

RSE RESPONSE TO SIR ANTON MUSCATELLI REVIEW ON ECONOMIC IMPACT OF UNIVERSITIES

The Royal Society Edinburgh (RSE) welcomes the Muscatelli Review but notes that the current evidence base is limited and incomplete, and further research may need to be done to assess the economic impact of universities in a holistic and systematic way. While individual programmes have been subject to periodic evaluation, we are not aware of any research or evaluation which assesses the overall economic impact of the Higher Education Sector on economic development and working with businesses.

Nonetheless, within the current landscape there is a recognition that where universities and businesses work together there are examples of success stories. While in comparison to the Golden Triangle Scotland does not produce as many spinouts, relative to size, it can be argued that its performance is good. There is no magic bullet that can fix specific areas of under-performance and a coordinated approach will be necessary to identify where changes can add value to the current landscape, building on best practice and examples of success. We believe that this Review should be an appreciative inquiry in that it looks at ways to expand what is already being done well.

Beyond the core remit of producing work ready graduates, the most direct way universities can have a positive economic impact is through spinouts, start-ups, successful contract research and commercialisation of research. In this area the Society highlights several success stories, including our own Enterprise Fellowship programme, Unlocking Ambition, Converge Challenge, Catapult Centres and reports from Scottish universities.

While spinouts from universities achieve impact, the Review should also consider the importance of peer-to-peer learning and knowledge exchange programmes. Innovation Centres, Interface and Knowledge Transfer Partnerships all play an important role in developing relationships between academia and business. Ensuring that these partnerships can be sustained and expanded beyond the current limited support that is available will further boost innovation and economic growth.

While the funding landscape is crowded there are new opportunities arising, particularly through funding mechanisms such as City Growth Deals, Industrial Strategy Challenge Funds and Innovate UK. It will be important that opportunities are properly signposted, and that Scottish businesses and universities get the most from these.

The role of the Enterprise and Skills Strategic Board and its analytical unit will be important in ensuring the work of the enterprise and skills agencies supports better engagement between universities and businesses across Scotland. The analytical unit may be able to provide specific analysis in this area and identify where improvements could be made. Additionally, the Board can assist Scottish businesses and universities in getting the most from programmes and initiatives, including new funds via the UK Industrial Strategy.

The RSE highlights that it will be important to ensure that all the parts of the university sector that interact with business do so effectively and can access and benefit from the funding available to achieve economic impact. Additionally, the role of colleges is important, particularly in the development of skills and their connection to business. The RSE therefore welcomes the commissioning of a complementary review on the economic impact of colleges.

Summary

Introduction

- 1 The Royal Society of Edinburgh welcomes the invitation from Sir Anton Muscatelli to provide evidence to his review of the role universities play in working with industry and stimulating inclusive economic growth.
- 2 Scotland is widely renowned as a country in an advantageous position with regard to its many world-class universities, particularly given its comparative size and small population. Despite this, the economy has evidently struggled since the 2008 recession, particularly in productivity growth, which has stagnated since 2010. While Scottish Higher Education Research and Development (HERD) investment is high, Business Enterprise Research and Development (BERD) has been consistently low; this is often cited as one of the reasons behind slow productivity growth. The lack of BERD consequently damages the potential of all businesses including start-ups and spinouts to become high-growth companies which could have a significant economic impact.
- 3 This is an area in which the RSE and its Fellowship have significant experience and expertise. The RSE's work is led by our Economy and Enterprise Committee (formerly the Business Innovation Forum), which brings together Fellows with relevant experience and expertise across areas such as academia, enterprise, economics and skills. In addition, the RSE has successfully operated its Enterprise Fellowship Scheme for over 20 years to provide support to individuals wishing to create businesses based on university research. This response has been facilitated through the Committee, as well as including input from additional Fellows, and builds upon the RSE's previous work which is referred to in this response.
- 4 In 2015 the RSE responded to the Dowling Review, led by Dame Ann Dowling. The response presented recommendations, some of which are still relevant today, these are:
 - New and better arrangements need to be established about the sharing and exploitation of intellectual property (IP);
 - There needs to be a step change in the support for programmes that support the commercialisation of research;
 - Future rounds of the Research Excellence Framework should ensure that full recognition is given to all relevant commercialisation activity in universities;
 - Both the public and private sector need to increase their R & D activity to seek to close the gap in research investment between the UK and our major international competitors;
 - The UK Government needs to move beyond the “flat cash” funding of research of recent years;
 - Business involvement must be fully embedded in the Technology Innovation or “Catapult” Centres¹.
- 5 Shortly after the response to the Dowling Review the RSE produced a report focusing on Entrepreneurial Education². The report found that Scotland's universities can play a leading role in developing a new dynamic generation of entrepreneurs. It recommended that universities employ more teaching staff with practical experience of industry and entrepreneurship; support lecturers to increase their own industry awareness and capacity to introduce enterprise skills into courses; and establish a network of ‘Enterprise Champions’ and a dedicated entrepreneurial strategy for each university. While there has been progress on these recommendations, they are still relevant, and we would encourage the Review to consider these recommendations as ones which the Scottish Government could implement through SFC and the network of Enterprise Agencies.
- 6 One issue that should be addressed urgently is the current lack of independent data or economic analysis to assess the economic impact of the universities' engagement with business in Scotland in a holistic and consistent way, whether through company formation, licensing, contract research or consultancy. This hampers the creation of effective policy and supporting interventions. We would advise that Scottish Government and SFC should consider how such data can be collected and utilised.

1 Royal Society of Edinburgh 2015, ‘The Dowling Review’. URL: https://www.rse.org.uk/wp-content/uploads/2016/09/AP15_03.pdf

2 Royal Society of Edinburgh 2015, ‘Entrepreneurial Education in Scotland’. URL: https://www.rse.org.uk/wp-content/uploads/2016/09/AP15_09.pdf

- 7 In addition, the debate around entrepreneurship and commercialisation is heavily dominated by research which focuses on examples of high-growth, technology-enabled, venture capital backed businesses such as Apple, Google, Skyscanner etc. (It should also be noted that these companies mirror experience in Scotland where start-up companies have achieved greater success than spin out companies from academia, although they may develop relationships with universities). Subsequently this leads to selective public policy decisions being focused around this evidence base. It can, therefore, be argued that the current evidence base, particularly in Scotland, is incomplete³. The review should consider if the empirical evidence is sufficient and whether there should be a shift from focusing on high-growth technology-based start-ups to a more inclusive approach.
- 8 There are no ‘magic bullets’ or single intervention that will be able to dramatically improve the inclusive economic impact of universities through working with business. The RSE therefore, encourages the review to adopt an appreciative enquiry approach to analyse areas of best practice and suggest how these can be built on or developed in other areas which are less successful. Scottish universities and business should learn from success stories rather than seek to create brand new methods which have no history of success in Scotland. This does not, of course, preclude learning lessons from elsewhere and piloting new initiatives where appropriate.
- 10 Previously, Scotland regularly outperformed its UK counterparts on the levels of university spinouts. From 2000 to 2012 Scotland produced 172 new spinouts compared to 115 in London and 85 in South East of England⁵. However, since 2012 Scotland’s performance in the creation of spin outs has declined, with the number of spinouts falling sharply from 2013-15, meaning that the number of spinouts dropped from 21 in 2009 to 7 in 2015⁶.
- 11 These figures do, however, need to be treated with caution given the differing definitions of spinouts and their economic impact. For example, we understand that in certain universities the development of a product such as an app by a single post-graduate student without the creation of a company is counted as a spinout.
- 12 At the same time, further work is required to assess whether spinouts make a sustained contribution to the Scottish economy through the development of high value jobs and generation of profit. As previously stated, we would recommend that this should be prioritised as an area of further analysis.
- 13 However, since 2015 there have been several success stories from across the university sector that could be built on. For example, there are many distinct success stories which have been produced from University of Edinburgh, most notably Wolfson Microelectronics and MTEM as well as the numerous spinouts from the Roslin Institute. Both Wolfson and MTEM experienced relative success and growth but were sold to international companies before their full potential could be achieved. demonstrating that success is often measured by an exit value rather than continued contribution to the Scottish economy.
- 14 Investment via the Edinburgh and South East Scotland City Region Deal will support aims to improve commercialisation and the number of spinouts, with the university committed to achieving 40 spinouts a year.

Success Stories

Spinouts and Universities

- 9 As spinouts come directly from university research, they can be viewed as a key indicator of the economic impact of universities in Scotland. A report by the Kauffman Foundation in 2009 illustrates the importance of spinouts and start-ups in the creation of ‘new jobs’. In analysing the landscape of the United States, the report illustrated that young firms still account for two thirds of job creation⁴.

³ Brown, R; Mawson, S; Mason, R (2017). ‘Myth-busting and entrepreneurship policy: the case of high growth firms’, Routledge Publishing.

⁴ The Kauffman Foundation (2009), ‘Where Will the New Jobs Come From?’. URL: https://www.kauffman.org/-/media/kauffman_org/research-reports-and-covers/2009/11/where_will_the_jobs_come_from.pdf

⁵ Brown, R (2016). ‘Mission impossible? Entrepreneurial universities and peripheral regional innovation systems’. Routledge Publishing.

⁶ Young Company Finance Scotland (2016), ‘Scottish Spinout Performance Study’.

- 15 Similarly, the University of Strathclyde has experienced consistent success in delivering spinouts, as the case study below shows, and has recently received significant funding via the Glasgow City Region City Deal which has contributed to the development of the Glasgow City Innovation District in the campus. Strathclyde has experienced notable development with the new Technology and Innovation Centre, CENSIS, and the Industrial Biotechnology Innovation Centre which all facilitate engagement with industry.

Case Study ClinSpec Dx

ClinSpec Diagnostics Limited (ClinSpec Dx) is a spin-out from the University of Strathclyde commercialising the ground-breaking technology platform that uses infra-red light and proprietary algorithms to analyse patient blood serum samples and detect the presence/absence of disease.

The company's first clinical product will be a brain-cancer diagnostic test which will be used to triage patients with suspected brain-cancer. The test allows same-day detection of disease with >80% sensitivity and specificity, enabling fast referral of patients for full diagnosis and treatment. Currently more than 60% of malignant brain tumours are diagnosed as emergency cases with poor survival rates because there is no cost-effective blood test to assist earlier detection and treatment.

The technology was developed by Dr Matt Baker and was identified as part of the outreach activities of the university's commercialisation team. Based on a strong market opportunity and Matt's aspiration for establishing of a spin-out company, the university supported Matt's team to participate in BioCity Scotland's DEVELOP Programme and to prepare an application for Scottish Enterprise High-Growth Start-up Programme (HGSP) funding. During this process, Dr Mark Hegarty, formerly CEO of Daysoft Ltd, was appointed first as a commercial champion and then as a CEO of the company.

In May 2016 University of Strathclyde was awarded £600K HGSP grant funding for the 'ClinSpec' project, which ran until Jan 2019 enabling to de-risk the opportunity both technically and commercially. This, coupled with the ClinSpec team's extreme professionalism throughout, meant that ClinSpec Diagnostics Limited successfully completed its first funding round and spun-out from the university on 6th February 2019. The company has raised £1.68M in total including equity investments from EOS and Mercia.

During this last three years, the ClinSpec team won a number of awards including PitchPerfect @ BioDundee, 2016; Runners-Up @ Converge Challenge, 2017; the Moonshot Award @ Global Gamechangers, 2018; the Higgs Award @ Scottish EDGE, 2018 and the Scottish Enterprise Life Sciences Innovation Award, 2019. This success reflects a key characteristic shared by every individual in the team, which is their willingness and enthusiasm to make the most of all opportunities presented to them, from training programmes to business plan competitions.

The company currently has 5 FTEs and is developing other diagnostic tests for several difficult-to-detect cancers, including pancreatic.

The university continues to support ClinSpec via its Board Observer role and through active networking and opportunity signposting. ClinSpec will also be eligible for follow-on investment from the university's Enterprise and Investment Committee.

- 16** The Tay Cities Region Deal is boosting investment into life sciences and creative industries at both The University of Dundee and University of Abertay. While the Deal develops, it is widely recognised that both universities have contributed to notable economic success in Dundee within specific sectors. Spinout companies such as Axis Shield Diagnostics Ltd; ExScientia; Concept Life Sciences; and Vascular Flow Technologies Ltd contribute to the output of the biomedical sector which sustains more than 4,000 high-value jobs⁷. The region is also home to the James Hutton Institute, one of the UK's main research centres on the environment, crop and food sciences. In collaboration with the University of Dundee and with Cities Regional Deal investment the James Hutton Institute will develop the International Barley Hub and the Advanced Plant Growth Centre.
- 17** Additionally, the University of Aberdeen has also experienced success and has a considerable economic impact on the city and the region. Along with research into oil and gas innovation, the city has a prominent biotech drug-discovery cluster, with the backbone of this cluster comprising spinout companies from the University of Aberdeen. The Aberdeen City Region Deal is delivering significant investment into the cluster, as well as into universities and innovation in oil and gas. The City Deal has invested in a new £40M 'Bio-hub', which will open in 2021 and host all of the significant companies in Aberdeen, including spinouts from the university⁸.
- 18** It appears the biotech cluster in Aberdeen is now experiencing stability and is reaching a level of maturity and size which is approaching a critical mass that is well networked and has an international outlook. The cluster should use the stability to improve its performance in producing and supporting spinouts that grow and have a significant economic impact in the area. A new programme, which is now in place, will help build a pipeline of new companies that can use the opportunity of being in the bio-cluster to reach their potential.
- 19** Examples such as Elasmogen, which started as an RSE Enterprise Fellowship and is included in a case study below illustrate the extent of the success achieved so far in Aberdeen.
- 20** We understand that the Aberdeen biotech cluster is one of the only Scottish clusters that have managed to successfully 'escape' the low risk low return early revenue, angel MedTech company model which has historically been a barrier to the creation of companies of scale as there are now several companies that could be able to see exit evaluations of over £100M.

Features of Successful Spinouts

- Having a specific focus for university research areas helps develop better 'know how' and networks and attracts increased funding. For example, The University of Edinburgh has a clear focus in the biotech, technology and data sectors.
- Having the capacity to have a strong leadership/management team tends to help spinouts attract greater investment thus performing better.
- Escaping the low risk low return early revenue investment models, enables spinouts to attract more investment.

Programmes, Peer to Peer Learning, and Business Support Initiatives

- 21** There are also several programmes within Scotland that encourage start-ups, spinouts and peer-to-peer learning.
- 22** The RSE, through a partnership with Scottish Enterprise and other stakeholders within the UK, supports the commercialisation of technology-based ideas developed from academic research within the Enterprise Fellowship programme. Now in existence for over 20 years, RSE Enterprise Fellowships are widely recognised as a leading development programme for the Higher Education sector, enabling science and technology researchers to develop their ideas into successful businesses through a 12-month programme of funding and business training support.

⁷ Tay City Region Deal, (2018). 'Head of Terms'

⁸ Aberdeen City Region Deal, (2018). '£40m hub to drive health innovation and life sciences company growth in Aberdeen'

For the duration of the award, Enterprise Fellows are hosted by a UK university or research institute, and receive a year's academic salary, £10K business support funding, cutting-edge business training, access to RSE affiliated mentors and entrepreneurs, and membership of RSE's Entrepreneurs' Club. The RSE has recently commissioned Biggar Economics to provide an independent economic analysis of the programme, which will be published after summer. The Enterprise Fellowship programme creates significant economic impact with £77.3 million annual Gross Value Added (GVA) in Scotland since 1997. This will illustrate the significant economic impact the scheme has and the wider impact of the Higher Education in the economy.

- 23** Additionally, the RSE is part of Unlocking Ambition which supports highly ambitious entrepreneurs, chosen for their individual

entrepreneurial potential, the quality and innovation of their business and the contribution they can make to an inclusive Scottish economy. The individuals selected to be part of the initiative have received support from either the RSE's Unlocking Ambition Enterprise Fellowship (for start-up businesses) or the Scottish Enterprise programme (for more established businesses), which have run in parallel. Through the RSE's programme 20 outstanding, early-stage entrepreneurs have received a £25-£50K maintenance grant, up to £20K business development fund, business training, a business mentor, hosting status at a Scottish university or research institute, free membership of Entrepreneurial Scotland and Scotland House, as well as access to GlobalScot network and the Scottish Investment Bank.

Case Study Caroline Barelle, CEO Elasmogen Ltd. (SE & BBSRC Funded RSE Enterprise Fellow 2015-16)

Caroline Barelle was awarded an Enterprise Fellowship in April 2015. Due to the bioscience nature of her commercialisation project, Caroline's award was co-funded by Scottish Enterprise and BBSRC.

The aim of Caroline's Fellowship was to spin-out a new biotech company - Elasmogen - from the University of Aberdeen. Elasmogen is a next generation, therapeutic biologics company that develops soloMERs to help treat disease, such as inflammatory eye disease. Recognising that traditional antibodies are expensive to produce and, are also large, complex molecules that cannot easily penetrate tissues in the body, Caroline saw a market opportunity for Elasmogen to produce SoloMERs which offer a cheaper, less invasive and more effective solution for the treatment of autoimmune diseases.

During the Fellowship Caroline and her team accrued significant supporting data for the product, outlined a product pipeline and developed a robust IP protected portfolio to cover the platform, the production process and the product. Caroline also took part in Converge Challenge during her Fellowship coming second. Shortly afterwards, and before the end of her Fellowship, Elasmogen spun out of the University of Aberdeen.

Caroline is currently presenting all over the world, securing investment to expand clinical trials whilst negotiating sales with several pharma companies. So far, the company has now achieved an equity and grants raise of over £7M since 2016, signed 3 target deals, including one with a big pharmaceutical company and a licensing deal in South Korea and has won numerous awards at a European level such as Biofit Innovative Company award and Life Sciences Rising Star award.

Case Study David Hunter, CEO Shot Scope Ltd. (SE Funded RSE Enterprise Fellow 2014-15)

David Hunter saw a gap in the market when he recognised that the available performance tracking technology in golf was outdated, with many players using pen and paper or manually inputting data into performance apps. A former secondary school teacher, David decided on a career change and quickly set about combining his love of golf with his electronic design experience. He developed Shot Scope; a wearable technology that automatically collects data to enable uninterrupted play. During his RSE Enterprise Fellowship, David built on his knowledge of sales and marketing, raising finance, building a team and understanding IP. Shortly after completing his Fellowship, with a small team in place, David launched his first product in January 2016.

With headquarters in Edinburgh, Shot Scope now employs over 25 staff and the company have now launched their second-generation product; Shot Scope V2. This device is now available in hundreds of pro shops throughout the UK, has amassed thousands of users globally and sells in over 38 countries worldwide. The business has raised over £4.5M since it first launched, with investors including Old College Capital, the University of Edinburgh's investment arm, Scottish Investment Bank, Equity Gap and high-net-worth individuals. With the launch of Shot Scope V2 and their traction in the US, the company are expecting to grow their revenue to well over £5M.

At the end of 2017, David spoke at an event to celebrate the 20 Year Anniversary of the RSE Enterprise Fellowship programme. He said that the Fellowship gave him global ambition, allowed him to network with the right people and develop himself. Lastly, but most importantly, he said the Fellowship gave him belief in himself and the company.

- 24** The success of recent applicants, who were awarded funding in 2018, shows the impact of this scheme. Twenty entrepreneurs were awarded RSE Unlocking Ambition Enterprise Fellowships, receiving between £25–50K in maintenance grants and £20K to work full-time developing and scaling their business. In the first year alone, these early start-up businesses recruited over 50 people; appointed 37 board members; secured 2700 customers, contacts and users; negotiated 16 investment deals; and won 19 award nominations; while simultaneously developing their business and product⁹.
- 25** Converge Challenge is the largest award programme available to Scottish university staff, students and graduates. With nine years of experience the programme has developed and established three new categories: KickStart Challenge (for early stage ideas); the Impact Challenge (for enterprises with social or environmental missions); and the Creative Challenge (for innovative, new projects in Scotland's creative industries).
- 26** The independent analysis of the Converge Challenge published in 2017¹⁰ found that since 2011 the programme has provided training to 180 start-up businesses, of which 69 have been formally incorporated. Of these 69 businesses, 60 remained active in 2016: a survival rate of 87%. There is wide satisfaction with the programme with 97% of participants reporting that they were satisfied or very satisfied. This satisfaction is clearly linked to the rate of positive financial returns as businesses that have participated in the programme are estimated to have leveraged a total of £55.1M in additional funding, of which £20M is directly attributed to the support provided through the programme. There has also been wider impact and it is estimated that the programme has generated £5.2M GVA for the Scottish economy in 2016 and supported 180 jobs.

⁹ Royal Society of Edinburgh (2019), 'Scotland's Next Generation of Entrepreneurs Unlock Their Ambition'.

¹⁰ Biggar Economics (2016), 'Evaluation of the Converge Challenge'.

- 27** It is clear that these programmes are vital mechanisms in commercialising research and fostering university- business relationships, becoming positive investments from the Scottish Government and other partners. These programmes are instrumental in improving Scotland's performance in producing spinouts and it is important that support for them is sustained. At the same time there is a need to consider whether there is potential for follow on funding for these programmes or a similar type of programme that can improve commercialisation by solely focusing on scaling up.
- 28** Additional initiatives funded by the Scottish Government through the SFC and its enterprise agencies, such as Innovation Centres, the Interface, and Knowledge Transfer Partnership programmes, focus on peer-to-peer learning and knowledge exchange.
- 29** The Innovation Centres harness a similar philosophy to that of the Research Pools in harnessing the research capabilities of Scottish universities and facilitating peer-to-peer learning to drive innovation and commercialisation. The centres have helped to improve the interface between university and publicly-funded research with industry and business. In the Independent Review of the Innovation Centres in 2016, conducted by Professor Graeme Reid FRSE, there was general satisfaction with the Centres their role of improving innovation, skills development and commercialisation. There was widespread agreement that the development of the Centres has changed the landscape for innovation support in Scotland and this should gradually evolve to keep pace with the changing landscape. The review presented several recommendations around improving the Centres, through financial support, measuring and monitoring economic impact, and becoming more inclusive¹¹.
- 30** Similar to the Innovation Centres, the Catapult programme, from Innovate UK, has established research centres which aim to bridge the gap between business and academia. The programme in Scotland focuses specifically on manufacturing through the Advanced Forming Research Centre and the Offshore Renewable Catapult in the University of Strathclyde. These are the only Catapult Research Centres in Scotland but are supported by the National Manufacturing Institute in Renfrewshire. The programme has experienced significant success with investments in projects, value of assets and sales (from collaborative R&D) all increasing across the UK from 2017-2018¹². There is no specific review of the AFRC in Scotland, and this is something that could be explored to illustrate the economic impact of commercialisation in the manufacturing sector.
- 31** An additional flagship initiative which has experienced significant success is Interface, funded by the Scottish Funding Council. Established in 2005 Interface has worked to facilitate peer-to-peer learning by acting as a hub which connects universities with businesses. Interface has connected over 2900 businesses to academic partners, over 4700 expertise search specifications have been forwarded to academia, and over 2000 company and university collaborative projects initiated. Independent economic analysis of Interface identified that the initiative enabled Scottish businesses to generate £64.2M GVA per year for the Scottish economy, which directly supports 1060 jobs¹³.
- 32** Similar to Interface, the Knowledge Transfer Partnership programme, funded by several organisations such as the SFC and Innovate UK, also aims to facilitate peer-to-peer learning. Facilitating connections between business and academia, within Scotland the partnerships operate regionally, and success varies between regions. For instance, over 23 years the West of Scotland has helped establish over 450 projects and generated more than £58M of KTP grant¹⁴.
- 33** The current funding through KTP is short term and does not necessarily reflect the time required to build an effective relationship between a university and a business to achieve successful outcomes for the business through commercialisation of university research or response to consultancy advice.

¹¹ Reid, G (2015), 'Independent Review of the Innovation Centres Programme'. Scottish Funding Council.

¹² HVM Catapult Review (2015), 'Annual Review 17/18'.

¹³ Biggar Economics (2016), 'Economic Impact of Interface – The Knowledge Connection for Business'. URL: https://interface-online.org.uk/sites/default/files/Economic%20impact%20of%20Interface%20Executive%20Summary%20Sep%202017_0.pdf

¹⁴ West of Scotland KTP Centre (2016), 'About Us'

- 34** These programmes and initiatives operate in a crowded landscape in Scotland, and with the new UK Industrial Strategy focusing on improving commercialisation it is likely that UKRI will develop its role to achieve the target of spending 2.4% of GDP on research. It is important that Scottish universities and businesses make the most of this opportunity of renewed interest and increased investment in commercialisation. There is a key role for the Strategic Board for Enterprise and Skills to oversee the research and innovation landscape ensuring that programmes and initiatives are focused, and that businesses and universities make the most of increased funding from the Industrial Strategy.
- 35** It is clear that these programmes and initiatives have had a positive impact across the Scottish economy, in either improving commercialisation of research for Scottish universities or facilitating peer-to-peer learning, connecting business with academia. These are clear examples of good practice and should be built upon, either through sustained funding and resources or developing similar projects in areas which are not well served by current programmes.
- 36** Programmes and initiatives may need to be more inclusive, as currently participation is dominated by well-established universities. Younger universities such as the University of the West of Scotland and the University of Highlands and Islands are not involved nearly as much. Methods should be explored to ensure that programmes are inclusive and involve as many universities in Scotland as possible.
- 37** From the perspective of an inclusive economy, universities key role of producing graduates who are ready to enter the workplace should not be underestimated. Universities should engage with business to create courses that would be of relevance to business in Scotland. This is even more the case for workers currently in the labour force who will be required to re-train during their working life as the advance of artificial intelligence and automation creates new job opportunities to replace those eradicated by technological change in business.

Features of successful programmes:

- Programmes such as EFs work effectively to link entrepreneurs with the necessary expertise and leadership which is crucial to help them grow their businesses.
- Interface now has a significant knowledge and experience of the environment and works to use this to effectively link businesses with universities.
- Innovation Centres are still learning but their ability to pool research together will improve the commercial opportunities.

Barriers

- 38** While Scotland performs well in the creation of spinouts compared to other regions in the UK, spinouts in Scotland are more likely to stay small and struggle to expand. Furthermore, the businesses that do expand are highly likely to be bought over at an early stage in their development.
- 39** Research from Young Company Finance Scotland identifies 139 spinouts from Scottish universities in the past ten years (2005-15). None have managed to reach a turnover of £5M within five years and only one has secured £10M funding within five years¹⁵.
- 39** It is clear that there are several barriers for spinouts to scale up (as described by the OECD¹⁶) and achieve high growth potential. These include issues around intellectual property, access to finance, skills and features of university-business engagement. We cover each in turn.

Intellectual Property

- 41** The approach of some universities to the level of equity that a university should obtain in a spinout/start-up on creation can act as a disincentive to further investment. For instance, the RSE are aware of examples of universities 'strangling' spinouts and young companies with unrealistic equity requirements for the use of IP. This is a factor in the low numbers of scale up businesses from academia.
- 42** The introduction of a Single IP Agreement has not resulted in an increase in the number of spinouts, start-ups or licences. This may reflect the complexity of IP and the challenge in devising a one size fits all approach for IP in areas as disparate as genetics, software and renewable energy. Better resourced and experienced commercialisation offices should be considered in helping address issues around IP.

¹⁵ Young Company Finance Scotland (2016), 'Scottish Spinout Performance Study'

¹⁶ Audrestch, D (2012), 'Determinants of High-Growth Entrepreneurship', OECD. Definition: *A scaleup is an enterprise with average annual growth in employees or turnover greater than 20 per cent per annum over a three-year period, and with more than 10 employees at the beginning of the period.*

Access to Finance

- 43** While there is an active early stage angel community in Scotland that provides support to emerging spinouts, there is a lack of large-scale venture capital within Scotland that is necessary for upscaling. This arguably results in companies being unable to scale up or attract appropriate investment in Scotland. We are aware that at least two universities have entered into preferential arrangements with funders who specialise in the commercialisation of university research to foster the creation of high growth spinouts. However, we have been unable to find any evidence that suggests these arrangements have seen a marked increase in the creation of the number of spinouts from those institutions.
- 44** We are aware of views that the prevalent approach to angel funding in Scotland of low risk low return early revenue business models may be a drag on growth and it has been suggested to us that the Aberdeen biotech cluster (highlighted earlier) is one of the only Scottish clusters that have managed to successfully 'escape' this model with several companies within the cluster now able to see exit evaluations of over £100M.
- 45** The drivers behind the lack of venture capital funding may be the level of participation in spinout equity and further associated commercial returns such as royalties which may result in spinout companies being unattractive investments for larger private equity or venture capital investors. In addition, the investment models for early stage research and technology-based companies with high growth potential are changing radically in response to the emergence and use of technology to create businesses that are disruptors in sectors, and which have different growth models. The majority of these companies are dependent on the use of digital and data including in life sciences. The companies which have been successful recently in these fields have not been spinout companies but instead have been start-ups with Skyscanner being the most notable example. Very few spinouts and start-ups have achieved this success. To accelerate their development, it will be important to ensure that the finance and advisory communities in Scotland have the appropriate

expertise, capability and skills to support universities and those wishing to form spinouts to address these new models.

- 46** Providing that it is sufficiently staffed and resourced, the new Scottish National Investment Bank offers a means of potentially addressing some of the challenges around access to finance.

Skills

- 47** Evidence suggests that entrepreneurs from academia have a reluctance to scale up and grow their company and lack managerial capability and capacity¹⁷. Companies in Scotland which have achieved high growth are frequently being led by experienced business managers who are not academics and have both the capability and experience to create high growth companies. Interventions should be made which tackle the barriers to scaling up directly. New programmes (similar to Enterprise Fellowships and the Scotland Can Do Scale Programme) which are solely focused on businesses scaling up could be established in Scotland.
- 48** Universities should consider introducing modules on spinouts, start-ups and licensing for undergraduates and postgraduates along with basic IP training. This closely relates to the recommendations of our Entrepreneurial Education report mentioned in Paragraph 5.
- 49** Additionally, while the review focuses on the role of universities and business, it is important to note the growing contribution of the further education sector in Scotland to the innovation agenda. Colleges are now playing a significant role, and arguably gaining in importance, as they provide skills development (as well as in-work skills development and reskilling) for key professions in important areas of the economy such as engineering. Colleges are also increasingly more likely to connect with business through the provision of these skills and other activities. The RSE understands that a similar review of colleges has been commissioned and recommends that if there any changes made to funding or programmes then these should also consider the role of colleges.

¹⁷ Bower, J. 2003. "Business Model Fashion and the Academic Spinout Firm." R&D Management

Wider Context

- 50** As evident from the success stories highlighted above, the creation of spinouts is heavily dominated by the bigger and older universities such as Edinburgh, Strathclyde and Dundee. While their contribution is vital, it is important that research and funding opportunities are more widespread across all of Scottish universities. For instance, there are several universities in Scotland which play a particularly important role in their region such as the University of Highlands and Islands and University of West of Scotland and the ability of these universities to access finance for commercialisation and expertise could have a wider and more significant impact on their regional economies.
- 51** Despite the success of initiatives such as Interface it can be difficult for business to engage with universities to access support for research and innovation. This can be related to both the capacity of businesses to seek opportunities with universities and the (lack of) signposting of these opportunities and capacity by universities.

Conclusion

- 52** As noted earlier, while there are economic evaluations of individual programmes and projects, we encountered some difficulty in identifying independent empirical evidence and research on the impact of universities engagement with business on inclusive economic growth either by institution or as a sector.
- 53** In that context, RSE recommends developing an evidence base that tracks the impact of universities on the economy in a consistent and systematic way. While universities securing contracts with businesses for research or creating spinouts is positive (and there are some powerful case studies of success), the longer-term economic impacts are not always clear and may not always be sustained, for example, where spinouts fail to scale up or are bought out before they have achieved their full potential. Regular independent analysis of impact, which could be a role for the Strategic Board Analytical Unit, would provide the government with objective analysis to inform the development and implementation of effective public policy interventions.

- 54** Nonetheless, our response identifies several examples of best practice in commercialising research and enabling entrepreneurs to develop the skills necessary for a successful business which contributes to the economy. This includes the RSE's own Enterprise Fellowship Programme, Unlocking Ambition and Converge Challenge. Sustained funding for this kind of entrepreneurship support will be important in ensuring that Scotland can continue to realise the benefits of its research base.
- 50** However, the RSE believe there is still room for improvement and present the following additional recommendations to the Review:
- An analysis should be led by the Enterprise and Skills Strategic Board to assess the extent to which commercialisation teams within universities are equipped to advise and support individuals wishing to create a spinout in the context.
 - Universities should review their policies on investment in spinouts, including the percentage of equity and other returns that are demanded in return for access to university IP.
 - Universities should consider how they can support academia entrepreneurs to develop skills to build businesses and to facilitate engagement with experienced entrepreneurs who wish to start-up businesses using the knowledge assets of universities.

Additional Information

This Advice Paper has been signed off by the RSE General Secretary. Any enquiries about this Advice Paper should be addressed to Paul Stuart (email: pstuart@theRSE.org.uk)

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The Royal Society of Edinburgh, Scotland's National Academy, is Scottish Charity No. SC000470

Advice Paper (Royal Society of Edinburgh) ISSN 2024-2694