

Gateways to growth

Entrepreneurial Impact
Report 2023

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A brighter way

How UK universities can fuel economic growth and solve society's biggest challenges





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Foreword



Octopus has championed early-stage companies and their ability to change the world since 2008.

That's why we're one of Europe's most active investors in deep tech startups. Deep tech has enormous potential to shape the future, because deep tech businesses focus on significant innovation and scientific breakthroughs. They can disrupt industries and create entirely new markets.

Combating climate change, caring for an ageing population, and the next generation of industry will all require novel and transformational technology. We will need deep tech to help tackle some of the world's greatest challenges.

But how can we ensure the UK creates an environment where deep tech can flourish?

We know firsthand that universities are critical.

Universities lay the foundations for creating many deep tech companies, not just directly through spin-outs, but also in training and nurturing the next generation of minds.

It gives me great pleasure to introduce this report as a follow on from our 2020 report, "Spinning out success". We've worked with Ideas2Impact to update the Entrepreneurial Impact Ranking, revealing universities' success at turning their academic achievements into thriving companies.

Since our last report, it has become increasingly evident why spin-out businesses are vital to society. The race to tackle COVID-19 highlighted the power of academic institutions to mobilise, catalyse, and invent out of the box solutions to transform millions of lives.

The UK university system is a world-leader. It has an integral role in economic growth and fuelling innovation. Commercialisation of its research has also been on an upward trajectory over the last decade.

Yet spin-outs still face enormous challenges. Taking a blue-sky research idea through to mass market applications is no small feat. A university spin-out needs significant support over a prolonged period.

I hope that in celebrating the success of our universities, and drawing attention to some of the challenges, this report can highlight the need for strong and effective partnerships between entrepreneurs, financiers, regulators, and corporations — so that together we can translate research into world-changing businesses.

With a co-ordinated, long-term commitment to supporting deep tech research in universities, spin-outs can deliver unprecedented benefits to the economy. Only this way can we build a sustainable planet, revitalise healthcare, and empower people to live better lives.

Amy Nommeots-Nomm, PhD
Octopus Ventures

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Why spin-outs matter more than ever

We need deep tech to solve the world's biggest problems

When the world has faced its toughest and most complex challenges, researchers have found ways to solve them.

Research must find its way into mass market applications to create a lasting impact.

Spin-outs are an important way in which this research moves from the academic sphere into our everyday lives. These businesses are formed when technologies developed within a university environment are de-risked to the point where they transition from “research” to “development”. This is usually punctuated by an inflow of private capital. Spin-outs typically have a co-ownership structure between the academics and researchers who created the technology, and the university which incubated them.

Spin-outs have proven extremely successful in delivering step change.

Most recently, COVID-19 threatened life as we knew it. Yet mRNA vaccines, formed by years of university medical research, offered a solution. Oxford spin-out, Vaccitech, and Johannes Gutenberg University Mainz spin-out, BioNTech, developed the technology behind the AstraZeneca and Pfizer vaccines. Built over more than two decades of research, they resoundingly confirmed the importance of universities as the origin of world-changing ideas.

Universities, and the businesses emanating from them, will only become more important as the world faces an ever-growing number of crises. We no longer have the luxury of looking for incremental improvements to problems like climate change, food security, effective healthcare, or sustainable industry. Transformational solutions to these challenges are needed, and needed at scale, to secure quality of life for generations to come. Spin-outs have the ability to deliver those transformational solutions.

We can lead a deep tech revolution

Universities are the home of big ideas and individuals who can seek answers to even the most challenging questions. They are important sources of innovation and crucial to the economy. According to the most recent data available, Universities in the UK contributed £95 billion to the economy and supported more than 815,000 jobs in 2018-19.¹

This impact has the potential to be even greater. In the UK and Europe, the spotlight on spin-outs has grown particularly intense. Europe is a continent that missed out on a huge technology wave that brought about American giants such as Google. Over the past twenty years, Europe has made it a priority to not make the same mistake again.

The next wave of technological advancement and the next economic shift is being led by scientific innovation. Think semiconductors, biotechnology, and artificial intelligence. Universities are at the epicentre of this revolution and it is imperative that they are supported.

Spin-outs drive long-term economic growth in the UK

The UK is a hotbed of research excellence and provides a solid foundation for deep tech innovation.

It has a tremendous positive impact on the economy when this research is spun out of our research institutions.

In the UK, for every £1 invested in research, the government sees around £3.60 in terms of economic benefit.² On average, the Higher Education Institutions Initiative features as a co-applicant on 69% of UK Intellectual Property filings.³ And in 2020/21, businesses spun out from Russell Group universities created 33,000 jobs and brought in £4.9 billion of investment.⁴

All of this is achieved with relatively less funding than our peers. UK funding for research and development is around 2.4% of GDP⁵, while the United States, Germany, South Korea, Israel, and Japan, are already investing more than 3% of GDP.⁶

If we can continue to create effective pathways for commercialisation, our universities can continue to have a disproportionate impact in shaping a better future for society.

“The next wave of technological advancement and the next economic shift is being led by scientific innovation. Think semiconductors, biotechnology, and artificial intelligence.”

The Entrepreneurial Impact Ranking 2022

Methodology

The Entrepreneurial Impact Ranking is calculated according to the most crucial indicators that influence spin-out activity at universities. These are disclosures, patents, spin-outs created, and subsequent financial transactions associated with exits. The exiting of spin-out companies is fundamental to how well universities perform in the ranking. The wide variation in resources available to each of the universities is taken into account and weighted according to the funding inputs received by each institution. Building successful spin-out companies is a matter of patience, so the ranking uses the latest available data from a decade long-period, sourced from the Higher Education Statistics Agency. This approach emphasises long-term performance.

“Building successful spin-out companies is a matter of patience”

Rank	University	Movement since 2020 Report
1	The University of Dundee	↑4
2	The Queen's University Belfast	↓1
3	The University of Cambridge	↓1
4	Cardiff University	↓1
5	University College London	↑9
6	The University of Oxford	↑1
7	King's College London	↑3
8	The University of Leeds	↓2
9	University of Nottingham	↓1
10	Edinburgh Napier University	↑32
11	Imperial College of Science, Technology and Medicine	0
12	The Institute of Cancer Research	↑24
13	The University of York	↓4
14	The University of Surrey	↑24
15	The University of Aberdeen	↓2
16	The University of East Anglia	↑9
17	The University of Strathclyde	↑6
18	The University of Glasgow	↑3
19	The University of Liverpool	↑12
20	Queen Mary University of London	↓16
21	The University of St Andrews	n/a
22	The University of Sunderland	↓2
23	The University of Salford	↑1
24	The Nottingham Trent University	↑8
25	University of Durham	↓6
26	University of Ulster	↓10
27	The University of Bradford	↓5
28	University of South Wales	↓11
29	The University of Bristol	↓17
30	Royal Holloway and Bedford New College	↓15
31	The University of Portsmouth	↑49
32	Royal College of Art	↑8
33	The University of Manchester	↓15

Rank	University	Movement since 2020 Report
34	The University of Bath	↓5
35	The University of Birmingham	0
36	The University of Southampton	↓2
37	Loughborough University	↓9
38	The University of Kent	↑22
39	The University of Warwick	↓13
40	The University of Edinburgh	↑22
41	Glasgow Caledonian University	↓11
42	Newcastle University	↑25
43	The University of Exeter	↓10
44	The University of Sussex	↑28
45	The University of Leicester	↓18
46	The University of Essex	↑40
47	Swansea University	↑24
48	Coventry University	↓11
49	The University of Sheffield	↑17
50	University of the Arts, London	↑11
51	University of Plymouth	↓12
52	Oxford Brookes University	↓11
53	Staffordshire University	↓7
54	The University of Central Lancashire	↑1
55	The University of Wolverhampton	↓10
56	De Montfort University	↑1
57	The University of the West of Scotland	↑2
58	St George's Hospital Medical School	↓15
59	City, University of London	↓7
60	The Robert Gordon University	↓13
61	University of the West of England, Bristol	↓8
62	The University of Huddersfield	↑2
63	Brunel University	↓5
64	The Royal Veterinary College	↓15
65	Aston University	↓11
66	Cranfield University	↓10
67	University of Hertfordshire	↑2

Rank	University	Movement since 2020 Report
68	Middlesex University	↓20
69	University of Northumbria at Newcastle	↑7
70	Falmouth University	↓7
71	Heriot-Watt University	↓6
72	Liverpool John Moores University	↑3
73	Aberystwyth University	0
74	Bangor University	↓30
75	The University of Northampton	↑18
76	Birmingham City University	↑2
77	Keele University	↓7
78	University of Wales Trinity Saint David	↑19
79	The University of Greenwich	↑2
80	Sheffield Hallam University	↓1
81	The University of Hull	↓31
82	The Manchester Metropolitan University	↓31
83	Birkbeck College	↑2
84	Kingston University	n/a
85	London South Bank University	↑2
86	Roehampton University	↓3
87	Anglia Ruskin University	↑4
88	The University of Lincoln	↑1
89	The University of Bolton	↑6
90	Bournemouth University	↓22
91	The Open University	↓9
92	The University of Westminster	↓8
93	University of Bedfordshire	↑6
94	Goldsmiths College	↑2
95	The University of Reading	↓18
96	The University of East London	n/a
97	Wrexham Glyndŵr University	↑1
98	The University of Brighton	↓6
99	The University of Stirling	↑1
100	University of Derby	n/a

An evolving ecosystem

Growing exits and research funding

The UK's universities continue to build upon the milestones set in 2018/19 when a record £61 million worth of university shares in spin-outs were sold. In all three of the years we have analysed since our last report (2019/20, 2020/21, and 2021/22), sales of shares from spin-out companies have broken the historic record. Remarkably, the peak of the three years under analysis was during the height of COVID-19, where the sales of shares in spin-outs totalled £87 million for the 2020/21 year.

At the same time, private sector research funding into UK universities has reached record highs, with 2021/22 being the highest ever, totalling more than £1.5 billion. Public sector research funding also hit a record high in the same year at more than £1.8 billion.

A new leader emerges

A new leader has risen to the summit of the Entrepreneurial Impact Ranking — the University of Dundee has an incredibly high average exit value for its spin-out companies, which saw it rise through the rankings to a top five spot in our previous report. With recent successes such as the £2.2 billion IPO of Exscientia on the US NASDAQ — one of the largest ever UK university exits — and the oversubscribed £38 million Series B funding round of Amphista Therapeutics, it has claimed the top spot this year. Both these spin-outs are life sciences companies, proving Dundee's status as a leader of innovation in the space.

Excellence outside of the golden triangle

The top two performers, and 60% of the top ten, lie outside of the golden triangle. This highlights that the academic strengths needed for deep tech success stories are distributed across the UK. It also shows the potential for deep tech innovation to form part of the broader levelling up agenda, by harnessing local pockets of excellence to help the whole of the UK flourish through high value job creation and economic growth.

Queen's University Belfast (QUB) is one such institution which is regarded as leaders in the community. Its ongoing commitment to commercialisation led to them announcing the creation of their 100th spin-out.⁷ In our last report we conducted a deep dive into QUBIS, a wholly owned subsidiary of QUB, which turns high-quality academic research into high-impact commercial innovation. QUB have become advocates for sharing best practices, through their leadership in the North by North West consortium. The consortium delivers customer discovery programmes for early-stage University-based teams and has a regional emphasis, covering North of England, Scotland and Northern Ireland.

Cardiff University has also been a strong performer. In 2021, it became the newest member of the SETsquared partnership. The partnership works across six institutions in the Southwest to support the entrepreneurial ecosystem. SETsquared member businesses have raised £3.9 billion of private and public investment over the last 20 years, with 70% of this investment being in the last five years.

A core group forming

A core group of universities are consistently producing excellent results.

As you would expect, the Universities of Oxford and Cambridge are important contributors to the UK's deep tech and innovation ecosystem. Between 2019-2022, Cambridge created 32 spin-out companies and had exit sales totalling just under £35 million. A recent highlight for Cambridge was the sale of Flusso for £28 million.

Oxford sold £21.9 million worth of shares in existing spin-out companies, and the \$405 million acquisition of MiroBio by Gilead Sciences was a clear highlight for the team at Oxford.

Another standout performer is University College London (UCL). UCL created 18 spin-out companies, in the 2019-2022 period, and sold shares worth more than £45 million in existing companies. A highlight for UCL was life sciences firm, Autolus, receiving \$250 million investment from Blackstone Life Sciences in 2021.

Imperial College London, a well-known contributor to the UK's deep tech ecosystem, generated £28.7 million from sales in shares of its spin-out companies. It also created an additional 31 companies. AstraZeneca's \$195 million investment into VaxEquity was a highlight for Imperial.

The challenges and opportunities for deep tech

The current environment has never felt more complex for the university ecosystem. The deep tech innovation cycle is long, and requires continuity, support, and long-term vision. Right now, universities — and the spin-outs they create — are facing several pressing issues.

Hurdles in research

The UK academic community has been disproportionately affected by the outcomes of Brexit. The ending of many European funded research grants and Regional Development Funds, academics leaving, and uncertainty around the UK's future membership of the EU's Horizon funding scheme, have exacerbated challenges in the ecosystem. At the time of writing this report, the government has guaranteed Horizon Europe grants until September 2023,⁸ but our inclusion into future Horizon programmes remains uncertain.

We've seen academics striking over pensions, short term contracts, and workloads, resulting in what some are calling the 'great resignation'. A report from the University and College Union (UCU) titled "UK Higher Education: A workforce in crisis", estimates that 60% of its members are likely to leave the university ecosystem within the next five years.⁹

In the last twelve months, PhD students and researchers around the world have been striking due to stipend and salaries, lack of mental health support, and career security. A study by The Royal Society found that only 3.5% of students

that complete a PhD secure a permanent research position at a university. Of that number, only 12% (or 0.45% of the total) become a professor.¹⁰

Post-Brexit, EU citizens were no longer eligible for funding through the UK research councils, resulting in EU students falling under the international tuition fee bracket. This has led to a significant shortfall in funding opportunities for European talent. Combined with other factors, this has led to anecdotal reports of unfilled PhD and post-doctorate positions across top tier academic research groups in the UK.

Due to the length of the deep tech innovation cycles, the effects of these pressures on the research community and spin-out outcomes are yet to be seen. Regardless, the shortfall in available talent to fill academic positions should concern us. Entrepreneurship is a credible and exciting alternative to the traditional academic career path where PhD students and postgraduates can excel. With appropriate training, innovation fellowships, and translational funding, there is an opportunity waiting to be unlocked.

Period of uncertainty

Deep tech companies are founded based on years of research conducted by talented individuals. Iterative gains are built upon year after year until the resulting technology is robust enough to seek external investment.

During COVID-19, universities experienced an unprecedented time of uncertainty. Some academics pivoted their research to strive towards the common goal of fighting the pandemic. This is a testament to their intellectual capability. However, nearly

all non-COVID focused research labs were forced to close. Experiments were halted in some institutions for between three and six months, disrupting the education and research of masters and PhD students, and postdoctoral researchers.

When researchers were able to return to the lab, social distancing was implemented to keep researchers safe, resulting in reduced productivity. There is anecdotal evidence from the community that they are starting to see the effects of this period on invention disclosures and spin-out numbers. However, we are yet to see an impact within the Entrepreneurial Impact Ranking.

COVID-19 vaccine success has shown that academic research can be commercialised and scaled quickly when motivations are aligned. Historically, academic success measures have been aligned with grants, high impact papers, and the parameters stipulated by the Research Excellence Framework (REF). Today there is a debate around what qualifies as "impact", if the effect of the academic publishing cycle on research, and paywalls for publicly funded research are fair. Within this debate, and partly driven by COVID-19 success stories, commercialisation of technology is starting to be reframed as an opportunity rather than a distraction from core academic activities.

Motivated by a desire to see real-world impact from their research, we are seeing increasing numbers of PhD students and early career researchers taking part in accelerator and entrepreneurship development programmes, such as ICURe, SETsquared, and Conception X. As such, entrepreneurship is becoming a more widely recognised career path for researchers. We hope this shift to an entrepreneurial, impact-driven mindset will result in the creation of more spin-outs in the years to come.

Talent distribution

During COVID-19, there was a short-term halt to spontaneous interactions and networking events. This created a barrier to entry for angel investors and advisors to meet budding startups. Following the pandemic, there has been a positive shift in communication methods through the rise of digital-first interactions. Not only has this enabled employees to work more flexibly, resulting in an opportunity for talent to be more evenly distributed across the country, but it has also created an opportunity to improve relationships between London-centric investors and universities across the UK. This has the potential to create stronger and more fruitful connections between every stakeholder within the community, regardless of geography.

The broader technology ecosystem is facing a time of uncertainty. The peak valuations of 2020-22 are in the past and, due to redundancies, there is an abundance of tech talent seeking their next opportunity. It is imperative that these people are kept in the UK. Retaining and recycling leading talent is something the Cambridge ecosystem has managed phenomenally well since the foundation of Cambridge Consultants in the 1960s. It has led to Cambridge often being cited as one of the world's leading innovation ecosystems.

We see the current economic climate as a huge opportunity to build some of the greatest deep tech companies of our time. There will be a wealth of talent available, with people who have lived and breathed the startup life looking for their next challenge as advisors, co-founders, or C-suite employees for the next generation of university spin-outs.

Availability of space

Deep tech spin-outs commonly rely on innovative manufacturing processes and complex analytical techniques to develop technology. For them to grow, they need infrastructure and specialised facilities which support their needs. Currently there is a shortage of available lab space, with a recent Financial Times article citing that, in June of 2022, Oxford and Cambridge saw the number of available lab spaces reduced to zero.¹¹

Some venture capital funds are taking on this problem themselves. Science Creates in Bristol and OSE in Oxford are leading the charge on optimised rental space for budding startups. In addition, as part of the Government's £14.9 billion investment in R&D, they have committed £500 million to provide world-class lab space to help unlock UK researchers' full potential.¹²

In researching this report, institutions outside the golden triangle voiced a key challenge in trying to retain spin-outs in their regions. This is often difficult due to a lack of local talent, space and infrastructure they need as they scale. If capital can be unlocked for lab spaces and positioned in line with regional development opportunities, there is the potential to create new clusters of excellence across the UK.

“We see the current economic climate as a huge opportunity to build some of the greatest deep tech companies of our time.”

Availability of capital

Speaking to commercialisation leaders across the UK, many name their biggest challenges as the availability of funds to hire and retain technology transfer staff, and the availability of capital for early-stage translational funding.

Technology transfer offices are a crucial resource in the ecosystem, acting as the conduit between academics, industry, and investors. Continued support for their funding, training, and retention is key.

UK universities' main purpose is education and research, exemplified by the teaching and research excellence frameworks. At less well funded institutions, finding the resources to hire and retain supporting staff, such as technology transfer specialists, can be challenging.

In the last few years, this has been changing with some funds being made available through the devolved nations, and entrepreneurship and commercialisation becoming embedded as core pillars of university values, leading to a greater allocation of internal funding. At many institutions this has been driven by spin-out success stories, which have highlighted the potential of both financial and cultural wins from embedding entrepreneurship within the university's ethos.

In the last two years, we've seen a rise in the amount of capital available to invest in spin-outs. Northern Gritstone's £245 million mandate¹³ to deploy capital across spin-outs from Manchester, Leeds, and Sheffield, and Mindforge's intention to raise a fund to deploy across the Midlands, are exciting developments. In July, we saw the announcement by the UK government that it will unlock 5% of UK pension capital for investment into high growth companies.¹⁴

Increasing capital and talent availability will create new opportunities for growth across the whole of the UK.

Working together for success

To create success, we need to unite and galvanise the bright minds that can instigate change. We need forward thinking and clear government strategies, commitment and clarity on funding models, and motivated and informed investors.

The government has shifted gears and placed a greater emphasis on the deep tech ecosystem. TenU's work to create unified guidance for technology transfer offices and founders has helped align expectations between competing motivations. In addition, the Government is currently conducting a review of university spin-outs, with best practice to be published. The ongoing debate around what constitutes an appropriate founder/university equity split is not the only aspect to be considered; funding availability for translational research, market analysis and patents, the timeline from ideation through to spin-out, and a supportive investor base with available capital all need to be factored into this review.

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Building an environment for spin-out success

The significant returns in venture capital are driven by outliers. In the same way, all the deep tech ecosystem can need is one spark, one brilliant idea to enable the technology of tomorrow.

But what is needed to support these world-changing moments is a continuous and best-in-class support structure. That includes a consistent government strategy, fair regulatory environments, sufficient research and translational funding, support for technology transfer offices, and a willing investor base.

Across the UK, we have pockets of academic strength within every university, phenomenal research groups, and individuals with world-leading capability. The next major development in technology could come from any one of our institutions. This is why broad and consistent support is so important.

The deep tech ecosystem has faced immense challenges over the last five years, and we are yet to see the full impact of these headwinds. Yet with collaboration and communication, we can strive to mitigate them.

Spin-outs are essential for economic growth and deep tech is a proven route to creating value and securing jobs for the future. Building success hinges on effective cooperation toward shared goals, as well as the prioritisation of deep tech within our universities and the wider ecosystem.

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