Summary

- A broad, systemic review of commercialisation that addresses the fundamental question of how to create a culture of creativity and entrepreneurship in the UK is needed.

- Considering commercialisation in the context of the full sequence, from fundamental research to post-commercialisation, highlights that there is no single silver bullet. A package of incentives and actions will need to be combined with a change of attitudes across academia and the private and public sectors in order to achieve a step change.

- Government has a role to play in addressing a number of key challenges. Firstly, to improve the interface between universities and industry, government should stimulate industry ‘pull’ on the research base (particularly from SMEs), and encourage universities to make such engagement easier, e.g. through better visibility of their research activity.

- Where there are gaps in funding, and in sectors that are capital intensive or highly regulated, the government should focus on de-risking investment, and so making it more attractive. This may take the form of financial support, such as co-investment, but can also call for long-term policy stability, smarter regulation, or further development of incentives such as tax relief.

- The RSE welcomes the commitments of HM Government, set out in recent growth strategies, to support commercialisation through initiatives such as the Smart scheme, the Innovation Vouchers scheme, and through improved public procurement.

- However, moves towards increasing open access to publicly-funded research must be carefully handled: while stimulating innovation by enabling interested parties to use such research, any company interested in making commercial profit will not carry out its activities in the UK if forced to open its work to competitors.

- Ultimately, commercialisation will only be successful, and investors will only take risks, if the management team involved have the skills and expertise needed to steer the project. Government should work with universities and industry to ensure that graduates are commercially-aware, and equipped with the skills and entrepreneurial spirit that are necessary to a flourishing economy.

Introduction

1. The Royal Society of Edinburgh (RSE), as Scotland’s National Academy, welcomes the opportunity to comment on the Science and Technology Committee’s inquiry into the commercialisation of research. With experience and expertise amongst its Fellowship in both academia and industry, and across the spectrum of research disciplines, the RSE is well-placed to comment on the issues raised.

Culture for commercialisation

2. The question of how to better support the commercialisation of research has been under discussion for years, with each review leading to one or two initiatives of varying degrees of success and depth of impact. The RSE calls for a broader, systemic approach that gets to the root of the challenges to research commercialisation, and that will allow us, in the UK, to create a culture that fosters creativity and entrepreneurship.

3. The issue at hand is not merely how we increase the number and profitability of spin-out companies issuing from British universities. A key role of universities, albeit one that is more difficult to track, is in producing graduates who enter industry with the skills, and the mind-set, needed to identify commercial opportunities and to exploit them. Further, commercialisation is not a stand-alone activity, but rather must be considered in the context of the sequence that begins with fundamental research, carried out in both universities and industry, and continues to post-commercialisation.
Throughout this process there is no single ‘valley of death’ and there exists no one silver bullet that will cut down the barriers to commercialisation. Rather, a package of actions – from investment incentives to smarter regulation – will need to be combined with a change in attitudes across academia, industry, the investment community and the public sector, in order to stimulate and facilitate more effective commercialisation of research to the benefit of the UK economy.

What are the difficulties of funding the commercialisation of research and how can they be overcome?

A starting point in addressing the difficulties of commercialising research has to be the relationship between universities and industry. Where there are credible ideas that can be commercialised for potentially good returns, the private sector can bring significant investment to the table. But, in the UK, as elsewhere, the interface between the academic and private sectors can be strained and marked by poor communication.

Industry cites a lack of visibility of the research being carried out in universities as a key barrier to investment on their part. While Research Councils and Higher Education Institutions (HEIs) produce much literature on the research being funded, there is little information on the value or implications of this research that can be easily assessed by companies that might invest. The web-based Gateway to Research initiative set out in the Innovation and Research for Growth Strategy1 may help to overcome this barrier, but only if it is designed with the needs of industry in mind. Encouraging academics to disseminate their research activities to industry, particularly the SME sector, would allow interested industrial partners to consider opportunities early and, where appropriate, provide an informed view of market needs.

The relationship is further complicated by the differing approaches taken to commercialisation from university to university. While accepting that a ‘one stop shop’ approach is not practical, moves towards pooling initiatives (such as the Scottish Universities Physics Alliance, or the Scottish Informatics and Computer Science Alliance) have been useful in providing central points of contact and improving communication with industry. Further, in November 2011, Scotland’s universities signed up to a single set of contracts to aid the commercialisation of research, simplifying the process through which businesses, particularly small businesses, can partner with HEIs2.

These initiatives are a welcome indication that commercialisation is becoming embedded in Scottish universities where, for many years, prevailing cultures and attitudes meant that, for those attempting to commercialise research, the process was an uphill struggle. Long-standing regulations and the parameters on which universities’ performance is measured have often placed commercialisation on the back burner. The inclusion of impact as an element of the Research Excellence Framework is a welcome step in bringing commercialisation to the fore. The difficulty for the REF is in finding a balance between teaching, the development of well-educated, commercially-aware graduates, fundamental research and impact. Where impact drives commercialisation, without impeding the quality of teaching or levels of fundamental research, then an increased allocation of score will encourage a change in academic mindsets.

Even as the interface between academia and the private sector improves, we are left with a perennial problem that has characterised both the Scottish and UK commercialisation landscapes: the lack of pull on the research base from industry. In Scotland there is a lack of large industry, out-with Aberdeen, that has capacity to take risks and invest large sums in commercialising research. This challenge can be somewhat overcome by the increasingly global nature of markets - Wolfson Microelectronics for example, is an Edinburgh-based company that is successfully integrated into the global audio-technology market – but proximity and visibility continue to be important factors.

Small and Medium Sized Enterprises (SMEs) account for over 99% of businesses in Scotland3. While some of these will be on the cutting edge of new product development, the vast majority do not have the resources or skills capacity to actively seek commercialisation opportunities that could boost profitability over time, stimulating economic growth. An added difficulty for the SME sector is the loss of people with R&D experience coming out of large industry; and the lack of recent graduates with industry knowledge. There is a role for government to assist SMEs to engage in research commercialisation. There have been initiatives in Scotland where the Scottish Government, Scottish Enterprise and the EU (e.g. the STRIDE programme) have supported the redeployment of skilled engineers and scientists from large businesses which are downsizing to the SME sector, for example in times of major redundancies at Rolls Royce Aerospace, BAE Jetstream and Volvo Trucks.

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11 Angel investors and venture capitalists of course have an important role to play in the commercialisation process. In Scotland the number of angel investors in the market has grown, in part because of the co-investment scheme run by Scottish Enterprise. But venture capital is increasingly limited and there is a trend for venture capitalists to invest at later and later stages of the process, including at the post-commercialisation stage where a company has realised profits and is looking to expand. This reluctance on the part of venture capitalists to take risk, combined with the unwillingness of early stage investors to risk the levels of investment that are now needed to carry a company to the venture capital stage, highlight the lack of ambition and aversion to risk that dog research commercialisation in the UK.

Are there specific science and engineering sectors where it is particularly difficult to commercialise research?

12 Challenges for the funding of research commercialisation arise particularly in sectors that are capital intensive and sectors that are highly regulated. In the former, the large levels of investment needed, for example in the development of new energy technologies, inherently carry greater risk for investors. In the latter, the difficulties of complying with regulation, for example in the life sciences sector, combined with the perils of litigation, increase the risks to successful commercialisation.

13 In both of these instances, government can help to stimulate investment, not simply by providing financial support but by ensuring that policy and regulation reinforce the commercialisation agenda. Stable policy that sends clear messages on the long-term commitments of government, for example renewable energy priorities, is key to reducing risk for investors looking at long payback periods. Regulation, for example covering the development of new drugs, must necessarily be robust, but smarter regulation, and smarter regulators, could do more to minimise the risks for investors in certain sectors. New initiatives announced in the UK Life Sciences Strategy, including the creation of the Biomedical Catalyst Fund and a commitment to speed up the adoption of new drugs and technologies by the NHS, are welcome. But without a major culture change, with decision-makers taking a longer-term view, better risk management and more timely feedback, in conjunction with streamlined regulation, there is unlikely to be a step-change in the levels of commercialisation.

14 From university to university there are any number of examples of research undertaken in the UK that has been commercialised abroad. Plastic Logic, a successful spin-out company from Cambridge, is now headquartered in the USA and principally owned by Russian investors. Many green energy technologies are being bought up by China, and, in informatics, much research is transferred to the US at an early stage.

What, if any, examples are there of UK-based research having to be transferred outside the UK for commercialisation?

15 There are a number of reasons why research carried out within UK universities and early stage spin-out companies is transferred abroad for commercialisation. The lack of local markets and industry bases is one aspect of this. While, as previously noted, markets are now highly globalised and manufacturing often takes places in countries such as China and India, physical proximity to customers (whether industry or end-users) and investors can be crucial to raising visibility and building reputation. Companies such as Cisco will always look to Silicon Valley for new innovations and developments.

16 The unwillingness of angel investors to carry start-up companies through to venture capital stage can force the sale of early-stage UK spin-outs, or their research, to buyers abroad. Government support that contributes to de-risking investment, for example by reshaping the Enterprise Investment Scheme to make subsequent venture capital investment more acceptable to early stage EIS investors, together with better risk assessment and management on the part of investors, is urgently needed.

17 As the UK moves towards increased open access to publicly-funded data and research, as set out in the Innovation and Research for Growth strategy, it should be expected that conflicts with the commercialisation agenda will occur. While recognising the opportunities that open access will bring, allowing a wider range of interested parties to use the research in potentially innovative ways, there are already sectors in which this is limiting commercialisation activity.

18 The obligation in the UK for every human embryonic stem cell line that is developed using public funds to be placed in the Stem Cell Bank and made open source, discourages any company that wants to commercialise stem cell research from carrying out its activities in the UK. The Medical Research Council has been lobbied extensively on this, but no solution has been found.
What evidence is there that Government and Technology Strategy Board initiatives to date have improved the commercialisation of research?

19 In Scotland, a number of initiatives, principally run by Scottish Enterprise, have contributed to improved commercialisation of research. The Scottish Co-investment Fund, a £72 million equity investment fund, has been effective in creating partnerships with private sector business angels and, to a lesser extent, venture capitalists. At UK level, the Carbon Trust programme of co-investment in low-carbon technologies has played a key role in leveraging private equity in the sector.

20 SMART:SCOTLAND, providing grant assistance for technical and commercial feasibility studies and R&D projects that represent technological advances in their fields, is a highly-rated source of funds for potentially high-growth SMEs in Scotland. The relaunch of the Smart scheme at UK level under the Innovation and Research for Growth Strategy is a positive step.

21 ITI Scotland, and its subsidiaries focused on energy, life sciences and tech media, that operated in Scotland from 2003 until its integration into Scottish Enterprise in 2009, did make a contribution to the commercialisation of research in Scotland. While not without controversy, for example, in regard to its outright ownership of IP, the organisation invested £134 million across 25 research programmes.

22 However, public initiatives to date have often focused on technology push rather than industry pull, and have contributed more to accelerating the speed with which companies arrive at one side of the commercialisation valley, without taking them across. Initiatives now coming out of the Technology Strategy Board and those focusing on industry pull, for example the R&D Tax Credit scheme, are particularly welcome.

23 The Small Business Research Initiative (SBRI) scheme championed by the Technology Strategy Board, and based on the SBIR programme which has long been in place in the USA, is a key element of public sector pull on the research base. Engaging with companies to find innovative solutions to identified public sector needs, allows for substantial expenditure across government departments on the commercialisation of research, while allowing IP to rest with the company. The American scheme stands as a highly successful exemplar that benefits both government and small businesses; translating the scheme to the UK has had its difficulties, due in the past to procurement rules, lack of budgets and lack of understanding across departments, but under the management of the TSB the programme has become more effective.

What impact will the Government’s innovation, research and growth strategies have on bridging the valley of death?

24 As outlined above, the proposed greater use of public procurement, through increased investment in the SBRI and the setting up of Procurement Centres of Expertise, could be a strong lever in improving the commercialisation landscape in the UK. However, for this to be truly successful, a forward-looking, innovative culture must prevail across government departments, together with an understanding of the challenges and opportunities of commercialisation. The high rotation of civil servants between posts, and subsequent backsliding in deep understanding of the complex issues that hinder and support commercialisation, can only be overcome if this knowledge is embedded throughout the organisation.

25 The relaunch of the Smart scheme reinstates a well-respected brand and programme of funding for high-tech SMEs with the most growth potential in the UK. The SMART:SCOTLAND scheme has certainly had some success in recent years and we would like to see this replicated throughout the UK. At the other end of the SME spectrum, we look forward to seeing the results of the Innovation Voucher scheme pilot that will target SMEs which have not previously engaged with the research base.

26 The ownership of Intellectual Property is an outstanding issue that requires to be addressed. While noting the commitment of HM Government to accept the recommendations in the review of intellectual property by Professor Ian Hargreaves, there is more to be done around the transfer of IP relating to research developed in universities to the company that will take it forward to commercialisation.

27 IP created using public funds administered through the Research Councils is vested in the universities, but each university has its own policy for the handling of IP thereafter. For companies interested in commercialising research, negotiations with the university on IP ownership or licensing can be complex. The situation becomes even more complicated where more than one university, or another body, such as the NHS, is involved.

5 http://www.scotsman.com/business/macpherson_out_as_scottish_enterprise_takes_charge_of_iti_1_754035
There is a common perception among industry and investors that universities can be unrealistic in negotiating terms on the transfer of IP, often expecting large percentage returns even where IP is not assigned but exclusive licence granted. In a company’s early years, when cash flow is often a make-or-break issue, heavy repayments to the university in the form of licence payments or wage costs for academics involved, can be a significant factor in the success or failure of commercialisation. A long-term view, anticipating returns on future profits, would help in the agreement of deals that will be beneficial to the universities, the companies, and any other investors involved. There has been positive progress with initiatives such as the Easy Access IP approach developed by the University of Glasgow and partners that opens up much of the unallocated IP created within the university to industry without cost.

However, we would again re-emphasise that there is no single silver bullet that will solve the challenges of commercialisation; a fundamental review of the issues involved and broad understanding of how initiatives sit together in addressing barriers is needed.

Should the UK seek to encourage more private equity investment (including venture capital and angel investment) into science and engineering sectors and, if so, how can this be achieved?

Private equity investment that enables commercialisation will become increasingly important as the levels of funding government is able to invest become squeezed. The most important role of government in attracting private investment, including from angel groups and venture capitalists, is in reducing the risks that investors must take and in making such investments attractive compared to alternative options.

Some of the options through which government can minimise risks for investors have been mentioned throughout this response. Providing clear long-term signals to markets, innovative procurement policy, smarter regulation and co-investment are examples of these.

The Enterprise Investment Scheme, and the new Seed Enterprise Investment Scheme, offering tax relief for private equity investors in start-up companies, are two useful initiatives. However, at present, under the EIS, early stage investors can purchase only ordinary shares, placing them on unequal footing with later venture capital investors who will take only preference shares. Allowing some flexibility for early stage investors in these schemes to convert their holdings to shares with preferential rights after a certain period, would provide greater parity and make the schemes more attractive.

Venture Capital Trusts which can take a longer-term view on returns, and take more risks, could potentially be vehicles through which larger levels of investment – sources of which are difficult to find in the UK – can be harnessed. VC Trusts are currently often risk averse, but tax breaks for investing in such Trusts could be given in return for a requirement to take more risk.

Venture capital companies themselves do have a role to play in improving their ability to ‘pick winners’. Investors will be more likely to be attracted by a 20% success rate than a 10% success rate. Employing the right staff who can provide high quality analysis and implement better screening processes will contribute to an improving success rate.

What other types of investment or support should the Government develop?

The successful commercialisation of research will always depend in large part on the skill of the management team involved. While it is usually possible to assess technical risk, i.e. whether research can successfully be scaled up; and market risk, i.e. the level of demand; the unknown factor will often be the skills, experience and attitudes of the management team. Most investors will not consider funding projects in which there is any doubt over the credibility of the management team.

There is a great degree of variability across UK universities in the extent to which students are equipped with business skills and industry exposure. While accepting that some students will intend to pursue a career in academia, the majority will not, and therefore should be given the opportunity to develop the skills that employers need. Fostering an understanding of industry needs and an entrepreneurial spirit will encourage British graduates to identify and exploit commercial opportunities.

Support from government at this stage of student development would have a follow through impact on the commercialisation of research. It is countries that produce graduates with creative, ambitious mindsets that have strong track records of commercialisation, demonstrating the need for an entrepreneurial culture that permeates across academia, industry and the public sector. A number of initiatives that have brought British and American students together have provided stark examples of the attitudes that typically prevail in each country; but, equally, such initiatives have provided important learning opportunities for UK participants.

http://www.easyaccessip.org.uk/
There are existing schemes that act to strengthen links between British and international researchers, for example the Saltire Foundation, which does not call on public funds, Knowledge Transfer Partnerships and the Roberts Enterprise Scheme. The RSE Enterprise Fellowship Scheme has been highly successful over the past 14 years, resulting in more than 60 prosperous companies that have attracted around £100 million of investment. There is a case for this to be adopted much more widely across the UK. But in almost all of these initiatives there are questions over the levels of future funding. Government should carefully consider the benefits of such links and how it might support them in the future.

At the same time, government should consider how it can support an increase in the level of industry exposure students can access during degree and post-graduate courses. This could be through co-funded studentships that include mandatory time spent with industry partners; or payments towards wages of PhD and Master students hired by industry, incentivising HEIs and the private sector to work together.

Conclusion

The RSE welcomes continued commitment to improving the commercialisation of research in the UK. To overcome the numerous ‘valleys of death’ that occur throughout the process, a range of incentives (financial, legislative, regulatory) will be required from government. But the much-needed step change in the UK commercialisation environment will only come when attitudes across the academic, private and public sectors fully embrace a creative and entrepreneurial culture, and when our graduates are equipped with the skills, confidence, and ambition that are needed to become successful innovators.

Additional Information and References

Advice papers are produced on behalf of RSE Council by an appropriately diverse working group in whose expertise and judgement the Council has confidence. This Advice Paper has been signed off by the Chair of the group and by the General Secretary.

Any enquiries about this Advice Paper should be addressed to Susan Lennox (Email: evidenceadvice@royalsoced.org.uk)

Responses are published on the RSE website (www.royalsoced.org.uk).

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7 http://www.royalsoced.org.uk/564_EnterpriseInnovationFunding.html
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