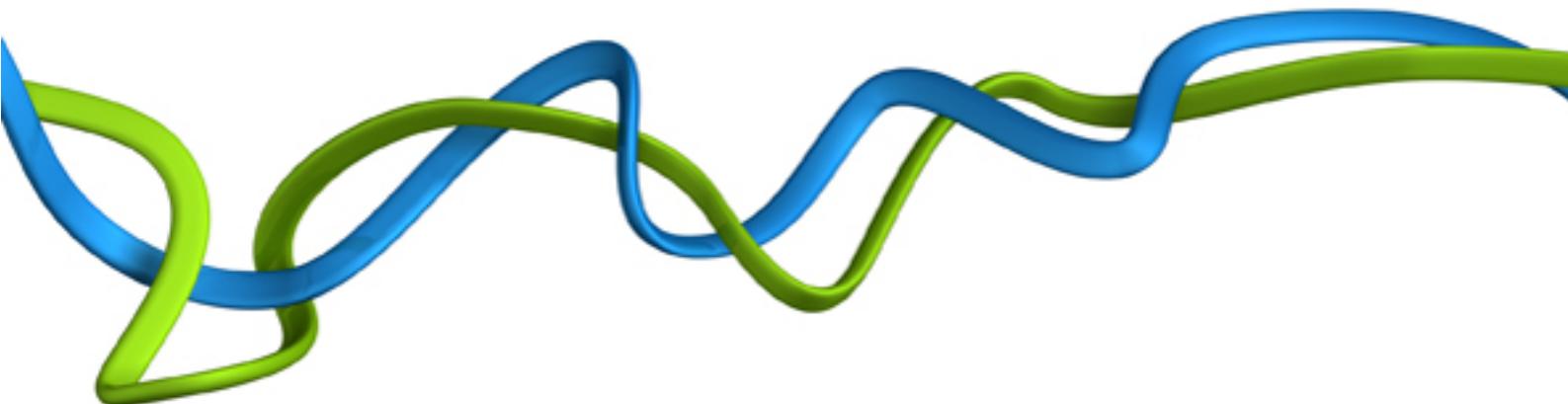


National Innovation Plan – Call for Ideas

Submission from the Royal Academy of Engineering

30 May 2016



About the Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

Summary

The Royal Academy of Engineering welcomes the opportunity to contribute to the Department for Business, Innovation and Skills' call for ideas for the National Innovation Plan. Government has a pivotal role to play in stimulating innovation. By creating a conducive policy environment, using procurement intelligently and providing targeted direct support, the public sector can be extremely effective at enticing the private sector to invest in innovation. In today's highly competitive and internationalised environment, it is more important than ever that government provides an assertive, effective and long-term commitment to innovation, backed up by funding and incentives, that reflects its aspiration for the UK to be the best place in Europe to innovate.

There is much that is positive about the UK's current innovation landscape and the work of Innovate UK has widespread support across the engineering community. It is essential that any changes to policy improve and build upon existing strengths and recognise where good progress has already been made, for example Innovate UK's recent simplification of its business support. The challenge now for government is to ensure that there is an overarching vision and a coherent and stable policy framework that enables the various actors involved in innovation to act effectively in concert over the long term. Areas for improvement include the following:

- The government must adopt a stronger leadership role in regulation and standards setting and encourage the participation of UK experts in these activities. It needs to give a clearer message to regulators that early interactions with innovators and technology experts are an essential part of their responsibilities, as well as facilitating closer working between regulators and innovators. Regulators should be encouraged to explain how risks for innovative technologies are being managed to allay public concerns.
- Public procurement provides a crucial opportunity to stimulate innovation, yet the perception remains that procurement decisions continue to prioritise low cost over best value and risk aversion hinders the introduction of innovative solutions. Government needs to adopt the established best practice around intelligent procurement which will involve cultural change and a greater willingness to accept the risk of failure or perceptions of it. Only government can effect the improvements to public procurement that are so urgently needed to enhance its impact on innovation and value for money.
- Harnessing the power of open data has immense potential to drive innovation. For the UK to realise this potential it must support and facilitate the development of methodologies for the formal valuation of data assets and the creation of data markets. Government also needs to promote the development of the multi-skilled workforce required for the UK to take full advantage of open data.
- Innovation needs to be considered in the development of all infrastructure strategies, so that opportunities for innovation in infrastructure and the impact of infrastructure investments on innovation are understood and maximised. This will require the adoption of a systems approach. Access to high-speed broadband services is an enabler of innovation, yet the UK lags behind competitor economies in terms of connectivity, highlighting the need for government to raise its level of ambition in this area.
- A clear industrial strategy is one of the most effective ways of encouraging private sector investment in priority sector and technology areas. Greater access to long-term, patient capital would help more UK companies grow to scale.

- Direct public support to help bridge the ‘valley of death’ along with interventions targeted at building the capacity, global vision and resilience of entrepreneurs are key. Government needs to invest in skills and incentives to enhance the absorptive capacity of established business to ensure they get the maximum benefit from adoption of existing innovation, including disruptive technologies. Grant funding remains crucial for stimulating high-risk, early-stage innovation.
- Building the investment readiness of entrepreneurs and companies is essential: without such support the UK risks investors increasing their overseas investments instead of investing in the UK. UK university knowledge exchange has many strengths but there are also opportunities to make improvements, for example, to the spinning out process and the way university technology transfer offices are resourced. Initiatives to increase the flow of skilled people between academia and industry will facilitate greater opportunities for business-university collaborations, which contribute to innovation and increase the UK’s absorptive capacity.
- For the National Innovation Plan to have the greatest impact, it needs to connect with relevant policy areas beyond those for which BIS is directly responsible. If the support of other government departments could be secured, the potential impact of the National Innovation Plan would be amplified significantly.
- The acknowledgement of the distinctive role and business-facing orientation of Innovate UK in the Higher Education White Paper, along with the commitment to reflect this within UK Research & Innovation, is very welcome. The challenge now is to ensure that these statements of intent are fully realised during the implementation phase so that existing strengths are built on and any disruption to innovation support minimised.

1. How best can our regulators drive innovation and make the UK the regulatory test bed capital of Europe?

- 1.1. Regulation and standards have the potential to play a powerful role in stimulating innovation and creation of new market opportunities. Clearly, regulation can also hamper innovation if it reduces flexibility, delays commercialisation or adds to business cost and compliance requirements. This means that consideration of the potential impact of regulation on innovation must be integrated into the impact assessment process for the introduction of new, or amendment of existing, regulation.
- 1.2. There are significant advantages to the UK assuming a leadership role in the international negotiations that underpin the development, adoption and implementation of regulation and standards. This can both help to ensure that they are fit for purpose and maximise the opportunities for success for UK innovators. However, SMEs often struggle to engage in these negotiations due to lack of resources and for many academic researchers such activities may not be seen as high priority. It is important to raise awareness among R&D and innovation funding bodies and private investors of the value of this type of activity for accelerating routes to market and enable the participation of appropriate individuals. Existing networks, such as the Knowledge Transfer Network, Enterprise Europe Network and the Catapult network, could be utilised to encourage and facilitate such participation. In addition, university researchers, who often have relevant expertise, should be provided with the necessary

funding or career incentives to participate in international standardisation and regulations activities.¹

- 1.3. Speed and agility are vital for successful innovation. To ensure that regulation does not impede innovation unnecessarily or unintentionally, regulators need to engage early with innovators and experts in the relevant technology areas. Such early and collaborative interaction is particularly important for fast moving areas of innovation such as data analytics and machine learning. If this does not happen, the benefits of first mover advantage will be lost. Government needs to give a clear message to regulators that early interactions with innovators and technology experts are an essential part of their responsibilities and consider how closer working between regulators and innovators can be incentivised or facilitated.
- 1.4. An effective regulatory framework requires a positive approach to risk management that adequately reflects the benefits of the relevant innovations as well as the potential existence of hazards. The measures introduced to offset risk should also be in proportion to the probability of the risk occurring and the likely impact if it does materialise.
- 1.5. Regulators also have a critical role in communicating how risks are being managed for new technologies, which in turn can influence public confidence in innovations, particularly those with the potential for transformative change. The strength of such messages when delivered by trusted regulators should not be underestimated as similar messages from the innovators themselves are more likely to be met with scepticism.

2. How can we deliver real culture change within public procurement?

- 2.1. In 2014 the Academy published a report entitled *Public projects and procurement in the UK* which set out how an engineering systems approach could help the UK government meet its tactical, operational and strategic objectives for procurement.² Its key findings remain relevant and could usefully inform the National Innovation Plan.
- 2.2. A systems approach focuses on the way that a system's constituent parts interrelate and work over time, within the context of larger systems, while also considering design and risk mitigation to generate an effective and sustainable solution. Such an approach is becoming increasingly important as many aspects of society become more complex and interdependent. For example, the Academy is currently working to understand how a systems approach can help deliver a better health and social care system as well as working with various policy groups in government to use systems thinking to develop policy solutions.
- 2.3. Adopting a systems approach in procurement allows the technical, financial and human factors to be considered in an integrated manner and maximises the opportunity for it to act as an effective stimulus for innovation. The limited budgets and complex specifications often associated with public sector procurement can actually serve as drivers for the introduction of innovative solutions. Unfortunately, despite numerous

¹ [Connecting Data](#), Royal Academy of Engineering and The Institution of Engineering and Technology, 2015

² [Public projects and procurement in the UK](#), Royal Academy of Engineering, 2014

reports and recommendations highlighting the importance of intelligent procurement, concern remains that lowest cost is being favoured over best value.

- 2.4. One of the reasons for this may be the tendency towards risk aversion in the public sector, driven at least in part by the high visibility of failure (or even the perception of failure) and the consequent political and public reaction. Establishing and accepting an appropriate level of risk is simply essential if the opportunities to stimulate innovation provided by procurement are to be exploited. Government needs to find a way of accommodating the potential for failure where there is a desire for innovation or an unavoidable degree of risk. It also has a role to play in articulating to the public and the media that investment in innovation is a means of fuelling our future prosperity and that responsible risk taking can deliver better value for the UK from procurement.³
- 2.5. By factoring in the risks associated with innovation at the outset of the planning stage, failures can be identified early and a change of direction can be implemented before severe financial ramifications occur. A two-stage bidding process can allow for a more mature assessment to be made of risk, programme requirements and cost, leading to better understanding by both parties of the scope of the project and the apportionment of risk before committing to the project in full. In addition, contractors can then be remunerated for developing innovative ideas even if they do not go on to win the project contract.
- 2.6. The Small Business Research Initiative (SBRI) is intended to use procurement as a mechanism to pull through new products or services of benefit to the public sector but is widely perceived to be less successful than the US Small Business Innovation Research model. There is a particular concern that SBRI has not had the desired impact on strengthening procurement. A reinvigoration of the scheme to emphasise its potential role in improving procurement, alongside its role in stimulating R&D and innovation, would be welcomed. Best practice from government departments which are perceived as having successfully implemented SBRI should be shared. As for public sector procurement in general, a cultural tendency towards risk aversion may be preventing SBRI from fulfilling its potential. Visible support from a Ministerial Champion and Departmental Champions tasked with promoting the benefits of SBRI would be helpful.

3. How can we ensure that we put the UK at the forefront of open data opportunities?

- 3.1. In November 2015 the Academy, in collaboration with the Institution of Engineering and Technology (IET), published a report entitled *Connecting data, driving productivity and innovation*.⁴ Some of its key recommendations are outlined below; the report contains further detail likely to be of relevance to this consultation.
- 3.2. The open data initiatives of recent administrations have contributed greatly to the development of a data-enabled economy, and the work of the Open Data Institute in supporting the use of open data should continue to be supported. However, much potentially valuable proprietary data remains locked away in corporate silos or within

³ [Investing in Innovation](#), Royal Academy of Engineering, 2015

⁴ [Connecting Data](#), Royal Academy of Engineering and The Institution of Engineering and Technology, 2015

sectors. The ability to trade data in ‘data markets’ under rigorously specified conditions is a necessary condition for gaining access and platforms need to be created that enable proprietary datasets to be traded within a framework that promotes trust. *Connecting Data* recommended that multidisciplinary working groups should also be established to explore new and sustainable business models for data trading.

- 3.3. For effective trading of data, methodologies for the formal valuation of data assets need to be established. By failing to adequately measure this key and growing element of national value creation, UK assets are being underestimated and a significant element of wealth creation omitted from the tax base.⁵ Despite the real challenges, the benefits of introducing valuation methodologies into corporate governance and accounting practice could be substantial.
- 3.4. *Connecting data* identified areas of excellent practice and innovation in multiple sectors which, if shared more broadly both within and between sectors, could realise major improvements in performance. Catapults should be tasked with developing and implementing mechanisms for sharing best practice in data analytics and connectivity with particular emphasis on reaching SMEs within sector supply chains. The Climate Data from Space Stakeholders Group, set up by the UK Space Agency, provides a useful example of how data analytics can be translated into real world applications and services by convening academic, public and industry elements of, in this case, the climate data community.
- 3.5. However, most sectors lack the multi-skilled workforce required to convert data analytics theory into genuine changes to business practice and performance. Furthermore in both industry and research there is a paucity of knowledge of the basic techniques needed for good data governance including data definition, metadata specification, data collection, data curation and data linkage. The required combination of skills is challenging, drawing on engineering, computer science, mathematics and statistics as well as specific sector knowledge. Tackling this will require changes to be made to undergraduate and postgraduate education as well as continuous professional development to reflect the new demands for multi-skilled individuals and teams with data science skills.
- 3.6. The Academy held a workshop on ‘Data as an asset: exploring how to value data better and unlock its potential for wealth creation’ with relevant stakeholders in May 2016 and is engaged in several other activities to progress a number of the recommendations made in *Connecting Data*. The Academy would welcome the opportunity to engage with government further on these issues.
- 3.7. Open data opportunities arise in all sectors of the UK economy, both private and public, so it is critical that there is effective cross-government working to support coherent implementation of strategies and initiatives. This will also require coordination between the National Innovation Plan and the anticipated UK Digital Strategy.

⁵ [Independent Review of UK Economic Statistics](#), Professor Sir Charles Bean, 2016

4. Where can we maximise the opportunities for innovation, as we deliver high-quality infrastructure that unlocks broad economic opportunities?

- 4.1. The National Infrastructure Commission provides a welcome opportunity to strengthen long-term, strategic decision making around infrastructure. The Commission should ensure that it embeds innovation in its decision-making framework so that opportunities for innovation in infrastructure and the impact of infrastructure investments on innovation are understood and maximised.
- 4.2. Decisions regarding infrastructure should not be viewed through a single sectorial lens: sectors and their infrastructures are more connected than ever before, with areas such as digital, energy and transport influencing growth across all sectors of the economy. Consequently systems thinking should be applied during the development of strategies related to infrastructure. For the UK to deliver high-quality infrastructure that unlocks broad economic opportunities, the speed of technological change needs to be considered and infrastructure strategies developed in a way that allows for flexibility and responsiveness.
- 4.3. For example, energy is a critical and broad sector, underpinning the UK's ambitions to deliver innovation in many other areas, such as low carbon garden cities and advanced manufacturing. When developing energy infrastructure and policy, consideration needs to be given to electricity, heat and transport, which are all part of the UK's energy system and interact in a complex manner.⁶ For energy, the scale of the engineering challenge is massive and a coordinated national energy strategy that engages industry, the research and innovation community and government is required to help align and inform energy infrastructure investment and development. The UK National Infrastructure Commission could serve as a catalyst to drive the development of a coherent energy strategy informed by expert bodies active in this area.
- 4.4. In addition, ubiquitous access to high-speed broadband services is a prerequisite for a data-enabled economy which benefits all sections of business and society. Sectors such as advanced manufacturing and precision agriculture, despite making a significant contribution to the UK's GDP, are currently at a significant disadvantage as a result of their rural locations.⁷ The announcement in the recent Digital Economy Bill that government intends to introduce a new Broadband Universal Service Obligation with initial minimum download speed of 10Mbits/sec is to be welcomed. However, the EU Digital Agenda for Europe has a target of universal fixed access at a minimum of 30 Mbits/sec download by 2020 and competitor economies such as Germany and South Korea have already achieved superior levels of connectivity, highlighting the need for the UK to urgently raise its level of ambition.
- 4.5. There is a growing awareness of the importance of 'place' for innovation, reflected in the introduction of Local Enterprise Partnerships (LEPs), University Enterprise Zones, Growth Hubs and the focus on the Northern Powerhouse and Midlands Engine. Regions have different innovation characteristics, determined through a combination of the presence of Higher Education Institutions, the level of skills available, the types of companies present, and, critically, the infrastructure available and its quality.

⁶ [A critical time for UK energy policy](#), Royal Academy of Engineering Report for the Council of Science and Technology, 2015

⁷ [Connecting Data](#), Royal Academy of Engineering and The Institution of Engineering and Technology, 2015

Recognising the differences between these local areas allows policies to be developed which seek to maximise the contribution made by innovation to local growth.

4.6. Although LEPs and Growth Hubs have been tasked with playing a strategic role in signposting and coordinating national and local business and innovation support it is unclear how successful this approach will be. In particular, there are concerns whether all LEPs are adequately equipped, both with regard to skills and resourcing, to provide effective support at the local level. BIS and DCLG need to set out clear guidance on supporting innovation at the local level, including ensuring that the innovation strategies emphasise collaboration rather than competition between regions.⁸ The Science and Innovation Audits now underway should assist with this process.

5. Where can the UK work alongside the private sector to create the deepest pool of innovation finance in Europe?

5.1. One of the most significant roles of government in stimulating innovation is in articulating a clear vision and establishing an accompanying stable and coherent policy framework. Evidence demonstrates that a lack of policy stability can substantially undermine the effectiveness of otherwise favourable policies.⁹ While changing circumstances and governments may result in differing policy priorities, the value of stability and continuity for giving business and others the confidence to make investments over the long term should not be underestimated. The introduction of the UK's modern industrial strategy was warmly welcomed across a range of industrial sectors and the engineering community, and the subsequent move away from it was greeted with disappointment.

5.2. Industrial strategy, or a framework for key sectors, can provide a powerful lever for stimulating business investment in R&D and innovation. The aerospace and automotive industries provide excellent examples of what can be achieved through effective sector leadership councils with strong political and industry buy-in, creating business confidence and a clear vision for the sector. The sector leadership councils act as platforms to convene private sector stakeholders, with major corporates bringing with them potentially valuable links to a wide range of SMEs through their supply chains. Government could require a sector-wide commitment to an increase in R&D, or associated investment in innovation and manufacturing capability, in the UK for a sector to be included in future iterations of the industrial strategy or other forms of publicly-backed sector support. The impact of this approach would be amplified if government also committed to provide an increase in R&D investment of relevance to the sector, in proportion to the increase in private investment secured.¹⁰

5.3. There are numerous government backed schemes, tax incentives and initiatives in operation that aim to increase the availability of and access to finance for high-growth innovative businesses that are broadly regarded as useful by the engineering community. Although improvements to some schemes would be welcomed, the overriding message must be that the stability and longevity of successful schemes needs to be prioritised. Continuity in the support on offer, set against a consistent and long-term

⁸ [The Dowling Review of Business-University Research Collaborations](#), 2015

⁹ [Supporting Investment in Knowledge Capital, Growth and Innovation](#), OECD 2013

¹⁰ [The Dowling Review of Business-University Research Collaborations](#), 2015

policy framework, could substantially improve the ability of businesses, funders and investors to develop and grow businesses to scale.

- 5.4. Nevertheless, there are specific changes that government could make to ensure that all its schemes and incentives deliver the intended impacts and that any perverse incentives are minimised. For example, Entrepreneurs' Relief allows directors who own 5% or more of a company to enjoy a reduced level of Capital Gains Tax upon business disposal. However, Entrepreneurs' Relief could be perceived to be acting as a disincentive to growth, as the directors in question would not want to see their share diluted below 5% as they would then become ineligible for the tax relief. It has also been suggested that the limits on the amount that can be invested through the highly regarded Enterprise Investment Schemes and Seed Enterprise Investment Schemes should be increased.
- 5.5. For R&D tax credits, much clearer guidance from HMRC and BIS is needed for businesses on how they can best make use of R&D tax credits and how these interplay with State Aid restrictions.¹¹
- 5.6. A shortage of long-term patient capital has been identified by many experts as a barrier to the ability of UK companies to innovate.¹² The creation of the independent Business Growth Fund (BGF) in 2011 has made a significant impact and demonstrates that the UK has potential investees with sufficient ambition to warrant the provision of long-term patient capital. The establishment of the BGF also demonstrates the considerable enabling influence government can have through encouragement and effective articulation of the case for investment. Government backed financial guarantee schemes, if designed appropriately, can be used to support long-term investment loans by the private sector, by mitigating the associated risk - the German Kreditanstalt für Wiederaufbau is considered a successful example of this. Consideration should be given to increasing collaborative working between the government and existing financial institutions, as is already done by the British Business Bank, to expand the portfolio of incentives to increase long-term investment by the private sector.
- 5.7. Through Corporate Venture Capital (CVC), large companies can make investments in small or start-up firms that can be of particular importance to relatively high risk engineering and industrial based start-ups, who may find it difficult to access finance otherwise. However, depending on the size of the shareholding held by the corporate, CVC equity investment can result in a change to the accounting process and ineligibility for tax relief for the SME, both of which can act as disincentives for participation. It has been suggested that it could be beneficial if the requirement for the change in accounting processes was only enforced once companies started creating material revenues streams.¹³
- 5.8. Innovate UK administers several different types of competitive grants each targeted at different stages of the innovation process and generally requiring co-investment by the

¹¹ [The Dowling Review of Business-University Research Collaborations](#), 2015

¹² [Credit and the crisis, Access to finance for innovative small firms since the recession](#), Lee, Sameen & Martin, Big Innovation Centre, 2013; [Investing for Prosperity](#), Aghion et al., LSE Growth Commission, 2013; and [House of Commons Science and Technology Committee, Bridging the valley of death: improving the commercialisation of research](#), 2013.

¹³ [Royal Academy of Engineering's submission to the BIS select committee's Access to Finance inquiry](#), 2016; [The Missing Piece](#), James Clark, BVCA, 2013

recipient or other funders. There is an established evidence base regarding the effectiveness of grants for encouraging applicants to engage in various stages of innovation and returns from Innovate UK schemes show substantial leverage with an average £7.30 returned to the economy in gross value added for every £1 invested.¹⁴ Serious concerns exist about whether the new financial products Innovate UK are developing will be effective in stimulating and supporting early-stage, high-risk and disruptive innovation, or business-university collaboration. Furthermore there are concerns that accepting a loan rather than a grant may make a company less attractive to downstream investors. It would therefore be a mistake to substitute grant funding for loans; instead loans should be seen as a means of providing follow-on financing for innovations at higher technology readiness levels (TRLs).

6. What do we need to do to get maximum benefit to the UK economy from challenger businesses?

- 6.1. It is well established that appropriate (pre-)seed stage funding is important for supporting 'proof-of-concept' activities and bridging the 'valley of death' between the development of a prototype and a product or service that is an investable proposition. Direct public support to help bridge the 'valley of death' for innovations associated with risky, emerging, or disruptive technologies can be crucial for both enabling the UK to secure an early foothold in a potentially important future market and preventing UK companies from losing their competitive advantage as other countries take a lead.¹⁵
- 6.2. Entrepreneurs in any field require a high degree of resilience; those introducing disruptive innovations are likely to face even greater personal challenges. Initiatives such as the Royal Academy of Engineering Enterprise Hub, which harnesses the expertise and networks of Academy Fellows with first-hand experience of building and leading successful companies to provide bespoke mentoring and training to the next generation of engineering entrepreneurs, can play an important role in helping entrepreneurs develop their capacity, global vision and resilience.
- 6.3. Interdisciplinary and cross-sector interactions are key for challenger businesses that are embracing disruptive innovations and identifying new market opportunities. The Enterprise Hub addresses this through its Innovators Network which brings together innovators, investors and corporates from a wide variety of technology areas and sectors (including hardware, software and medtech). Greater government support for platforms that enable cross-sector interactions could facilitate the creation and growth of more challenger businesses.
- 6.4. Although discussions about innovation support often focus on relatively new high-tech businesses with the potential for fast growth, it is also important to ensure that appropriate support and financial incentives, for both lenders and potential recipients, are in place for more established companies who wish to innovate, scale up or access

¹⁴ GVA and job figures calculated by Innovate UK from their published evaluations of Collaborative Evaluation of the Collaborative Research and Development Programmes, PACEC, 2011), Feasibility Studies Programme (TSB Feasibility Studies Programme, WECD, 2013), Smart Awards (Evaluation of Grant or Research and Development & Smart, PACEC, 2009) and KTPs (Knowledge Transfer Partnerships Strategic Review, Regeneris Consulting, 2010); and [Estimating the effect of UK direct public support for innovation](#), BIS, 2014

¹⁵ [Bridging the valley of death: improving the commercialisation of research](#), House of Commons Science and Technology Committee, Eighth Report of Session 2012-13

new markets, especially for companies who may not have undertaken such activities previously. Given the appropriate support, these companies have the potential to become challenger businesses.

- 6.5. Precompetitive research, involving multiple industry partners across a sector, can be an effective way of tackling shared issues, such as environmental challenges, through collaborative innovation and can raise standards across a sector by offering insights into new techniques and potential efficiencies. Challenge-based approaches to tackle stringent environment targets often lend themselves to disruptive, innovative solutions. Again, an industrial strategy would help identify opportunities for, and support the development of, this type of innovation.¹⁶
- 6.6. Timely adoption of externally-generated innovation can be one of the most important ways of helping established companies scale up and improve productivity. Organisations that have embraced such open innovation approaches may also allow their internally generated innovations to be exploited outside of the company. In order to adopt innovation, companies need to have 'absorptive capacity': the ability to recognise the value of new, external information, assimilate it and apply it to commercial ends. Absorptive capacity relies heavily on the availability of people with the right skills and experience. Indeed, the most significant impact on innovation generated by academia is often argued to be the introduction of skilled people into the workforce, who transfer knowledge and increase absorptive capacity.¹⁷ Government can support this process by ensuring that the education system produces a sufficient quantity and quality of graduates and apprentices to populate the future workforce. In addition, while companies clearly need to take much of the responsibility for ongoing training and organisational development, government can use policy levers and co-investment to encourage this.¹⁸
- 6.7. Finally, across all types of business, there is a clear need for simplification of all the publicly-funded schemes to support innovation, many of which are targeted at specific industry sectors or location.¹⁹ As detailed in the Dowling Review of Business-University Research Collaborations, businesses, especially SMEs, can be deterred from applying for support due to the sheer complexity of the funding and support landscape.²⁰ Innovate UK has embraced the Dowling Review recommendations on simplification, which is very welcome. Further work is needed to ensure that support mechanisms for business provided by other public bodies and government departments are readily accessible and navigable.

¹⁶ [The Dowling Review of Business-University Research Collaborations](#), 2015

¹⁷ [Royal Academy of Engineering's submission to Lord Stern's Review of the Research Excellence Framework](#), 2016

¹⁸ [Investing in Innovation](#), Royal Academy of Engineering, 2015

¹⁹ [The Dowling Review of Business-University Research Collaborations](#), 2015; [Government Support for Business](#), House of Commons Business, Innovation and Skills Committee, Eighth Report of Session 2014-15

²⁰ [The Dowling Review of Business-University Research Collaborations](#), 2015

7. How can we ensure that the UK's inventiveness and creativity capitalises on our strong intellectual property system to generate growth and further innovation?

- 7.1. There is a growing recognition of the importance of supporting entrepreneurs to gain the appropriate skills and experience to enable them to attract investment. The Academy's Enterprise Hub provides a successful example of this, with 38 early-stage Enterprise Hub Members creating businesses that have attracted £23M in external investment in the first three years of the Hub's operation. Government should continue to invest in activities to help increase confidence in the UK's ability to foster successful entrepreneurs and innovators. Following the closure of the Business Growth Service government needs to ensure that there is suitable provision to support companies, as well as entrepreneurs, to become investment ready. Without such support the government risks UK investors increasing their overseas investments instead of investing in the UK.
- 7.2. Universities, often through their TTOs, play an important role in facilitating and supporting the commercialisation and translation of research generated in their organisations. TTOs can provide advice and expertise in areas including: business development contracting, IP protection, spinning out and technology licensing. While the UK TTO system has been identified as world-leading in many respects, concerns have also been raised that competing missions may sometimes detract from the effectiveness of knowledge exchange. If universities expect TTOs to generate sufficient income to cover their costs and provide an additional revenue stream for the university, it is highly likely that short-term revenue generation will be prioritised, potentially to the detriment of effective knowledge exchange. Further work is needed to explore the funding mechanisms and incentives that will best support knowledge exchange by universities and their TTOs.
- 7.3. The challenges associated with spinning out a company from a university have also come under increased scrutiny in recent years.²¹ The Academy has been involved in discussions regarding spin out practices as a result of our experiences supporting Enterprise Fellows.²² While there will clearly be valid reasons for adopting different approaches, the variation across the sector is noteworthy and further efforts to share best practice would be welcomed. The Academy is keen to work with TTOs and other partners to see the information asymmetry between the academic entrepreneur and the university levelled, efforts made to reduce the time taken by negotiations, and further work undertaken to ensure that academic entrepreneurs are adequately supported and incentivised.
- 7.4. The Higher Education Innovation Fund (HEIF) and the Research Councils Impact Acceleration Accounts (IAA) are important funding sources to help academics pursue knowledge exchange work. Both schemes are particularly valued for the speed and flexibility with which the funding can be mobilised and deployed and are regarded as a

²¹ Recent related publications include [Keys to the kingdom](#), Nature Biotechnology, Wong et al., 2015 and [UK Technology Transfer: behind the headlines](#), 2015

²² The Royal Academy of Engineering Enterprise Fellowships support outstanding entrepreneurial engineers, working at a UK university, to prove the utility of an innovation by spinning out a business based on that innovation. The Hub provides the host university with salary support for the Fellow and additional funding for continued development of the innovation. In addition, the Enterprise Fellow becomes a member of the Enterprise Hub where they receive an intensive, bespoke package of training and mentoring.

vital means of stimulating translation activity. Government and the Research Councils should make a long-term commitment to maintaining these sources of funding in order to support knowledge exchange and collaboration.²³

7.5. Boosting mobility between industry and academia could yield substantial dividends for the UK. Increased people mobility would not only facilitate greater opportunities for business-university collaborations, which contribute to innovation, but would also increase the UK's absorptive capacity. There are already a number of publicly funded schemes that facilitate the flow of people between industry and academia and it is crucial that government continues to support and incentivise such activities. As noted in the Dowling Review, the Research Excellence Framework (REF) could be adapted to provide explicit recognition for staff who have moved between industry and academia (in either direction) by offering allowances, similar to those made for researchers who have taken parental leave.²⁴ Universities should also ensure that students in appropriate subjects receive wider business skills and IP awareness training to improve their ability to undertake knowledge exchange activities across the course of their careers and help companies to generate and absorb innovation.

8. Is there anything else the UK could do to create the best possible framework for innovation?

- 8.1. The National Innovation Plan needs to connect with relevant policy areas beyond those which BIS is directly responsible for, with important interfaces to policies on infrastructure, education and skills, immigration, procurement, energy and tax etc. If the support of other government departments could be secured, the potential impact of the National Innovation Plan would be amplified significantly.
- 8.2. If the National Innovation Plan is to be effective, it must consider the position of the UK's research and innovation system within a highly interconnected global system. Coordinated and well-designed communications material that can be shared across key UK agencies, including UK Trade & Investment, will help ensure that a consistent and compelling message about the strength and stability of the UK research and innovation system is transmitted to potential international partners, investors and talent.²⁵
- 8.3. The UK's ability to develop, attract and retain people with the right skills and capabilities will be one of the most critical factors in determining its future competitiveness. Engineering is a global profession: UK engineers are in demand internationally, UK universities educate many foreign students and a majority of the large engineering firms active in the UK employ significant numbers of engineers from overseas. It is worth noting that evidence suggests that sectors with high concentrations of graduate engineers report higher than average levels of innovation activity as well as higher levels of labour productivity.²⁶ It is therefore a source of concern that the government's immigration policy and, importantly, messaging pose a risk to the attractiveness of the UK as a destination for international talent. The

²³ [The Dowling Review of Business-University Research Collaborations](#), 2015

²⁴ [The Dowling Review of Business-University Research Collaborations](#), 2015 and [Royal Academy of Engineering's submission to Lord Stern's Review of the Research Excellence Framework](#), 2016

²⁵ [Royal Academy of Engineering's submission to the Science and Innovation Strategy](#), 2014

²⁶ [Assessing the economic returns of engineering research and postgraduate training in the UK](#), Technopolis, 2015

National Innovation Plan needs to ensure that the government's approach to immigration helps rather than hinders the national growth agenda.

- 8.4. For many businesses, accessing international markets is an essential part of their growth strategy and may be necessary for them to grow to scale. However, as has been recognised by government, this is not always an easy or simple process. UK Trade and Investment plays a critical role in supporting UK businesses in understanding how to trade successfully in international markets. In addition, UK Export Finance assumes financial risks associated with exporting on behalf of British businesses, including through the provision of insurance, loans or loan guarantees for commercial banks. Government should do more to increase awareness of the support available.
- 8.5. Finally, this response needs to be seen in the context of the substantial changes that are underway following the Nurse Review and Higher Education White Paper. It is encouraging that several of the concerns raised by the engineering community seem to have been addressed, with a new name for the overarching structure that includes innovation, acknowledgement of the importance of Innovate UK's distinctive role and business-facing remit and the need for sufficient autonomy in order to maintain the effectiveness of support. The recent review of innovation agencies by Nesta provides further evidence that innovation agencies that target higher-risk innovations benefit from autonomy and the ability to respond with agility and flexibility.²⁷ It is now crucial that the intent articulated in the White Paper flows through into implementation so that the structures, processes and policies that result from these highly significant changes preserve the current strengths of UK innovation support and deliver demonstrable improvements in the areas that government identified as the key drivers of the integration of Innovate UK into UK Research & Innovation. It is also critical that government puts in place a transparent evaluation framework to enable an assessment to be made of whether this has indeed been accomplished and, more widely, the extent to which the new organisation succeeds in achieving its objectives.

²⁷ [How Innovation Agencies Work](#), Nesta, 2016