Economic growth and innovation

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In 2019 I was privileged to become a Royal Society Entrepreneur in Residence at the University of East Anglia. In addition to supporting commercialisation activities of the academics within the School of Biological Sciences, part of my role was to research and write a book on "The Nature of Scientific Innovation". Five years later, the latter task has been completed and the research and analyses I undertook has been published as a Monograph by Palgrave Macmillan in two volumes, the first dealing with 'processes, means and impact' while the second addresses issues relevant to 'those' [individuals and institutions] who deliver' innovation.

The two volumes challenge conventional views and approaches to scientific innovation, how we conduct our scientific research and deliver outputs and impact, and our failure to educate and train cadre's of innovators, particularly disruptive scientific entrepreneurs. I make the case that we are too 'blinded by adequacy' and that fundamental change is required in order to actually deliver significant economic growth, societal impact and environmental sustainability; change that the tax-paying public deserve and the nation needs from its publicly funded scientific research.

Two parallel approaches by economists have been used to describe and explain the role and need for innovation for economic growth for over a century; firstly in terms of the requirement for 'technological change' (particularly neo-classical economics) and secondly in terms of the role of entrepreneurs as 'disruptors of markets' (Schumpterian economics), with the former rather than the latter dominating economic thought, models and subsequently, government policy.

This is not to say there is no acknowledgement of the role and importance of entrepreneurs to a nation's economy. However, ask of yourself but one question – if entrepreneurs are so essential for our economy, growth, employment and wealth, why then is not our education system geared-up to primarily deliver to this purpose? Why instead do we prioritise intellectual attainment, of a prescribed type of intelligence over that of creativity, emotional intelligence and the training of business skills at all levels of learning and education.

Instead we follow an habitual line of thinking and logic that considers that economic growth arises from technological change, technologies arise from scientific discovery, which in turn arises from scientific research, that is best undertaken by scientists trained as elite specialists, given freedom to follow their own curiosity – therefore our education system at all levels prioritises these types of individual and grants them access to the funding, resources and institutions they need to generate discoveries. Such thinking and logic is no longer fit for purpose (if it ever was) and I simply ask the question – why and what needs to be done differently so that public research does deliver to current needs and priorities for innovation?

There are many questions we should be asking ourselves about our scientific research capability. For example, should our measures of scientific achievement be based on publication of research papers that are read on average by around 20 other scholars or focus more on impact and publication of highly cited patents.

Only around 15% of our academics account for their research in terms of impact, while a single patent can generate impact for inventors, investment in start-ups, employment (and hence livelihoods and taxes), the benefits of sales of products, services and processes, and exports as well as value attained at company sale or IPO. The evidence demonstrates that businesses filing a single patent benefit more in each of these areas than companies without a patent(s). From a UK perspective, the independent inventors (the general public) file as many patents as our academic community, ca. 10% each of our total national portfolio, but of course the former at no cost to the public purse.

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If we wish for economic growth, social impact and environmental sustainability we need to achieve more than just highly cited scientific publications from our public research base, we have to increase the efficiency of papers needed per highly cited patent, to around values of other economically advanced nations.

There are also questions about how we view innovation. Without doubt by seeing innovation in aggregate rather than its individual components of scientific discovery, invention, entrepreneurship and markets – then innovation loses all meaning, which maintains the status quo and hinders the ability to focus on where to target change. It is important to recognise that scientists make discoveries but these are different skills from those of inventors who can recognise an opportunity and

turn a discovery into a novel artefact having utility, and then it is an innovator (intrapreneurs, entrepreneurs and disruptive entrepreneurs) who will take all the real risks (less so for intrapreneurs working within established companies) and marshal the people, the resources and the knowhow to take an invention and turn it into a product, service or process – the embodiments of innovation, and deliver into the market. Innovators may be inventors and/or scientists and while some scientists are inventors the vast majority are certainly not innovators – with around only 0.1% of UK academics per annum establishing a spin-off company. We need trained and resourced innovators not more researchers.

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In an article for SiP in 2010, I emphasised the need for a better balance between science supply-led research and market-led research, and have extended this thinking to a better and more nuanced understanding of technology and market related risks and opportunity. Risks are central to innovation and a key attribute of being entrepreneurial, particularly with regard to disruptive innovations.

We need to identify those entrepreneurs who aspire to be scientists rather than the press-ganging of academic researchers into becoming entrepreneurs – a bit like asking performing seals to become trapeze artists – those individuals who have a different set of skills, attitudes to risk, self-efficacy and resilience who are comfortable challenging accepted orthodoxy. But this would require a different approach to education and addressing the point made at the start of this article – education needs to be built around the needs of those who are our drivers of the economy – our entrepreneurs.

Given that entrepreneurs are often school-leavers, or university drop-outs or are graduates who start-up a business post university, the initial emphasis must be on education within schools and as undergraduates – creating a learning environment and education relevant to these different but talented students. It is our most conformist students who 'fit' the system, who pass exams and who stay on into higher education to undertake an MSc or PhD and become researchers – these individuals are not the challengers of orthodoxy or the disrupters of markets. There may be the odd one, (see above) but they are trained in all the wrong things by academics who are rarely risk takers themselves or exude a passion for changing the world. Even our MBAs, as wonderful as they are as a qualification, emphasise the 'what' of entrepreneurship rather than the 'how'. A rethink is required.

A report from the APPG on Entrepreneurship back in 2014 argued the case for less bolt-on activities relating to enterprise and entrepreneurship, and a more strategic approach to promoting both. We need every University science faculty to be able to integrate entrepreneurially relevant content, and appropriate business skills training, and communication skills, knowledge of self, into science undergraduate courses. We need entrepreneurs who do science and can treat research as a sophisticated tool rather than a vocation.

As argued and evidenced in my books, faced with a general decline in creativity, reduced novelty derived from large collaborative research programmes, a reductionist knowledge burden that hinders interdisciplinarity, paradigm-limiting research and a systematic decline in innovative output at all of scales of operation (aggregate, industry sector or individual business), as well as a decline in research productivity across the board, simply granting more money to research is not the solution to boosting innovation. The need is not for more scientific research or researchers but rather those who know how to exploit opportunities offered by discovery – entrepreneurs who know science.

The conventional models of financing innovation involving a series of barriers erected and manned by risk-averse individuals with little genuine experience of innovation and entrepreneurship or an inability to recognise opportunity (albeit a bit risky) does not deliver novelty or creative solutions for new products, services and processes. Rather what will deliver, is to place greater trust in non-conformist unconventional individuals who fail to meet all the conventional qualifications and lack institutional track records, but who have self-efficacy, the resilience to challenge orthodoxy, tenacity, risk taking and hence, the psychological make-up that makes them elite entrepreneurs, good decision makers regarding opportunity and the skills and know how to deliver products, services and processes to the market.

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In the same way we develop the means to select elite professionals in other roles, for example airforce fighter pilots whose training costs exceed £5 million per pilot which allows them to fly under extreme risk an aircraft valued at over £100 million – then by analogy, how much are we prepared to identify those most likely to be great entrepreneurs, pay to train them and how much finance should be released in order generate significant economic growth. How would we make that happen? We need to think differently about how we value entrepreneurs – if we want economic growth then let's be innovative about how we achieve it!

My books pose the question about how many successful entrepreneurs we need, how many intrapreneurs, how many innovative disruptors and what impact can they each have on an economy, and then set about delivering on creating this vital resource for the nation. More of the same just does not 'cut it'!

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