COUNCIL FOR SCIENCE AND TECHNOLOGY

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Prime Minister
10 Downing Street
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21 October 2016

Dear Prime Minister

Strengthening entrepreneurship education to boost growth, jobs and productivity

There is evidence from around the world that entrepreneurship boosts growth, jobs and productivity. The UK has a burgeoning community of entrepreneurs. There is an opportunity for us to build on this by strengthening entrepreneurship education, particularly for STEM undergraduates, as a means to boost productivity further.

We attach a note which explores this challenge and recommends six actions.

Entrepreneurship education for undergraduates is an area for which universities need to take primary responsibility. However, we believe that leadership from you and the Government can help to catalyse its implementation and reap the benefits.

Work on this subject has been led from within the Council for Science and Technology by Professor Fiona Murray – Associate Dean for Innovation at the Massachusetts Institute of Technology and Co-Director of the MIT Innovation Initiative. We have worked closely with senior officials in BEIS and the Cabinet Office, including the BEIS Chief Scientific Advisor Professor Tim Dafforn.

We would be pleased to discuss this topic and our recommendations with you or your ministerial colleagues.

We are copying this letter to Greg Clark, Justine Greening, Jo Johnson, Margot James, Ben Gummer and Jeremy Heywood.

Mark Walport

Sir Mark Walport
Co-Chair

Nancy Rothwell

Professor Dame Nancy Rothwell
Co-Chair

Strengthening entrepreneurship education to boost growth, jobs and productivity

1. Turning innovative ideas into new businesses can deliver huge economic benefits for the UK. Innovative enterprises have significant growth potential, creating jobs and boosting productivity.[i]

2. Entrepreneurs with a STEM background are most likely to build their companies on innovative foundations. Encouraging such enterprise will yield long-term economic dividends and additional benefits from government's investment in science.

3. Entrepreneurship education works. Graduates who have participated are more willing to engage in entrepreneurship, more likely to start and build their own businesses, and their companies tend to be more innovative and sustainable. The more an individual participates, the greater and quicker the benefits.[ii] We recommend six ways to inspire STEM undergraduates to become entrepreneurial, by encouraging greater take-up of formal entrepreneurship education.

4. Entrepreneurial skills were once considered innate, but it is increasingly recognised that they can be learned in the same way as other skills or knowledge. Entrepreneurship education is designed to help students develop an understanding of the mind-set and practical skills needed to start and grow a new business venture. Programmes typically teach entrepreneurship theory and practical skills to help graduates identify business opportunities, launch start-ups and manage new and growing ventures.[iii] Entrepreneurship programmes at university are particularly valuable, coming at a stage when students are forming their career plans and ambitions.

5. However, relatively few students from STEM disciplines also study entrepreneurship. The existing data does not give us a comprehensive picture of how many individual students engage in formal entrepreneurship education through their entire degree course. But recent analytics, which provide a snapshot of the whole undergraduate population in the 2014/15 academic year,[iv] are revealing. Students in many traditional STEM subjects are poorly represented: only 1% to 3% of undergraduate students of mathematics, medicine and the biological and physical sciences participated in formal entrepreneurship education. These figures compare unfavourably to those for law, social studies, and creative arts and design (all between 5% and 7%), and more traditionally business focused courses like engineering and computer sciences, where participation rates were 10% and 16% respectively. Female students were also under-represented in formal entrepreneurship education: 3% compared to 6% for men.[v]

6. Our six recommendations propose ways to encourage greater participation in, and improve the quality of, formal entrepreneurship education.

Recommendation 1: We recommend that universities consider how to incorporate entrepreneurship education in their core curriculum, particularly for undergraduates of STEM subjects with the lowest participation rates.

7. We suggest an aspiration that at least a quarter of all undergraduates participate in formal, credit-bearing entrepreneurship education at some point during their course. To date, most formal entrepreneurship education in universities has focused on postgraduate rather than undergraduate students. While increasing participation is useful for all subjects, efforts should focus on those STEM subjects with the lowest participation rates in the first instance. Equal participation rates for men and women should be a core part of this aspiration.

8. These measures will complement other excellent informal and extra-curricular activities at universities, as well as entrepreneurship education in schools and at post-graduate level. Many UK universities offer opportunities for undergraduates to participate in extra-curricular clubs and competitions related to entrepreneurship. Universities are already an important source of start-ups, with over 4,000 new graduate start-ups created in 2014/15.[vi]

9. This success demonstrates the potential for universities to act as a crucible for entrepreneurship in the UK. This potential can be developed and focussed to encourage the growth of innovation-driven enterprises. Formal entrepreneurship education has a particular role to play here. It is more likely to reach those students who either assume that entrepreneurship is not for them or are less likely to engage with extra-curricular activities.

Recommendation 2: The National Academies should lead work to provide coordinated guidance to universities on entrepreneurship education. This should bring together best practice in educational materials. It should specifically include guidance for STEM undergraduates with the lowest participation rates.

10. Universities will tailor their own programmes according to their students, but would benefit from greater sharing of best practice. As with any discipline, there is value in having good quality core resources to underpin entrepreneurship teaching. It is currently difficult to access such material for entrepreneurship, particularly in relation to STEM subjects. For these subjects, it is important to combine subject-specific information with broader entrepreneurial content to deliver effective courses.

11. Several organisations have been developing initiatives around the teaching of entrepreneurship.[vii] Information and expertise about entrepreneurship and specific disciplines and sectors is also held by the National Academies, Learned Societies and Catapults. We welcome this activity and believe it could have an even greater impact if insights and best practice are shared and coordinated.

Recommendation 3: We recommend that Innovate UK, the Catapults and their business networks build on existing initiatives, including their links with Local Enterprise Partnerships, to provide opportunities for:

- **students to gain direct experience of entrepreneurship through internships at innovative businesses and Catapults**
- **entrepreneurs to participate in teaching entrepreneurship at universities, alongside academics**
- **university researchers with commercially-promising ideas to access schemes that help build entrepreneurial skills and validate their ideas in the marketplace.[viii]**

We recommend that the Department for Business, Energy and Industrial Strategy and the Department for Communities and Local Government should identify how other parts of their innovation infrastructure can also encourage the development of entrepreneurial skills (both through teaching and direct experience). This might include encouraging entrepreneurs who have benefited from publicly funded initiatives to volunteer their expertise at universities (for instance, those who benefit via apprenticeships, Innovate UK support and University Enterprise Zones).

12. Working in entrepreneurial firms is a highly effective way to gain entrepreneurship skills.[ix] We welcome the development of a new apprenticeship standard for entrepreneurs, which will be piloted in 2017. The Government could also harness other parts of its innovation infrastructure to generate opportunities, gaining extra value from this network.

13. Catapult Centres are already developing good relationships between universities and business, helping to move ideas from the laboratory to market. The Satellite Applications and High Value Manufacturing Catapults have introduced programmes that give students direct experience of working in an entrepreneurial business. Dr Hermann Hauser noted this work and recommended in 2014 that "Catapults should develop a stronger more coherent engagement model for working with universities".[x] We welcome these initiatives and recommend they are expanded to become more comprehensive.

14. These networks could also be used as a pipeline for experienced entrepreneurs to teach the subject in universities, in conjunction with academics. This can help plug the gap in the limited supply of educators in STEM-oriented, innovation-driven entrepreneurship, which creates a bottleneck in offering the best teaching in universities. It can also improve the quality of teaching, by offering the best combination of formal knowledge and practical insights.

15. There are already examples of good practice. The Royal Academy of Engineering has run a successful scheme of Visiting Professors in Innovation to enhance teaching of innovation in universities. Many universities have entrepreneurs in residence. Encouraging a diverse pool of entrepreneurs to teach

students is also an important consideration: studies suggest that role-models and mentors are of particular benefit to women entrepreneurs.[xi]

Recommendation 4: We recommend that the Higher Education Statistics Agency (HESA) destinations data should capture additional information, including:

- **for those who have started a business, what kind of business is it (innovation-driven or otherwise)**
- **for those working for a company, what kind of company is it (large, medium, small, start-up).**

Recommendation 5: Universities, working with HESA and the Government, should evaluate the impact of their entrepreneurship education to better understand how to tailor their offer. This should assess whether graduates who have participated in formal or informal entrepreneurship education go on to:

a. **form new businesses**
b. **take jobs in early growth-stage companies**
c. **select jobs in large companies (or a combination of the above over the life course of their careers).**

16. We need a better evidence base to help UK universities identify the relative impact of different educational interventions. This will help them to develop the best courses for their students and shape graduates' subsequent economic and social contributions. Combining data sets from universities, HESA and HMRC for instance, can provide significant insights about the impact of entrepreneurship education on jobs and the economy and allow for richer comparison over time.

17. All graduates receive a Destination of Leavers from Higher Education (DLHE) questionnaire asking about their employment or further study activities six months after graduation. This currently records a host of useful information, including:
    - whether graduates are self-employed or starting a business;
    - whether they felt their recent course and any extra-curricular activities prepared them for starting up their own business;
    - the name of the graduate's employer.

18. Gathering more detail about graduate destinations will, in particular, help identify the impact of entrepreneurship education on innovation-driven entrepreneurship in the near and long term. It will also be valuable to better understand how graduates use their entrepreneurship skills in the workplace.

Recommendation 6: The process for assessing higher education teaching should include a metric that clearly signals the value of

entrepreneurship to students and universities, by recognising and including its particular career benefits.

19. The entrepreneurship community and educators should work with the Government to develop metrics that reflects the career benefits of entrepreneurship. Government is currently developing the Teaching Excellence Framework (TEF), to widen participation and drive up teaching quality in universities. It may wish to consider including indicators that recognises the value of high quality entrepreneurship education.

20. The effectiveness of higher education can sometimes be measured by the starting salary of its graduates. This does not fully capture the benefits of entrepreneurship, where the starting salary can often be low for founders and early employees. The long-term benefits to the UK of these career choices can be significant however, creating jobs and tax revenue as turnover and productivity increase. While graduate salary remains a useful indicator, this may have the unintended effect of dissuading universities from encouraging students to start and join new enterprises. We are pleased to note that the TEF is not currently proposing to use graduate salary as a metric and is instead considering the proportion in highly skilled employment or further study; however, we are concerned that this alone will not fully capture the value of entrepreneurship.

21. We note that three consultations are considering areas that are relevant to recommendations 4-6 above: regarding the design of Year 2 of the TEF; the replacement for the current DLHE; and the development of the Longitudinal Education Outcomes (LEO) dataset. The relevant parts of this letter should be regarded as our response to these consultations.

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[i] The Organisation for Economic Co-operation and Development estimates that in the past decade net new job creation has come disproportionately from young start-ups under five years old.

[ii] A range of studies demonstrate a correlation between entrepreneurship education and entrepreneurial activity and success:

- A report commissioned by the Department for Business, Innovation and Skills (BIS) showed that enterprise and entrepreneurship education encourages more students to start new businesses and contribute to the growth of existing businesses (Enterprise Education Impact in Higher Education and Further Education, BIS report, June 2013).
- The Higher Education Funding Council for England (HEFCE) found that around two thirds of respondents to their study felt influenced to develop start-ups by their university support, including through their courses and specific enterprise support (Research to Assess the Nature and Annual Value of Student Start-Ups, HEFCE, March 2015).
- The European Union 2015 identified 91 studies on entrepreneurship education from 23 countries and demonstrated its multiple benefits (Entrepreneurship Education – A Road to Success, European Commission, 2015).
- Graduates who participated in entrepreneurship education reported higher scores in 10 out of 12 key entrepreneurship competences, compared to a control group. Entrepreneurship education was also shown to have a positive effect on employability in terms of job experience, creativity in current job and annual income earned. (Effects and Impact of Entrepreneurship Programmes in Higher Education, Entrepreneurship Unit, European Commission, 2012).
- A Danish study showed that higher education students who participated in entrepreneurship education more often run a business than those in the control group. Their businesses tend to be more sustainable than those in the control group. (Impact of Entrepreneurship Education in Denmark 2011, 2012 and 2013, FFE-YE, 2013)
- A study on specialised programmes in higher education provided evidence about the impact of an entrepreneurship course delivered by the University of Arizona over the span of 18 years. It showed that graduates of the university's entrepreneurship education programme were three times more likely to get involved in creating new business

ventures than their non-entrepreneurship course peers. (Impact of Entrepreneurship Education, A. Charney and G.D. Libecap, 2000)

[iii] Entrepreneurship Education – A Road to Success, European Commission, 2015, p.34

[iv] Students enrolled jointly in Business and Administrative Studies subjects were excluded from the BIS analysis. https://www.gov.uk/government/publications/entrepreneurship-modules-student-numbers-august-2014-to-july-2015-academic-year

[v] The BIS analysis is based on data collected from universities by the Higher Education Statistics Agency (HESA) during the August 2014 to July 2015 academic year. This analysis was based on a free text search of the HESA student record for 2014-15, to ensure that combination modules (where an entrepreneurship component may otherwise have been disguised by association with the name of another discipline, typically engineering) were also captured.

[vi] https://www.hesa.ac.uk/pr/3890-press-release-232

[vii] These include the National Association of College and University Entrepreneurs; the Quality Assurance Agency for Higher Education; HEFCE; the Higher Education Academy; Enterprise Educators UK and the National Centre for Entrepreneurship in Education.

[viii] Schemes in this area include: the ICuRe pilot programme (run by the SetSquared Universities and funded by Innovate UK and HEFCE, which offers training, mentoring and up to £50k to 'get out of the lab' and validate their ideas in the commercial marketplace) and Lean LaunchPad, a teaching programme that challenges students to create and develop their own business models.

[ix] Entrepreneurship Skills: literature and policy review, BIS, 2015

[x] Review of the Catapult Network, Hermann Hauser, 2014

[xi] Women Entrepreneurs Need Mentors, Robin Laukhuf and Timothy Malone, 2015; Towards Building Cumulative Knowledge on Women's Entrepreneurship, Anne De Bruin, Candida Brush, Friederike Welter, 2006