemic when numbers of interactions temporarily declined before quickly rebounding. We also identify sustained increases in university commercialisation activities, such as new IP licences, patents and spinouts.

Reaction. Underpinning the resilience of interaction is the ability of universities and businesses to react effectively to emerging challenges and opportunities. This section examines the strong culture of continuous development within university knowledge exchange practices, as well as the required agility to react to change and reflect on lessons learned from events like the Covid-19 pandemic. We examine how universities pivot their activities to maximise their impact, and how they have maintained global connections following the UK’s withdrawal from the EU.

Reform. An important theme for universities and businesses alike in the years ahead is reform. Universities and businesses will have a central role to play in partnership with policy makers to define and deliver a reformed economy that seizes the opportunities of a green and digital economy. This section examines the role that universities and businesses play in not only looking forward and shaping a vision for the future, but also in reforming their own approaches and practices to adapt to change.

We thank all contributors, and those who worked to make this report possible.
Context

Last year’s CPM, using data from 2020/21, began to reveal the impact of the Covid-19 pandemic on university-business collaborations. This year’s CPM, which covers the period between August 2021 and July 2022, captures a more complete picture of the impacts of the pandemic on university-business collaboration through to the start of recovery. It also covers a period of significant economic and geopolitical turbulence.

Economic Recovery Lost Momentum in 2022

In 2020, during the initial year of the pandemic, the UK experienced the steepest decline in GDP among the G7 countries, amounting to -9.3%. However, in 2021 and 2022, the UK economy performed well with GDP growth rates of +7.4% and +4.1%, respectively. These positive figures were mainly driven by the continuous rebound from the pandemic-recovery. It also covered a period of significant business collaboration through to the start of recovery.

Despite facing setbacks such as rising inflation and supply chain disruptions, the UK Government pivoted to prioritise research and innovation as key drivers for achieving sustainable economic growth and bolstering resilience.

Table 1: Contributions to the UK’s Monthly GDP Growth by Industry (2021/22)

<table>
<thead>
<tr>
<th>Month</th>
<th>Services</th>
<th>Production</th>
<th>Construction</th>
<th>GDP</th>
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<tr>
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<tr>
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<td>1.2</td>
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<tr>
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<tr>
<td>2022 Aug</td>
<td>3.0</td>
<td>2.8</td>
<td>2.6</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Source: ONS, GDP monthly estimate, Oct 2023

Figure 1: Illustrating the monthly changes in UK GDP growth, demonstrates that by the close of 2021, there were encouraging indicators hinting at an economic resurgence in the UK for 2022.

As the UK entered 2022, the nation and economy faced significant challenges. These were fuelled by rising inflation, supply chain issues and skill shortages. Towards the end of February 2022, the fallout from the Russian invasion of Ukraine added to the headwinds faced by the UK economy. As a result of these challenges and uncertainties, overall GDP growth throughout 2022 remained relatively flat, posing risks to the anticipated period of economic recovery.

Economic outlook from the optimism of the growth and bolstering resilience. A Vision for a More Innovative Economy

Over the course of 2020 and 2021, there was a growing nationwide consensus that research and innovation should play a pivotal role in fostering sustainable economic growth. This sentiment was underscored by the UK Government’s strategic vision for the nation’s role on the global stage, outlined in the Integrated Review announced in 2020 and officially published in March 2021. Subsequently, this vision materialised into the unveiling of the UK Innovation Strategy in July 2021.

The CPM captures activities taking place immediately after the launch of this Strategy, which placed business engagement with innovation institutions at its heart.

Supportive policies and increased R&D funding have been critical to university-business interaction, but the pandemic and other external factors did have an impact. Last year’s CPM – covering 2020/21 data – reported a drop in the number of interactions for the second year in a row, driven specifically by declines in interactions with small and medium-sized enterprises (SMEs). This impact was smaller than expected, considering the substantial disruptions caused by the pandemic. It must also be noted that commercialisation activities grew during this period.

Subsequently, this vision materialised into the unveiling of the UK Innovation Strategy in July 2021. The CPM captures activities taking place immediately after the launch of this Strategy, which placed business engagement with innovation institutions at its heart.

Supportive policies and increased R&D funding have been critical to university-business interaction, but the pandemic leading to geopolitical tensions and increased uncertainty. Factors such as elevated inflation, tighter financial conditions, reduced monetary and fiscal support, supply-chain disruptions, and labour shortages have further added to the challenges. These external challenges have been compounded by internal issues such as running disputes over pay and working conditions and gaps between funding and costs for research. Given these circumstances, we anticipate that this year’s CPM, as well as those in the future, will serve as a rigorous resilience test.
Overview

The CPM offers rich insights into collaboration trends in recent years. Comparing recent data, we make the following central observations.

1. The number of university interactions with businesses reached its highest level since the pandemic

The number of interactions between universities and businesses had declined by 1.9% during the pandemic between 2019/20 and 2020/21, but the data for 2021/22 reveals a noteworthy upswing, marking the first positive shift since the pandemic. The total number of interactions reached 88,881, a 5.1% increase on the year before, 76,952 in 2020/21.

Notably, interactions between universities and SMEs, which had experienced consecutive declines in the previous two years, have now stabilised at 54,090 (up 4.0% from 2020/21). SME engagement levels closely align with the five-year average. During 2021/22, the CPM also reveals that interactions with large businesses have not only returned to pre-pandemic volumes but have exceeded them, increasing by 7.5% and reaching a total of 26,791 in 2021/22.

Overall, these trends indicate a robust resurgence in university-business interactions, suggesting that interactions between businesses and universities have not only stabilised but are actively regaining momentum following the Covid-19 pandemic, and in defiance of the challenging financial climate. The next CPM will capture 2022/23 data and the first year of universities not being able to benefit from the European Regional Development Fund (ERDF), which has historically supported university and business collaboration at a local level. It will be critical to consider the impact of this on both the number and scale of interactions, particularly with SMEs.

2. Total income to universities from knowledge exchange activity grew to £1.2bn

Following a decline in number and income received since the pandemic, university-business collaboration rebounded in 2021/22. Income from knowledge exchange (KE) activity grew by 16.1%, reaching pre-pandemic levels of £1.2bn. This increase was driven mainly by a 14.8% rise in contract research services and an 8.5% increase in consultancy services. Universities’ revenue from engagement with both SMEs and large businesses also surged, with increases of 10.8% and 15.5%, respectively. Additionally, overseas and UK business investments in university R&D increased incrementally – 0.5% and 0.05% respectively, contributing to the sector’s revival.

There was also a notable increase in the value per interaction for both sectors. For large businesses, the value per interaction increased from £27,162 to £29,570. Notably, for SMEs this figure grew from £4,023 to £4,545, aligning with their peak in 2019/20.

3. Commercialisation trends continued to show strong growth

The CPM also shows positive trends for academic research commercialisation and spin-out activity. In the academic year 2021/22, the UK experienced a significant boost in licensing activities, characterised by a 40.0% increase in the number of licences issued, reaching 22,222 million. This overall upward trend in 2021/22 was mainly driven by a 70.1% increase in software licences. Conversely, non-software licences saw an 8.3% decline, dropping to 6,465, a level similar to that at the onset of the pandemic. In terms of the type of companies that were granted licences, universities experienced a 62.7% increase in the number of licences granted to large businesses, totalling 21,000, while SMEs faced a 12.9% decrease in licences granted.

The CPM also highlights a slight decrease in the number of patents granted to universities, with 1,622 patents reported in 2021/22, reflecting a 21.9% decline from 2020/21.

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Source: NCUB (2023). Notes: Five-year average set to a value of 1, with individual averages scaled. This indicator refers to Innovate UK academic grants awarded in any given year and includes both single and multi-year grants awarded.

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2. Collaboration in the context of the CPM does not include collaboration research activities.

4. To note: This is the first year that NCUB used finance data from the Higher Education Statistics Agency (HESA) to analyse overseas and business funding into R&D performed by the UK’s higher education sector instead of Higher Education Research and Development (HERD) data released by the Office for National Statistics (ONS). This change was made to reflect the ongoing changes the ONS is making to data on R&D.

5. Figures for knowledge exchange were obtained from the HESA’s Higher Education Business and Community Interaction (HE-BCI) Survey data and are underpinned by metrics that include the number of, and income from, consultancy, contract research and facilities, equipment-related services, and Continuing Professional Development (CPD) and exclude intellectual property income.
Conversely, there was a record number of 1,444 academic spin-outs that successfully sustained themselves for a minimum of three years. This signifies a 4.7% increase from 2020/21 and a remarkable 9.7% rise since the onset of the pandemic, spanning the period from 2018/19 to 2021/22.

In summary, the data suggests that while there are some fluctuations and areas for consideration, overall, university commercialisation activities, particularly in terms of licences and academic spin-outs, exhibited positive trends in 2021/22.

4 Knowledge flow between universities and businesses continued to demonstrate positive trends

The CPM reveals a significant growth in degree apprenticeship starts over the past year, continuing the trend with a nearly fourfold increase in five years. From 2020/21 to 2021/22, starts increased by 10.3%, from 39,200 to 43,230, emphasising the growing popularity of degree apprenticeships in the UK. On the other hand, CPD/CE courses for business and the community experienced a drop in enrolments from 4,136,090 in 2020/21 to 3,906,709 in 2021/22. However, the average CPD/CE annual learner days per university rose by 5.2% during this period, indicating that while enrolments declined, engagement or course duration at universities increased.

The CPM shows there was a 41.2% increase in the number of people who transitioned from the private to the academic sector, totalling 7,915 researchers. Conversely, intersectoral mobility from the academic sector to the private sector increased by 45.0%, amounting to 2,160 researchers. Overall, intersectoral mobility levels closely align with the five-year average. These trends and additional insights were closely analysed in a recent NCUB evidence report, as part of the NCUB researcher Career Mobility Taskforce.

5 There are consistent trends across the four nations, with some variations across CPM indicators

Figure 4 offers a detailed breakdown of the research and innovation CPM indicators by UK nation. Across all nations, it is apparent that the number of university-SME interactions slightly lags behind the established 5-year average. In contrast, engagements with large businesses consistently meet or exceed this long-term average. It is worth noting that universities in Wales and Northern Ireland deviate from this pattern, experiencing a reduction in SME interactions, with declines of 11.9% and 10.1%, respectively. This contrasts with the broader UK data.

There is also considerable variation between the four nations on commercialisation indicators. The remarkable surge in licensing in the UK was mainly driven by English universities, with licensing soaring by 43.4% in number and 23.9% in income, totalling 24,331 licences and £203 million in 2020/21. Irish and Scottish universities also saw significant gains in licensing income, with increases of 561.8% and 58.5%, respectively, resulting in £6.2 million and £9.8 million.

In the 2021/22 academic year, patents declined in all regions, dipping below the five-year average in all three nations except for Northern Ireland. Regarding spin-out activity, the academic year 2021/22 marked a remarkable increase in survival rates across all nations, with the exception of Scottish universities. England led the way with a 6.6% growth, boasting a total of 1,093 thriving spin-outs. Wales and Northern Ireland followed suit, both showing a positive trend with 7.4% and 6.3% increases, resulting in 102 and 68 spin-outs, respectively. These figures highlight the resilience and importance of academic spin-outs in the UK, playing a pivotal role in fostering innovation and driving economic growth.

Headline Findings

Collaboration Activity

- **80,881** interactions between universities and businesses were recorded in 2021/22. University engagement with businesses saw a marginal increase of 5.1% between 2020/21 and 2021/22.

- **4.0%** rise in the number of interactions with SMEs in 2021/22, which also experienced a 10.8% on-year income increase, amounting to £235m.

- **7.5%** rise in the number of large business interactions in 2021/22, which also experienced a 15.5% on-year income increase, amounting to £792m.

- **16.1%** increase in the number of licences granted relative to 2021/22. 25,760 software and non-software licences were granted in 2021/22. This increase was largely driven by a 62.7% growth in the number of licences issued to large businesses, from 13,000 to 21,000.

- **40.0%** increase in the number of academic spin-outs survived at least three years. A 4.7% increase from 2020/21 and a 9.7% increase since the beginning of the pandemic (between 2018/19 and 2021/22).

The Products of Collaboration

- **1,622** patents granted. This represents a **21.9% decrease** from 2020/21 and a 13.1% decrease on pre-pandemic levels.

- **1,444** degree apprenticeship starts in England. An **increase of 10.3%** from 2020/21. This is the fifth year in a row with recorded growth.

Joint People Development

- **43,230** degree apprenticeship achievements. A **14.9% increase** from 2020/21.

- **20,327** CPD/CE learner days were delivered on average by universities. This represents a **5.2% increase** from an average of 19,323 observed in 2020/21 and a 3.8% decrease against the 5-year average (19,562).

- **21,403** higher apprenticeship achievements. A 14.9% increase from 2020/21.

- **23.6%** of undergraduates were on sandwich courses with an employment placement in 2021/22.

- **7.1%** of university R&D in 2021/22 was funded by UK business investment, marking a 0.5% increase from 2020/21 and a 9.3% increase compared to the pre-pandemic period.

- **9.1%** of university R&D in 2021/22 was funded through foreign investment. This Remained in line with previous years and pre-pandemic levels.

Investment in Collaboration

- **7.5%** increase in total income from wider knowledge exchange activities between industry and academia (excluding licensing). An increase that was especially driven by a considerable rise in contract research services (up by 14.8% to £671 million in real terms).
Next year’s CPM will focus on data from 2022/23, which should enable further analysis of collaboration following the pandemic. The data will also demonstrate the possible impact of the loss of access to the European Regional Development Fund (ERDF), and any wider impacts from the UK’s economic position or growing geopolitical tensions.

**Path to SME Interaction Recovery**

While SME interactions have increased in the past year, they still lag slightly behind pre-pandemic levels. The UK experienced political instability in late 2022, including the resignation of two Prime Ministers, impacting economic stability, business decisions, and government priorities.

The UK economy currently grapples with challenges, notably a 40-year high inflation rate at 9.1% in May. The Bank of England’s five interest rate hikes since December 2021 have tightened monetary policy, raising borrowing costs for businesses, potentially slowing investment and research and development initiatives. Such economic strains, encompassing rising inflation and elevated borrowing rates, have notably strained the financial footing of many small businesses. The British Business Bank’s recent findings further amplify this concern, highlighting the escalating difficulties SMEs face when seeking finance. This trend also underscores a deteriorating market landscape, evidenced by a downturn in investment and a marked reduction in equity market deals involving SMEs.

Simultaneously, the global economy is slowing, discouraging foreign investment in university research. Brexit adds uncertainty for businesses and academic institutions, affecting investment. The loss of European funding streams, like the ERDF, strains universities, especially those supporting SME engagement.

**Continued High Performance in University Commercialisation**

University commercialisation has seen consistent growth over the last 5 years, covering licensing, spin-out setups, and longevity. Although there has been a slight reduction in patents granted to universities this year, it remains to be seen if this signifies a temporary decline. The impact of rising interest rates on university commercialisation activities is uncertain. Interest rates can affect the cost of borrowing, investor behaviour, intellectual property valuation, and research and development allocation. Universities need to be mindful of this as they plan their future commercialisation activities.

SECTION 01

In Summary

The overarching trends unveiled by the CPM point to a remarkable resilience and favourable momentum in university-business collaboration and commercialisation activities. These trends not only underscore the vitality of these activities but also their significant contributions to fostering innovation and driving economic growth. As we delve deeper into this report, we will continue to draw upon the insights derived from the data that forms the foundation of the CPM, guiding and enriching our exploration of the core themes.
Resilience

Over the last decade interaction between businesses and universities has expanded and deepened. Many of the indicators within NCUB’s CPM have consistently trended upwards. This section examines collaboration trends over this decade, observing that despite being faced with varied challenges, collaborations remained resilient.

The latest CPM findings are significant. They demonstrate that despite the unprecedented context of the pandemic, declines in the numbers of interactions with businesses, particularly small businesses, quickly rebounded and commercialisation activities significantly grew. This pattern of resilience also holds when a longer time frame is investigated.

In this section, NCUB’s Head of Policy and Engagement Rosalind Gill, examines the ‘Decade of Collaboration’ when significant and ongoing efforts were made by universities and businesses to drive up interaction.

Perhaps one of the most remarkable trends in recent years is the growth in the scale and value of university commercialisation activity. The growth in both the licensing of intellectual property as well as in the formation of new and sustaining spin-out companies—important vehicles for expanding direct and successful commercial outcomes from research— Figure 5 shows a striking 533.2% increase in the number of licences granted and a 219.1% increase in licensing income to £221,642 between 2012/13 and 2021/22. This trend was particularly strong in England, which saw a 310.4% rise. Scotland, Wales, and Northern Ireland also had increases in the number of licences granted but had varying patterns in licensing income.

Whilst these trends have an increasingly important impact on the economy, it must also be noted that commercialisation is only a small part of a larger story. There are a breadth of drivers for interactions between businesses and universities, from developing new technologies to introducing new products and services, to growing talent and improving business strategy. In this section, we also share a selection of business stories and case studies to demonstrate their multifaceted interaction with universities.

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Figure 5. Number of Licences Granted and Licensing Income Between 2012/13 and 2021/22 in the UK

NCUB (2023), based on HESA (2023).
Project (FIP), aligning with Marine ground-breaking Fishery Improvement groundwork led to the inception of a prime fishing areas and conducted which is also used to support Heriot-Watt University, renowned for high-end supermarkets. Through prior collaboration with OSF, disease. There are primarily two main groups of users who utilise HGMD® on a regular basis, research scientists and clinical diagnosticians. HGMD® is freely available to registered academic/ non-profit users. In addition to up-to-date mutation data, HGMD® Professional also features advanced search tools and gene- and mutation-specific information not available on the public site.

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RealTalk is an evidence-based training resource that teaches health and social care practitioners how to talk confidently and with compassion in these sensitive situations. The resources are based on recordings of actual hospice consultations and bereavement support group sessions. They illustrate common communication problems and teach the complex skills for dealing with them.

The resources are freely available – via the RealTalk website – for use by communication skills trainers within the NHS, HE institutions, hospices and third sector organisations. Accompanied by guidance notes and safeguarding prerequisites, the resources can be embedded in existing training packages.

In September 2022, Loughborough University licensed RealTalk to Treetops Hospice, ensuring widespread use. Although Treetops will be responsible for the operational management of RealTalk, Loughborough’s research team will remain involved in the project – generating new training modules and assessing the impact of the programme.

The license agreement means that financial support of RealTalk is secure, ensuring its long-term sustainability. And, thanks to Treetops’ experience in end-of-life care and communication skills training, RealTalk will be used more widely – benefiting practitioners, patients and their companions, as well as the bereaved across the UK. An international version of RealTalk was launched in 2023.

Case study: Cardiff University, Qiaogen and the Human Genome Mutation Database

A recent licence agreement with Qiagen provides exclusive worldwide access to the most up-to-date version of the Human Genome Mutation Database (HGMD®) database. This constitutes a comprehensive collection of published germline mutations in nuclear genes that are thought to underlie, or are closely associated with human inherited disease.

The licence agreement has continued to generate significant income which is also used to support ongoing HGMD® activities at Cardiff University. The licence agreement with Qiagen allows access to up-to-date mutation data for thousands of users worldwide. HGMD® was first established in April 1996 and during this time, the database has grown considerably, from under 10,000 mutation entries in 1996 to over 350,000 entries by December 2021.

Through prior collaboration with OSF, Heriot-Watt University, renowned for high-end supermarkets. Through prior collaboration with OSF, Heriot-Watt University, renowned for high-end supermarkets. Through prior collaboration with OSF.

The impact of this was:
• WWF-endorsed Orkney’s fishery for ‘Sustainable Practices in place, enabling the marketing of brown crab as a premium product.
• Heriot-Watt’s scientific support augmented the brown crab’s market value by £1 million, strengthening ties with retailers like Marks & Spencer and Waitrose.

The domestic brown crab market shielded Orkney from Brexit-related seafood export disruptions. ORA’s Hannah Fennell commended Dr Bell and the university’s collaboration, emphasising its positive industry impact.

Dr Michael C. Bell, Research Fellow, School of Energy, Geoscience, Infrastructure and Society, Institute for Life and Earth Sciences, who led on the project underscored the evidence-based sustainable fishery management, highlighting the collaboration’s dual success in meeting industry objectives and enhancing the university’s industry reputation. “This triumph illustrates how academia and industry, in tandem, forge a sustainable model propelling economic growth and environmental stewardship”, he said.

Watch the success unfold in this video: https://www.youtube.com/watch?v=G_hZhGwrUs8

Case study: Orkney’s Fisheries Flourish; Heriot-Watt’s Research-Led Sustainability Triumph

Orkney, a pivotal fishing hub, sought to validate the sustainability of its shellfish for entry into high-value markets. Dependent on fishing, Orkney Fisheries Association (OFA) and Orkney Sustainable Fisheries (OSF) aimed to address this challenge and access premium markets, including high-end supermarkets.

Through prior collaboration with OSF, Heriot-Watt University, renowned for high-end supermarkets. Through prior collaboration with OSF, Heriot-Watt University, renowned for high-end supermarkets. Through prior collaboration with OSF.

Spin-out ChromaTwist was founded in 2019 to commercialise a new class of fluorescent dyes for flow cytometry – an analytical technique used in medical research, vaccine or drug development, and disease diagnosis. One of the central challenges in flow cytometry is the ability to detect multiple targets from the same sample (known as ‘multiplexing’). ChromaTwist’s exceptional versatility, and large range of ‘signalling colours’, should enable simultaneous tests to be carried out on a single sample, which increases throughput and speeds output from existing flow cytometry equipment. There are many other possible applications, and Chroma Twist has already secured a long-term supply agreement with a global chemical distributor. The company is keeping its eyes on opportunities in other sectors including security inks, (multiphoton) fluorescent microscopy, marker dyes; that enable more efficient sorting of plastic waste for recycling, and applications in organic electronics such as OPVs and OLEDs.

Over the last 30 years the UK university sector has transformed. This transformation was driven by external reform of policy and funding as well as internal changes to universities’ priorities, management and governance. In her article, Rosalind Gill, Head of Policy and Engagement at NCUB, explores the recent history of the university sector and examines the rise of collaboration over the last decade.

Case study: Cardiff University, Qiaogen and the Human Genome Mutation Database

A recent licence agreement with Qiagen provides exclusive worldwide access to the most up-to-date version of the Human Genome Mutation Database (HGMD®) database. This constitutes a comprehensive collection of published germline mutations in nuclear genes that are thought to underlie, or are closely associated with human inherited disease.

The licence agreement has continued to generate significant income which is also used to support ongoing HGMD® activities at Cardiff University. The licence agreement with Qiagen allows access to up-to-date mutation data for thousands of users worldwide. HGMD® was first established in April 1996 and during this time, the database has grown considerably, from under 10,000 mutation entries in 1996 to over 350,000 entries by December 2021.

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The impact of this was:
• WWF-endorsed Orkney’s fishery for ‘Sustainable Practices in place, enabling the marketing of brown crab as a premium product.
• Heriot-Watt’s scientific support augmented the brown crab’s market value by £1 million, strengthening ties with retailers like Marks & Spencer and Waitrose.

The domestic brown crab market shielded Orkney from Brexit-related seafood export disruptions. ORA’s Hannah Fennell commended Dr Bell and the university’s collaboration, emphasising its positive industry impact.

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Case study: Loughborough University licenses RealTalk to Treetops

Training for healthcare practitioners – supporting confident, compassionate conversations

Sensitive, open conversations about illness progression and end-of-life allow people and their loved ones to make informed decisions. However, many of us find these conversations extremely difficult and distressing.

RealTalk is an evidence-based training resource that teaches health and social care practitioners how to talk confidently and with compassion in these sensitive situations. The resources are based on recordings of actual hospice consultations and bereavement support group sessions. They illustrate common communication problems and teach the complex skills for dealing with them.

The resources are freely available – via the RealTalk website – for use by communication skills trainers within the NHS, HE institutions, hospices and third sector organisations. Accompanied by guidance notes and safeguarding prerequisites, the resources can be embedded in existing training packages.

In September 2022, Loughborough University licensed RealTalk to Treetops Hospice, ensuring widespread use. Although Treetops will be responsible for the operational management of RealTalk, Loughborough’s research team will remain involved in the project – generating new training modules and assessing the impact of the programme.

The license agreement means that financial support of RealTalk is secure, ensuring its long-term sustainability. And, thanks to Treetops’ experience in end-of-life care and communication skills training, RealTalk will be used more widely – benefiting practitioners, patients and their companions, as well as the bereaved across the UK. An international version of RealTalk was launched in 2023.

www.realtalktraining.co.uk

Case study: Innovating Fluorescent Materials for Diverse Applications

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Growth and Resilience: The remarkable recent history of university-business collaboration

Throughout the late 1990s and the 2000s there were concerted efforts to improve the foundations of the higher education system to enable sustainable growth in student numbers as well as expansion of the university mission. A consistent theme to debates about funding was fairness, recognising that there are both public and private benefits to university. Tuition fees were introduced in England and Wales, and experimental funds to support business-university collaboration were also rolled out, including the Higher Education Innovation Fund (HEIF) in England in 2001.

If the 1990s were about expansion and the 2000s were about sustainable funding, arguably the key in the 2010s was impact. From 2009, Research Councils required impact statements and the 2014 Research Excellence Framework represented a major step change to assess research impact outside of academia. A drive for impact was accompanied by significant interest in strengthening business-university interaction. Between 2010 and 2015 there were nine reviews of business-university collaboration with a total of 297 recommendations. In 2012, Professor Sir Tim Wilson completed his review of business-university collaboration, where universities and businesses are at different stages of their journeys, every university, regardless of size or mission was committed to knowledge exchange. The Wilson Review argued that the UK must strive for “world leadership in university-business collaboration”. The 2015 Dowling Review of business-university collaboration attempted to synthesise years of reviews and steered the conversation from strategy to delivery. Ten years on from Wilson and seven from Dowling, the latest 2021/22 data on university-business collaboration paints a positive picture. Arguably, the 2020s represent the decade of collaboration, where universities and businesses are shifting vision and strategy into change and practical delivery. The NCUB 2021 evaluation of submissions made by universities as part of the Knowledge Exchange Concordat shows that although universities are at different stages of their journeys, every university, regardless of size or mission was committed to knowledge exchange.

Exhibit 1. Timeline of the Recent History of University-Business Collaboration

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R&D funded by UK and overseas businesses has seen steady growth over the past decade. These robust indicators highlight the dynamic and evolving nature of university-business collaborations. Whether through the establishment of new small and medium-sized enterprises (SMEs), collaborations. Whether through expanded consultancy services, growing contract research initiatives, or enabling access to cutting-edge facilities and equipment, universities have demonstrated their unwavering commitment to driving innovation and fostering knowledge exchange within the business landscape. In recent years, UK universities have also demonstrated a concerted drive towards fostering strategic partnerships. This is evidenced by the substantial 40% increase in the value per interaction, climbing from £9k to £12k over the last six years. This remarkable surge in value underscores their proactive stance in fostering these collaborations.

These trends not only showcase universities’ adaptability in addressing evolving industry needs but also emphasise their pivotal role in stimulating economic growth, advancing technology, and cultivating a culture of innovation. As universities continue to embrace their role as vital knowledge hubs, these strong collaboration indicators underscore the enduring and mutually beneficial partnerships between academia and industry, poised to shape the future of innovation and entrepreneurship.

Although the overall picture is positive, the decade has presented universities and their collaboration with business with significant challenges too. The growth and resilience of business–university collaborations over the last decade lays a solid foundation from which to build.
Impactful University-SME Interaction

Qualifying the next generation solar cells for space
The Open University’s training program has helped SME Microlink’s employees gain space environment knowledge.

Accelerating access to technology design for Scotland’s SMEs
Heriot-Watt University and Technology Scotland entered a five-year partnership to accelerate technology medical device design capabilities for Scottish SMEs.

Using data science for problem solving
A collaboration between Northumbria University and Freudenberg Sealing Technologies (FST) showcases the practical value of data science.

Turning waste heat into energy
Together, Dext Heat Recovery and Sheffield Hallam University found a high-impact, low-cost method to make use of waste products, leading to a cleaner, greener world.

Developing cancer treatment through collaboration
The partnership between the University of Leicester and Isogenica delivered personalised immunotherapies that harness patients’ immune systems to fight Cancer.

Creating fabrics from waste
A collaboration between SME Ananas Anam and the University of Arts London developed clothes with fabric made from recycled pineapple leaves, creating sustainable textile products.

Empowering SMEs: Digital Innovation Hubs
Cardiff University, Newcastle University, and Ulster University have each been awarded an equal share of £4.5 million to fund SMEs.

SMEs account for more than 99% of registered firms and 60% of total private sector employment in the UK. Universities have worked hard to sustain their interaction with SMEs, though some barriers do remain. SMEs themselves report that often their own resource constraints make interactions with universities more difficult.

Collaborations between universities and SMEs can foster a culture of creativity and innovation and contribute to the development of novel and groundbreaking ideas. Their collaborations with universities, research institutions, and larger enterprises lead to the generation of new ideas, curriculum development and knowledge exchange, thereby accelerating innovation and equipping students with the skills needed for employment. These collaborations lead to benefits for both universities and businesses, leading to greater exchange of knowledge, better innovation outcomes, and ultimately contributing to economic growth and societal impact.

In October 2023, NCUB published an addition to our showcasing series, where we celebrate and share the best of NCUB member collaborations. This edition, “Making Small Mighty,” looked at collaborations and partnerships between universities and SMEs and included. These case studies illustrate just some of the opportunities that collaborations with SME are generating up and down the UK, and how important the rebound in SME interactions post-pandemic is.

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References:
The Role of konfer in Spotlighting University Capabilities to SMEs

konfer is an innovation brokerage platform developed by NCUB, in partnership with Research England. The free to use platform was designed to help innovators and experts search, discover and collaborate with partners across the UK research and innovation system. Today, konfer features 72 thousand innovation firms, 142 thousand academic profiles and more than 1.6 million research projects. To date, konfer has supported more than 1,400 collaboration calls. Many institutions across the sector are developing a direct data feed (DDF) as the latest answer to this phenomenon. DDF improves representation for individual academics/institutions and policy makers giving a more complete picture of UK capability with easy access and connection function.

In Summary

Section 2 examined the resilience of university-business collaboration, which has been challenged to grow but has also faced significant barriers due to the Covid-19 pandemic and a challenging economic and geopolitical context. We demonstrate that there has been resilient and long-term growth in most forms and indicators of collaboration, but identify space for improvement, as the number of SME interactions, whilst growing over the last year, will take further effort to achieve sustained growth. The outcomes of several SME-university collaborations are showcased through case studies, and we comment on the evolving role of konfer in driving up SME engagement.
Collaboration Progress Monitor, as well as sizeable growth in commercialisation activity, demonstrates the ability of universities and businesses to react to change and disruption so that collaboration endures.

The latest CPM identifies another interesting trend that will require further investigation in future editions of this report: a steady rise of contract research as the main form of collaboration with SMEs. In the past, the most common form of interaction between universities and SMEs was through consultancy services. However, from 2016/17 onwards, consultancy services began to gradually diminish in importance, with a significant surge in contract research, although this trend slowed during the pandemic. Post-pandemic, contract research has regained momentum and currently stands as the most significant source of collaboration between universities and SMEs. In the academic year 2021/22, contract research accounted for a substantial £88.6 million, marking a 21.6% increase from the previous year and an impressive 82.8% surge from 2014/15 (See Figure 7). This shift can be attributed to several factors. First, the growing demand for innovation and competitiveness in the market necessitates increased investment by SMEs in research and development activities. Second, the evolving nature of the challenges and opportunities faced by SMEs demands more intricate and tailored solutions than consultancy services can provide. Third, the availability of funding schemes and incentives for contract research, such as grants, tax credits, or vouchers, substantially reduces costs and risks for SMEs. 12 We will continue to investigate this trend in the years ahead.

Universities and businesses have proven resilient in recent years that they react effectively to change and that their collaborations endure. The Collaboration Progress Monitor shows growth but also change in the shape of collaboration. This section explores how universities and businesses are simultaneously adapting and improving practices and partnerships to prosper, and how they strategically prioritise activity with impact even in difficult circumstances.

Over the last decade, policy makers and universities have strived to grow business-university collaboration in the UK. There have been thoughtful reviews as well as supportive policy and funding interventions. So, all things being equal, a gradual increase in university-business interaction may not seem remarkable.

However, significant disruptive events have challenged effective delivery of collaboration with three seismic events: the Covid-19 pandemic, the UK’s departure from the European Union and the return to war in Europe with significant geopolitical consequences. Individually and collectively, these events have presented uncertainty, as well as a need to rapidly transform practices and strategically prioritise resources. The overall increase in the frequency and value of interactions identified in the A Culture of Continuous Development

Universities, with their business partners, strive to continuously improve their external engagement and impact. They do this through a range of mechanisms, including individual initiatives and collaborative, sector-led approaches.

We reflect on recent trends and developments, including progress on the Knowledge Exchange Concordat and the 2023 Review of Spin-outs. We also consider how universities and businesses have adopted lessons from the Covid-19 pandemic.

Strategically Prioritising Engagement for Impact

Universities and businesses actively pivot their activities towards the needs and opportunities of their local areas and the national context. With the wider environment changing, they are actively considering, prioritising and sustaining their activities to maximise their impact, even when challenges arise.

We consider how universities have responded to changes to funding for regional development following Brexit, and also how they are reacting with employers on profound shifts in skills needs.

Driving Global Connectivity

The UK research base is intrinsically globally connected. Over 60% of publications involving a UK researcher has an international co-author. The UK’s association to Horizon Europe played a part in both enabling direct collaborations with partners around the world, as well as demonstrating the prestige and openness of UK research.

In a year when full association has been confirmed, we reflect on what it will take to seize the opportunities that this can present.

Figure 7. Number of, and Income from, Interactions with SMEs (Real Prices of 2022)

This section delves deeper into three important themes that demonstrate and underpin the ability to adapt to change:

1. A Culture of Continuous Development
2. Strategically Prioritising Engagement for Impact
3. Driving Global Connectivity

Source: NCUB based on HESA (2023).

12 Recent statistics regarding research and development tax credits provide further substantiation. They reveal a notable increase in claims under the SME scheme, demonstrating a consistent positive trend over the past five years. HMRC data also underscores an increase in SME R&D expenditure, particularly during the 2021/22 fiscal year. https://www.gov.uk/government/statistics/corporate-tax-research-and-development-tax-credit/research-and-development-tax-credits-statistics-september-2023
A Culture of Continuous Development

Reflecting a collaborative culture of continuous development, since 2016, universities have collectively led the development of a Knowledge Exchange Concordat (KED). The KED seeks to further evolve knowledge exchange practices across the sector. The approach recognises that there is no single profile of knowledge exchange that is appropriate to all universities. The Concordat allows universities to review their performance across a wide range of knowledge exchange activities and identify and drive improvements in areas that are consistent with their priorities and expertise. In 2023, NCUK led the development and launch of a new KECon repository to share and control examples of good practice and resources.

In her article, Professor Dame Jessica Corner, Executive Chair of Research England, considers the important and evolving role of universities as drivers of economic growth. Also in the spirit of progress, 2023 marked a significant and coordinated effort to further strengthen the future of university spin-outs with the development and publication of an Independent Spin-out Review. Chief Executive of Amadeus Capital, Anne Glover, looks beyond university practices and comments on what should be next to create a successful environment for businesses to scale up, including acknowledging the importance of association to Horizon Europe to the investor/startup community. Professor Paul Beasley, Head of R&D UK at Siemens, looks at how some universities are leading the way in establishing themselves as Living Laboratories in collaboration with industry.

Universities at the heart of Economic Growth

There has never been greater recognition of the crucial role universities play in support of local, regional and national economic growth or of the opportunity to contribute substantially to the UK’s longstanding challenge in achieving higher economic growth. Universities are key drivers of local, national and international relationships. They create and provide innovation, develop highly skilled talent pools and generate talent pipelines. They are the heart of Economic Development.


In her article, Professor Dame Jessica Corner, Executive Chair, Research England

The task ahead is to drive further intensity of innovation through these ecosystems across the UK and to create dynamic networks of innovation and commercial activity as we deliver on the ambition for a highly productive R&D based knowledge economy.

This has been given further impetus and support in the recent announcement by Michelle Donelan, Secretary of State for Science Innovation and Technology, of a new £60m pilot Regional Innovation Fund to further support knowledge exchange, commercialisation and economic growth as a supplement to HEIF and its equivalent funding streams in Scotland, Wales and Northern Ireland. How universities can build further dynamism and support companies to form, grow and scale is currently the subject of an independent review of university spinouts by Professor Irene Tracey and Andrew Williamson.13 These developments have celebrated the importance of association to Horizon Europe to the investor/startup community. Professor Paul Beasley, Head of R&D UK at Siemens, looks at how some universities are leading the way in establishing themselves as Living Laboratories in collaboration with industry.

The focus on knowledge exchange - university knowledge-based service to society. This was developed further with the inclusion of impact in the Research Excellence Framework. And this baton is picked up in our work with other UK HE funding bodies now to develop and deliver the next Research Excellence Framework that will enable more movement between universities and other sectors, and to drive improvements in the dynamism of the R&D system and through benefits to the economy and wider society.

We all want a system where researcher entrepreneurs – like Dr Harry Destecroix at Science Creates and Bristol – can emerge, thrive and drive the next generation ecosystem. Dr Destecroix was an alumnus of the University of Bristol and has stayed in partnership with the University and the city – “paying it forward” in silicon valley terms. As an exemplar of new models of university and entrepreneur innovation £4.75 million has been awarded from the Research England Development Fund to the University of Bristol-Science Creates partnership to develop a unique and novel incubation facility to unlock significant new investment in the ecosystem by incubating IP-based spin-outs in the West of England.

I celebrate the investor and business partners of universities – people like Dr Harry Destecroix, and Mike Rees on our Research England Council who has advised us on university-investor partnerships as well as putting this into practice with the Midlands Mind Forge, the investor members of our CDP expert group and the many business members of NCUK. As with NOVA, a spinouts review conducted jointly by university and investor leaders is an important symbol of finding ways forward together, that work for universities, researchers and private partners. We look forward to making contributions as Research England that can strengthen these partnerships, align practices and reduce friction in the process of forming and supporting university spinouts and overall drive forward our economy and society.


Why Attracting Domestic Capital into Our Deep Tech Growth Companies Matters

As a deep tech investor for over 30 years, I have seen how the flow of ideas and talent between academia and business has acted as a vital driver of innovation and new thinking in both worlds. There is widespread recognition that startups which spin out from universities contribute to our economic growth, but that the UK has yet to reach the momentum found in the US, where the virtuous circle of technology innovation, entrepreneurship and venture capital, is plain to see in Silicon Valley and increasingly elsewhere.

Although playing catch up, the UK has a great competitive advantage in its legendary universities that still attract the best and the brightest from across the world. The emerging deep technology sectors of genomics, quantum technologies and artificial intelligence (AI) play to the UK’s academic strengths. The industries of the future will evolve from the companies that spin out and succeed in these sectors from the laboratories, accelerators and innovation centres across the UK.

We have many good examples from the Amadeus Capital Partners’ portfolio. Look at Paragraf, the first company in the world to mass produce graphene-based electronic devices using standard semiconductor processes, spun out from Cambridge University in 2017 and now recognised as one of the most exciting companies to emerge in the UK. Then there’s On Biotech, which came out of UCL and is revolutionising cell and gene manufacturing processes to deliver cost-effective, personalised, life-saving treatments.

These companies exhibited the chief qualities we look for as venture capitalists when deciding to invest – they were led by experienced academics who also had business experience from startup and industry roles. We need both those PhD students and executives with corporate experience who can themselves attract business leaders to their companies in the early stages. And, crucially, they’re attacking very large, global problems, with great commercial potential.

They’ve been able to raise significant equity rounds, predictably from international investors who recognise that potential. The challenge remains to fund these companies so they do not need to sell to a large corporate or move overseas in order to grow. I am writing this as ARM, the UK’s largest tech business and a spin out created by my Amadeus co-founder, Hermann Hauser, has disappointingly felt the need to hold its major IPO on the Nasdaq to get access to sufficient liquidity and capital.

The UK is still behind where it needs to be in this vital respect. There is a tendency for scaleups to sell out early because fundraising is too difficult. Our collective challenge is to direct more capital to growing businesses. The recent defined contribution pension funds compact to drive more investment into productive assets is welcome but we need a much greater appetite for ‘risk’ here in the UK, especially with other European financial and tech centres biting big chunks out of our heels.

With our European neighbours in mind, it is with great relief that the startup community has welcomed the UK Government’s agreement to re-enter the Horizon Europe programme. Science is one of the most cross-border, collaborative endeavours, and Brexit brought many challenges that needed to be addressed. Restoring access to this huge funding pool for the UK academic community is a great step forward. We now need to tackle the threat to our talent base that immigration policies are having on our ability to attract executives across the functional disciplines needed to grow British companies.

The UK has the potential to be a technology superpower but this will require effort, risk-taking and long-term visionary policy-making. We need to keep our sights beyond our borders and take more calculated risks to ensure the wonderful innovations emerging from our academic communities can become era-defining businesses.
Harnessing the potential: Universities as Siemens Living Laboratories in the UK

Universities have long been recognised as hubs of knowledge, driving progress in various fields. In line with the sector’s work in exploring new frontiers of innovation, Siemens has been working with UK universities to promote a new concept – establishing universities as Living Laboratories, or demonstrator facilities.

This approach involves utilising the vast resources and intellectual capital within universities to address real-world challenges, promote sustainability, demonstrate the art of the possible and foster collaboration.

The concept of a Living Laboratory revolves around the idea that a university campus can serve as a dynamic and adaptable environment for experimentation, research, and innovation. They can become open innovation ecosystems in real-world environments, are not confined to science labs but encompass various aspects of university life, including energy management, transportation, waste reduction, and more.

One prominent example of this concept in action is the ongoing work University of Birmingham is doing to establish a smart campus. Here, the campus itself becomes a testbed for sustainable practices and innovations, with students and faculty actively participating in research projects that aim to reduce the university’s environmental footprint.

By integrating sustainability into everyday campus operations, institutions like the University of Birmingham are not only reducing their environmental impact but also creating valuable learning and research opportunities.

As Carl Ennis, CEO of Siemens in the UK and Ireland, puts it: “We know that our universities are among the best globally. Adopting the Living Laboratory concept that many are already doing allows institutions to take their research capabilities even further. It also makes them a keystone in the delivery of a net-zero society – helping uncover how infrastructure needs to evolve and adapt to solve the biggest global challenge we now face.”

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There are also a host of partnership benefits that come from establishing Living Laboratories.

Real-World Problem Solving: Universities as Living Laboratories provide a platform for addressing real-world challenges. This practical approach to problem-solving allows researchers and students to work on projects with direct applications, leading to tangible results that benefit society.

Experiential Learning: For students, this concept offers hands-on, experiential learning opportunities. They gain practical experience by working on real projects, making them better prepared for their future careers.

Industry Partnerships: Universities can collaborate with industries to test and develop new products, technologies, and solutions. This not only benefits the university but also stimulates economic growth and innovation within the region. Whilst industry can quickly evaluate new business models, “system of systems” solutions and demonstrate the “art-of-the-possible”, enabling acceleration to market.

Interdisciplinary Collaboration: They promote interdisciplinary collaboration, breaking down traditional silos. Not only for academic researchers from different fields but also through partnerships with local government, supply chains, start-ups, etc, to come together to tackle complex issues, resulting in innovative solutions that may not have emerged otherwise.

Sustainable Practices: They can serve as models for sustainability. By implementing and testing green technologies and practices on campus, universities set an example for the broader community and contribute to a more sustainable future.

Support and Funding: Once established the benchmarked campus offers opportunities to attract mutually beneficial funding for the wider partnership to de-risk and accelerate innovation. This is of particular interest to start-ups to demonstrate the benefits of their solutions in real world environments.
Challenges and Considerations

While the concept of universities as Living Laboratories holds great promise, it also comes with its share of challenges and considerations.

Firstly, resource allocation can be a challenge particularly when it comes to maintaining the living laboratory, which can be resource intensive and might require diverting investment away from other pursuits. Successful Living Laboratories also require collaboration with local communities, government and industry partners, for instance, and this requires effective engagement and communication to build trust. Equally, technology partnerships might require managed access to assets, data and intellectual property, which requires thinking.

Secondly, there are also potential ethical concerns. Research conducted in a living laboratory setting must adhere to ethical guidelines, particularly when involving human participants or sensitive data - protection, storage and sharing. Partners must establish robust ethical review processes to ensure the responsible conduct of research and innovation.

Finally, they’re a long-term commitment. Sustainability and innovation often require long-term research. The partnership must be prepared to invest in and sustain Living Laboratory projects over extended periods to realise their full potential.

But the rewards are there for the taking. Universities as Living Laboratories represent a dynamic and forward-thinking approach to addressing real-world challenges. In the UK, institutions like the University of Birmingham, the University of Keele and the University of East London are leading the way. They’re creating mutual benefits, in turning their campuses into vibrant hubs of innovation and experimentation.

As these initiatives continue to grow and evolve, the benefits extend beyond university campuses, working for other environments, such as, hospitals, science parks, ports etc, which reach into the surrounding communities, industries, and society as a whole. By harnessing the potential of living laboratories, the UK can accelerate progress toward a more sustainable, innovative, and inclusive future.

Building Bridges Through International Collaboration

As well as long-term, contemplative approaches to development, universities have demonstrated their ability to learn from sudden and extraordinary circumstances. The Covid-19 pandemic showed part of the possible for collaborative innovation and commercialisation. Responding to a clear societal imperative, universities, businesses and government partnered at pace to produce vaccines and treatments. In the years since the pandemic, there has been a wave of concerted effort to capture the learnings from the pandemic and evolve practices accordingly. In his reflections below, Dr Phil Clare considers the Oxford Summit, an initiative that brought together an international community of universities, large businesses and governments to consider how lasting partnerships that make a difference can be formed.

In a world where the gaps between nations seem to be gradually widening, it is ever more important for the research and innovation community to recognise its important role in building bridges and collectively solving the problems that face humanity on a global scale. International co-development of science, technology, and social and cultural understanding has never been more vital. The importance of the Company of World Traders’ motto ‘Commerce and Honest Friendship with All’ is as relevant now as when it was first coined by Thomas Jefferson.

International collaborations are higher cost and higher risk than more national, parochial work. Similarly, building university-business collaborations takes effort and investment. Nevertheless, we are faced with conflict, climate change, pandemics, antimicrobial resistance, and any number of threats that cannot be tackled by one nation alone. At a national and institutional level, we need funding and aligned incentives to build projects with global reach that balance the interests of different communities around the world.

The report from the latest Oxford Summit gives us fresh insights and tools to use as we set up new projects and partnerships. One area of discussion was the importance of developing clearer frameworks for translation and commercialisation of research outcomes that accelerate the use in practise of new technologies and insights. The response to the Covid-19 pandemic showed that it is possible. Complex societal crises are often systems-level problems and require the effort and involvement of many organisations along the research-to-innovation pathway. Ways of galvanising
organisations around a challenge, and better coordinating their efforts to find solutions, are needed.

Other than funding, other important factors for driving change include a strong ‘pull’ incentive (e.g. market or public demand), commitment from across the system, willingness to experiment, challenge traditional ways of doing things, and take calculated risks; greater flexibility from universities and companies on contractual terms to make things happen; more agile and faster decision-making; a more active and engaged leadership in delivering change, and much stronger incentives for societies to change behaviours.

The Importance of International Collaboration

International R&I partnerships require much more than funding programmes. Crucially, they require people with the ability to nurture relationships across borders, cultures, and companies and institutions prepared to back their people by investing the resources to sustain these collaborations. Countries are at different starting points in terms of their experiences in developing and nurturing effective international collaborations. We need to learn from each other about what works, and under what circumstances, and be willing to experiment with new approaches for specific national contexts. These collaborations need to be inclusive, equal, and create partnerships between countries at all levels of development, receiving support and acknowledgement of their contributions.

Global challenges such as climate change, extreme poverty, and global health would benefit from funds of substantial scale at the global level, aimed at delivering breakthroughs at pace and scale. These make it easier to identify and assemble capabilities, wherever they exist in the world, to drive progress. These resources and the engagement of companies and universities with global reach may help to overcome the skewing effects of national political objectives that can make it harder to develop new collaborations.

Our start-ups and university spin-outs must be driven by global ambitions. We need to ensure that the system does not lead these companies to settle for a ‘good enough’ national market but drives them to develop globally competitive value propositions aimed at changing the world. This needs to be backed by the range of resources (financial, human, physical, technological) to allow them to develop and scale ideas into products and services.

Moving forward

The Summit’s call for increased clarity between universities, investors and businesses has been answered in part by the recent USIT Guide, a set of recommendations for the innovation sector, produced by an international group of investors and universities, that will accelerate and support the founding of a new generation of start-ups.

University-Business Collaborations in a Post-Brexit Wales

Wales’ Varied Strengths

Universities across Wales have a diversity of research strengths - from agri-tech and marine sciences to compound semi-conductors and creative industries - which have had a significant boost via Strength in Places funding. Our universities collaborate with businesses up and down the country, providing knowledge exchange, insight and product development.

Partnerships between universities and SMEs make a significant contribution to local and national economies. The Higher Education Business, Community and Industry (HE-BCI) survey revealed that, in 2021/22, research partnerships between Welsh universities and businesses were worth almost £18m. We delivered significant benefits to the people and places of Wales through ERDF funding, leaving us in a challenging position as ERDF cycles come to an end.

Challenging Policy Environment

Universities Wales found that up to 60 collaborative projects across Wales, and up to 1,000 jobs, could be put at risk when ERDF comes to an end. Despite its intention to be replacement funding, universities have struggled to access the UK Government’s Shared Prosperity Fund due to its design and remit.

Wales lost innovation funding from 2013 until 2019, when the Research Wales Innovation Fund (RWIF) was introduced. We’ve pedalled hard to try and make up for lost time, but it’s no secret that institutions

Strategically Prioritising Engagement for Impact

Professor Elizabeth Treasure, Vice Chancellor of Aberystwyth University, reflects on how universities in Wales are continuing to support valued partnerships with businesses in Wales despite an uncertain policy and funding environment.

Universities and many of their business partners are strongly rooted in their local areas. They, alongside others, make an important contribution to local growth and leadership. Historically, funding through the European Regional Development Fund (ERDF) helped universities drive local growth through activities like upskilling and innovation initiatives, R&D processes and provision of research infrastructure, technology transfer, and support for entrepreneurship and social innovation. Since leaving the European Union, a UK “Shared Prosperity Fund” has been developed as an alternative to ERDF, but to date universities have secured limited funding.

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The Global Wales programme, delivered by Universities Wales, is expanding the reach of Welsh innovation activity on an international stage, setting up reciprocal arrangements with enterprise hubs such as T-Hub, the world’s largest incubator hub for start-ups and innovation, based in Telangana State, India.

Closer to home, Professor David Sweeney was a welcome appointment as the Deputy Chair of the new Commission on Tertiary Education and Research (CTER) in Wales, which takes over from HEFCW in April 2024. We’re encouraged by his message of continuity and assurance that RWIF funding will continue, providing the foundations for university KE. We’re building on past successes as we enter a new RWIF cycle, and it’s time for those projects to take off.

We welcome the announcement of a new Regional Innovation Fund across the UK, and look forward to working with the Welsh Government on how to best utilise the £3.4m allocated to Wales to boost local and regional economies.

This is a new era for higher education in Wales under a new funder and regulator - without ERDF but with access to Horizon Europe and opportunities to expand our international reach, with WIN developing our capacity and with RWIF-funding coming through. As we enter this new phase our universities will continue to innovate and build partnerships to enhance business and the economy.

The world is rapidly changing in the fourth industrial revolution. Technological advances are disrupting some occupations, while creating others. Employment structures and roles, as well as the skills and wider competencies demanded by employers, are already profoundly changing and will continue to do so in often unexpected ways. To improve UK productivity, secure future competitiveness and resilience, and unlock future success, educational institutions must create opportunities for lifelong learning. Dr Annabel Kiernan, Pro Vice Chancellor Academic, describes how Staffordshire University is responding to the challenge of expanding opportunities for lifelong learning, and comments on the issues of policy uncertainty and design.

Of course, universities are not only responding to the consequences of technological advancement. UK universities and their people are also at the forefront of generating the ideas and inventions that drive this advancement. They are actively considering how to foster and build their own researcher talent to achieve the UK’s ambitions for science. Dr Elizabeth Gadd, Head of Research Culture & Assessment at Loughborough University reflects on research culture and how universities can shape a sustainable and effective researcher workforce. We also include two case studies, from Amazon and AWE, to demonstrate how businesses are proactively working with universities to develop their talent and ideas.

Now that the Lifelong Learning Entitlement (LLE) Bill has received Royal Assent (announced 20th September 2023) the hard work of refining the detail begins. It is fair to say that the policy ambition has certainly been welcomed by the higher education sector, not least because both pragmatically, and in the widest sense of mission, lifelong learning, transforming individual and collective opportunities, and having tangible economic and mobility impact through higher education, is at the heart of what universities do.

The Bill aims to achieve this by making the student loan system accessible to adults, by enabling those seeking university and college delivered short courses to learn now and pay later. Although not a new concept, legislating to enable the flexibility required for broad access to higher learning and lifetime opportunities (until you are 60) for the accrual of new skills, is an important step.

Adaptation
At Staffordshire University we are embracing Lifelong Learning as part of the new higher education architecture, and we are looking at the ways we can best respond to and put in place the types and modes of learning which will support the LLE’s success. In our specific case we are already offering microcredentials (smaller units of learning) as part of the newest iteration of the Department for Education’s short course pilot. These courses have been built with local businesses and colleges, and designed to meet local and national skills’ needs, as well as to support transition from further to higher education. We are also exploring an extension of our Higher Technical Qualifications footprint, along with our partners, to tailor our portfolio to newly emergent learning and skills demands. So, we are on board and ready to deliver industry-relevant skills, whenever the train is ready to leave the 2025 station!

Questions Remain
But a large number of questions remain unanswered. The detail will inevitably follow as part of the implementation of this ambitious policy, but details matter. How, for example, will new modular LLE provision be regulated in practice? How will universities shoulder the burden if we move to module-level regulation? How will learners easily navigate the potential complexity of modular stacking, which should also be transferable between universities? How will credit transfers be best facilitated? How will personal learner accounts be owned and managed, and explicitly supported by appropriate information, Advice and Guidance? These questions and the potential barriers of cost, complexity and low uptake, could undermine the delivery and effectiveness of the LLE bill.

Lifelong Learning: the journey continues

Professor Annabel Kiernan
Pro Vice Chancellor Academic, Staffordshire University

The Wales Innovation Network (WIN) was established in 2021, to facilitate greater collaboration between Welsh institutions and capitalise on our various strengths to increase grant capture from sources such as UKRI. WIN is exploring ways to encourage consistency across approaches to KE, making it easier for businesses to knock on the door of our universities and establish partnerships.

We will lean into our City and Growth Deals. Cardiff Capital Region is a good example of collaborative working between universities, local government and businesses, partnering to secure Strength in Places funding for innovative projects. Aberystwyth University and Swansea Bay are following suit.

Cluster models, like AberInnovation - which provides incubator space and state-of-the-art facilities that best utilise the £3.4m allocated to Wales to boost local and regional economies.

Across the UK have depended upon income from international student recruitment to subsidise research activity, which is not necessarily a sustainable funding model. Furthermore, Welsh universities don’t have access to some of the same funding as our English counterparts. Additional HEIF funding provided post-pandemic, along with Research England’s Connecting Capability Fund, has topped up KE funding, allowing English universities to experiment with their offer.

Staying at the Cutting Edge
In the face of this challenge, how are we staying at the cutting edge of innovation?

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Skills are clearly at the forefront of government thinking and policy ideation, as recent statements on low value, or ‘mickey mouse degrees’, and the burnishing of apprenticeships illustrate a trend that short, modular and applied courses are being increasingly favoured politically.

Let’s be clear - universities are not set in contradiction to skills’ development and are in prime place to deliver these applied skills, working alongside industry employers. At a fringe event at the Conservative Party Conference, Professor Graham Baldwin, Chair of MillionPlus, urged the Government to recognise and utilise modern universities as a key piece in the skills puzzle, ready to ‘seize the opportunity’ to address skills gaps.

Modern universities were actually established to upskill learners in applied professional areas, and that has continued in recent times through the professionalisation of key sectors, from nursing to policing. Those ‘asks’ came from the sectors themselves. These universities play a crucial role in supporting sectors as their skills are from nursing to policing. Those ‘asks’ came from the sectors themselves.

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Another question is how many is too many young people going to university? Internationally there is a mixed economy. UK universities are widely regarded as one of our finer ‘exports’, and recognised worldwide for their teaching quality and learners’ strong occupational outcomes. There is a further counter-argument that other highly innovative economies tend to fund short courses, which would be best served by shorter course provision, funded either by industry or by the individual. In fact, end point qualifications short of degrees which support SMEs to grow and/or inject necessary forward-thinking – like the transition to net zero and the green economy – can and should be part of a university offer to help drive high level skills in a regional economy.

The other challenge here is that student finance funding within the LLE bill covers adult learners for courses at Levels 1–3. This has been designed to provide learners with broad knowledge in and across new subjects, without developing what has been criticised as over-specialisation, as well as to buck trends of few adults holding Level 4-6 awards at their highest qualification. However, it is arguable that the LLE scope should be extended to Level 7 for the type of upskilling required to have real meaning and impact. Similarly, for LLE to work and to be an attractive and real option in education and skills ‘cold spots’, there is a need for further investment in developing skills at Levels 1–3. In that sense, LLE could have the most significant impact if it covered the full breadth of education.

If lifelong learning is to be the radical step-change that the ambition implied, it needs to be situated in a more tertiary model to facilitate the full spectrum of further, higher learning, and the skills development our economy needs, as well as to end the distinction between technical and academic education. We need a different funding model which balances the individual, the taxpayer and importantly, the businesses contribution to investment in our economic future.

What next?
Upskilling to meet very specific industry needs is arguably not best served by chucking up a three-year degree programme into its constituent parts. This is even more the case if we consider in-work reskilling, which would be best served by shorter course provision, funded either by industry or by the individual. In fact, end point qualifications short of degrees which support SMEs to grow and/or inject necessary forward-thinking – like the transition to net zero and the green economy – can and should be part of a university offer to help drive high level skills in a regional economy.

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The other challenge here is that student finance funding within the LLE bill covers adult learners for courses at Levels 1–3. This has been designed to provide learners with broad knowledge in and across new subjects, without developing what has been criticised as over-specialisation, as well as to buck trends of few adults holding Level 4-6 awards at their highest qualification. However, it is arguable that the LLE scope should be extended to Level 7 for the type of upskilling required to have real meaning and impact. Similarly, for LLE to work and to be an attractive and real option in education and skills ‘cold spots’, there is a need for further investment in developing skills at Levels 1–3. In that sense, LLE could have the most significant impact if it covered the full breadth of education.

If lifelong learning is to be the radical step-change that the ambition implied, it needs to be situated in a more tertiary model to facilitate the full spectrum of further, higher learning, and the skills development our economy needs, as well as to end the distinction between technical and academic education. We need a different funding model which balances the individual, the taxpayer and importantly, the businesses contribution to investment in our economic future.
We must recognise that institutional research cultures do not exist in isolation; they are influenced by global factors and, in particular, by international rankings. Within current international ranking systems, research reigns supreme and drives international recognition. In fact, entrepreneurial pursuits are not represented at all in the most influential global rankings.

There are promising initiatives underway to address these issues. Efforts to reform research assessments are gaining momentum, including the Coalition on Advancing Research Assessment. This international initiative seeks to recognise a broader range of contributions to research, and eliminate the use of university rankings in researcher assessment. Some universities are signing up to the “More than Our Rank” initiative to highlight their diverse contributions beyond those captured by the global university rankings.

Working Towards Solutions

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Case study: The Importance of University Collaboration to Amazon

Amazon is deeply invested in supporting ongoing academic research and building ties with academia. We believe that Amazon is a unique place to measure the impact of new scientific ideas, given our scale and our ownership of both an information infrastructure and physical infrastructure.

**Amazon Scholar program**

In 2018, Amazon launched the Amazon Scholar program – this initiative has broadened opportunities for academics around the globe to join Amazon in a flexible capacity throughout year through part-time arrangements or while they are on sabbatical. Through the program, academics have the chance to contribute toward Amazon’s businesses and customers, all the while remaining employed by their institutions.

One success story from the Amazon Scholar program is Franco Raimondi, who joined Amazon in 2019. Franco currently works with Amazon’s Prime Video business while also serving as a Professor of Computer Science at Middlesex University. Since joining Amazon, Dr. Raimondi has applied his expertise of software verification to the Prime Video Automated Reasoning. Through the program, Dr. Raimondi has worked closely with software developers and applied scientists to deliver real-world solutions for improving the experience for millions of Prime Video customers.

“I find that the Amazon Scholar program is an unparalleled opportunity that allowed me to retain my position as a university professor while also working for Prime Video,” Dr. Raimondi notes.

Since launching in 2018, the Amazon Scholar program has expanded to numerous countries globally, deepening our commitment to building productive collaborations with world-leading institutions. Following the success of the Scholar program, in 2020 Amazon launched the VLying Academic program, which is designed to enable pre-tenure and newly-tenured early-career academics to gain early applied experience and obtain both valuable insight and industry networks to support their academic careers.

**Postdoctoral Research Program**

Most recently in 2022, Amazon launched its Postdoctoral Research Program. While operating slightly differently than the dual-employment model of the Scholar and Visiting Academic programs, the Amazon Postdoctoral Science Program offers recent PhD graduates a formal avenue to gain industry experience, apply their subject matter expertise, and gain mentorship from established Amazon scientists.

Postdoctoral scientists explore new research ideas, accelerate scientific innovation and impact, and publish their work in peer-reviewed scientific literature. The program advances postdoctoral scientists’ career development through industry exposure, publishing research, and mentorship from the broader Amazon Academic and Science communities.

**Strategic Partnerships**

Understanding that innovation cannot be achieved with internal science alone, Amazon has also established several strategic collaborations with top-tier research universities, creating a “hub” with a framework agreement for research collaboration using a common set of mechanisms including sponsored research, gift research, and PhD fellowships. Each hub is governed by a joint advisory board consisting of the university and Amazon, and centrally managed both at Amazon and the university.
The foundations of AWE’s mission in national defence and security are based on the expertise of its people coupled with the strength of the company’s partnerships and collaborations with academia and industry. AWE’s links with academia are considered invaluable for knowledge sharing, promoting best practice and building future and lasting relationships – that will continue to support the company’s mission. The links also facilitate a vital means for accessing research and capability to deliver mutual benefit for UK STEM.

AWE’s range of academic partners, some of which have a long history and continue to endure, help scientists, engineers and other experts access capability and skills that might not otherwise be available on AWE sites, whilst giving sponsored postdoctoral students the opportunity to work on exciting technical projects with a leading and respected employer. That opens up career opportunities for them and, in turn, gives AWE a talent pipeline to stimulate debate and discussion in areas of technical interest.

There are many different mechanisms by which AWE works with academia, including student placements, postgraduate and postdoctoral projects – as well as encouraging staff to partner with academic and special interest groups to work on areas of mutual benefit and reward – for the defence enterprise and wider.

Centres of Excellence

AWE funds a number of Centres of Excellence (CoEs) at universities across the UK that support the company’s technical programmes. The CoEs are designed to increase capability and capacity where specific support or demands are required. They also provide opportunities for research and innovation through a unique blend of academic, postdoctoral and postgraduate level activity – in many diverse and different areas of STEM. The CoEs motivate and inspire university researchers and AWE specialists to work together in the spirit of sharing expertise, whilst also understanding the pace and emergence of new technology that may influence where future investments could be potentially applied.

Some examples of AWE’s CoEs include the Centre for Computational Plasma Physics, the Centre for Nuclear Security Detection, the Centre of Excellence in Materials Ageing, Performance and Lifetime Prediction, the Centre for High Energy Density Studies, and the Centre of Excellence in Energetic Materials.

Fellowships

There are also a number of William Penney Fellows, each of whom is a highly respected leader in their field and whose role is to act as an ambassador in various scientific and technical communities. Professor Julie Yeomans is an example of our recipients of the prestigious William Penney Fellowship. She was bestowed this award in recognition of her international leadership in materials research and the wider partnership between the University of Surrey and AWE. Based in the University of Surrey’s Department of Mechanical Engineering Sciences, she is the second woman to have ever been awarded the Fellowship. Professor Yeomans’s Fellowship consolidates Surrey’s position as a long-term partner of AWE which saw the launch, in April 2021, of the AWE-University of Surrey Centre of Excellence in Materials Ageing, Performance and Lifetime Prediction.

AWE actively sponsors academic forums with the William Penney Fellows* to stimulate debate and discussion in areas of technical interest.

About AWE

For over 70 years, AWE has supported the UK Government’s nuclear defence strategy and Continuous At Sea Deterrence. On behalf of the Ministry of Defence, AWE manufactures, maintains and develops the UK’s nuclear warheads, and applies its unique expertise to support nuclear threat reduction and to protect national security. The company provides guidance to UK military and police counter-terrorism teams, as well as emergency response to the event of nuclear or radiological incidents.

PROFESSOR GRAEME REID
Chair of Science and Research Policy, UCL, Strategic Advisor, NCUA

* For further information visit: www.awe.co.uk/about-us/our-partners/

After several years of uncertainty, there was a collective sigh of relief from the academic community when Rishi Sunak and Ursula von der Leyen finally brought the UK into Horizon Europe as an associate member. The UK has left the Euratom programme, as requested by the nuclear fusion research community in the UK.

Throughout the hiatus, the Government’s funding guarantees allowed UK academics to continue to participate in Horizon projects with the UK – rather than the EU – meeting the cost. UKRI played an important role in delivering these funding guarantees in an unpredictable political environment. In consequence, the UK is not rebuilding its involvement in Horizon from scratch.

However, it may well take time for the quality and quantity of UK engagement in Horizon to recover fully. It remains unclear who will be accountable for the speed and scale of the recovery in UK participation.

During the prolonged negotiations on Horizon association, the Government published its plans for Pioneer “A UK prospectus for Opportunities Beyond Horizon Europe”. There have been repeated signals that the Government wishes to implement parts of the Pioneer Prospectus alongside Horizon association.

Secretary of State Michelle Donelan said (in her introduction to the prospectus) that “Building on lessons learned from the 2019 Smith-Reid...
Review, it is really important to me that we [the Government] are engaging diverse voices... creating a programme that works for everyone."

Former Science Minister George Freeman has signalled that "we must focus on building ever-stronger relationships... with partners around the world."

As the UK forges its future outside the European Union, it is implausible that the shape and size of our international research partnerships will return to their pre-2019 form.

The EU will no doubt remain a close and important partner but stronger emphasis on relationships with the USA, the Asia Pacific and other parts of the world.

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Case study: Advancing cognition and efficiency in robots through a global multidisciplinary consortium

The next generation of personal robots needs to reach a level of cognition and motor intelligence, such as interacting with people and adapting to different situations. This isn't currently possible, and the required co-design of body (robot) and mind (AI) is missing. Currently mainstream AI and robotics are based on inefficient computing and sensing resources that cannot be scaled up to the required level.

To allow these robotics systems to reach the next level, the Performance in Robots Interaction via Mental Imagery (PRIMI) project from Sheffield Hallam University will combine knowledge from fields like brain science, psychology, artificial intelligence, and robotics.

The project aims to make robots that can think and learn like humans but are also energy efficient. These new robots will be able to interact with people more effectively and learn from their experiences.

A highly innovative project like PRIMI requires a multidisciplinary consortium of academic and industry leaders and an international environment.

Only Horizon Europe is able to give this unique opportunity.

PRIMI'S goal is to change the way we think about AI and robots and create robots that can do more for us in our daily lives. As a first step, they will test these new robots in a real-life situation by helping stroke survivors with their physical therapy.

Over the course of several years, the project's development emerged from previous collaborations in other EU-funded projects, which are essential for UK science to thrive. The partners' confidence in the project's innovative ideas and their strong will to work together as Europeans pushed them to overcome uncertainty.

Sheffield Hallam University accepted the challenge, confident that the consortium would support a solution allowing them to continue leading the project in the event that an agreement on Horizon Europe was not reached on time.

Horizon Europe is the EU's key funding programme for research and innovation.

The framework programme runs from 2021-2027 and has a total budget of €95.5bn. Prior to association, UK researchers had been able to apply to participate in Horizon Europe projects with support from UKRI through the Horizon Guarantee. However, they had not been able to receive funding directly from the European Commission, not could UK participants lead project consortia or count towards the minimum number of countries required to meet eligibility rules. Following association, in 2024 Work Programmes onwards, UK researchers and institutions will be able to participate fully as an Associated Country – with the same rights as EU participants except for the European Innovation Council Fund and exceptional cases where funding is limited to member states. Alongside Horizon Europe, the UK associated to the Copernicus European Earth Observation Programme, but not the Euratom Research and Training Programme which is focused on nuclear research and innovation.

NCUB welcomed the announcement of the UK's association to Horizon Europe in September. 'Investing in global research partnerships is critical to maximise UK universities and business ability to lead projects, generate high-impact outputs and realise a range of economic, health, environmental and social benefits.'

How Has Horizon Supported UK Universities and Businesses in the past?

Horizon 2020 (H2020), the European Union's research and innovation framework programme, operated from 2014 to 2020, and it had a significant impact on a diverse set of stakeholders, including small and medium-sized enterprises (SMEs). Participation data reveals that a total of 46,460 organisations actively engaged in H2020 projects. Among these participants, 7.7% were based in the UK.

Within the UK, universities played a prominent role, constituting the majority of organisations involved, accounting for a substantial 69.2% of the total. In contrast, the business sector in the UK accounted for a modest 18.6% of the overall participants from the country, a figure noticeably below the program’s average participation rate of 28.2% observed across all signatory nations.

One of the standout features of H2020 was its commitment to promoting SME involvement, exemplified by its goal of allocating 20% of the total budget for these enterprises. Throughout the program's implementation from 2014 to 2020, a total of 1,842 SMEs in the UK actively participated in various research projects, constituting 17.6% of all UK organizations engaged in the initiative.
These SMEs secured a funding amount of €984.7 million. Significantly, the three foremost sectors among SMEs that reaped the benefits of funding encompassed engineering and naval architecture, energy generation and hydropower, as well as research and experimentation, highlighting the programme’s tangible contributions to innovation and growth in these critical areas.

Another important feature of H2020 was to foster collaboration between different sectors, particularly between academia and the private sector, to drive innovation and address societal challenges (European Commission, 2018). One significant metric that underscores this collaborative effort is the type of research outputs generated under H2020. Specifically, 20% of the publications resulting from H2020-funded projects involved co-authorship between academic and private entities. This not only highlights the interdisciplinary nature of the research but also demonstrates how the program encouraged entities with different expertise and backgrounds to tackle complex problems. Other tangible outcomes include the inception of new start-ups, facilitation of knowledge transfers and innovations.

**Support for Universities and Businesses**

The Horizon Europe Main Work Programme 2023/24 was published in December 2022. The UK, as an Associated Country, will be able to participate fully in funding calls that include the call identification number 2024. Funding calls across the three pillars and one part support collaboration between universities and businesses. For example, the Marie Skłodowska-Curie Actions are a set of talent programmes that can be used to facilitate intersectoral mobility between academia and industry. Discrete sector and discipline specific funding opportunities for universities and businesses are available within the Horizon Europe missions areas and the Clusters within Pillar II.

**How Can People Find Out More About the Opportunities that Exist?**


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**Horizon Europe includes three pillars and one part:**

**Pillar I**

**Excellent science:** This includes the European Research Council, Marie Skłodowska-Curie, and Research Infrastructures;

**Pillar II**

**Global challenges & European industrial competitiveness:** This includes Clusters – Health, Culture, Creativity & Inclusive Society; Digital, Industry & Space; Climate, Energy & Mobility; Food, Biotechnology, Natural Resources, Agriculture & Environment – and Joint Research Centre;

**Pillar III**

**Innovative Europe:** European Innovation Council and European Innovation Ecosystems; and

**Widening participation and strengthening the European Research Area:** This includes ‘Widening participation and spreading excellence’ and ‘Reforming & Enhancing the European R&I system’.

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**In Summary**

Section 3 examined how universities and businesses are reacting effectively to change and how they are constantly and consciously evolving their collaboration practices across a wide range of R&D, commercialisation and education activities. We covered a variety of examples, including reflections on what can be learnt from the response to the Covid-19 pandemic, the continuous development enabled through the knowledge exchange concordat, and engagement in the 2023 Spinout Review. We also demonstrated how universities are sustaining local engagement despite a loss in ERDF funding, how they are leading the way in lifelong learning and researcher culture, and offered the business perspective on the multifaceted relationships with universities that they value. We conclude with the importance of global networks and connection to the research base, and the important opportunity that full association to Horizon Europe presents to universities and businesses alike.

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**Participation data reveals that a total of 46,460 organisations actively engaged in H2020 projects. Among these participants, 7.7% were based in the UK.**
Together, universities and businesses create and drive the society and economy of the future. The Collaboration Progress Monitor allows us to look back at past trends and what they tell us about UK university-business collaboration. This section looks forward towards the major shifts and decisions of the future. Decisions made in the years to come by government, as well as senior leaders in business and universities, will have profound implications for the shape of the future economy. There is increasing recognition that continuing with the status quo will leave the UK trailing behind leading economies, lacking resilience and facing the perpetual cycle of low growth. The UK’s major political parties, as well as many thought leaders, argue that the UK must rebalance its economy towards greater R&D and innovation, and must adopt to greatly changing skills and wider competency needs.

The section explores how universities, businesses and policymakers together, are driving a vision for the future and are also actively implementing reforms to start shaping change. Specifically, their collective efforts are focussed on:

- Unlocking R&D-led growth and opportunity.
- Delivering the talent the future economy needs.

The UK’s ambition to grow its research and innovation base was clearly articulated in the 2017 Industrial Strategy and has not lost momentum. In March this year, the UK Government published the latest in a series of commitments to Science and Technology with a new Framework to make “… the UK a science and technology superpower by 2030”. The narrative in the framework is consistent with messaging from both major parties and sets out clear actions to be achieved by 2030.

The challenge now is shifting from strategy and review to delivery. Successful delivery will require systematic and strategic policy development, as well as coordinated decision making and delivery across different levels of government and parts of the UK, across the remits of Departments and budgets. Businesses and universities are not just stakeholders in this process. They must be partners in defining and delivering a clear, enduring vision. Throughout various R&D strategies and reviews, a recurring theme is to treat business R&D in broad brush terms, often citing well-rehearsed and used recommendations intended to offer incentives (to stimulate market development) or provide enablers (to make it easier to do business-led activities). There is an urgent need to change this approach and to work in closer partnership with business to co-create the vision and longer-term delivery plans in the chosen areas of focus.

Growth will be driven by people, by their connections and by their ideas. Policymakers, educational institutions and employers must work in lock-step to train and attract a new generation of highly skilled people able to deliver a vision for a more research and innovation intensive economy. They must also equip and empower them to develop the ideas and applications that will transform society and herald a new era of progress.

A number of actions have already been taken by government to realise its science ambitions, including:

- Critical increases in public research spending, as well as reviews to strengthen the delivery and impact of this spending, including the Nurse Review of the R&D Landscape and the Grant Review of UKRI.
- The development of the Department for Science, Innovation and Technology this year, creating a single Department tasked with strengthening and maximising the impact of UK research and innovation.
- Incremental changes to wider government science structures, including the creation of a new National Science and Technology Council and an Office for Science and Technology Strategy, and the creation of a chief science advisor role in each government department.
- Full association to the Horizon Europe programme following the UK’s withdrawal from the EU.
- Review of various incentives, policies and regulation, including a wave of sector specific strategies and reviews of R&D tax credits.
- The development of a new Advanced Research and Invention Agency (ARIA).
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R&D-Led Growth and Opportunity

Rebalancing the economy towards greater R&D and innovation in the future will require the UK to build, attract and expand R&D investment and performance by business. Policy makers, universities and businesses all have a critical role to play in driving this reform. To do so, the factors that drive business R&D investment decisions need to be better understood so that strategic, evidence-driven steps can be taken nationally and locally to attract private R&D investment. This year NCUB published a series of evidence reports to improve the insights that policymakers can draw upon. Professor Nigel Driffield, Professor of International Business at Warwick Business School, has made a significant contribution to better understanding private R&D investment into the UK’s regions. In the article below, he and colleagues synthesise work on the drivers of private R&D investment and the role of universities locally.

Universities play a critical and multifaceted role in their local areas. In his article, Indro Mukerjee, CEO of InnovateUK, considers the role of universities in robust local and national innovation ecosystem, including the activities now and the aspirations for the future. Although recent evidence has emphasised the scale of the problem, the degree of regional disparity of earnings within the UK has been apparent for some time. Policy makers, and scholars from various disciplines including geography, politics, economics and business have debated this issue for a long time, and offered a number of causes for both regional inequality and the extent to which it is hampering UK economic development. The common factor of all of these debates is simple: there is "too large" a disparity in productivity between the richest regions of the country and the rest. We argue that this is a symptom of deeper problems, linked to low levels of innovation and investment. An often-cited solution to this is that lagging regions need to attract more inward investment (be it from abroad or from other parts of the UK). However, this solution lacks nuance. To solve this problem, the different types of capital investment need to be both understood and deployed to address the specific shortcomings of each region. To re-frame, investment needs to "move the dial" on productivity, not simply provide more of the same. It is not enough to simply throw capital at a region and hope for the best.

For direct investment to be transformational, it needs to do two things – one on the demand side and one on the supply side.

• First, it must increase the demand for skilled labour in the location.
• Second, it must amplify the opportunities to local people or the returns to individuals to acquiring skills, improving local human capital.

In addition, one needs to think about both the direct effects within the firm and the indirect effects – across the sector or across other sectors locally or regionally.

There is no such thing as "bad" direct investment, but to be truly transformational, investment must introduce new technology or otherwise foster innovation that increases the demand for skills. Transformational direct investment is therefore intrinsically linked to both the local economy and the local population, driving positive productivity and labour demand effects that lead to both economic growth and improvements in local human capital.

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Universities’ Role in Maximising the Benefits of Inward UK Investment
To understand what transformational direct investment involves, two processes need to be understood. The first concerns the location of investment, and the second is how to maximise the benefits, in terms of employment, innovation and productivity for the local economy, particularly in terms of secondary effects (spillovers). Firms consider these simultaneously, while policy makers tend to consider them sequentially. Universities need to be seen as central to these decisions and processes. To illustrate, hi-tech investments require three basic conditions from a location:

- A constant stream of skilled workers, both for their own businesses, but also to support the local ecosystem.
- Protection of intellectual property, and mechanisms for developing further IP without fear of expropriation.

Collaboration with local firms, either to help adaptation to local conditions or to act as key suppliers. When making such location decisions, firms therefore face a number of trade-offs. For example, it is reasonable to assume that firms seeking locations for R&D activities require a certain degree of technological competence locally, in the form of suppliers, an available labour force, universities, inventor connectivity and perhaps (internal and external) agglomeration economies. At the same time, such locations are likely to have higher levels of absorptive capacity, thus potentially stimulating knowledge leakage, with other firms being able to assimilate such knowledge. Similarly, such locations are already experiencing skill shortages in high tech activities, at all levels of skills. Thus, in order for inward investment to help address regional productivity imbalances (in other words, levelling up), there is an onus on the host economy, to link skills development, innovation strategy (including clusters), and business support (i.e., what activities should a location prioritise). We argue that universities, and their associated science parks and existing collaborations are ideally placed to lead on this.

This is why it is welcome that universities are seen as central to many of the current initiatives, including the piloting innovation accelerators, investment zones and innovation zones. Locations need to ensure that universities are central to the value proposition from the perspective of inward investment, and also central to efforts to maximise the benefits of this. We argue that universities can provide this, by facilitating the coordination between innovation activities, the supplies of skills (in terms of both HE and FE) and the efforts to encourage clusters.

In the context of transformational foreign direct investment, the gradual devolution of research and development funding is welcome – at least in abstract. In practice, decision makers in the regions will have to build new capabilities and capacities to make effective decisions. This includes being able to evaluate, the quality of the science and (for example) the potential for innovation through collaboration between universities and frontier firms, but also the capacity for this to foster productivity growth along supply chains and in supporting technology. Universities can play a crucial role in here too – not just as anchor institutions, but by drawing on the economic expertise and analytic capabilities that they have to support local authorities make informed decisions as well. In the context of fiscal constraint, this must surely be welcome.
Universities as Engines of Local Innovation

In addition to the flagship Innovation Accelerator programme, we have been developing a coherent package of products and services to accelerate place-based potential.

Our dedicated team for Place and Levelling Up across England and Devolved Nations, are actively working with universities to foster co-creation and knowledge exchange, helping and facilitating academic involvement in innovation clusters.

Collaborating closely with Devolved Nations and Mayoral combined authorities in England, we are committed to developing local action plans that position universities as key players. These plans align our combined offer with local needs, priorities, and academic expertise, promoting co-creation with universities as catalysts for innovation. So far, we have released action plans with West Yorkshire, Liverpool, and West Midlands, and signed MOUs with Manchester and Wales for stronger innovation partnerships.

Our Catapults are delivering local impact through more than 50 sites throughout the UK, often embedded in, or strategically associated with, universities. The centres play a vital role in bridging opportunities between industry and the research base, and are vital components in anchoring innovation clusters – drawing on and translating academic expertise, infrastructure and skills to enhance collaborative creation, knowledge transfer and commercial exploitation. As just one example, our Digital Catapult is a key member of the Smart Nano Consortium in Northern Ireland; with partners at Ulster University and QUB, their relationship has driven the world-leading photonics cluster in this region.

Other elements of our Products and Services include the business growth advisors across our Innovative UK EDGE network. Four of our delivery partners in this network are part of university business support activities, such as at University of Hertfordshire.

Two key commercialisation products of note are the Innovate UK Knowledge Transfer Partnership (KTP) and Innovation Commercialisation through University Research (ICuRe) programmes. These programmes drive innovation from and with expertise, ideas, and knowledge in the more than 110 universities that have participated.

We are bringing all these products together under a further £75 million of Launchpad investment, which is targeted support for clusters to drive local impact and encourage businesses to be more R&D active.

A Call to Universities

Innovation is not easy, and never follows a linear path. Yet in many, many cases universities and their collaborations with industry are at the heart of stimulating, scaling, and catalysing innovation. Let me conclude by reiterating the central message – a call to action for universities across the UK to join us in the journey towards a more prosperous, innovative and inclusive future. Your participation is not just welcome, it is essential.

Actively engage with Innovate UK, and let’s co-create together to be the driving force behind the innovation-based growth in the UK. As we move forward, we invite all stakeholders, especially universities, to join us in this journey. Innovate UK is not just an organisation; it’s a catalyst for positive change, and we are excited about the future that we can build together.

Universities and businesses play leading roles in identifying areas of future technological opportunity and potential. Two major drivers of technological change in the next decade will be the further development of the digital economy, with rapid advancement in AI expected, as well as the wide-ranging set of changes needed to drive a green economy.

Over the next ten years, the impact of Artificial Intelligence on businesses across the UK and the wider world will be profound. In his article, Professor Rahim Tafazolli describes the work of the University of Surrey’s 6G Innovation Centre in working with businesses to identify long-term research opportunities. We also showcase a range of case studies to demonstrate how universities and businesses are working together to advance AI.

This is followed by two articles from Rio Tinto and EDF Energy demonstrating how they are working with universities to improve environmental sustainability and to help achieve the UK’s long-term Net Zero goals.

Defining the Art of the Possible at the University of Surrey’s 6G Innovation Centre

REGIUS PROFESSOR RAHIM TAFAZOLLI
Director/founder of 5GIC and 6GIC

Introduction
6G Innovation Centre (6GIC) is the continuation of the award-winning 5GIC programme at the University of Surrey. 5GIC was the winner of the 2021 Royal Academy of Engineering, Lord Bhattacharyya award, for being the best UK research centre for impactful collaboration between academia and industry.

The mission of 5GIC and now 6GIC is to work closely with industry and collectively define the future (at least) 10-year research and innovation strategy. Within this research strategy, our mission is to define “the art of the possible” from a technology perspective and demonstrate the feasibility of these technologies through a combination of theoretical, and experimental research towards innovation. In addition to technical research, 5/6GIC also develop solutions to overcome possible regulatory and policy barriers to new solutions. 6GIC also considers use cases that have a clear business case whilst being innovative. An example of such new use cases is technologies that make science fiction teleportation a science fact.

Underpinning all of our research are solutions that are highly energy and bandwidth efficient technologies whilst developing solutions for universal coverage of broadband communications. The general theme of 6GIC research strategy is integrated communication and sensing (ICS).

Teleportation
We argue that every science fiction book and film than has been written and produced so far, is technically possible to become a reality today with near future technology advances.

One may disagree and say, how about teleportation? Teleportation, such as in now famous episodes and films of Star Trek which coined the well-known phrase “Beam me up Scotty”,

I initially addressed this question at a TEDx event in 2015, as part of my talk on the “Future Wireless World in 30 years”, where I first presented the idea of using wireless technology as a means for realising a type of teleportation.

In this short article, I lay out some key ideas; teleportation is in fact possible if we push our ideas in engineering and science. But we have to first think laterally about what we mean, and what our goal is in teleportation. Clearly, science is not at the point where complex matter itself can be instantly transported.

Defining the Vision

First, we must ask ourselves what is important for human teleportation. This then enables us to address the question of what technologies will be required to realise the vision, and whether we have these to hand, or if new ones will be required.

If we had to only choose from the two options of teleporting either the body of a human without our five common senses or teleporting five human senses without the body, which one is more important to give true sensation of teleportation? It is obvious that a body without senses is a dead being. Therefore, why not focus on transmitting and receiving the five human senses? From the beginning of modern technology and in particular, in telecommunications we have managed to transmit two of the human senses namely hearing and seeing that is audio and video. For teleportation, we need to transmit all remaining three senses of touch, taste, and smell.

Physical teleportation, without the five senses and spatial elements is meaningless if these cannot be accurately represented in any new place. It is also fair to say that some of these elements are what make us “us”, and perhaps not all are equally important. If the spatial element is removed, but key senses remain, a level of the vision is effectively realised.

The natural next step in communications such as 6G is the transmission of a wider set of information and representation of other senses, leading to 4D video, where the fourth dimension is other human senses complementing the 3D version of a person in the form of virtual reality which is enabled with high bandwidth and guaranteed low latency of 5G and future 6G technologies. 4D media is a realistic way of realising teleportation in the real world. Teleportation in this form, will enable many new services that range from entertainment and gaming, to telemedicine, to cooperative and remote working, and will enable realistic fusion between virtual and physical worlds for both social and professional activities.
Highlighting University-Business Collaborations to Address Human Challenges Through AI Partnerships

Artificial Intelligence: the Present and Future of Technology

In April 2023, NCUB published a further edition to our showcasing series, where we celebrate and share the best of NCUB member collaborations. This edition, ‘Artificial Intelligence: the present and future of technology’ celebrated our members’ crucial work in developing AI for the benefit of society and the economy.

It is absolutely right that society asks difficult and challenging questions about the significant risks that aspects of AI technologies pose. But, as ‘Artificial Intelligence: the present and future of technology’ shows, there are many positive uses for AI and, if it is developed and used responsibly, it has enormous potential to improve lives, grow the economy and support responses to major societal challenges.

Brunel University London and Volt Vision have used AI to monitor industrial machinery and power networks and spot faults, enhancing operational efficiency and achieving significant cost savings.

The University of Southampton and 2Excel have utilised AI to improve earth observation imagery that is used in disaster assessment, urban analysis and military intelligence in peace operations.

Together the BBC, Lancaster University and the University of Surrey have used AI to improve earth observation imagery that is used in disaster assessment, urban analysis and military intelligence in peace operations.

A team of scientists from Cardiff University is using state-of-the-art AI techniques to automatically segment, catalogue and manage the Natural History Museum’s huge collection of specimens.

The British Library, the Alan Turing Institute and the Universities of Cambridge, East Anglia, Exeter, and Queen Mary University of London are using AI to generate new historical perspectives and look at how machines changed the lives of the population in the 1800s.

A collaboration between researchers at the University of Sheffield and AstraZeneca has used AI to reduce the cost and speed-up the discovery of new medicines.

Researchers from the University of Edinburgh and Heriot-Watt University and the National Robotarium’s new Laboratory for Robotic Assistive Living, are using AI to better diagnose and treat a range of health issues.

Using AI, the University of Birmingham are working with Autodesk, a Manufacturing Technology Centre to design implants that are specifically engineered to match patient’s requirements, allowing a swifter return to full function and maintaining quality of life for as long as possible.
Case study: Rio Tinto’s US$150 Million Commitment Energy Transition

In an era when global efforts are directed towards achieving net-zero emissions and sustainable development, the mining industry has an important role to play in supporting the transition.

The demand for materials crucial to the energy transition is soaring, however some of the conventional extraction and processing methods have significant environmental and social impacts. Rio Tinto, a leading global mining group, is committed to finding innovative, sustainable solutions.

Rio Tinto, a leading global mining group, is committed to finding innovative, sustainable solutions. The company’s overall approach to finding better ways to help provide the materials the world needs to support the energy transition.

The Centre builds on Rio Tinto’s long-standing support of research and innovation. It will complement an Innovation Advisory Committee of global experts in their fields that Rio Tinto recently established to accelerate its innovation portfolio and provide external insights and guidance on emerging and disruptive technologies. The Committee includes members with experience in academia, industry and government.

Building on Rio Tinto’s rich history of collaboration with universities, the Centre for Future Materials adopts an interdisciplinary approach, fostering systems thinking and collaborative governance. By partnering with world-leading institutions, the Centre aims to transcend traditional research boundaries and tackle complex global challenges head-on.

Under this partnership, Rio Tinto and Imperial College London will identify major global challenges that demand attention. These challenges will serve as the foundation for the Centre’s initial research programs, which will be carried out in collaboration with select international academic institutions.

New partnerships across the globe are core to the Centre’s success. In order to achieve their aim, Rio Tinto requires strong partnerships with other leading global universities and a successful track record in establishing and operating similar centres, made it the right choice.

Complementing Existing Partnerships

Rio Tinto has an extensive network of university partnerships and collaborations across the globe. They will continue to work with their existing university partners outside the work of the Centre. In fact, the Centre for Future Materials will complement these collaborations, enhancing the company’s overall approach to collaborative innovation.

A Global Reach

Rio Tinto and Imperial College London will strategically select university partners, with a focus on regions where Rio Tinto has a strong operational presence or a significant customer base. This approach ensures that the Centre benefits from a diverse range of expertise, spanning technical fields to social sciences.

Impacting the Future

The Centre for Future Materials represents an opportunity to identify, explore, and advance research that can unlock the provision of sustainable materials, crucial for a zero-carbon future. The Centre’s vision encompasses fundamental research into groundbreaking technology and science that have the potential to accelerate the global energy transition and the development of sustainable materials.

Rio Tinto Chief Executive Jakob Stausholm said “For the world to reach net zero, we must find better ways to provide the materials it needs. No single player can do this alone, and research and development plays a vital role. Imperial College London is one of the world’s leading institutions focused on science and engineering – I cannot wait to see the progress we make, as we bring together the best of industry and academia, with shared ambition.”

Rio Tinto’s US$150 Million to funding research to find better ways to help provide the materials the world needs to support the energy transition.

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The Centre Model

Building on Rio Tinto’s rich history of collaboration with universities, the Centre for Future Materials adopts an
Industry-academia partnerships are essential for addressing global challenges. The collaboration between EDF UK and the University of Manchester is a prime example of how such partnerships can drive innovation, sustainability, and knowledge exchange.

EDF, a global energy leader, recognizes the importance of advancing technology and sustainability in the energy sector, with our motto “helping Britain achieve Net Zero”. Meanwhile, the University of Manchester has a rich history in science and engineering. Our partnership represents a longstanding commitment to advancing clean energy solutions and nurturing future talent.

One of the most significant areas of collaboration has been in the field of nuclear energy. Facing the world’s rising energy demands, EDF and the University of Manchester have joined forces to explore advanced reactor designs, safety protocols, and nuclear waste management. This collaboration not only contributes to cleaner and more efficient nuclear energy but also fosters the development of the next generation of nuclear engineers.

Beyond research, EDF actively participates in educational initiatives. Students benefit from internships, collaborative programs, and sponsored research projects. These experiences provide invaluable insights into the energy industry’s dynamics, offering students real-world preparation and promoting a smooth transition into the workforce. The partnership extends to policy and sustainability initiatives, exploring the environmental impacts of energy production and strategies to mitigate them. The interdisciplinary approach bridges the gap between science, engineering, and policy, shaping a holistic understanding of the energy sector’s role in addressing climate change. Both EDF and the University of Manchester prioritize diversity and inclusion. Collaborative initiatives promote diversity in STEM fields and actively support underrepresented groups in pursuing careers in energy-related disciplines. This commitment fosters a more inclusive and equitable energy sector.

The case of EDF’s collaboration with the University of Manchester stands as a testament to the power of partnerships between industry and academia.

Delivering the Talent the Future Economy Needs

Businesses around the world choose to invest in the UK for its talent. Rapidly changing technologies, as well as the UK’s deliberate drive towards greater research and innovation, will have a significant impact on the future talents that will drive success and prosperity. To deliver future talent, the UK has a number of hurdles to cross. First, it is essential that teaching and training provided at all levels of the education system prepares students of all ages for the future, including for job roles and approaches that may seem unimaginable today. Helen Laville, Provost at Kingston University, reflects on how universities, working with employers, can approach this challenge.

There is also further to go in supporting the effective movement of people across traditional academic-industry boundaries. Professor Karen Holford, Vice-Chancellor of Cranfield University, reflects on work she led with NCUB to consider how industry, academia and industry can be improved.

Rethinking Future Skills and the Needs of Employers at Kingston

It has perhaps always been the case that the current cohort of students at any given time at any given university is being educated to do jobs that do not yet exist, to develop products and services that have not yet been thought of, using tools, systems and approaches that have not yet been designed, to solve problems and create opportunities that have not yet emerged. Over the past twelve months, however, the pace of publicily surrounding the launch of new Artificial Intelligence and other emerging technologies has given new weight and urgency to this truth. It seems likely that the distance between ‘not yet’ and ‘now’ is getting smaller faster.

Our work with employers tells us that in this fast-paced context of change, human-centric skills, such as creativity, lateral thinking and working in a team are already being prioritised by employers over more narrow discipline and system-specific knowledges and competencies. Moreover, they believe that this shift is likely to become more pronounced in the future.

The pace of technological, societal, and personal change is now so rapid that we believe a rapid rethink is necessary to ensure that universities are able to prepare graduates for their future. For all university programmes, it is no longer enough to simply offer learners high-quality profession-specific training for their next employer. The reliance in universities on extracurricular programmes to build a broader set of individual characteristics and attributes has two fundamental shortcomings; firstly, in a higher education sector with significant differences and diversity amongst its student population, the extra-curricula offer struggles to overcome an inherent bias towards those with the time, resources and ability to take part.
Secondly, the contribution of an extracurricular offer to the development of higher skills is hard to define, articulate and assess, and contributes to the vagueness, and lack of academic credibility that often surrounds discussions of higher skills.

Our research with business partners has demonstrated that while businesses understand the importance of these human-centric skills to the sustainability of their businesses, they lack a credible approach to defining or assessing them. The frequent reference to the very skills that we understand are the partners has demonstrated that they are often seen as things that are identified, improved and measured.

At Kingston University we have committed to a radical and unique transformation: embedding the Future Skills necessary to support our students to thrive in a world of lightning-fast change, across our curriculum. In September 2023, every first-year undergraduate student will complete a Future Skills module as a core part of their degree. This will be built on each new academic year until all undergraduates at the university have completed Future Skills training. This radical transformation is based on research of thousands of businesses and students to understand the Future Skills they need to succeed. Our collaboration with businesses has asked leaders and employers to step back from the different specialisms they may require today, and to identify the broader set of human skills and attributes which are crucial to the long-term creativity, resilience and sustainability of their different businesses. It also asks them to help us develop a methodology that delivers meaningful assessment and accreditation of these future skills in a way that adds value and meaning for individuals and employers.

Crucially then, alongside our work on developing these skills within our curriculum, we are working in partnership with leading businesses and organisations to ensure that our approach has credibility and currency with employers. Early examples of our partnership working on Future Skills includes working with IBM on co-delivery of design thinking workshops for students across Business and Computing, leading to a ‘design thinking credential’ that IBM employees complete, working with James Dyson Foundation to reach Engineering and Design students in curriculum, and linking to the James Dyson Award, an international design competition, working with Lidl on a Hackathon within an Explore prototype, and working with SME partners to understand the models of work-related learning that would work best for them to embed into Explore.

Like many universities, we have a long history of working with employers through advisory panels and professional and accrediting bodies to ensure our individual degrees are aligned with the current skills required across specific professions and vocations. We are now adding a far broader and more holistic approach. The development of our Future Skills module and our work with businesses and employers will focus on promoting the abilities of universities to identify, improve and access broad human-centric skills within their curriculum framework, ensuring that they are central to the experience of all our students.

Creating New Pathways to Success for Researchers

As a world-leading research nation, our R&D excellence is powered by a highly skilled and knowledgeable workforce who design and deliver the innovation which drives our nation. However, successive reviews, including the recent (March 2023) Research, Development and Innovation Organisational Landscape Review by Sir Paul Nurse, find that across the ecosystem, researchers are often limited to working in silos within sectors and disciplines.

Despite efforts to boost mobility, outlined in the UK Government R&D People and Culture Strategy (July 2021), just 20% of the researchers within academia have previously been employed in an industrial research role, and researchers tend to be mobile across sectors only at the beginning of their career. From my conversations with researchers in both academia and industry, I know that it is not that they don’t want to be mobile between sectors, it is often that they just don’t know how to navigate the opportunities and are uncertain of the impact on their career prospects. Those of us who have worked across sectors, and have enabled our researchers to do the same, know the benefits this brings for the organisations and the individuals.

We can build a more connected, integrated research and innovation system that enables the research careers needed to meet the global challenges of the coming decades. This is why I was so keen to contribute to the work of the researcher career mobility taskforce. I have personally seen the benefits in knowledge transfer, individual effectiveness, and collaboration that many different types of mobility have enabled. I truly believe that if we are to fully harness the power of our ecosystem and unlock the potential of our research workforce, more needs to be done to build the pillars of our research and innovation system together.

Our vision for the sector is based around three pillars:

Integrated System:
On a systematic level, to be successful, mobility should be a design feature of researcher careers, delivered through policy. In providing exciting opportunities to build careers across sectors, the UK would become internationally renowned for this system and attract top talent.

Innovative Organisations:
Employers across the innovation ecosystem have a responsibility to ensure that they actively facilitate mobility. A vital action is to ensure that they recognise and reward skills, knowledge and networks based on their value. They can empower researchers to build careers at and across the interfaces in the system, de-risking cross-sector moves, and opening opportunities to all.

Individual pathways:
Researchers, well-informed by a breadth of pathways across sectors, should be offered the opportunity to explore their ambitions and interests safe in the knowledge that mobility will benefit and not hinder their career progression.
The Mechanics of Decision and Policy Making

Those making and delivering policy, nationally and locally, have a critical role to play in both defining and preparing for significant changes in the future. They have an important convening and coordination power, as well as responsibility for establishing appropriate mechanisms, support and enablers of UK research, innovation and education.

Rebalancing the UK’s economy to focus more strongly on research and innovation will require more holistic, systemic policy making that coordinates the decisions that need to be taken across different levels of government and parts of the UK, as well as across the remits of departments and budgets.

NCUB warmly welcomed the creation of the Department of Science, Innovation and Technology (DSIT), which shows how the importance Government is placing on R&D in powering its economic growth plan. In her article, Dr Alexandra Jones, Director General at DSIT, describes the ambitions of the Department and its activities in the first eight months, as well as its longer term goals.

Reflections on the creation of DSIT

Dr Alexandra Jones
Director General, Science, Innovation and Growth, Department for Science Innovation and Technology

It’s not often that changes in the way Whitehall organises itself get warmly and widely welcomed, but that’s how it felt when the Department for Science, Innovation and Technology (DSIT) was established in February. It’s a reflection of the Government’s commitment to ensuring that science, technology and innovation are at the heart of everything we do, helping us boost productivity and growth as well as change people’s lives. That aim is at the core of DSIT’s mission: stronger growth, better jobs, and bold discoveries.

The UK has genuinely strategic advantages in science and technology, with four of the top 10 universities in the world, and just the third tech sector in the world valued at over one trillion dollars. We have to make the most of them, DSIT creates the opportunity for government to bring together our research and innovation ecosystem with incredibly powerful, general-purpose technologies and data assets, with some of the most R&D intensive sectors including life sciences, space and digital, all in one department. It’s a huge opportunity to be more than the sum of our parts.

And now is the right moment for DSIT’s creation. We are at a pivotal point when technology is advancing rapidly and we know it will change all our lives and the jobs that we work in – but we don’t know how yet. The potential that a technology like AI has to transform our lives is huge, from rapid personalised diagnosis of health conditions to transforming transportation. The need to establish appropriate mechanisms, support and enablers of UK research, innovation and education.

We must act decisively and collectively to open opportunities for researchers, so that they can navigate the full breadth of the system across their careers.

This year, NCUB’s Researcher Mobility Taskforce undertook a comprehensive inquiry into this issue, developing a Call to Action for the sector. The Taskforce proposes a series of recommendations to meet this challenge – recognising that action is needed on a system-level, from organisations, and from individuals.

Making our system more navigable will benefit all of those in the innovation sector. Evidence gathered by the Taskforce finds that recruiting staff with diverse expertise, experiences and knowledge brings improved innovation and research outcomes for universities and businesses. It opens new partnership opportunities, grows networks, and improves knowledge exchange. For researchers, researching in new environments improves the impact of their work, and enables highly fulfilling careers.

My own experience bears this out. I started out in industry, being industrially sponsored first through an undergraduate degree apprenticeship and then through an industrial CASE award PhD. Following a few years in industry during which I worked closely with a local university on many research projects, I moved into academia as an industry facing role. I know that this enabled me to develop skills that I would not have gained if I had stayed in one lane. I have engaged actively in Knowledge Transfer Partnerships where my own research has benefitted from working with industry to deliver innovation projects led by inspired graduates. In my leadership role now, I actively encourage secondments from industry into university and vice versa and I seek to recruit experienced and talented individuals from industry into academic roles.

The benefits of all these pathways are clear. It is now up to all of us to transform our landscape to ensure that the research and innovation system in the UK is geared towards big, complex challenges that will require multiple sectors and multiple disciplines to address. We need to be connected, collaborative and creative.

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I’m proud of how much we’ve done in eight short months, working with partners in the public, private and third sectors, to progress the Government’s Science Superpower and Innovation Nation ambitions. We rapidly published the Science & Technology Framework, the strategic anchor for how the Government will deliver prosperity and security for the UK through science and technology. We have published sector strategies including for life sciences, semiconductors and quantum, as well as the Tickell and Nurse reviews of R&D bureaucracy and landscape respectively. ARIA has announced its first programme directors and is empowering them to reach for the edge of the possible. And of course, we announced the UK’s association to Horizon Europe and Copernicus just last month, with a bespoke deal that was good value for the taxpayer and a great result for the research and innovation community.

DSIT has even more to do if we are to deliver the S&T Framework, make the most of the Government’s £20 billion commitment to investments in R&D by 2024/25, and incentivise further private investment into the system. Working with partners within and far beyond government, we have an opportunity to review and make the most of the portfolio of R&D investments we are making across the UK in talent, discovery research, infrastructure and equipment. We are supporting innovative businesses, vital research institutes like the Met Office and National Physical Laboratory, the five critical technologies (AI, quantum, engineering biology, semiconductors and telecoms) and critical sectors, from advanced manufacturing to agriculture. We have an opportunity to be even more effective in stimulating business investment and sector growth.

Ultimately, DSIT’s success is not only making the most of our innovation and technology assets or strengthening our innovative sectors, important though those are. Its success will be in the difference it makes to people. Technologies like engineering biology promise to reduce our reliance on petrochemicals in the fuels we use and the products we buy. Quantum could fast track development of new drugs. New technologies will emerge that can do even more. By combining these developments with a research and innovation ecosystem that thinks about everything from ethics to adoption, we can make the most of these developments in a way that benefits people. Working out how best to boost jobs, growth and discoveries with our partners will be critical – and I look forward to working with universities, businesses, charities and many others over the months and years ahead to make that happen.

In Summary

Section 4 examined how universities, businesses and policy makers are setting out a vision for the future and are reforming their own priorities and structures to unlock R&D-led growth and opportunity, as well as deliver the talent that the future economy needs. We looked at the importance of partnership to attract foreign direct investment into R&D, the critical role of universities in local innovation systems, as well as the advances that businesses and universities are leading together in critical areas like AI and environmental sustainability. We also examined how universities and businesses are working together to identify the skills needs of the future and to drive greater mobility between industry and academic careers. Finally, we investigated the recent changes that policy makers have driven, and how the creation of a new government department dedicated to science, innovation and technology offers important opportunities to bring together people from the full research and innovation ecosystem.
Conclusions

Policy makers are grappling with how to drive enduring growth in a world that is changing at an unprecedented rate. In the UK, and in many other countries around the world, rebalancing the economy towards greater R&D and innovation activity is seen as a critical part of the solution. Unlocking innovation is essential so that UK businesses remain resilient and can grow in a changing world with difficult trading conditions, whilst also boosting productivity, generating high value jobs, becoming greener and driving further advances in technology, medicine and energy.

Businesses, universities and policymakers each have a role to play in scaling up our research, innovation and education systems. However, the leading economies and industries of the future will not only have many researchers, entrepreneurs and healthy research and education budgets and incentives. They will be characterised by an effective web of connectivity between those that generate and disseminate ideas, and those making, designing, marketing and embedding new products, services and approaches.

Our analysis shows that the UK has a strong and resilient foundation of business-university collaboration from which to build. There were early signs of downturn during the Covid-19 pandemic, but this report demonstrates the resilience of collaboration in rebounding from disruption. Despite ongoing economic pressures, organisations continue to prioritise the networks and partnerships that bring a wealth of benefits to all those involved.

This year’s State of the Relationship report provides important insights into collaboration trends. Our Collaboration Progress Monitor shows continued growth in university-commercialisation and increases in degree apprenticeships and internships. It also shows increases in the numbers of interactions between universities and business since the Covid-19 pandemic, with the number of SME interactions rising by 4% between 2020/21 and 2021/22. Whilst this growth is positive, further efforts may be needed to revitalise and stimulate university-SME collaborations to reach and exceed pre-pandemic levels.

Contract research with SMEs appears to have become a more important method of collaboration with universities, exceeding consultancy. Drawing on insights from across our members and stakeholder community, this report investigated the resilience of collaboration.

First, we demonstrated the remarkable recent history of university-business collaboration, which has seen resilient and steady growth across most indicators of business-university collaboration and a significant surge in commercialisation activity.

Second, we presented case studies that demonstrate the multifaceted relationships that large businesses have with universities, the diverse commercialisation activities of universities, and also the innovative, impactful partnerships that universities across the UK are forming with SMEs.

Third, we examined the ways in which resilience is underpinned by a culture of continuous development in universities, as well as an ability to identify and sustain important activity, such as driving local growth and maintaining global partnerships.

The report concludes by reflecting on the role that universities and businesses are proactively playing to drive and anticipate the future, both in terms of driving major technological advancements and reforming education in partnership with employers. We also comment on the policy context generated by the welcome move to create a single Department for Science, Innovation and Technology.

What this report highlights most acutely is that universities and businesses are moving towards the ambitions set out in a series of reviews of collaboration in the early 2000s in the UK, and have built a stable, resilient, and gradually growing foundation for a wide breadth of collaborative activities. However, the UK’s ambitions for the future are bolder still. The opportunities from research and innovation are there for the UK to grasp. Seizing the opportunities will require bold and ambitious leadership, unwavering political will in concert with corporate and institutional drive. This is not a moment for minor interventions, but for the adoption of collaborative leadership models that maximise the full levers across the R&D system including government, industry and academia.

NCUB is proud to play our role in that mission, by making the UK the lead destination for university-business collaboration.
Appendix A: Collaboration progress monitor data tables

Table 1: Collaboration Progress Monitor on Research and Innovation: Collaboration activity, investment in collaboration, and products of collaboration, UK-wide.

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>2019/20</th>
<th>2020/21</th>
<th>2021/22</th>
<th>Relative difference from 2021 to 2022</th>
<th>Annual growth rate (2017-2022)</th>
<th>5-Year Average (2017-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE income from business collaboration (excl. IP) as percentage of grand total income</td>
<td>37.6%</td>
<td>35.4%</td>
<td>37.0%</td>
<td>1.6%</td>
<td>-0.6%</td>
<td>37.5%</td>
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<tr>
<td>Business Funds in HE</td>
<td>6.6%</td>
<td>6.6%</td>
<td>7.1%</td>
<td>0.5%</td>
<td>1.6%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Overseas Funds in HE</td>
<td>9.9%</td>
<td>9.2%</td>
<td>9.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>9.1%</td>
</tr>
<tr>
<td>HEI interactions with SMEs</td>
<td>5,100</td>
<td>5,032</td>
<td>5,000</td>
<td>0.1%</td>
<td>0.0%</td>
<td>5,000</td>
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<tr>
<td>Total income from interactions with SMEs (2000)</td>
<td>£2,303,175</td>
<td>£2,314,804</td>
<td>£2,355,001</td>
<td>10.6%</td>
<td>0.1%</td>
<td>£2,425,356</td>
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<tr>
<td>HEI interactions with large business</td>
<td>23,059</td>
<td>24,320</td>
<td>26,701</td>
<td>7.3%</td>
<td>0.5%</td>
<td>26,055</td>
</tr>
<tr>
<td>Total income from interactions with large businesses (2000)</td>
<td>£7,232,255</td>
<td>£6,866,194</td>
<td>£7,925,255</td>
<td>15.5%</td>
<td>1.4%</td>
<td>£7,441,918</td>
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<tr>
<td>Number of Innovate UK academic grants</td>
<td>705</td>
<td>938</td>
<td>821</td>
<td>-12.3%</td>
<td>-2.6%</td>
<td>866</td>
</tr>
<tr>
<td>5-Year average UK academic grant (£000)</td>
<td>£213,916</td>
<td>£285,012</td>
<td>£264,000</td>
<td>-10.5%</td>
<td>4.3%</td>
<td>£332,653</td>
</tr>
<tr>
<td>10. Licences granted</td>
<td>12,984</td>
<td>17,466</td>
<td>21,716</td>
<td>55.3%</td>
<td>22.3%</td>
<td>26,156</td>
</tr>
<tr>
<td>11. Income from licensing (£000)</td>
<td>£484,449</td>
<td>£294,880</td>
<td>£849,101</td>
<td>187.9%</td>
<td>53.9%</td>
<td>£392,150</td>
</tr>
<tr>
<td>12. Patents granted</td>
<td>10,763</td>
<td>14,054</td>
<td>14,549</td>
<td>3.5%</td>
<td>-5.9%</td>
<td>14,948</td>
</tr>
<tr>
<td>13. Academic spin-outs</td>
<td>237</td>
<td>195</td>
<td>181</td>
<td>-7.2%</td>
<td>-5.7%</td>
<td>220</td>
</tr>
</tbody>
</table>

Source: NCUB based on HEA (2023) and UKRI Innovate UK grants (2023). Notes as in Table 2.

Table 2: Collaboration Progress Monitor (CPM) on Research and Innovation: Collaboration activity, investment in collaboration, and products of collaboration, by UK country

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>2019/20</th>
<th>2020/21</th>
<th>2021/22</th>
<th>Relative difference from 2021 to 2022</th>
<th>Annual growth rate (2017-2022)</th>
<th>5-Year Average (2017-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE income from business collaboration (excl. IP) as percentage of grand total income</td>
<td>37.7%</td>
<td>38.1%</td>
<td>36.3%</td>
<td>1.8%</td>
<td>-0.4%</td>
<td>37.3%</td>
</tr>
<tr>
<td>Business Funds in HE</td>
<td>5.3%</td>
<td>5.4%</td>
<td>5.8%</td>
<td>0.4%</td>
<td>1.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Overseas Funds in HE</td>
<td>9.6%</td>
<td>9.2%</td>
<td>7.1%</td>
<td>-0.4%</td>
<td>0.1%</td>
<td>7.9%</td>
</tr>
<tr>
<td>HEI interactions with SMEs</td>
<td>36,158</td>
<td>37,907</td>
<td>37,177</td>
<td>4.3%</td>
<td>-1.7%</td>
<td>36,101</td>
</tr>
<tr>
<td>Total income from interactions with SMEs (2000)</td>
<td>£1,094,490</td>
<td>£1,144,660</td>
<td>£1,178,860</td>
<td>10.9%</td>
<td>0.3%</td>
<td>£1,184,216</td>
</tr>
<tr>
<td>HEI interactions with large business</td>
<td>18,168</td>
<td>17,488</td>
<td>19,264</td>
<td>10.3%</td>
<td>-2.5%</td>
<td>19,264</td>
</tr>
<tr>
<td>Total income from interactions with large businesses (2000)</td>
<td>£62,173</td>
<td>£58,539</td>
<td>£69,455</td>
<td>16.8%</td>
<td>1.6%</td>
<td>£67,702</td>
</tr>
<tr>
<td>Number of Innovate UK academic grants</td>
<td>609</td>
<td>796</td>
<td>647</td>
<td>-15.3%</td>
<td>-3.5%</td>
<td>759</td>
</tr>
<tr>
<td>5-Year average UK academic grant (£000)</td>
<td>£262,425</td>
<td>£233,613</td>
<td>£282,995</td>
<td>10.7%</td>
<td>-0.4%</td>
<td>£280,449</td>
</tr>
<tr>
<td>10. Licences granted</td>
<td>13,880</td>
<td>14,205</td>
<td>14,500</td>
<td>4.3%</td>
<td>-3.0%</td>
<td>14,905</td>
</tr>
<tr>
<td>11. Income from licensing (£000)</td>
<td>£158,385</td>
<td>£164,305</td>
<td>£210,562</td>
<td>23.3%</td>
<td>9.0%</td>
<td>£175,217</td>
</tr>
<tr>
<td>12. Patents granted</td>
<td>1,763</td>
<td>1,689</td>
<td>1,422</td>
<td>-22.1%</td>
<td>2.2%</td>
<td>1,569</td>
</tr>
<tr>
<td>13. Academic spin-offs</td>
<td>1,050</td>
<td>1,025</td>
<td>1,093</td>
<td>6.6%</td>
<td>7.3%</td>
<td>940</td>
</tr>
</tbody>
</table>

Source: NCUB based on HEA (2023) and UKRI Innovate UK grants (2023). Notes as in Table 2.

Table 3: Collaboration Progress Monitor (CPM) on Research and Innovation: Collaboration activity, investment in collaboration, and products of collaboration, by region

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Scotland</th>
<th>England</th>
<th>N. Ireland</th>
<th>5-Year Average (2017-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE income from business collaboration (excl. IP) as percentage of grand total income</td>
<td>37.6%</td>
<td>37.1%</td>
<td>36.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Business Funds in HE</td>
<td>0.9%</td>
<td>0.9%</td>
<td>0.9%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Overseas Funds in HE</td>
<td>1%</td>
<td>0%</td>
<td>1.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>HEI interactions with SMEs</td>
<td>12,069</td>
<td>14,054</td>
<td>14,549</td>
<td>3.5%</td>
</tr>
<tr>
<td>Total income from interactions with SMEs (2000)</td>
<td>£33,304</td>
<td>£31,284</td>
<td>£35,850</td>
<td>14.0%</td>
</tr>
<tr>
<td>HEI interactions with large business</td>
<td>5,738</td>
<td>6,084</td>
<td>6,191</td>
<td>1.5%</td>
</tr>
<tr>
<td>Total income from interactions with large businesses (2000)</td>
<td>£17,981</td>
<td>£10,182</td>
<td>£10,007</td>
<td>1.1%</td>
</tr>
<tr>
<td>Number of Innovate UK academic grants</td>
<td>101</td>
<td>105</td>
<td>105</td>
<td>0%</td>
</tr>
<tr>
<td>5-Year average UK academic grant (£000)</td>
<td>£163,714</td>
<td>£160,494</td>
<td>£164,012</td>
<td>1.7%</td>
</tr>
<tr>
<td>10. Licences granted</td>
<td>492</td>
<td>471</td>
<td>435</td>
<td>-0.7%</td>
</tr>
<tr>
<td>11. Income from licensing (£000)</td>
<td>£6,712</td>
<td>£8,019</td>
<td>£5,951</td>
<td>8.5%</td>
</tr>
<tr>
<td>12. Patents granted</td>
<td>492</td>
<td>513</td>
<td>621</td>
<td>10.5%</td>
</tr>
<tr>
<td>13. Academic spin-offs</td>
<td>227</td>
<td>193</td>
<td>16</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

Source: NCUB based on HEA (2023) and UKRI Innovate UK grants (2023). Notes as in Table 2.

Table 4: Collaboration Progress Monitor (CPM) on Research and Innovation: Collaboration activity, investment in collaboration, and products of collaboration, by country

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Scotland</th>
<th>England</th>
<th>N. Ireland</th>
<th>5-Year Average (2017-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE income from business collaboration (excl. IP) as percentage of grand total income</td>
<td>35.7%</td>
<td>37.3%</td>
<td>34.1%</td>
<td>-3.2%</td>
</tr>
<tr>
<td>Business Funds in HE</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Overseas Funds in HE</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>HEI interactions with SMEs</td>
<td>789</td>
<td>939</td>
<td>737</td>
<td>11.8%</td>
</tr>
<tr>
<td>Total income from interactions with SMEs (2000)</td>
<td>£7,213</td>
<td>£8,209</td>
<td>£7,817</td>
<td>14.3%</td>
</tr>
<tr>
<td>HEI interactions with large business</td>
<td>768</td>
<td>943</td>
<td>947</td>
<td>0.4%</td>
</tr>
<tr>
<td>Total income from interactions with large businesses (2000)</td>
<td>£11,224</td>
<td>£16,090</td>
<td>£16,130</td>
<td>0.2%</td>
</tr>
<tr>
<td>Number of Innovate UK academic grants</td>
<td>26</td>
<td>37</td>
<td>36</td>
<td>0.6%</td>
</tr>
<tr>
<td>5-Year average UK academic grant (£000)</td>
<td>£108,812</td>
<td>£232,999</td>
<td>£474,070</td>
<td>4.6%</td>
</tr>
<tr>
<td>10. Licences granted</td>
<td>701</td>
<td>850</td>
<td>975</td>
<td>6.7%</td>
</tr>
<tr>
<td>11. Income from licensing (£000)</td>
<td>£2,101</td>
<td>£3,012</td>
<td>£2,678</td>
<td>-11.1%</td>
</tr>
<tr>
<td>12. Patents granted</td>
<td>701</td>
<td>850</td>
<td>975</td>
<td>6.7%</td>
</tr>
<tr>
<td>13. Academic spin-offs</td>
<td>102</td>
<td>102</td>
<td>102</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Source: NCUB based on HEA (2023) and UKRI Innovate UK grants (2023). Notes as in Table 2.
Table 3: Collaboration Progress Monitor on Skills and Talent: joint people development, employment levels, and readiness for work

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Description</th>
<th>2020/21 (or 2019/20, marked*)</th>
<th>2021/22 (or 2020/21, marked*)</th>
<th>Change 21-22 (20-21, marked*)</th>
<th>Annual average growth rate (2017-2022)</th>
<th>5-Year Average (2017-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Degree apprenticeships starts</td>
<td>Number of degree apprenticeship starts (level 6 and 7) in England.</td>
<td>39,200</td>
<td>43,230</td>
<td>10.3%</td>
<td>31.8%</td>
<td>29,248</td>
</tr>
<tr>
<td>2. Higher apprenticeship achievements</td>
<td>Number of Higher Apprenticeships provided by Universities in England, by apprenticeship achievements.</td>
<td>18,621</td>
<td>21,403</td>
<td>14.9%</td>
<td>6.6%</td>
<td>15,982</td>
</tr>
<tr>
<td>3. CPD/CE courses for business &amp; the community</td>
<td>Total learner days of Continuing Professional Development (CPD) and Continuing Education (CE) courses for business and the community, provided by HEIs in the UK. Total learner days</td>
<td>4,136,090</td>
<td>3,906,709</td>
<td>-5.5%</td>
<td>0.8%</td>
<td>4,032,726</td>
</tr>
<tr>
<td></td>
<td>Average annual learner days per HEI</td>
<td>19,323</td>
<td>20,327</td>
<td>5.2%</td>
<td>1.6%</td>
<td>19,562</td>
</tr>
<tr>
<td>4. Source of salary of HE staff</td>
<td>Percentage of all academic staff whose basic salary is: 'Wholly general financed by the HE provider'</td>
<td>77.9%</td>
<td>79.8%</td>
<td>1.9%</td>
<td>0.7%</td>
<td>78.2%</td>
</tr>
<tr>
<td></td>
<td>by 'UK industry, commerce and public corporations'</td>
<td>0.5%</td>
<td>0.5%</td>
<td>-0.04%</td>
<td>-5.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>5. Graduate employment (in %)</td>
<td>Percentage of UK-domiciled Undergraduate leavers who are in employment (full-time or part-time) in the UK, as a share of all Undergraduate leavers in the UK.</td>
<td>67.0%*</td>
<td>70.0%*</td>
<td>3.0%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>6. Postgraduate employment (in %)</td>
<td>as a share of all Postgraduate leavers in the UK</td>
<td>77.0%*</td>
<td>80.0%*</td>
<td>3.0%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>7. PhDs in employment (in %)</td>
<td>Percentage of UK-domiciled PhD graduates entering employment: working in HE</td>
<td>40.0%*</td>
<td>41.4%*</td>
<td>1.4%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>not working in HE (industry and other)</td>
<td>60.0%*</td>
<td>58.6%*</td>
<td>-1.4%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>8. HE leavers running own business</td>
<td>Number of UK-domiciled HE leavers that run their own business as an activity</td>
<td>5,060*</td>
<td>5,035*</td>
<td>-0.5%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>1.6%*</td>
<td>1.6%*</td>
<td>-0.05%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>9. Private sector staff inflow and outflow</td>
<td>Number of HE academic staff (research and teaching): inflow from private</td>
<td>5,605</td>
<td>7,915</td>
<td>41.2%</td>
<td>5.9%</td>
<td>6,334</td>
</tr>
<tr>
<td></td>
<td>outflow to private</td>
<td>1,490</td>
<td>2,160</td>
<td>45.0%</td>
<td>4.1%</td>
<td>1,817</td>
</tr>
<tr>
<td>10. HE leaver satisfaction</td>
<td>Percentage of HE leavers who are full-time employed and agree or strongly agree that they are currently utilising what they learnt during their studies: Undergraduate</td>
<td>69.0%*</td>
<td>67.0%*</td>
<td>-2.0%</td>
<td>NA</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Postgraduate</td>
<td>79.0%*</td>
<td>78.0%*</td>
<td>-1.0%</td>
<td>NA</td>
<td>N/A</td>
</tr>
<tr>
<td>11. HE leavers on an internship in the UK</td>
<td>Number of UK-domiciled HE leavers undertaking an internship in the UK</td>
<td>1,255*</td>
<td>930*</td>
<td>-25.9%</td>
<td>NA</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Postgraduate</td>
<td>205*</td>
<td>130*</td>
<td>-36.6%</td>
<td>NA</td>
<td>N/A</td>
</tr>
<tr>
<td>12. Undergraduate students on a sandwich course</td>
<td>Percentage of Undergraduate sandwich student enrolments in the UK as a share of all Undergraduate student enrolments.</td>
<td>24.1%</td>
<td>23.6%</td>
<td>-0.5%</td>
<td>-1.9%</td>
<td>25.1%</td>
</tr>
</tbody>
</table>

Notes: Apprenticeship achievement refers to “the number of learners who successfully complete the programme.”
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HELPING THE UK PROSPER, BY WORKING FOR THE UK TOGETHER

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