

UK universities in the innovation ecosystem

Universities in the UK

Higher education in the UK is provided by a range of institutions, known collectively as higher education institutions (HEIs). In 2014–15 there were 164 higher education providers in the UK including over 130 universities which received public funding through the UK funding councils.

Many of these universities are internationally known, with global reputations based on research excellence and high quality teaching. UK universities are independent legal entities, with councils or governing bodies responsible for strategy and monitoring financial health. Universities guard their autonomy and their reputation for intellectual and academic freedom. Their autonomy is considered a central factor in the UK higher education sector's record of international success in research, scholarship and education.

Higher education policy is developed separately by the government bodies in each of the four countries making up the UK - England, Scotland, Wales and Northern Ireland. However, these bodies have no direct role in determining courses or directing research undertaken by individual academics.

Students and staff

In 2015–16 there were 2.28 million students studying at UK higher education institutions:

- Undergraduate: 1.75 million
- Postgraduate: 532,970
- Full time: 1.7 million
- Part time: 540,285
- Students from the UK: 1.84 million
- Students from the EU: 127,440
- Students from non-EU countries: 310,575

There were nearly 500,000 staff:

- Academic staff: 201,380
- Non-academic staff: 208,750

Figure 1

Universities have a major economic impact for the UK. In 2011–12, universities generated more than £73 billion for the economy. Their contribution to UK GDP was £39.9 billion (2.8%) with export earnings of £10.7 billion and 757,268 jobs (full-time equivalent) created either directly or indirectly.

Universities' income comes from a variety of public and non-public sources. In 2014-15 only 26% came from direct government sources:

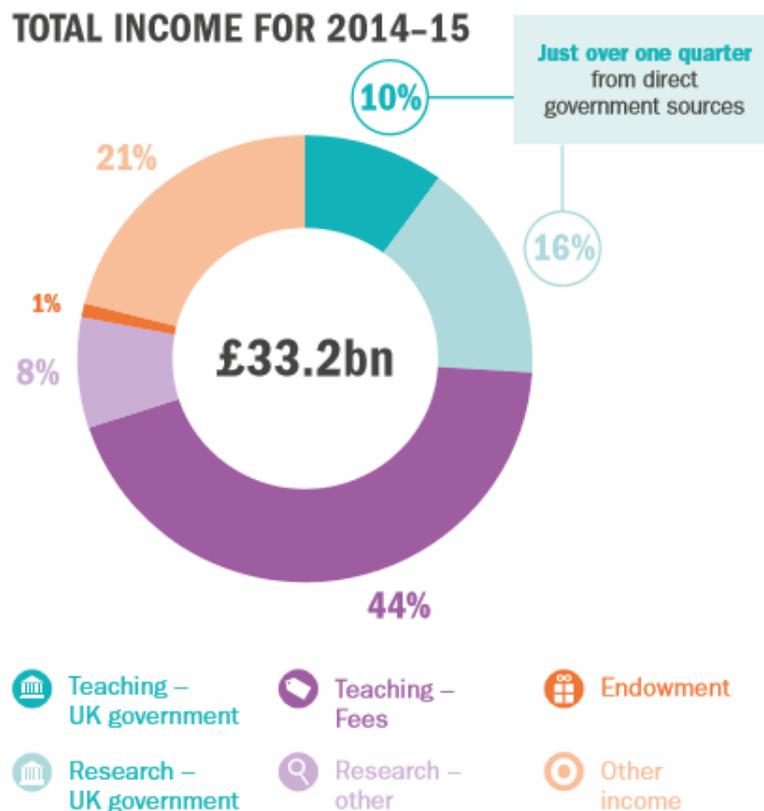


Figure 2

In terms of research funding, two-thirds comes from government sources:

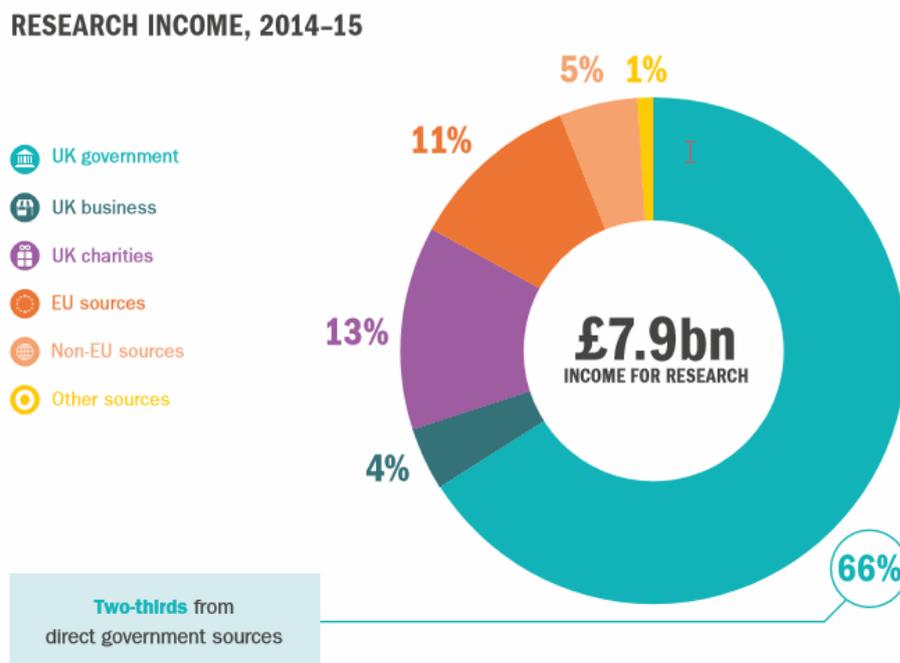


Figure 3

Currently, government funding for research is administered under a 'dual support' system. The Higher Education Funding Councils provide annual funding for institutions in the form of a 'block grant' (for 2016-17 this was £1.6 billion in England), while the UK Research Councils provide funding for specific research projects and programmes, normally through a competitive bidding process. The block grant supports higher education institutions' research infrastructure and enables ground-breaking research in keeping with their mission. It is also known as 'quality-related research (QR) funding' because it is allocated on the basis of research quality. To assess the quality of research for funding purposes, the Funding Councils, run a periodic assessment exercise. The most recent was the Research Excellence Framework (REF 2014).

Universities and innovation

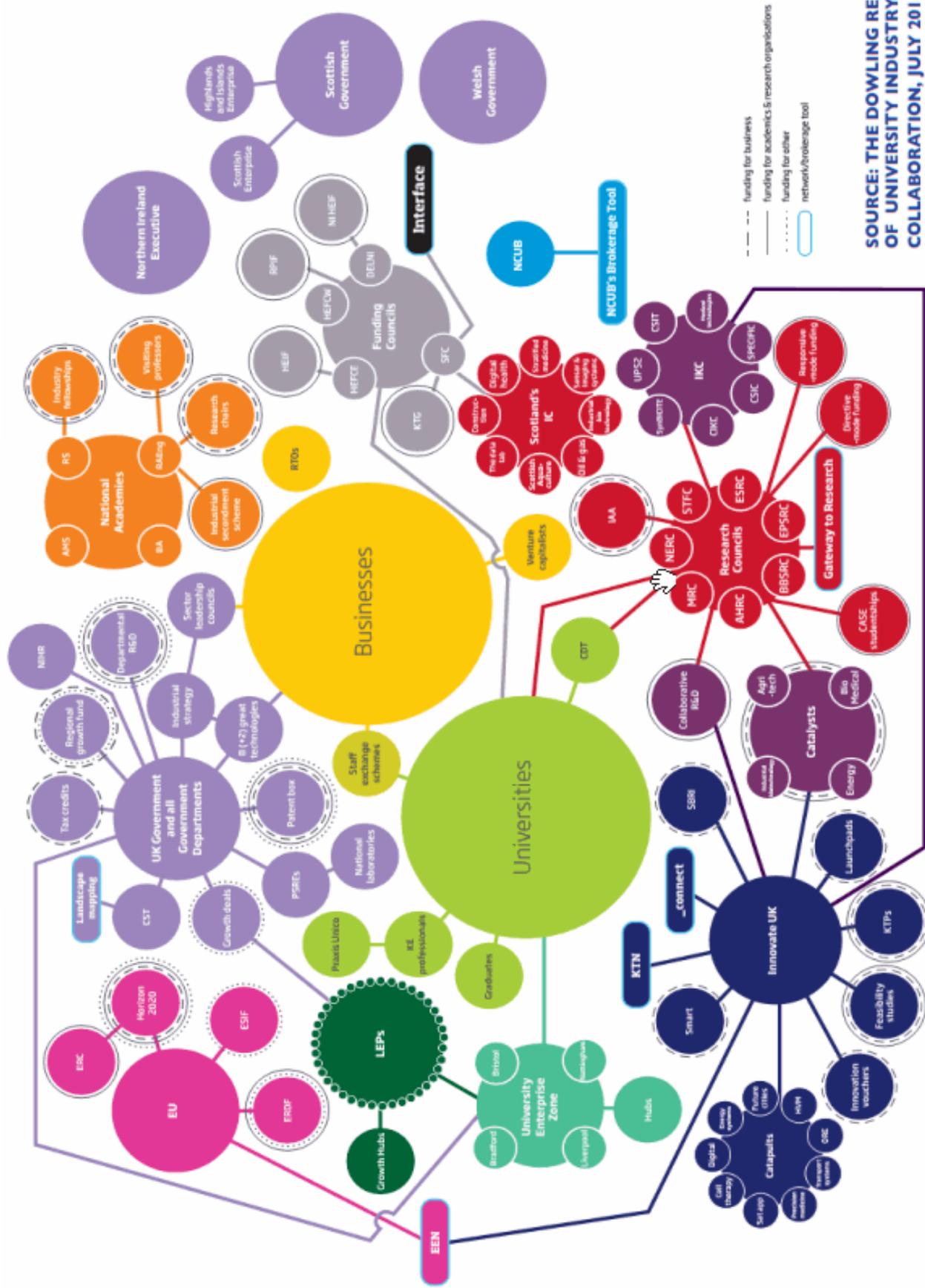
Universities produce two vital ingredients for innovation – world class research and highly skilled human capacity. Over the last 15 years, there has been an increasingly strong UK government focus on how universities' contribution to the innovation process might be maximised. Universities and businesses are the two largest and most important players in the UK's innovation system (*figures 5,6*) and over the last two decades there have been a series of government commissioned reviews (*figure 4*) investigating the complex links and relationship between the two and how these might be made more effective and better supported through a variety of policy initiatives and infrastructure development.

Reports relating to universities, research & business

- 2003 Review of Business-University Collaboration ('Lambert' Review)
<http://www.ncub.co.uk/reports/lambert-review.html>
- 2007 The Race to the Top. A Review of Government's Science and Innovation Policies ('Sainsbury' Review)
http://www.rsc.org/images/sainsbury_review051007_tcm18-103118.pdf
- 2012 Review of Business-University Collaboration ('Wilson' Review)
<https://www.gov.uk/government/publications/business-university-collaboration-the-wilson-review>
- 2013 Encouraging a British Invention Revolution: Review of Universities and Growth (Witty Report)
<https://www.gov.uk/government/publications/universities-and-growth-the-witty-review>
- 2015 Dowling Review of Business-University Research Collaborations
<https://www.gov.uk/government/publications/business-university-research-collaborations-dowling-review-final-report>
- 2015 Ensuring a successful UK research endeavour ('Nurse' Report)
<https://www.gov.uk/government/publications/nurse-review-of-research-councils-recommendations>

Figure 4

The UK innovation ecosystem



SOURCE: THE DOWLING REVIEW OF UNIVERSITY INDUSTRY COLLABORATION, JULY 2015

Figure 5

The UK's innovation ecosystem is highly complex. Important players are:

Innovate UK

Innovate UK is the UK's innovation agency and in 2014/15 had a budget of £536 million. Its aim is to 'fund, support and connect innovative businesses to accelerate sustainable economic growth'. It is responsible for the network of Catapults and runs a range of programmes that support business innovation, from the 'connect' open innovation network to 'Collaborative R&D' funding aimed at solving specific technical or societal challenges.

Research Councils

The seven UK Research Councils invest around £3 billion annually in research across the full spectrum of academic disciplines, from the life sciences to the physical sciences and engineering, the social sciences, and the arts and humanities. They support collaborative research through a variety of mechanisms.

Funding Councils

The Funding Councils are the bodies responsible for funding higher education. In England, this function is carried out by the Higher Education Funding Council for England; in Northern Ireland by the Department for Employment and Learning (DELNI); in Scotland by the Scottish Funding Council (SFC); and in Wales by the Higher Education Funding Council for Wales (HEFCW). In the 2015—16 academic year: the total HEFCE grant available is £3,971 million; HEFCW will allocate £154 million in funding for universities; the SFC will allocate £1,041 million to universities, and DELNI has a non-ring-fenced resource departmental expenditure limit for higher education, including teacher training, of £186.5 million.

Innovation Centres

Innovation Knowledge Centres are Research Council and Innovate UK-supported centres of excellence in specific technologies. Led by academic institutions, IKCs are intended to accelerate the commercialisation of world-class science and emerging technologies into new products, processes or services. Designed to foster collaboration and deliver competitive advantage to the businesses with whom they interact, IKCs possess expert knowledge and understanding of core science and technologies

PSREs

Government also funds a range of Public Sector Research Establishments (PSREs), such as the Met Office and National Physical Laboratory, many of which work collaboratively with businesses and universities.

National Centre for Universities and Business (NCUB)

NCUB is an independent and not-for-profit membership organisation that was created to promote, develop and support university-business collaboration across the UK.

Local Enterprise Partnerships are partnerships between local authorities and businesses that decide on priorities for investment in an area. They are also mandated to promote local innovation.

University Enterprise Zones (UEZs) are 'specific geographical areas where universities and business work together to increase local growth and innovation' through a partnership of LEPs, universities and others, alongside a package of business support from government.

Figure 6

Challenges and progress

The government reviews (*figure 4*) illustrate the challenges faced, as well as some of the progress made, as universities have moved to play a pivotal role in the UK innovation ecosystem. Some of the key questions for the UK have been about:

1. Research impact

How can the UK ensure that the research conducted in universities has the type of impact with potential to lead to innovation?

While UK academic research productivity is 3.6 times the world average (with just 4.1% of world's researchers, the UK produces 15.9% of the world's most highly-cited articles), this does not necessarily mean that research will feed in to innovation. The UK government has no direct control over the research conducted by universities and academics. However, it has sought to use funding as a way of encouraging certain types of research and shaping its focus on impact. In 2014 “impact” was included for the first time as an important measure for the Funding Council’s allocation of the block quality related grant to higher education institutions. The 2014 Research Excellence Framework (REF) defined impact as “an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia”.

The Research Councils (currently providing funding of around £3 billion per year) also emphasise that their priority is on funding research that has “impact on the growth, prosperity and wellbeing of the UK”.

2. Developing skills

How does the UK ensure that researchers and academics are equipped with the relevant skills, both to produce high impact research, and to translate that into innovation?

In 2002, the Roberts Review “SET for success. The supply of people with science, technology, engineering and mathematics skills” found that there was “*inadequate training – particularly in the more transferable skills – available during the PhD programme. As a consequence, many employers (view) ... the training (particularly in transferable skills) that PhD students receive as inadequate preparation for careers in business R&D*”.

(http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/d/robertsreview_introch1.pdf)

Following that report, the training for young researchers was reviewed and significantly developed. Current training puts much a greater emphasis on a range of transferable skills. The Researcher Development Framework (RDF), which is widely used to guide professional development of researchers, sets out to cover “the knowledge, understanding and skills needed to engage with, influence and impact on the academic, social, cultural and economic context” and includes, alongside research skills training:

- Working with others: collegiality, team-working, people management, supervision, mentoring, influence and leadership, collaboration, equality and diversity,
- Engagement and impact: teaching, public engagement, enterprise, policy, society and culture, global citizenship

3. Developing institutional cultures and systems

How will universities build internal systems and approaches to support their role in the innovation ecosystem?

One challenge is how universities convene different disciplines to work in multidisciplinary teams. The Nurse review commented “*Business problems are rarely focused on a single research discipline ... the natural sciences, technologies, and medicine, the creative disciplines of the arts and humanities, as well as the social sciences, have much to contribute to the commercial sector*”. A variety of different models have been developed within different universities to address this.

Additionally, universities’ role in the ecosystem has seen the development within the sector of knowledge exchange and commercialisation professionals whose role is to provide specialist expertise to support researchers and academics. PraxisUnico <https://www.praxisunico.org.uk/> is the national professional association.

4. University-business links

How can the links between businesses and universities be strengthened and supported?

While the links between universities and businesses has been an area of focus for successive governments, for universities this has long been a core area of their work. Added to their teaching and research missions, this “third stream” knowledge exchange activity is vitally important and generates substantial income (*figure 7*)

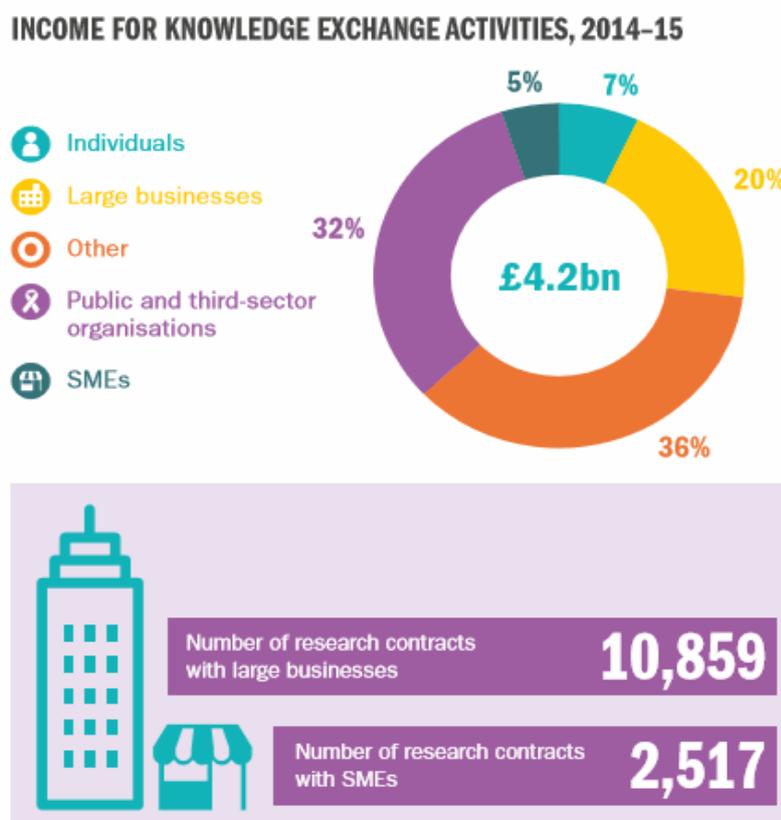


Figure 7

Importantly, for many UK universities, these links are increasingly being built beyond the borders of the UK, as their international collaborations grow to include global business partners as well as overseas universities. The implications of this are yet to be fully understood.

The latest review (Dowling in 2015) focussed on how the UK “*could take best advantage of the opportunity to expand the numbers of strategic research partnerships between universities and businesses across all areas of the country, disciplines and sectors, and all types of business, in order to scale up the benefits delivered to both the participants in the collaboration and the nation as a whole*”. Dowling suggested ways in which key support structures within the ecosystem could be streamlined but also identified a number of barriers in the university-business relationship that needed further work (figure 8):

Top ten most highly cited barriers to collaboration⁴²



Figure 8

5. Role of government

How can government best support the development of the innovation ecosystem and the players within that?

The most obvious way in which government drives the ecosystem is through policy and the funding that enables this to be carried out in practice. In terms of universities, funding is usually through intermediary bodies. However, universities’ role in innovation has also been supported through a number of government funded initiatives in which they are pivotal players (figure 9)

Examples of government funded programmes in which universities are pivotal

Higher Education Innovation Funding (HEIF) is administered by the Higher Education Funding Council for England and supports English HEIs to maintain and build capacity and capability to work with business and other external organisations. HEIF is an important driver of local activity. Universities, for example, are using funds to invest in local innovation infrastructure, increase work with employers for student placements and enterprise training, and provide expertise for local economic development.

Knowledge Transfer Networks (KTNs) are over-arching national networks which aim to improve the UK's innovation performance by increasing the breadth and depth of the knowledge transfer of technology into UK-based businesses. Launched in 2015, there are 15 KTNs with over 43,000 business members. They aim to help industry to access knowledge and information central to innovation growth. They make connections between the various players - large and small companies universities and research organisations, tech hubs and startups, government agencies and public funding bodies

Knowledge Transfer Partnerships (KTPs) aim to help businesses to innovate and grow by linking them with a university and a graduate to work on a specific project. Each KTP is a three-way partnership between a business, an academic institution and a graduate. The academic institution employs the recently-qualified graduate who works at the company. The graduate, known as the 'associate', brings new skills and knowledge to the business. A KTP can last between 12 and 36 months depending on the project and the needs of the business. It is part-funded by a grant with an amount contributed by the business

Catapult centres are physical centres where businesses, scientists and engineers work alongside each other on late stage R&D in order to turn high potential ideas into new products and services. The first Catapult centre was the High Value Manufacturing (HVM) Catapult opened in 2011 and formed of a group of research and technology facilities from across the country, with seven centres of excellence. The remaining six Catapult centres in the first wave were Cell Therapy, Offshore Renewable Energy, Satellite Applications and Connected Digital Economy, Future Cities and Transport Systems. Two new Catapults in the areas of Energy Systems and Diagnostics for Stratified Medicine were added in 2015/16.

Innovation Vouchers, launched in September 2012, aim to support small and medium enterprises (SMEs) in working with external knowledge providers. SMEs working in particular areas (agrifood, built environment, open data, cyber security and energy, water and waste) can claim up to £5000 towards the cost of expert advice from universities and other providers. Advice could be on an innovative idea, or learning more about using design within the business or how to make the most of intellectual property.

Innovation and knowledge centres (IKCs) operate at an earlier stage than Catapult centres. They offer a shared space and entrepreneurial environment in which researchers, potential customers and professionals from academia and business can work side-by-side on commercial applications of emerging technologies.

Degree Apprenticeships were launched in September 2015 and provide an opportunity for students to gain a full bachelor's (Level 6) or master's degree (Level 7). Apprentices are employed on a full-time basis for between one and six years, working at least 30 hours every week with blocks of practical on-the-job training. At the same time, they study a paid-for Bachelors or Masters degree at a partner university. Programmes are co-designed employers and higher education institutions to ensure that apprentices graduate with the career-boosting practical skills and academic knowledge their industry needs. The government pays the employer a completion fee of £2,700 when the apprentice graduates. If the company has fewer than 50 employees, the government will also pay an incentive fee of £2,700 for every degree apprenticeship start. In April 2017 an apprenticeship levy comes into place for employers whose overall annual salary costs are more than £3million.