

Hauser Review of the Catapult Centres

Evidence from the Russell Group

1. Summary

- Catapults have the potential to be a significant national asset for the UK if research excellence is at the heart of their operations and if long-term funding is available that will allow them to deliver meaningful benefit.
- The role universities have undertaken in the High Value Manufacturing (HVM) Catapult has proven invaluable in linking the Centres' activities into the broader academic research base, across host universities and the whole of the UK, allowing them to build on existing networks of connections and knowledge, and driving forward innovation. The success of the HVM Catapult demonstrates the value in building on existing investments in the research base to deliver economic and other impacts, particularly in a time of very limited public funding.
- Catapults should be engaged directly with the UK's excellent research-intensive universities, enabling them to build on areas of existing strength and international comparative advantage.
- The most recent Catapults being established appear much less well linked in with universities and their overall model for establishing engagement with excellence in the research base is unclear. We are very concerned that the value of Catapults will be undermined if engagement with the research base and academic networks within our world-leading universities is not at the core of their remit.
- Resources should be focused where there is most comparative advantage to be gained from integrating research, teaching and translation. By locating Catapults within or alongside research-intensive universities, their remit can be enhanced to deliver training and development informed by excellent research and expertise in knowledge exchange and translation. This will also allow Catapults to tap into other key facilities and services such as business incubation. In addition, research-intensive universities possess the expertise and intellectual capacity to operate larger facilities and equipment that make Catapults a distinctive offer to business.
- In future, the TSB should consider how to enable the Catapults to build new businesses and business sectors in areas where there is the potential for the industrial application of research, but a lack of currently available industrial income and activity. The funding model of Catapult Centres may evolve over time, so 'the one third, one third, one third' rule needs to be flexible.
- Decisions on Catapult location and coverage need to be taken in a more transparent way, reflecting potential regional and national roles. Any new

Catapult should also take into account, and be complementary to, current successful business-university partnerships.

- Our universities have built up substantial expertise in international engagement that will be vital for the long-term success of Catapults. These links will be valuable for accessing growing global markets for new technologies and in leveraging full impact from the Catapults – for example, through access to EU funding and undertaking collaborative activities with businesses, universities and research institutes overseas.

2. Introduction

- 2.1 The purpose of The Russell Group is to provide strategic direction, policy development and communications for 24 major research-intensive universities in the UK; we aim to ensure that policy development in a wide range of issues relating to higher education is underpinned by a robust evidence base and a commitment to civic responsibility, improving life chances, raising aspirations and contributing to economic prosperity and innovation.
- 2.2 We welcome the opportunity to provide evidence to the Hauser Review of the Catapult network, which we understand will feed into a new Science and Innovation Strategy for the UK. The Russell Group is well-placed to respond as our universities have forged strong relationships with the full spectrum of businesses, from SMEs to multinationals, charities and other organisations that can benefit from engagement with Catapults in developing research ideas into commercial propositions. Furthermore, many of our universities are active partners in Catapults and so have direct experience of their operations. See **Annex A** outlining how our universities are engaging with the existing Catapult network.
- 2.3 Our universities drive current and future economic prosperity by undertaking a range of activities, from basic research to applied R&D, knowledge exchange, business incubation and entrepreneurial opportunities. They contribute out of all proportion to their size on key economic measures, and are highly effective and successful in the commercial exploitation of their research.
- 2.4 In 2012-13, Russell Group universities accounted for:
 - 76% of the total income from contract research to UK universities (and made up 83% of those universities with contract research with commercial businesses worth more than £5 million)
 - 60% of the total income from collaborative research involving both public funding and funding from businesses to UK universities
 - 63% of the intellectual property income generated by UK universities
 - 62% of active spin-outs which survived for three years
 - The majority of IP income to UK universities from SMEs (61%) and the majority of contract research with SMEs (55%)
 - Eight of the top ten UK universities by value of contract research with SMEs.¹
- 2.5 Spin-outs and start-ups associated with Russell Group universities and their academics and graduates are also creating a significant number of jobs, employing 9,769 full time equivalent staff in 2012-13.²

¹ Higher Education – Business and Community Interaction (HE-BCI) survey data 2012-13

² Ibid

3. The development of the Catapult network so far

- 3.1 **Catapults have the potential to be a significant national asset for the UK if research excellence is at the heart of their operations and if long-term funding is available that will allow them to deliver meaningful benefit.**
- 3.2 Catapults represent an important opportunity to make a significant contribution to future economic growth in the UK through the exploitation of transformative new technologies in order to tap into growing global markets. There is an ongoing international race to take research breakthroughs to commercialisation faster, and the Catapult network has the potential to help the UK compete effectively in that race if properly funded over the long-term.
- 3.3 Catapult Centres can provide a 'safe' environment for businesses to explore ideas that might fail and help to stimulate wider collaborations, including business-business and business-university collaborations. They can also help develop new technological standards and ensure wider take up by business.
- 3.4 The Catapult network is now a major focus of activity for the TSB, with over £1 billion of public and private sector investment into the Catapults expected over the next five years³, with further Government investment into the Catapult network announced at Budget 2014.⁴ Given the level of investment into the network, it is imperative Catapults deliver the greatest impact in terms of driving economic growth.
- 3.5 The existing Catapults are at various stage of development. It may therefore be too early to conduct a comprehensive evaluation of their performance. It is also difficult to generalise about common strengths and weaknesses as the Catapults have not all taken the same approach to fulfilling their mission.
- 3.6 When the Catapult network was first proposed, the Russell Group stressed that the benefits of such centres would be maximised only if they were closely linked to existing centres of excellence in research-intensive universities, and built on existing innovation networks associated with such universities.⁵
- 3.7 The High-Value Manufacturing (HVM) Catapult followed this route and was developed principally out of existing academic centres of excellence in proximity to industrial critical mass. The success of the HVM Catapult is reflected in some key statistics:
- It has worked with over 1,500 businesses since its inception in 2011, the vast majority of which are SMEs, to close the gap between early innovation and full-scale production.
 - Of the Catapult's £134 million of innovation activity in 2012-13, 35% originated from private sector support, exceeding the 33% target set.
 - The Catapult has secured commitment to sources of additional funding totalling £214 million across the constituent Centres.⁶

³ Technology Strategy Board Catapult website

⁴ £74 million over 5 years in a Cell Therapy Manufacturing Centre and a Graphene Innovation Centre.

⁵ <http://www.russellgroup.ac.uk/russell-group-latest-news/121-2010/4163-hermann-hausers-recommendations-to-government-on-innovation/>

⁶ TSB, 'Catapult programme progress update 2012-13' (August 2013)

- 3.8 The location of six of the seven HVM Catapult Centres within the UK's world-class universities has provided access to a critical mass of excellent research and teaching, and a proven track record of translation. These universities have played a major role in the Catapult as facilitators, owners and operators of the Centres, whilst ensuring that industry also plays a leading role in their operation and direction.
- 3.9 See **Annex B** for examples of the ways in the HVM Catapult Centres located within our world-class universities are making use of their research excellence and nationally important physical assets in accelerating technology development and driving industry demand.
- 3.10 **The role universities have undertaken in the HVM Catapult has proven invaluable in linking the Centres' activities into the broader academic research base, across host universities and the whole of the UK, allowing them to build on existing networks of connections and knowledge, and driving forward innovation. The success of the HVM Catapult demonstrates the value in building on the strengths, competitive advantage and capacity of the existing research base, particularly in a time of very limited public funding.**

4. Engagement with the research base

- 4.1 The Catapults have developed different models of engaging with universities, through academic representation at Board level, advisory groups, and collaborations on projects and training. However, none except the HVM Catapult has established Centres within the UK's world-class research-intensive universities and it is not entirely clear how universities are being engaged in development of the new Catapult centres.
- 4.2 For example, there has been no indication of how the Transport Systems Catapult will engage with university partners (beyond appointing a small number of academic 'ambassadors'), despite the fact that many research-intensive universities have established research strengths in this area. Similarly, it is not known how the new announced Energy Systems and Diagnostics for Stratified Medicine Catapults will engage with universities when they come on stream in 2015 – and again these are areas where there are considerable research strengths in our world-class universities. Catapults which do not have strong links to one or more research-intensive universities are unlikely to benefit from excellent academic research in their specific areas of interest and the existing academic networks that this has created.
- 4.3 Similarly, without these strong links, Catapults will miss key opportunities to engage across the full breadth of research, facilities and expertise that is potentially available in the UK's research-intensive universities. Universities are highly collaborative, so a centre at one leading university opens the door to a much wider national network.
- 4.4 A number of other nations have recognised the benefits of building directly on research excellence within leading research-intensive universities in order to drive innovation and knowledge exchange.
- 4.5 For example, in Scotland, £80 million of investment from the Scottish Funding Council (SFC), in partnership with Scottish Enterprise and Highlands and Islands Enterprise, has been allocated over the next five years to the formation of eight Innovation Centres. The Innovation Centres aim to accelerate growth in target sectors and are directly engaged with Scottish universities and academic networks. The overarching vision for the Innovation Centres is to build directly on Scottish university infrastructure,

human resources and research excellence in order to create a platform for collaborations with businesses across Scotland.⁷ For example:

- Glasgow University is hosting both the Innovation Centre in Sensor & Imaging Systems (CENSIS) which is expected to stimulate over £70 million in external investment into industrially driven R&D; and the Stratified Medicine Innovation (SMS) Centre, which is looking at 'personalised' medicine designed to treat patients based on their individual genes. Collectively, CENSIS and SMS will create 655 high-value jobs and a GVA contribution of £664 million.
- The University of Edinburgh is hosting the Digital Health & Care Innovation Centre which aims to generate high-value health and social care solutions by bringing together health, care and third sector professionals, academics and industry partners.

4.6 Several European innovation agencies also work closely with universities in achieving their aims. For example:

- VTT Technical Research Centre in Finland - the largest applied research organisation in Northern Europe working across multiple technologies - develops its activities in cooperation with universities and research institutes.⁸
- Universities are partners with businesses in knowledge centres created by TNO in the Netherlands to commercialise research in selected fields.⁹
- The participation of scientists and researchers in governing and setting the policy of the Fraunhofer Institutes in Germany is written into their statute and Directors of the Institutes are university Chairs.¹⁰

4.7 In 2010, Dr Hermann Hauser envisaged that Catapults (or Technology and Innovation Centres as they were then termed), would be located in areas where a critical mass of research expertise and research excellence exists, including within universities, alongside industrial capability and absorptive capacity.¹¹ The apparent direction of travel away from locating Catapults within research-intensive universities and therefore, enabling engagement with the UK's world-leading academic expertise and excellent research, is a key weakness in the Catapult model. It also means there is a risk Catapults will simply duplicate the efforts of existing centres of excellence within research-intensive universities.

4.8 **Research excellence must be at the heart of the Catapults. They should be engaged directly with the UK's excellent research-intensive universities, enabling them to build on areas of existing strength and international comparative advantage.**

4.9 **The most recent Catapults being established appear much less well linked in with universities and their overall model for establishing engagement with**

⁷ Scottish Funding Council, 'Targeted process for the development of Innovation Centres in academic year 2012/13'

⁸ <http://www.vtt.fi/>

⁹ <https://www.tno.nl/index.cfm>

¹⁰ See: <http://www.fraunhofer.de/en.html>

¹¹ 'The Current and Future Role of Technology and Innovation Centres in the UK: A Report by Dr Hermann Hauser' (2010)

excellence in the research base is unclear. We are very concerned that the value of Catapults will be undermined if engagement with the research base and academic networks within our world-leading universities is not at the core of their remit.

5. The scale and scope of the future Catapult network

- 5.1 In assessing what the future scale and scope of the Catapult network should be, it is imperative to consider a number of factors including national research strengths, international developments and engagement, and industry demand. Any further expansion of the Catapult network must not be at the expense of weakened support for existing centres. The urge to overload Catapult Centres with too many additional functions should also be resisted in order to avoid watering down their potential impact.
- 5.2 The scope and scale of the future Catapult network will be restricted to some extent by the capacity and strategic intent of existing businesses to invest in innovation and new technologies, as the current Catapult model relies heavily on industrial income. **In future, the TSB should consider how to enable the Catapults to build new businesses and business sectors in areas where there is the potential for the industrial application of research, but a lack of currently available industrial income and activity. The funding model of Catapult Centres may evolve over time, so ‘the one third, one third, one third’ rule needs to be flexible.**
- 5.3 Up until now, the process by which technology areas and locations for Catapults have been selected has not been sufficiently transparent and the criteria are not well understood, meaning that confidence in the eventual selections made may have been undermined. **Decisions on Catapult location and coverage need to be taken in a more transparent way, reflecting potential regional and national roles. Any new Catapult should also take into account, and be complementary to, current successful business-university partnerships.**
- 5.4 Furthermore, whilst the concentration of resources for the Catapults into a number of narrowly defined fields provides the opportunity to generate critical mass in key areas, it comes at the expense of funding to allow innovation in other technologies and the development of other opportunities which may emerge. When considering technology areas in which to establish future Catapults, the opportunity for the UK to succeed in a particular technology area should be considered alongside the size of the global market. For example, there are other technologies outside of the Eight Great Technologies where the total global market is slightly smaller but the potential for the UK to gain a larger share of that market is greater.
- 5.5 As outlined above, the Catapults will have the greatest impact when situated within and networked into, the UK’s existing research base and academic networks within our world-leading universities. In locating Catapult Centres within the UK’s world-class universities, the Centres can take advantage of the research-led teaching approach to foster entrepreneurial and problem-solving skills in training and development, as well as a proven track record in providing business incubation services, along with investment and knowledge transfer support, to accelerate the growth of early-stage companies. For example:
 - (a) The University of Sheffield’s Advanced Manufacturing Research Centre (AMRC) as part of the HVM Catapult is already delivering training through its Industrial Doctorate Centre. The Centre’s four-year Engineering Doctorate programme provides students with the opportunity to gain practical

experience with the AMRC's state-of-the-art facilities while carrying out original applied research for world-leading engineering companies.

- (b) Similarly, there are strong links between the HVM Catapult network and EPSRC-sponsored Centres for Doctoral Training (CDTs) at many of our universities, enabling Catapults to engage with students working on business-relevant problems at CDTs and to widen their networks in order to pull in exciting research ideas from across universities.
- (c) Many Russell Group universities provide sophisticated business incubation facilities. One example is SETsquared, a collaboration between the Universities of Bristol, Exeter and Southampton and partner universities of Bath and Surrey, which has raised over £1 billion in 10 years and has been voted Europe's number one University Business Incubator.

5.6 Resources should be focused where there is most comparative advantage to be gained from integrating research, teaching and translation. By locating Catapults within or alongside research-intensive universities, their remit can be enhanced to deliver training and development informed by excellent research and expertise in knowledge exchange and translation. This will also allow Catapults to tap into other key facilities and services such as business incubation.

5.7 In addition, research-intensive universities possess the expertise and intellectual capacity to operate larger facilities and equipment that make Catapults a distinctive offer to business.

5.8 Locating Catapult Centres within research-intensive universities will also enable them to tap into universities' international links and expertise in terms of research, training, knowledge exchange and staff/student mobility. Russell Group universities in particular are extremely internationalised with a wide variety of strategic partnerships with major businesses and leading universities globally. Furthermore, the track record of our universities in accessing European funding is extremely impressive:

- More UK universities are in the top 50 participants accessing EU research and innovation funding than any other country
- Of the 14 UK universities in the top 31 higher education participants accessing EU research and innovation funding across all Member States, all are Russell Group universities.¹²

5.9 Our universities have built up substantial expertise in international engagement that will be vital for the long-term success of Catapults. These links will be valuable for accessing growing global markets for new technologies and in leveraging full impact from the Catapults – for example, through access to EU funding and undertaking collaborative activities with businesses, universities and research institutes overseas.

May 2014

¹² European Commission e-CORDA data

Annex A – Russell Group universities’ engagement with the Catapult network

The Catapults currently in operation are engaging with Russell Group universities to a greatly varying extent. Whilst the earlier Catapults, particularly the High Value Manufacturing Catapult, are strongly engaged with research-intensive universities, the more recently launched Catapults are more distant from the research base, as outlined below:

2011

High Value Manufacturing – six of the seven HVM Catapult Centres are situated at UK universities. The Advanced Forming Research Centre is based at the University of Strathclyde, while the other five Centres are located at Russell Group universities:

- The University of Sheffield’s Advanced Manufacturing Research Centre with Boeing
- The Nuclear AMRC at the Universities of Manchester and Sheffield
- The Manufacturing Technology Centre – a collaboration between the Universities of Birmingham and Nottingham along with Loughborough University, Rolls-Royce, Aero Engine Controls and Airbus
- Warwick Manufacturing Group (WMG) at the University of Warwick
- The National Composites Centre hosted by the University of Bristol

In addition, the Centre for Process Innovation is linked to Durham University through a managed project portfolio and through the Centre for Doctoral Training in Soft Matter and Functional Interfaces (SOFI CDT), in partnership with the Universities of Edinburgh and Leeds.

2012

Cell Therapy– collaboration with Newcastle University on research trials and with the University of Leeds to identify projects to jointly develop; academic representation at Board level via Professors Marc Turner, University of Edinburgh and Professor Michael Whitaker, Newcastle University.

2013

Offshore Renewable Energy - engages with academia through a Research Advisory Group, which includes representatives from the Universities of Edinburgh, Exeter, Oxford and Sheffield, Imperial College London, and Queen’s University, Belfast.

Satellite Applications– three new regional ‘Centres of Excellence’ launched including one to be co-located at the University of Nottingham along with the University of Leicester, and British Geological Survey and one to be hosted by Business Durham in partnership with Durham University; joint development of training courses with University College London to link space-related issues and technologies into end-user companies.

Connected Digital Economy - joint projects with the University of Oxford, the University of Southampton and the University of Edinburgh (School of Informatics) to train data scientists.

Future Cities - Professor David Gann, Imperial College London and Sir Alan Wilson, UCL, sit on the Smart Cities Forum.

Transport Systems– two academics from the University of Nottingham and UCL to act as ‘ambassadors’.

2015 (estimated launch)

Energy Systems Catapult – no indication of how universities will be engaged

Diagnostics for Stratified Medicine Catapult – as above

Annex B –Examples of High Value Manufacturing Centres at our universities

- The University of Sheffield recently announced the development of Sheffield Business Park to support the creation of a critical mass of hi-tech, advanced manufacturing businesses. The planned developments will build on the success of the University's investment in the Advanced Manufacturing Research Centre, where increasing demand means that the site has now expanded to operate on two shift patterns. The first development, Factory 2050, will directly contribute £6.4 million to the local economy and create 162 jobs.
- The National Composites Centre (NCC) hosted by the University of Bristol, opened with £25 million of investment from BIS, ERDF and the Homes and Communities Agency. Only 20 months after opening the NCC has more than 25 industrial members of all sizes, drawn from across a variety of sectors including: renewables, aerospace, motorsport, marine and satellite. The £28 million NCC Phase II project now underway will double the size of the centre to enhance the ability to include skills, training and further development opportunities for the UK Composites Industry.
- In three years of operation, the Manufacturing Technology Centre, in which the Universities of Birmingham and Nottingham are partners along with Loughborough University, Rolls-Royce, Aero Engine Controls and Airbus, has increased its employment base from 35 to 290, and has brought in income of £50 million, exceeding its original target of £10 million by 2020.
- The Warwick Manufacturing Group (WMG) at the University of Warwick has a thirty year history of engaging with industrial partners, including Jaguar Land Rover and Tata, in collaborative R&D. The WMG Catapult centre is focusing on Lightweight Technologies, and Energy Storage and Management. The WMG Catapult Centre's Energy Innovation Centre (EIC) includes a recently commissioned battery characterisation laboratory and an established electric/hybrid drives test facility, with a £13 million Battery Cell Pilot Scale-Up Line for producing cells based on new chemistries under construction. Recent successes include supporting Drayson Racing Technologies in achieving a world land speed record through the use of EIC's Powertrain testing facility.
- The Nuclear Advanced Manufacturing Research Centre (AMRC) run by the Universities of Manchester and Sheffield has engaged with over 40 companies as full members of the Centre, from global reactor providers to specialist suppliers. The Fit for Nuclear programme, developed by the Nuclear AMRC, helps companies measure their current operations against the standards required to supply the UK's new generation of nuclear power stations, and take the necessary steps to enter the £40 billion global nuclear power market.
- The Centre for Doctoral Training in Soft Matter and Functional Interfaces (SOFI CDT) at Durham University in partnership with the Universities of Edinburgh and Leeds, has partnered with the Centre for Process Innovation. SOFI CDT provides industrially integrated, postgraduate training in research, enterprise and innovation for future leaders in the soft matter industrial sector. Durham University is also part of a consortium comprising the Centre for Process Innovation and Proctor & Gamble's Newcastle Innovation Centre, which was awarded a £5.3 million grant from the Regional Growth Fund to establish a Centre of Excellence in Methods and New Technologies for Surface Modification and Cleaning (CEMENT) in the North East of England. The grant forms part of a combined strategic investment by the consortium of £14 million over a three-year period.