

Dowling Review Response

High Value Manufacturing Catapult

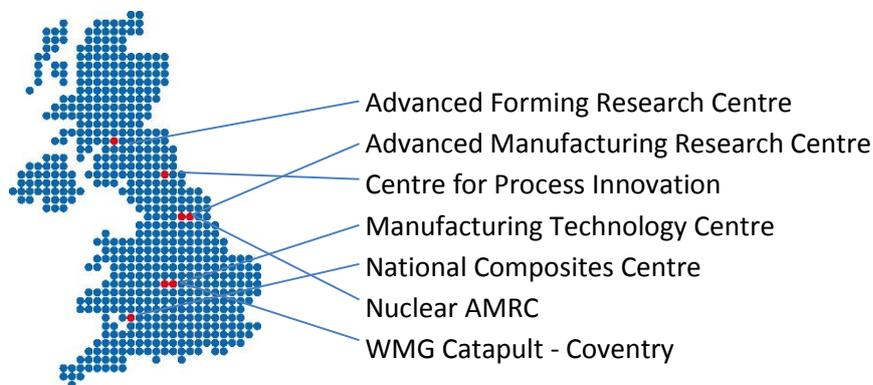
Introduction

The High Value Manufacturing (HVM) Catapult is one of seven Catapults set up by UK government to bridge the gap between early stage innovation developed in the UK's excellent research base, and commercial industrial scale production. Catapults focus on areas with great market potential, and where the UK has inherent strengths.

The HVM Catapult addresses the need of the high value, global sectors including aerospace, automotive, marine, renewables, energy, oil and gas, rail, nuclear, chemicals & polymers, biotechnology, pharmaceuticals and electronics. Possessing both component and process manufacturing expertise, the HVM Catapult has a strong industrial and academic partnership with broad applicability. Over the next decade significant market opportunities are expected to be realised in many areas addressed by the HVM Catapult

The HVM Catapult is making a positive contribution towards the economy, anchoring manufacturing jobs, skills and investment in the UK as well as encouraging investment from overseas in UK high value manufacturing.

The HVM comprises seven centres:



The HVM Catapult fills the gap in technology and knowledge readiness by providing:

1. capabilities which span basic raw materials through to high integrity product assembly processes. HVM Catapult
2. access to world class facilities and manufacturing equipment generally out of reach to individual companies.
3. over 1,300 engineers, scientist, technicians and other staff who provide at elbow support to companies and to push the boundaries of high end manufacturing.
4. a network of leading suppliers who contribute to key UK industry supply chains
5. collaboration between industry, government and research in a shared goal to make the UK an attractive place to invest in manufacturing.

1. What experience do you have of establishing, participating in or supporting long-term research collaborations between business and academia?

- 1.1 The HVM Catapult is specifically positioned to bridge the gap between early stage innovation, which tends to take place in an academic environment, and commercial applications funded and delivered by industry. Developers and adopters of new technologies often measure the technology's stage of development through Technology Readiness Levels (TRL's), which provide common and general terms to broadly define technology from concept to commercial production.



- 1.1 Since its establishment in 2011, the HVM Catapult has built on its strong relationships to successfully develop, maintain and participate in collaborations between industry and academia. Over the past 12 months, we engaged with over 1,550 industry partners in over 1,000 projects and in 2014 industry membership of our centres exceeded 250 companies.
- 1.2 Most HVM Centres were founded by or with Academic Institutions, i.e.

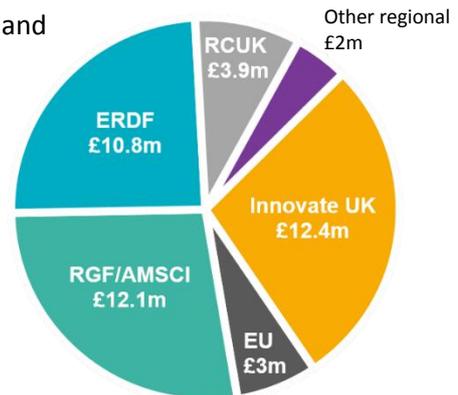
AFRC: Founded by the University of Strathclyde
AMRC: Founded by the University of Sheffield
MTC: Founded with support from the Universities of Nottingham, Loughborough and Birmingham
NCC: Founded by Bristol University
WMG: Founded by the University of Warwick

We also collaborate with over 60 UK universities and a range of international academic institutions.

- 1.3 HVM Catapult's engagement with Universities includes close collaboration with the newly established **Centres for Innovative Manufacturing**. Funded by the Engineering and Physical Sciences Research Council (EPSRC), these Centres are part of a novel approach to maximise the impact of innovative research for the UK, supporting existing industries and, more importantly, opening up new industries and markets in growth areas.

Dowling Review Response from HVM Catapult

- 1.4 HVM Catapult works closely with universities, and large and small companies on the development and delivery of **Collaborative R&D** projects. In 2013/14, 30% - or £44m - of our overall income was generated from competitively won Collaborative R&D projects, the majority of which included industry and academic partners. We secured our CR&D funding from a variety of sources, including regional funding, European sources, Research Council funding as well as CR&D support from Innovate UK.



- 1.5 HVM Catapult works with academia to provide **internships and placements** in its Centres and in industry, ranging from several weeks to months and years. This is an effective way of breaking down the cultural barriers between both sectors, as described in response to questions 3 and 4 below.

- 1.6 The HVM Catapult and the EPSRC have jointly established the **EPSRC High Value Manufacturing Catapult Fellowship Centre**, to help implant new scientific ideas into the manufacturing base. The Centre is coordinated through the University of Sheffield and receives its funding from Innovate UK. It brings the best of the UK's academics in a direct and long-term working relationship with industry. This is the most effective way of maximising and accelerating the commercial impact of the world-class academic and industrial research taking place in this country.

2. What are the key success factors for building productive, long-term research partnerships between business and academia and how do these vary across sectors and disciplines?

- 2.1 **Awareness** among industry of what relevant support is available, and among academics of which businesses could benefit from their research, is key to success. The UK has an excellent, broad and well balanced science base. A sufficient degree of awareness of the landscape of capital infrastructure, planned investments, supporting resources, research priorities and areas of interest needs to be established – creating a better linkage between the capacity and expertise that exists across the TRLs.
- 2.1 Academic research needs to be (made) **relevant** to business needs and research should be initiated with a business objective in mind. Route mapping and better alignment of industrial challenges to areas of research interest would help maximise collaboration
- 2.2 **Collaboration**, which is underpinned by clarity and approachability, is key to a productive industry-academic partnerships. Fostering opportunities for talented and motivated academics and people from industry to work together in a well-equipped suitable environment, breaks down barriers and facilitates innovation and collaboration.
- 2.3 Commercial **Confidentiality** needs to be clearly defined and commercial contracts in place at the outset to ensure industry can work with academia with the reassurance that no unexpected issues around Intellectual Property can arise.
- 2.4 These success factors are strengthened through the input from the **Catapults**, which function as a translation space between industry and academia. HVM Catapult brokers relations between high value manufacturing businesses of all sizes, and the most relevant UK research. The HVM centres offer open access facilities which receive thousands of business visitors a year to experience first-hand the R&D support on offer and in 2013/14 alone, over 1,000 projects involving commercial partners were delivered.

Case study – Technicut and Nikken



Cutting tool developer Technicut and toolholding specialist Nikken Kosakusho worked with HVM Catapult's Advanced Manufacturing Research Centre (AMRC) at the University of Sheffield, to prove that a new tooling system can achieve record-breaking rates of metal removal in the toughest alloys. The patented system is now in production, and being deployed at major titanium machine shops around the world.



“Being able to test our new tooling systems on the large-scale machining centres at the AMRC has allowed us to prove their value to the most demanding clients. Our membership has benefited us enormously – we have won new business and grown our workforce as a result of the collaborative research and networking opportunities here.” Mark Kirby - technical director at Technicut.

<http://www.amrc.co.uk/featuredstudy/titan-xtreme/>

3. What barriers do individual businesses face in developing long-term research collaborations with academic partners and how can these be overcome?

- 3.1 **Time** is industry's (and particularly SMEs') rarest commodity. A big barrier to businesses is therefore the need to spend significant amounts of time identifying the most relevant research partner, becoming acquainted with the variety of potential funding streams and associated administrative processes, and engaging in long-term collaborations in response to a (usually specific and short-term) business need.
- 3.1 **Money** is often also an issue for smaller businesses. Although there is support available, this often comes with a plethora of administrative requirements which can stretch the company beyond its capacity. Being engaged in, rather than leading a funding proposal, is often the only feasible ways for a smaller business to engage.
- 3.2 The lack of appropriately **skilled staff** is a major barrier to the future growth of high value manufacturing in the UK, and is an obstacle to individual businesses engaging in innovation activity and collaborating with academia. More needs to be done to attract, train and support new skilled engineers, technicians and other relevant workers into the industry.
- 3.3 The lack of the success factors identified in response to question 2 above, such as awareness (2.1), understanding of relevance (2.2), trust (2.3) and protection of commercial confidentiality (2.4) are significant barriers to individual businesses.
- 3.4 As per the response to question 2, the Catapult programme has a key role to play in helping industry overcome such barriers. The HVM Catapult provides specific technology-based support to businesses, and signposts to other relevant business support providers such Innovate UK and the Business Growth Service, as appropriate. The industry response to the HVM Catapult, since it was established in 2011, clearly shows the need for a structure that fits between industry and academia and bridges the gap between both.
- 3.5 HVM Catapult does not believe that long-term research collaborations are always the (only) desired outcome for industry or academia. Our industry engagements range from long-term strategic collaboration to clearly defined short-term and sometimes one-off technology-based interventions to address a specific business need. The latter interventions can generate significant business benefit which may in turn motivate the business to (encourage others to) collaborate again in the future. It is our view, therefore, that short-term specific interventions can be just as valuable as long-term collaborations.

4. What barriers do academics and universities face in developing long-term research collaborations with business and how can these be overcome?

- 4.1 The barriers faced by academics and universities are related to the lack of some of the success factors identified in our response to question 2 above, such as a lack of **awareness** of the businesses and sectors that could be **relevant** to their research, a lack of **time** to work with industry, a lack of readily available **funding** to develop new technologies to TRL 3+ work with industry, and – in some cases – a university **IP** policy which doesn't align with industry expectations. In addition, HVM Catapult sees a specific barrier to academics.
- 4.1 The UK benefits from world-class academic excellence. The top research establishments are however not the best at industry engagement. Academics in institutions which are driven by more traditional research excellence may find it more difficult to spend time on work which leads to economic impact, rather than academic publications. HVM Catapult works with universities with a very strong track record of industry engagement, as well as with universities which are traditionally more academically focused and benefit from the Catapult support to build a link to industry.

Case study – Polyphotonix



near Durham.

Founded by Richard Kirk in 2008, Polyphotonix is a biophotonix research company developing light therapy treatments for macular eye disease. Polyphotonix has grown from one employee to now manufacturing an eye mask that will save the NHS £1bn a year. The company is based at the HVM Catapult's Centre for Process Innovation

'We can see many cases of really interesting start-up companies that are spun out of universities, struggle on to the end of term, close down and the valuable intellectual property is sold off and lost, often outside the UK. However, our experience with the HVM Catapult's Centre for Process Innovation could not have been more different. Having deep knowledge of the R&D process, they understand how long the process to develop and take a product to market is, and consequently they have a more appropriate long-term view. I have been able to leverage their management and scientific expertise to fund much of our research through grants and competitions, many run by Innovate UK.'



Richard Kirk, CEO Polyphotonix

www.uk-cpi.com/case-studies/polyphotonix

5. How effective are current incentives, policies and funding streams for promoting the type this type of collaboration? How could these be improved in order to scale up the range and impact of collaborations being undertaken nationally?

- 5.1 The UK benefits from a comprehensive portfolio of incentives, policies and funding streams for promoting collaboration between industry and academia. These include Innovation Vouchers, KTN's, KTP and R&D tax credits to name but a few. The extent to which these incentives, policies and funding streams are effective, tends to be influenced by the specific funding arrangements and the organisations involved.
- 5.2 In the case of high value manufacturing companies, we find that the effectiveness of such incentives can be enhanced and maximised through involvement of HVM Catapult. The combination of funding and the best relevant research and academic expertise, with the industrial scale open access facilities and equipment offered through the HVM Catapult strengthens the relevance of the work and acts as a catalyst for (commercial) success of the innovation.

Case study – Hybrid Manufacturing Technologies



The 'Reclaim' research project involving HVM Catapult's Manufacturing Technology Centre (MTC), De Montfort University, The Welding Institute and several private businesses, has led to Britain becoming a world leader in developing 'game-changing' hybrid manufacturing technology.

Funded by Innovate UK, the project developed a multi-purpose machine which brings together the separate elements of remanufacturing high value metal parts - additive manufacturing, machining and inspection - into one seamless, fully automated process.

A new spin-out company, **Hybrid Manufacturing Technologies Ltd (HMT)** was formed to commercialise this new technology in 2012. Building on its position as a world leader in the field, HMT is developing the next generation of hybrid manufacturing systems - the **AMBIT™** multi-tasking system. It's working with Delcam and MTC to explore commercial applications for the system - which extend far beyond just remanufacturing or repair.

Delcam, MTC and HMT teamed up with German machine tool specialists Hamuel Maschinenbau, to develop a machine to manufacture or repair industrial gas turbine parts. It was launched in September 2013 to much acclaim at EMO, Europe's largest machine tool show, and was awarded the prestigious prize for 'Best Multifunction machine' at the show.



<http://www.the-mtc.org/case-studies/reclaim>

6. How can progress under the Industrial Strategy be harnessed to stimulate collaboration between businesses and researchers in the UK?

- 6.1 It is important and encouraging that the Industrial Strategy recognises the importance of (high value) manufacturing to a balanced economy in the UK. Such long-term support and commitment is essential to the industry. Despite recent successes and strong performance, the UK remains vulnerable to eroding manufacturing investment and capability. It is essential that the successful work that the HVM Catapult is leading in the translational environment - the so called "valley of death"- continues to receive the appropriate match funding from government to underpin industry confidence in the Catapult model and in the intentions of the Industrial Strategy itself.
- 6.1 Public investments should be targeted at areas which will benefit the UK's economy and in particular the established industrial sector strategies and the Ten Great Technologies. Attention should also be paid to how research conducted on capital equipment can be used to create value to the UK economy. Driving the integrated system from research through innovation into market and into UK job creation, should direct investment. If public money is spent, then there should be clear measures of its effectiveness and the value created from the investment.
- 6.3 Investment in capital projects should be mainly made at national level and be directed towards the creation of open access facilities that can be used by the whole UK R&D community. In this way, investment can be directed towards providing the maximum benefit to UK plc. There should be a balance of investment across TRL's, with investment in later stage levels particularly based on national strategy considerations. When making such investments, care should be given to providing ongoing, long term operational funding to ensure that a portfolio of projects can be developed based on the investment and that the return on this investment is maximised.
- 6.4 The UK faces a major skills challenge in the field of high value manufacturing technology. HVM Catapult works with the Engineering Employers Federation (EEF) to grow the skills alongside the centres within the HVM Catapult – something we call: *"Technicians with the technology"*. This proposition has won the status of the National College for Advanced manufacturing. The first operational hubs are the MTCs Advanced Manufacturing Training Centre which is due to open in 2015, and the AMRC's training centre, which has just won the Times Higher Education Award for Sheffield University for its work with apprentices at AMRC. Over 100 companies are training their apprentices at AMRC with the majority being SME's

7 Which models of collaboration have proved most successful for stimulating SME engagement with the research base in the UK? What additional action needs to be taken to strengthen UK performance in this area?

7.3 The HVM model of SME engagement brings together a number of elements. These include:

7.3.1 Linking SMEs directly to the relevant technologies and expertise available within the academic setting through dedicated project support, workshops, technology demonstrations, access to R&D, access to funding, access to students and graduates for internships,

7.3.2 educating intermediaries (e.g. high street banks, business support providers) to accurately refer relevant SMEs, rather than flood the SME community with information in the many support options available,

7.3.3 running funding programmes to reduce the cost to the SMEs. These may be funded through a mix of regional, national and European funding sources,

7.3.4 providing incubation and co-working spaces for companies to work closely with the HVM Catapult staff as well as with academics and with other relevant companies to stimulate cooperation and co-innovation

7.4 Innovation is not achieved overnight. Ongoing support for the Catapult programme, with an emphasis on growing and supporting the success of existing Catapults, as well as creating Catapults in new areas of the economy, is therefore key to long-term success.

Case study – Barkley Plastics



Matt Harwood (Barkley Plastic), James Pittard (Loqski) and Steve Gaston (MAN)

HVM Catapult's WMG centre at the University of Warwick, work with the Midlands Assembly Network (MAN) on a number of research led innovation projects, including the development of novel prototypes, materials analysis and the capture of funding for capital equipment, as well as on a programme of leadership support to equip management teams with the skills and know-how to implement their growth plans.

Barkley Plastics, one of the companies within the group, has seen an upturn in turnover of over half a million pounds and the creation of new jobs, as a result of the collaboration. The WMG SME Team supported the firm on developing a range of storage solutions for phone chargers and ear phones now being, as well as the recently launched "Loqski" product for the ski market.

Maurice Cassidy, Technical Director at Barkley Plastics, said:

WMG has been instrumental in helping us gain new business over recent months. The recent agreement of a long-term collaboration between WMG and the MAN Group is going to advance our capabilities even further and support innovation plans to come to fruition."

8 Which approaches / sectors / organisations – in the UK or internationally – would you identify as examples of good practice in business-university collaboration with the potential to be applied more widely?

- 8.3 Within the UK, the Catapult model has proven to exceed ambitious expectations regarding its engagement with industry and academia. Providing a translation space between university research and industrial application is key to unlocking the commercial potential of the UK's world-class academic excellence. The HVM Catapult was set the challenge to generate its funding from three, broadly equal, sources. These are core funding from UK government through Innovate UK; commercial income; and competitively won Collaborative R&D. In 2013/14, the HVM Catapult, in fact, generated over £3 of commercial and R&D income, for every £1 it received through UK government core funding. This is clear evidence of the level of industry buy-in into this model of collaboration, despite its early stage of development.
- 8.4 Internationally, Research and Technology Organisations such as the Fraunhofer Institutes formed the basis of original Catapult thinking. Collaboration between HVM Catapult and the other RTO's is strong and in several instances, other RTO's (including Fraunhofer) now look at the UK model as their benchmark for bridging the gap between innovation and commercialisation.

9 Please give your name, affiliation and contact details.

Dick Elsy, Chief Executive Officer
High Value Manufacturing Catapult
Oracle Building
Blythe Valley Business Park
Solihull
B90 8AD
dick.elsy@hvm.catapult.org.uk
www.hvm.catapult.org.uk