

**“Economic Prosperity in the United Kingdom and the Role of Science,
Technology, Engineering, and Mathematics Graduates”**

**Remarks to United Kingdom’s Parliamentary Select Committee on
Innovation,
Universities, and Skills**

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Mr. Chairman, thank you for inviting me to share my thoughts with you and the members of the Select Committee.

In 2005, after 15 years as an academic in American universities, I was recruited into permanent posts at University College London (UCL) and London Business School. My remit at UCL was to form a new academic Department of Management Science and Innovation in the Faculty of Engineering Sciences.

The remarks I will share today are informed from my time in the U.K. as well as my Department of Trade and Industry sponsored-visit in 2003 to all of the major university knowledge transfer programs in England and Scotland. I also lived in London 23 years ago when I was a post-graduate student at the London School of Economics (LSE).

My ideas are a synthesis of my British experience and my knowledge of U.S. models of university knowledge transfer such as those at Stanford, MIT, and Rice University in Texas where I founded the Rice University Alliance for Technology and Entrepreneurship. During its first five years, the Rice Alliance helped start 160 technology start-ups that raised \$300,000,000 in equity capital.

Much of the public discussion about Science, Technology, Engineering, and Mathematics (STEM) graduates has focused on the supply side of the argument. Undoubtedly, we need more of both school graduates and university graduates in the STEM areas to fuel knowledge-intensive industries such as financial services, information and communication technology (ICT), biomedicine, and creative industries.

In the U.K., our record on mathematics education for youngsters ranks 9th in the world and our science education places us at 8th. In terms of science and engineering doctorates, we place rather better at 3rd in the world behind the United States and Germany and roughly equal to Japan and China. (The Annexe contains the results and sources of data.)

Yet, there are other critical issues concerning STEM graduates and university knowledge transfer that we must address. In the next few minutes, I will pose questions that, historically, have received less attention than others. For example, let us consider:

- 1. When we refer to the “skills” of STEM graduates, precisely what types of skills are most valuable?**

2. What can the Government do to bring about a dramatic step change to enhance the effectiveness of its STEM education and knowledge transfer programs?

Typically, we tend to assess the commercial success of university knowledge transfer programs in terms of number of spin-out companies launched, venture capital raised, size of initial public offering, or price paid by an acquiring firm.

But, if our aim is to foster broad economic prosperity across the United Kingdom, should we not also include in the list of metrics the number of jobs created by university spinouts by STEM graduates?

Indeed, new high-technology start-ups are often the source of many high-paying, high-quality jobs. This has been the case in the Cambridge cluster, in Silicon Valley, and in the technology hub that is Boston.

I believe that these types of jobs are the very fabric of our future economic prosperity.

Consider some of the most commercially successful university start-ups in the U.K.:

- Cambridge Display Technologies
(University of Cambridge: http://www.cdttltd.co.uk/about_us/78.asp)
- Ceres Power
(Imperial College: <http://www.cerespower.com/>)
- Medic-to-Medic
(University College London: <http://www.medic-to-medic.com/home.php>)
- Offshore Hydrocarbon Mapping Services
(University of Southampton: <http://www.ohmsurveys.com/>)
- Oxford Asymmetry
(University of Oxford: <http://www.evotec.com/en/>)
- Transitive Technologies
(University of Manchester: <http://www.transitive.com/index.htm>)
- Wolfson Micro-electronics
(University of Edinburgh: <http://www.wolfsonmicro.com/>)

STEM graduates who founded companies like these have the potential to fuel economic prosperity because the companies are high-growth. By “high-growth,” I mean firms that generate substantial revenues and new jobs, perhaps in the hundreds or thousands.

Thus, STEM graduates can be sparkplugs for economic prosperity because of the multiplier effect they can have on job creation via the high-growth companies that they may launch. New job creation, in turn, produces increased tax revenue for

government spending on educational, health, transport, and environmental improvements.

So, I believe that we must orient STEM graduates toward contribution to, and leadership of, high-technology and high-growth companies. This begs the question, therefore, of how best to organise the skills training of STEM graduates to maximise their impact.

When we refer to the ‘skills’ of STEM graduates, precisely what types of skills are most valuable?

Traditionally, we have assumed that the value of STEM graduates is based on the quality of their technical skills. I wish to challenge that assumption. World-class technical skills are a necessary but not sufficient condition for our STEM graduates to make the economy more prosperous. We must develop new programs to ensure that STEM graduates have the skills to guarantee that their technical work has societal benefit. This benefit is typically accomplished by commercialisation and entrepreneurship; STEM graduates must be equipped to bring their innovations to the marketplace.

For example, my Department of Management Science and Innovation at UCL just this autumn launched a new B.Sc. degree in “Information Management for Business” (IMB). The Higher Education Funding Council of England (HEFCE) funds the course but the funds are managed by e-Skills, which is an industry consortium in ICT with corporate members including, BT, Hewlett-Packard, IBM, Microsoft, and Oracle, among others. The IMB course has a technical core in computer science and software engineering, which is wrapped in significant management and business training. The dozen or so universities participating in e-Skills courses correctly retain final authority over the curriculum. Employers, however, have input in the curriculum to ensure that the skills of our graduates are aligned with the needs of business.

This e-Skills model of collaboration with employers should be expanded to other technical areas such as biomedicine or energy.

The partnership between University College London and London Business School is another example of an academic initiative that promotes education of STEM students on topics relating to commercialisation and entrepreneurship. Each year, approximately 80 technical doctoral students at UCL take MBA elective courses at London Business School. This program has operated now for several years and has been shown to enrich the educational benefits received by both the doctoral students and the MBA students who work with doctoral students in the class.

We believe that this program can be a model across the U.K. for collaboration between science, engineering, and medical faculties and business schools.

As my final point, what can the Government do to bring about a dramatic step change to enhance the effectiveness of its STEM education and knowledge transfer programs?

The Government must continue its commitment to invest in these efforts. For instance, at the moment, the Government has devoted much of its effort to funding knowledge transfer programs in universities such as the £150 million Higher Education Innovation Fund (HEIF).

But, the government cannot succeed on its own. HEIF is not enough.

I call on this Committee, and the U.K. Government, to consider policies to create the conditions whereby individuals and corporations can make philanthropic gifts to fuel university programs in knowledge transfer and STEM education. The combination of both government funding and philanthropic generosity can ensure that programmes for knowledge transfer and STEM training excel.

Philanthropy cannot be a substitute for government funding of science and innovation. Rather, we must expand the total pie for support for science and innovation, not simply substitute private funding for government commitment.

The U.S. has a reputation for being a philanthropic society. For example, my last employer, Rice University, has an endowment with a market value of \$4 billion, which equates to \$795,107 per full-time student. On a per student basis, this puts Rice at around 4th in the league table of all U.S. universities. Yet, its total endowment ranks only in the upper teens compared with Harvard's rank of 1st with a total endowment of around \$30 billion. Oxford and Cambridge have endowments of approximately £6 billion (\$12 billion).¹

In the U.S. there have been several large gifts to fund university entrepreneurship centers such as MIT (\$24 million endowment to date) and Michigan (\$10 million endowment). Perhaps there will be a similar trend in the U.K.

So, what is the state of philanthropic giving to universities in the U.K.? Of the 81 institutions responding to the Survey by the Council for Advancement and Support of Education (CASE), £417 million was raised across the sector during 2005/2006.² In commenting on fundraising, the Sutton Trust noted:

¹ *University Fundraising – An Update*. The Sutton Trust, 2006.
<http://www.suttontrust.com/reports/UniversityFundraisingDec06.pdf>

² *U.K. Higher Education Survey of Gift Revenue and Costs, Report of Survey for 2005/2006*, Council for Advancement and Support of Education (CASE).

“Despite this growth, however, the UK sector continues to lag seriously behind the US universities in terms of funds raised, rates of alumni giving and endowment levels. The gap between the ten largest university endowments in the UK and US, for example, has widened by some £12.5 billion during the last three years alone” (p. 2).

This pattern is especially troubling because the gap between the U.K. universities and U.S. universities appears to be getting larger.

How can we in the U.K. compete in the global knowledge economy if our universities continue to fall farther behind in terms of their financial resources?

But, is the U.S. a special case of philanthropy that cannot be replicated elsewhere? I believe that it is not. Anecdotally, I was told recently of a case from Cambridge where £55 million was raised in just 18 months to construct a new building for the Department of Mathematics. Moreover, Oxford, Cambridge, Edinburgh, LSE, and Imperial are in the midst of, or have recently completed, ambitious fund raising campaigns.

I believe that higher education in this country has just started to scratch the surface of philanthropy. Perhaps the Committee is aware that:

- The U.K. is ranked 3rd place in the world listings of millionaires with a total of 610,000.³
- The number of millionaires in the U.K. has risen rapidly – between 2001 and 2005 the figure has increased more than 80% from 230,000 to 425,000.⁴

London, in particular, has a truly extraordinary concentration of wealth. Of the 1,000 richest individuals in Britain and Ireland, 411 were born or have their interests centered in London.⁵ In fact, of the ten richest postal codes in the U.K., seven are in London. An estimated 294 millionaires live in the wealthiest postal code, NW3, alone.⁶ You may recognise that postcode as Hampstead.

³ *Global Wealth Report*, Boston Consulting Group, 2007
http://www.bcg.com/about_bcg/media_center/press_releases.jsp?id=2423&yearpub= Wealth was defined as: “It defines personal wealth as listed securities, such as shares held directly or indirectly through managed investments, cash deposits and money market funds. It excludes wealth attributed to investors’ own businesses and luxury goods. It also excludes owner-occupied housing and investment property.”

⁴ *Millionaire Neighborhood Report* 2006, Eurodirect.

⁵ *Sunday Times* (UK) Rich List.

⁶ *Focus on London*, 2007 www.statistics.gov.uk/focuson/london/

I believe that greater philanthropic giving is the key to further enhancing the quality of higher education in general and the effectiveness of university knowledge transfer and STEM education programmes, in particular.

Indeed, because many of the U.K.'s wealthy are businesspersons for whom knowledge transfer and STEM education will strongly resonate. Knowledge transfer programs that concentrate on STEM graduates could be a suitable beachhead for new efforts to encourage greater philanthropic giving.

What can the Government do? I urge this Committee to reflect on the possibility of new policies that the Government can put in place to create incentives for wealthy individuals in the U.K. to get involved in philanthropic giving to university knowledge transfer and STEM education. For instance, perhaps this Committee can join forces with the other appropriate Parliamentary Committees to devise ways to create more appealing tax incentives for greater philanthropic giving.

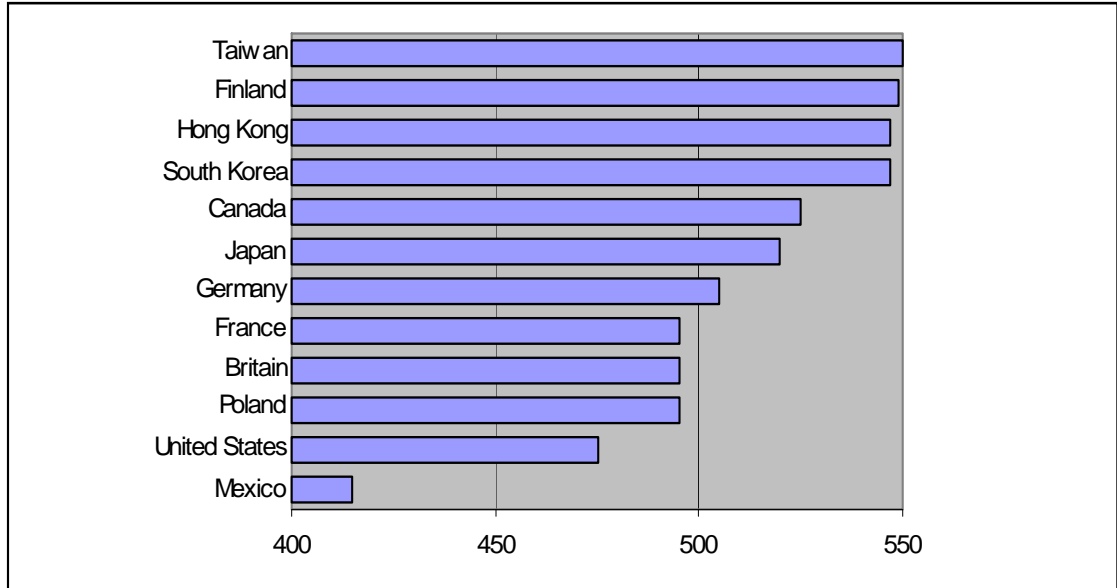
Let us aspire not only to be the best in Europe in knowledge transfer and STEM education. Indeed, the U.K. must look outside of Europe for its benchmarks. My instinct leads me to worry that the U.K. lags developments in North America and developing countries such as India and China. The Select Committee may wish to consider a benchmarking study against Europe, U.S., India, and China regarding funding of knowledge transfer and STEM education.

So, let us aspire to be the **most** efficient country in the world in translating science and innovation into new products, new companies, and new high-quality and high-paying jobs. One tangible step that you can take is to establish policies that create the conditions for philanthropists to contribute additional resources that add to existing Government funding of knowledge transfer and STEM education.

Thank you.

Mathematics Performance

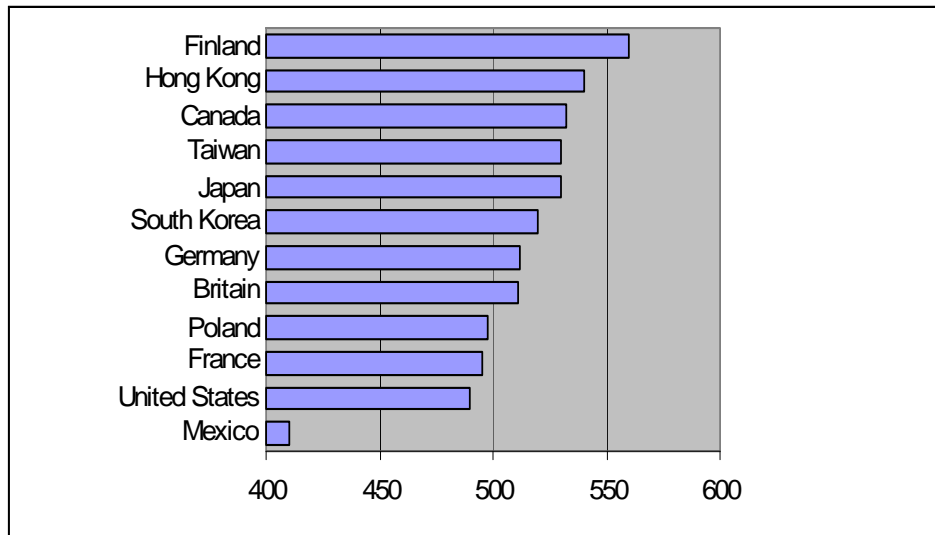
Selected countries, 2006, average=500



Taken from The Economist December 8th 2007
(Source OECD)

Science Performance

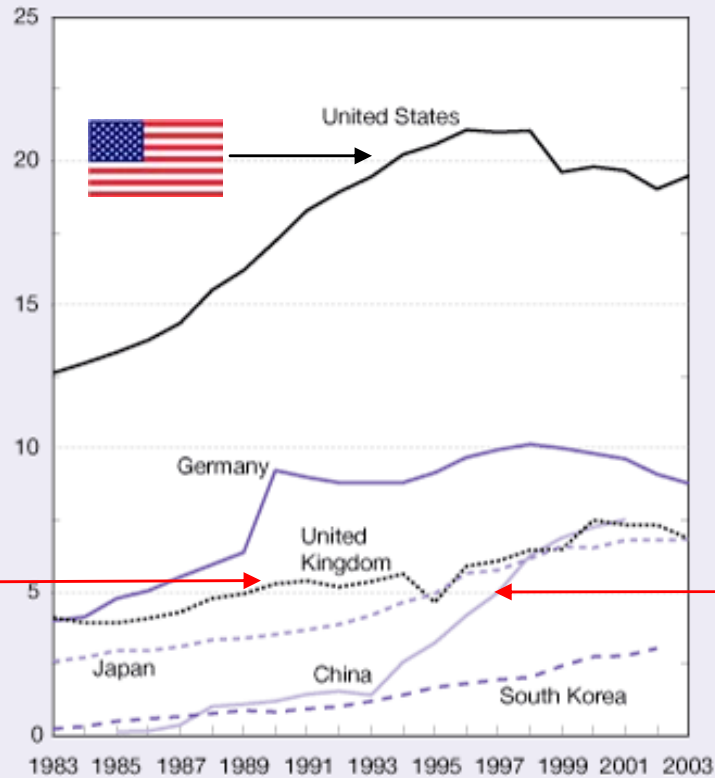
Selected countries, 2006, average=500



Taken from The Economist December 8th 2007
(Source OECD)

Figure 2-34
Natural sciences and engineering doctoral degrees, by selected country: 1983–2003

Degrees (thousands)



NOTE: Natural sciences and engineering include physical, biological, earth, atmospheric, ocean, agricultural, and computer sciences; mathematics; and engineering.

SOURCES: China—National Research Center for Science and Technology for Development; United States—National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates; Japan—Government of Japan, *Monbusho Survey of Education*; South Korea—Organisation for Economic Co-operation and Development, Education Online database, http://www1.oecd.org/scripts/cde/members/EDU_UOEAuthenticate.asp; United Kingdom—Higher Education Statistics Agency; and Germany—Federal Statistical Office, *Prüfungen an Hochschulen*. See appendix tables 2-42 and 2-43.

