Technology Strategy Board
Driving Innovation

Catapult update

Shaping the network of centres

CATAPULT

March 2012

CATAPULT

This document explains how the UK's new network of Catapults is being established by the Technology Strategy Board. Catapults are centres of technology and innovation that will transform the UK's ability to create new products and services in priority areas, and drive future economic growth.

Under this programme, Catapults are to be set up in seven areas and at the same time innovation opportunities in many other sectors have been identified and will be followed up.

Read on to find out more.

Foreword

Iain Gray
Chief Executive

It has been only 18 months since the Government tasked the Technology Strategy Board with setting up and overseeing a network of technology and innovation centres.

The pace of the programme has been dramatic, and the process of selecting the areas of focus for these centres has been a powerful and exciting one. We have engaged more deeply than ever before with our key business, academic and stakeholder communities, involving thousands of people.

The network of Catapults is a strategic long-term investment in the UK's innovation capability, which will drive economic activity for years to come and significantly increase wealth creation by building a bridge between our world-leading research base and business.

The Catapults are an integral part of our strategy to accelerate innovation as outlined in *Concept to Commercialisation: A strategy for business innovation, 2011-2015*. They will harness the UK's strengths in these areas, enabling businesses large and small to compete effectively in global, high-growth markets.

In this document, we explain the rationale for investing in the areas chosen for Catapults – areas where Catapults are the right answer at the right time.

We also outline how we will be supporting innovation in the other candidate areas identified in the Catapult strategy and implementation plan published last May.

Many of the UK's technology-intensive and innovative businesses are working in high-potential fields outside the areas identified for Catapults, so it is important to keep in mind that Catapults are not a universal solution. There are many other ways to stimulate innovation, and the priority areas where a Catapult is not the answer can count on our continued support.

The outlook for the global economy remains uncertain. What is certain, however, is that the UK must do all in its power to place innovation at the heart of its plans for growth. That is why we will meet the Government's challenge to maintain the pace and quickly establish the seven centres.

We extend our deep appreciation to everyone who invested their time to enable us to make these important decisions for the UK.

We are the catalyst in setting up the network, but we cannot achieve this without the tremendous work you do in the business, research and academic communities. Working together will continue to be critical both to the future success of the Catapult programme and to our broader understanding of business needs. We look forward to working with all of our existing partners and many new ones to make the Catapults the envy of the world and a force for innovation.

Contents

What are Catapults?

Catapult is the name for a network of new technology and innovation centres, designed to transform great research rapidly into commercial success.

This is a long-term investment that will open up global opportunities for the UK and generate economic growth for the future.

The Catapults each focus on a specific area of technology and expertise with great potential. Bringing together the best people in their fields, they will pull together all the UK's know-how to create innovation and develop new products and services. The momentum they generate will grow entire markets.

Catapults will be challenge-led; they will help businesses to innovate by developing new solutions and products to meet current and future market needs, not by developing technology for technology's sake.

To set up the Catapult centres, the Technology Strategy Board is focusing on technology areas where the need, the opportunity and the capability come together to make a Catapult the right answer at the right time – creating a long-term strategic resource that does not currently exist. We are working closely with the business and research communities to focus efforts and ensure we create successful centres.

Once fully established, and over time, the Catapult centres will receive broadly equal funding from the core Technology Strategy Board grant, from research and development grants won by the Catapult in collaboration with business, and from contract research funded fully by business – the so-called third, third, third model. When fully established, we would expect approximately 50% of funding for each Catapult to come from the private sector.

Creating a brand

This network of centres will be a new, dynamic force for innovation. It was clear from the outset that to realise this ambition, the network needed a distinctive and memorable name and a strong identity that would speak to business and resonate internationally.

As Hermann Hauser noted in his review, international best practice reinforces the value of a powerful and recognisable 'brand' for such a network.

The name had to represent a transforming force; not merely a set of technical facilities labelled with an acronym, but a dynamic and exciting programme. It would need to be unique, memorable and internationally recognisable.

In the search for the right identity, the Technology Strategy Board considered suggestions from many quarters and worked with some of the UK's leading brand experts. The result, Catapult, is a name that goes beyond the purely rational and literal, and expresses the energy, pace, direction and sense of purpose of the centres as they work to launch new ideas, products and services towards commercial reality.

To 2010
Community discussions on need for centres

March 2010
Hauser and Dyson reports published

October 2010
£200m-plus plan for technology and innovation centres announced by David Cameron

January 2011
Prospectus published and first centre in high value manufacturing announced

March 2011
Consortium partners of the high value manufacturing centre announced. Intention announced to establish a centre in cell therapy

From Hauser to Catapult

We have come a long way in the two years since the entrepreneur Hermann Hauser produced his influential report[1] proposing a national network of technology and innovation centres, and Sir James Dyson[2] reinforced the concept.

The project began in 2010, when Prime Minister David Cameron announced that, as part of its strategy to stimulate innovation and growth, the Government would invest over £200m in four years in a network of such centres to be created and overseen by the UK's innovation agency, the Technology Strategy Board.

In early 2011, we published a prospectus outlining the key principles behind what the centres should do, the broad areas of work that should be covered and how they should be run. There were more than 500 overwhelmingly positive responses, and many valuable suggestions were made that helped in drawing up a strategy.

At the same time, we identified that the first technology and innovation centre would focus on high value manufacturing. This centre was opened for business in October 2011. In March, we announced that the second centre would be in cell therapy.

May 2011 saw the publication of the full strategy and implementation plan for the centres and the selection of the third area – offshore renewable energy. The plan also identified a further ten promising candidate areas:

- complex systems
- digital media/creative industries
- future cities
- future internet systems
- photonics
- resource efficiency
- sensor systems
- smart grids and distribution
- space
- transport systems and integration

The review of the potential for Catapults in these areas, working closely with industry and research, has now concluded. As a result, four further Catapults have been decided upon in:

- satellite applications
- the connected digital economy (drawing together digital media/creative industries and future internet systems)
- future cities
- transport systems

As part of the review, plans were made to continue to accelerate innovation over the coming years in the other candidate areas, using a range of other approaches and support mechanisms.

May 2011
Offshore renewable energy centre announced. Technology and innovation centres strategy and implementation plan published

October 2011
High value manufacturing centre opens for business

December 2011
Technology and innovation centres named Catapults. Location of Cell Therapy Catapult announced

January 2012
Catapults in satellite applications and connected digital economy announced

March 2012
Catapults in future cities and transport systems announced

1 The Current and Future Role of Technology and Innovation Centres in the UK, 2010

2 Ingenious Britain, 2010

Consulting stakeholders

The process of selection has been extensive, challenging and rewarding. Starting in the summer of 2011, we carried out a major programme of consultation on candidate areas with business and research communities.

One of the first steps in the Catapult selection process was to identify some core criteria that would apply.

It was clear that Catapult centres had potential to add significant value in a number of technology areas but we have had to prioritise based on:

- the potential economic opportunity for the UK,
- the impact a centre could have, and
- the timing of the investment.

We have also taken into account the other options we have for supporting the development of new technology in each area.

It is important that investment is focused in a small number of centres with the greatest potential for impact, and that the Catapults chosen have critical mass and can provide world-leading commercialisation opportunities.

Our knowledge transfer networks and many other bodies have been very helpful in organising events as part of the consultation. There were a series of large workshops held in each area, and extensive discussions and one-to-one consultations were held with leading business people and academics.
We held around 50 separate events and countless individual briefings; and more than 3,000 organisations have invested time and resources in this process.
All the information collected was examined against the criteria set out in the panel.

The exercise has been very valuable in strengthening understanding of the opportunities and challenges for all the areas identified in the strategy and implementation plan – including those that will not be the focus of a Catapult. This document sets out how we propose to progress our investment in the new network and across these other areas.

Criteria for establishing Catapults

- Are the potential global markets that could be accessed through the centre predicted to be worth billions of pounds a year?
- Does the UK have world-leading research capability in the area?
- Does UK business have the ability to exploit the technology and make use of increased investment to capture a significant share of the value chain and embed the activity in the UK?
- Can a proposed centre in this area enable the UK to attract and anchor the knowledge-intensive activities of globally mobile companies and secure sustainable wealth creation for the UK?
- Is a proposed centre closely aligned with, and essential to achieve, national strategic priorities?

Investing in growth

Following consultation, the Technology Strategy Board has identified seven areas for new Catapults – and drawn up a co-ordinated programme of investment to meet innovation challenges in the other high potential areas identified during the process.

The next pages explain more.

High Value Manufacturing Catapult

The High Value Manufacturing Catapult was declared open for business by the Secretary of State for Business, Vince Cable, in October 2011, and it is already hard at work.

The seven members of the High Value Manufacturing Catapult currently employ 625 staff and, by the end of its first six months, the Catapult is projecting commercial income of £10m, with an additional £10m of in-kind contributions from industrial clients. Given that a number of the member centres are in the start-up phase, this is encouraging.

Over the same period, the Catapult will also have invested around £50m in capital and revenue programmes, including around £20m from the Technology Strategy Board.

The Technology Strategy Board will invest more than £140m in the Catapult over a six-year period to stimulate manufacturing in the UK, reduce the risk in innovation for new and established UK manufacturing businesses and attract international business to the UK.

Manufacturing has a key role to play in economic growth and rebalancing the economy, in particular driving exports and productivity. It represents between 11% and 12% of gross domestic product, and the international market for manufactured goods has grown at a consistent 3% a year over the last few decades.

The High Value Manufacturing Catapult will support manufacturing in a number of different industries including pharmaceuticals and biotechnology, healthcare, aerospace, automotive, energy, chemicals, electronics, and food and beverages. It will focus on technologies with the broadest possible applications across sectors. The Catapult will help UK businesses stay at the leading edge of manufacturing technology and create and protect jobs long into the future.

The seven members of the High Value Manufacturing Catapult

- Advanced Forming Research Centre, Glasgow (billet forging; sheet forming; precision forging)
- Advanced Manufacturing Research Centre, Sheffield (machining; materials and component testing; hybrid and metallic composites; assembly)
- Centre for Process Innovation, Wilton, Sedgefield (chemical processing; biotechnology; printable electronics)
- Manufacturing Technology Centre, Coventry (automation and tooling; fabrication, joining and assembly; additive and net shape; process modelling)
- National Composites Centre, Bristol (design and manufacture of composites)
- Nuclear Advanced Manufacturing Research Centre, Sheffield (fabrication of civil nuclear components)
- Warwick Manufacturing Group, Coventry (lightweight product system optimisation; energy storage and management; digital verification and validation)

The Catapult is working with some of the UK's leading manufacturing companies – including AgustaWestland, Airbus, Areva, Boeing, GKN, Gudel, Hewlett Packard, Jaguar Land Rover, Rolls-Royce, Vestas and Westinghouse – a long list of small and medium-sized enterprises and with academia to support the process of commercialising business-led research and innovation that will help UK manufacturing businesses become more competitive on a world stage.

One of the first activities of the Catapult was to commission a study of future trends in manufacturing by the Institute for Manufacturing. The aim is to map the landscape that will shape the UK's high value manufacturing and innovation base over the next 15-20 years. There was wide industry consultation and the results were published in February 2012.

Cell Therapy Catapult

The Cell Therapy Catapult will support the development and commercialisation of cell therapies and advanced therapeutics, as well as the underpinning technologies for manufacturing, quality control, safety and efficiency.

Cell therapies involve the use of living cells as, or incorporated into, a medicinal product. They have a number of uses including in the regeneration of tissues or organs, in gene therapies, and in the treatment of cancers and infections.

The cell therapy industry is expected to be worth £3.1bn by 2014 and to continue growing quickly beyond then.

The Catapult will help businesses to turn their innovations into commercial products that both bring significant benefits to the UK economy and provide therapies that could transform the lives of people with serious or chronic illnesses.

The UK is ideally positioned to gain a substantial share of this new market due to its leading position in the science of stem cells and regenerative medicine, its supportive regulatory environment, the NHS as a potential lead market, access to mature capital markets and established pharmaceutical, biotechnology, medical device and blood transfusion industry sectors.

The Catapult will be located in London and is expected to open in summer 2012. It will receive funding of £10m a year over the next five-year period from the Technology Strategy Board. London was chosen as the location for the Catapult following consultation with industry. The capital has a rich cluster of hospitals and clinical infrastructure, logistics, universities, talent and a reputation as an international business hub with proximity to the financial sector.

An interim advisory group made up of members of the governing board of the Technology Strategy Board and industry partners has been established to shape the direction of the centre and to advise on a leadership team.

Offshore Renewable Energy Catapult

The Offshore Renewable Energy Catapult will enable UK business to research, test and measure the application of new technologies and materials, building on the strong track record of innovation in offshore renewable energy undertaken in the UK over many years. It will also help the UK achieve its target of generating 15% of its energy from renewable sources by 2020.

In its recently published UK Renewable Energy Roadmap, the Department of Energy and Climate Change (DECC) predicts that this could mean the UK installing 18GW offshore wind capacity by 2020 and 400MW of tidal and wave power.

The global market for wind, wave and tidal power is predicted to exceed £64bn by 2050 and UK businesses are expected to gain a 12% share of the offshore wind industry and a 15% share of wave and tidal markets.

Following an open competition, a single consortium bid from the Carbon Trust, National Renewable Energy Centre (Narec), and Ocean Energy Innovation to run the Catapult was accepted, and in February 2012 we announced that the Catapult would have its primary location in Glasgow, Scotland, with a second site in the North East of England (Northumberland). It is expected to open for business in the summer of 2012.

The Catapult will receive up to £10m a year over five years from the Technology Strategy Board. Its focus will be on technologies applicable to offshore wind, and tidal and wave power.

The UK has world-leading expertise in offshore engineering and understanding of the seabed and marine environment. It has given us a worldwide reputation in offshore facilities and makes the UK an excellent base for offshore research and development.

The Catapult will work with the world-class UK research and innovation community in offshore wind, tidal and wave, and the growing UK offshore renewable energy industry, and will build strong links to centres of excellence, such as the European Marine Energy Centre (EMEC), Wave Hub, and the recently announced marine energy park in the South West of England.

It will establish the strong international links required to facilitate the commercialisation of new technologies and will also forge long-term relationships with the European Commission through active involvement in both its current and future framework programmes.

A delivery plan for the Offshore Renewable Energy Catapult will be developed over the next few months with the aim of opening the centre in summer 2012.

Satellite Applications Catapult

The Satellite Applications Catapult will help UK businesses develop new satellite-based products and services and stimulate growth across the UK economy. It will provide a range of research and development-intensive activities from the development and demonstration of game-changing satellite technology through to the delivery of everyday services derived from space data.

Satellite services will be a major growth area for the UK economy over the next decade and beyond. The global space sector is expected to grow to £400bn by 2030. The Catapult will help to achieve targets set out in the UK Space Innovation and Growth Strategy to grow UK market share from 6% to 10% by 2030 and create 10,000 new high-value jobs.

The centre will provide technology and service demonstration opportunities to address the difficulties associated with testing technologies and services destined for space. It will not work on space science, space exploration, manned space flight, expendable rocket launchers or astronomy.

The centre will provide testing facilities in space through satellite programmes – such as TechDemoSat and UKube1 which, once launched, will provide UK businesses with a platform in space on which they can test new technologies. It will also help smaller companies by providing facilities on the ground that give them access to simulation, data management and visualisation capability.

By providing both the in-orbit facilities and the ground-based data management capability, the Satellite Applications Catapult will allow UK businesses to work together to reduce the risk in developing new technology. It will help innovative organisations to demonstrate new satellite technologies, remove significant cost barriers and shorten the waiting time for first flight demonstrations of new equipment.

Priority will be given to building critical mass in growth areas, such as climate and environmental monitoring from space and maritime services, where bringing together earth observation data, accurate position information, modelling and visualisation expertise can create a basis for new commercial services. The centre will quickly build on the excellent track record of the UK space industry and the work of the International Space Innovation Centre (ISIC).

The Technology Strategy Board worked closely with the UK Space Agency, the trade association UKspace, the International Space Innovation Centre and the 1,200-strong special interest group of the knowledge transfer network. There was a large response to the open engagement process including: an orientation workshop attended by 84 people; an industry survey which had 80 responses; sessions at the UK Space Conference, Earth Observation Conference and Venturefest; and a series of workshops at the Innovate ‘11 event.

The response from industry has been well organised. The Space Leadership Council has made a strong commitment to a Satellite Applications Catapult and a response team was set up by UKspace and ISIC to coordinate engagement across the sector.

A document detailing the vision, scope, ways to engage and the next steps for establishing the Catapult was published in January 2012 (see the Satellite Applications Catapult page at **www.innovateuk.org**). We have been working with all partners to develop a delivery plan for the Satellite Applications Catapult, which we intend to publish in the coming weeks.

Connected Digital Economy Catapult

The UK is one of the world's strongest digital markets. The UK's ICT and software sectors alone are worth £74bn and recent estimates suggest the UK Internet economy is larger per head than in any other country. The UK Internet economy is forecast to grow 10% a year for the next four years, and to reach 10% of gross domestic product by 2015[1]. The Connected Digital Economy Catapult will deliver a step change in the UK's ability to capitalise on its strengths.

Market growth over the next 10 years will come increasingly from the convergence of creative industry products and services, data, devices, and digital services, driven by trends such as mobility, machine-to-machine communication, cloud adoption, and consumerisation. This is what we call the connected digital economy.

Large and competitive creative and media, financial, and services sectors combined with an early-adopter attitude make the UK one of the best places for digital innovation and exploitation. Media, Internet and cyber-security clusters and a growing open data movement are examples of world-class excellence. The UK has the highest ranking for ICT academic publications per capita, and particular strengths in creative industries, digital media technologies, data analytics, cyber security and communications.

As part of our consultation, we engaged with more than 400 organisations across the ICT and the creative industries. We held 60 in-depth interviews, had more than 300 responses to an online questionnaire from small and medium enterprises and universities, held a workshop with 25 participants from multinationals with nearly $1tn of combined revenue, held seven roundtable discussions, held an oversubscribed open workshop with 90 participants, and had numerous other submissions and one-to-one discussions.

Our consultation highlighted the key challenges as:

- lack of continuous, stable pre-commercial, pre-competitive collaboration mechanisms
- high investment risk in disruptive and transformative solutions
- ever more complex integration of technologies into systems needed to deliver new applications and services
- frequent disconnects (commercial, cultural, technological) between end-users and the ICT industry, and high fragmentation hampering innovation opportunities
- non-technology capabilities (economic, legal, human) that are required to commercialise at scale.

The Connected Digital Economy Catapult will deliver a step change in the UK's ability to capitalise on its strengths and inspire UK business to lead in the development and adoption of the technologies, systems and services that will underpin the future connected digital economy.

The centre will address the challenges and complement existing mechanisms by:

- addressing large, complex challenges that could unlock significant potential for the UK and globally
- providing a stable base for sustained collaboration across industries and with customers
- integrating component technologies into wider systems and solutions
- leading the development and operation of pre-commercial pilots and demonstrators
- providing access to capital-intensive experimental and testing infrastructure
- acting as a visible catalyst for other hubs, resources and centres of expertise.

The Technology Strategy Board has been working with interested individuals, companies, research groups, and key stakeholders to plan the establishment of a Connected Digital Economy Catapult. In early March 2012, we published a document detailing the vision, scope, challenges and next steps for establishing the Catapult.

We have set up a Special Interest Group and a dedicated **_connect** online collaboration space to help us to engage with the widest possible community, and we are running a number of workshops and events.

The first output from this consultation will be a detailed vision and scope for the Catapult.

1 Boston Consulting Group, The Connected Kingdom, Oct 2010

Future Cities Catapult

The Future Cities Catapult will drive economic growth by giving UK businesses access to the emerging technologies that will allow them to develop the products and services required for cities in the future. The market is large and growing.
Over £6.5tn will be invested globally in city infrastructure over the next 10-15 years, and the accessible market for integrated city systems is estimated to be £200bn a year by 2030.

Cities are vital to the future global economy. By 2050 more than 70% of the global population will live in cities. They are more economically productive and have a lower environmental footprint per capita than the average for the country in which they are located.
But cities are also struggling with:

- climate change
- changes in population and demographics
- congestion
- healthcare and
- pressure on key resources.

To succeed in the future, city governments have to deliver economic activity, quality of life and a lower environmental footprint. This cannot be delivered by optimising the separate components of the city infrastructure. New integrated and city-wide solutions are required.

The UK has the strength to exploit this market. We have world-leading companies in project management, engineering, architecture, finance, legal and insurance. Our ability to bring together the cluster of companies needed to design, finance, risk manage and execute large infrastructure projects makes the UK a major global centre for such projects. The UK has a world-class science and research base that supports the development of innovative solutions and provides a talent pool for UK and global firms.

The complexity of the challenge is beyond any single business or city, and there is strong demand for solutions. Cities representing over 80% of the UK's gross domestic product are telling us that they need new solutions if they are going to invest effectively.

Although this is a global challenge, no other country has yet developed a national centre to provide integrated solutions to the future needs of cities. With a growing market, a strong cluster of supply companies, and an excellent academic base, there is an opportunity for the UK to take a leading global position in providing the next generation of solutions for cities – integrated, city-wide systems.

We have involved many groups in developing the business case. We conducted well over 100 interviews and held five public workshops attended by more than 200 individuals. Nine of the UK's largest cities, more than 50 companies and 25 innovation groups are active supporters.

The Future Cities Catapult will bring together business, city governments and academia in a unique collaboration to enable businesses to develop products and services for this emerging market. It will:

- aim to test innovative business solutions in a series of large-scale demonstrator projects monitored and managed by a real-time city observatory, combining live data with advanced visualisation and simulation
- overcome the silos of different city systems to create integrated solutions, putting the citizen at the heart of the city
- target challenges, including increasing city density without congestion and the transition to a low-carbon economy.

The Catapult will deliver the intensity of collaboration required to provide the new solutions, together with the real world demonstration and validation required to help UK-based companies to capture an increasing share of a growing market. It will also help to create new supply chains, enabling small and medium-sized enterprises to access this large and complex market.

Over the next few months, we will be working with interested individuals, companies and groups to develop a practical plan for the establishment of the Future Cities Catapult.

We have set up a special interest group and a dedicated **_connect** online collaboration space to help us to engage with the widest possible community, and we are running a number of workshops and events. The first output from this consultation will be a detailed vision and scope for the Catapult..

Transport Systems Catapult

The Transport Systems Catapult will drive economic growth by enabling business to develop products and services to address the challenges facing the transport system of the future. In developed countries, transportation accounts for between 6% and 12% of gross domestic product, some £2.5tn-£4.7tn globally.

The existing transport system is under severe pressure. In order to tackle these issues we need a fully integrated efficient transport system. This can only be developed when transport is considered as a whole. The bringing together of partnerships across transport and with other sectors through a Catapult will place UK business in a position of strength to develop world-leading products and services to address these challenges and deliver novel solutions.

The accessible market for novel, efficient and cost-effective transport systems is huge, between £190bn and £890bn.

The UK has world-leading academic and business expertise in all the elements that can support the development of transport systems innovation. Areas of strength include traffic management systems, vehicle design and manufacture, infrastructure design and delivery, on-vehicle and off-vehicle communications, telematics, logistics provision and testing facilities.

The products and services developed by the partnerships using the capabilities of the Transport Systems Catapult will be deployed and tested in a range of activities from small-scale testing programmes through to large-scale demonstrator projects. The Catapult will host modelling and simulation capabilities to enable virtual analysis and development of new products. It will also provide small-scale prototyping capabilities and link to the key testing capabilities already in the UK. The Catapult will also manage small and large-scale demonstrations of the technologies and services that will be developed.

Initial challenges that will be addressed by the Catapult include:

- seamless journey systems (for freight and people)
- remote asset management and monitoring
- traffic management and control systems
- infrastructure design optimisation, journey assistance system
- infrastructure integrity and security
- connected vehicles and
- novel economic and business models.

During the consultation we had input from more than 110 organisations. There were six separately managed workshops with at least 250 attendees. There was significant input and support for the Transport Systems Catapult from the main industry strategy groups including the Train Strategy Leadership Group, the Automotive Council and the Marine Industry Leadership Council. An independent, transport-wide study and report looking at the business case for the Transport Systems Catapult drew on over 42 man weeks of rail industry input.

The Technology Strategy Board is working with the Department for Transport and the Transport Knowledge Transfer Network to develop a plan for the establishment of a Catapult. We will use the **_connect** online collaboration space to engage with a wide range of transport interests with the aim of confirming the scope and vision for the Catapult in April 2012.

Photonics programme

The Technology Strategy Board will work with the community to define a programme of R&D support over the next three years, amounting to £10m, which will target the opportunities identified in the consultation process.

The consultations with the UK business and photonics community demonstrated the potential opportunities for UK businesses to benefit from more research support in the area of photonics and a need for a more coordinated approach to the building of a community between businesses – particularly small and medium-sized enterprises and the research communities.

A workshop in July was attended by more than 100 people, and an online questionnaire received 146 responses. A further workshop was attended by 40 people, there were meetings with regional photonics networks, and more than 20 one-to-one meetings and teleconferences were held with industry leaders.

While a Catapult centre was sought by many in the sector, the Technology Strategy Board has concluded that the objectives would better be met at this stage by a coordinated research and development programme coupled with more support for networking.

The Board will therefore be working with the community to define a programme of R&D support over the next three years, amounting to £10m, which will target the opportunities identified in the consultation process – in bio-photonics, in smart imaging and processing systems for environment and security, and in laser material processing.

The first of these, to be announced after Easter, will be a £4m 'photonics in healthcare' competition, which will link our growing connections in the healthcare industry with the capabilities in the photonics industry. We also intend to invest £1.5m in a competition in bio-photonics, to be launched in the third quarter of 2012.

We will continue to develop our European programmes. In late 2012 we will invest €1m in a European ERA-NET+ competition in bio-photonics. The scope of this competition will be intentionally broad to accommodate other European sponsors.

Further investment in photonics will take place in following years.

Sensor systems programme

The Technology Strategy Board will work with the community to draw up a co-ordinated three-year £10m research and development programme to meet the challenges highlighted in the consultation.

Discussions with UK businesses and the research base working in this area have highlighted opportunities for the UK from bringing together the different sectors using sensors and the sensor providers to share experience and develop new products and services in a large and growing market. There is also a strong and interested UK business community, much of it in small and medium-sized enterprises, and a strong academic base.

We consulted across market sectors, including oil and gas, space, aerospace, defence, security, marine, environment, rail transport, road transport, food, built environment, healthcare and medical, life sciences, consumer goods, renewable energy, water, manufacturing and process industries, large-scale science, and sensors and instrumentation.

An online survey received 194 responses, a workshop at the National Physical Laboratory was attended by 110 delegates and two additional ones held in Glasgow and London brought over 40 experts together. There were 25 detailed submissions from a variety of organisations, one-to-one interviews were held, an industry focus group was organised, and there was input from the relevant knowledge transfer network and trade associations.

The main challenges articulated by the industry were in integrating early-stage technology into systems and in demonstrating the application of new technologies.

While this led those in the sector to argue for a dedicated Catapult, the Technology Strategy Board has concluded that these objectives could be met by creating a coordinated research and development programme focused on the opportunities identified in the consultations. We therefore propose to allocate £10m over the next three years for a coordinated programme in the area, including a significant package of funding for 2012.

The Technology Strategy Board will be working with businesses and the research base over the coming months to define the priorities for this. We will also be working with the defence sector, which has strong interests in the sensors area, to capitalise on opportunities for cross fertilisation between defence and civil applications of sensors.

Smart grids programme

The Technology Strategy Board will work with the smart grid community to support a co-ordinated interdisciplinary research programme to meet the challenges highlighted in the consultation and to complement the £25m Resilient Energy Systems programme.

The consultation in this area was met with great enthusiasm by business and academia. The community generally felt additional support in the smart grid area was welcome, appropriate and timely. The case for a physical centre however came second to the case for a coordinated, interdisciplinary research programme.

Consultation took place through a webinar, online surveys and a one-day workshop. The smart grid subgroup on **_connect**, the online collaboration space, and other discussion forums currently have more than 360 active members.

The broad areas identified where there was most opportunity for UK business and the Technology Strategy Board to make a difference in the commercialisation of smart grid technologies were:

- building coordinated partnerships across technology readiness levels
- developing and joining up supply chains
- an interdisciplinary and systems approach
- coordination of national research and demonstration projects and outputs
- improved knowledge transfer between sectors including ICT, electronics and transport
- coordination and alignment of research funding to optimise UK technology strengths
- enhanced speed of demonstration and deployment to capture the global market opportunities

We will therefore develop a programme to address the challenges and opportunities highlighted through the consultation exercise.

The programme will invest up to £25m over the next four years in technologies that will contribute to ensuring a resilient energy system with the overarching objective of supporting UK companies within the smart grid sector. The programme will focus on the application of integrated technologies within the broader energy system, including:

- hardware (sensors, power electronics, storage systems)
- software (virtual power plants, automation, demand side response)
- network infrastructure (security, data storage, communications)

The first competition opened on 9 January 2012 and makes available £2.4m for feasibility study funding in smart power distribution and demand.

Resource efficiency programme

The Technology Strategy Board will embed resource efficiency throughout its entire programme and invest at least £10m over the next three years to address the challenges highlighted in the consultation.

The commercial opportunity in resource efficiency is a large one. For the UK, savings for business through resource efficiency are estimated to be between £23bn and £53bn a year. Across the European Union, the opportunity is £220bn-£400bn a year. In addition, a transition to a more resource efficient approach will provide a wide range of opportunities for new businesses and the creation of many new jobs.

Efficient use of resources is critical for the future of the global economy. This is driven by the need to support a growing global population whilst reducing the environmental impacts of economic activity – to decouple economic growth from materials consumption. At the same time, there are many clear resource crunches in the foreseeable future, from water and oil to rare earth metals, leading to increased concerns about resource security.

The viability of a Resource Efficiency Catapult was tested through workshops and meetings with expert groups as well as discussions with more than 100 individual experts and businesses.

Two key themes emerged:

1. management of biomass to maximise production of food, energy and high value materials from available land and water
2. efficient use of materials through designing for the whole lifecycle and creating closed-loop systems for products and services.

These resource efficiency business opportunities occur across the economy, and each sector and application raises unique challenges.

The consensus from our consultation was that a series of targeted programmes addressing specific issues in specific business areas would offer more value than a Catapult.

To support this, the Technology Strategy Board will promote and embed resource efficiency across the whole of our programme. We will raise awareness by highlighting successful resource efficiency projects throughout our portfolio and by working with the knowledge transfer networks. We will integrate resource efficiency challenges into all our priority areas and relevant competitions. We will build capability by investing in resource efficiency tools and technologies, and work with other organisations with a similar focus on resource use to encourage the development of new solutions.

We have begun developing a programme to build key capabilities in the UK, such as sustainable design, lifecycle thinking, organisational management and new business models. The technical application of resource efficiency principles will be tackled through joint competitions being planned with other Technology Strategy Board areas such as high value manufacturing, materials, transport, and agri-food.

While more work remains to be done on the details, we expect the investment over the next three years across the whole programme to be at least £10m.

Complex systems programme

The Technology Strategy Board will continue to consult with key groups in the field of complex systems to assess how best to support the many different sectors working in this field.

A complex system is one made of interconnected parts whose combined actions are difficult to model or predict. The term is often used to describe the behaviour of things such as financial markets; the development of a city and its interconnection with humans; national infrastructure and the Internet.

During consultation, ideas emerged around a Catapult in complex systems but they only gained traction around the notion of working in a particular sub-sector, for example financial systems, the NHS or transport. There was no consensus to support a Catapult in complex systems working across sectors.

The lack of agreement around the size of the complex systems market or its constituents made it difficult to assess the potential value of a Catapult in this field.

There was wide consultation on the prospects for a centre for complex systems. The **_connect** group on complex systems has 96 members and was heavily involved. There was support from the UK Large-Scale Complex IT Systems Initiative which has some involvement from industry partners. A survey of the industry run by the Information and Communications Technology Knowledge Transfer Network had 12 responses from a variety of sectors and academics, but they conceded it would be difficult to build cross-application support for a Catapult in complex systems.

A workshop run by the ICT Knowledge Transfer Network offered many ideas but raised as many questions about the focus and value of a centre. No industry group or organisation has offered to be a lead partner in any such centre. In the absence of support for the concept we have concluded that it would not be appropriate to pursue investment in a Catapult in complex systems.

The Technology Strategy Board will continue to consult with business, academia and key stakeholders over how best we can support the area. This could include continuing our work with specific industry areas and helping to explore the synergies between them or devising a different framework that would engage businesses. Complex systems will also form part of the thinking of some of the Catapults, such as future cities and transport systems.

The Technology Strategy Board and the Financial Services Knowledge Transfer Network are working together on a number of proposed and current projects that fall under the heading of financial systems. They include: the Government Office for Science Foresight Project: The Future of Computer Trading in Financial Markets; the New Finance Institute proposal for an experimental facility bringing together leading researchers and providing a testbed for regulatory measures; and an intra-day cash liquidity market model to improve understanding of the way liquidity markets work, particularly when they lead to crises or market failures.

Next steps

The next steps involve working with partners to draw up more detailed business and delivery plans for each centre and setting up teams to lead and operate them. We will publish information detailing the vision and scope for each Catapult as it is refined and we will keep information and dialogue flowing through the website, **_connect** groups, workshops and other engagement activities.

And as the network of Catapults comes to life, we will continue to develop the brand and governance models and ensure there is wide engagement with the Catapults across innovation communities.

All the Catapults are expected to be fully operational in 2013.

Get involved

Together we have achieved a huge amount, thanks to the wide participation and enthusiasm shown by everyone involved.

We will continue to engage with the relevant business and academic communities as we draw up business and delivery plans for the specific Catapults, and bring the network to life.

To join in, please:

- sign up through the **_connect** collaboration and networking platform at **https://ktn.innovateuk.org**
- visit **www.catapult.org.uk**
- follow us on Twitter: **@Catapult_TSB**
- email **catapult@tsb.gov.uk**

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