

Innovating Across Boundaries: What Can Singapore Learn from the Cambridge Phenomenon?

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It is Winter 1914, and Britain faces an unexpected problem. The war, which would eventually come to be known as World War I, was five months old and had already descended into the stalemate of the trenches on the Western front. Quantities of soldiers and matériel were being consumed at unprecedented rates in a Europe more accustomed to wars limited in scope, objective and duration. Replacement of soldiers was achieved by vigorous recruiting campaigns and eventually by conscription. Armament and equipment were a different matter entirely – Britain’s sole source of certain goods essential to the war effort was now its enemy, Germany.

Why did Britain end up in such a perilous state in the early months of the war when compared with Germany? Germany’s advantage was derived from the disruptive innovation of higher education in the 19th century, sometimes called the “first academic revolution”. The establishment of Berlin University in 1810 saw the introduction of research as a core institutional mission in addition to the traditional mission of teaching, making Berlin the world’s first “modern university”. A strong education system, producing graduates trained in applied science and equipped with the latest research ideas, was a key factor in the emerging industrial revolution, which pulled Germany from a lagging position to one of industrial leadership by 1850.

Such was Germany’s dominance of the chemical industry, born of effective collaboration between industry and academia, that German suppliers quickly displaced British competitors, thereby creating the context for the subsequent strategic weaknesses in industrial capacity exposed by the outbreak of the war. Conversely, British universities, with some notable exceptions, lacked a strong research ethos and their culture for generating and applying knowledge was largely underdeveloped.

Today, one century after the terrible events of World War I, the situation has changed dramatically. A new race between nations is taking place to occupy

leadership positions in the “knowledge economy”. In many countries, this translates into Universities being regarded not as an “ivory tower” protected by the state, but as an instrument of economic policy. Acting as a source of innovation and entrepreneurship, a nexus of knowledge transfer, a catalyst for collaboration across industries, and the source of a technologically-savvy pool of graduates has become part of the modern university’s mission, what Henry Etzkowitz calls the “second academic revolution”. The once separate institutions of university, industry and government are now converging and adopting each other’s missions in order to generate economic growth. In the UK, nowhere is this more apparent than in Cambridge.

Cambridge’s academic research base is globally recognized: 92 university affiliates have been awarded Nobel Prizes across all categories since 1904. But how did one of Britain’s oldest universities, firmly grounded in 800 years of tradition, in a small city of only 120,000 people, give birth to one of the UK’s most exciting high technology business clusters? And addressing the focus of this article, what can Singapore learn from the Cambridge Phenomenon in order to push forward the boundaries of innovation? A key lesson for Singapore and one that can support the ‘Smart Nation’ vision is the ability to build bridges amongst institutions (government, universities, private sector) across disciplinary, sectoral and national boundaries to unleash innovation potential.

Reflecting on the UK experience, academia and industry have traditionally regarded each other warily, while government efforts to encourage cooperation between the two have not always been successful. Cambridge was among the first UK universities to respond to such efforts with the 1969 Mott report, recommending the establishment of the UK’s first science park to take advantage of the concentration of scientific expertise, equipment and libraries and to increase feedback from industry into the Cambridge scientific community.

Following the 1980 introduction of the Bayh-Dole act in the US, intended to overcome the problem of lock-up of publicly-funded intellectual property by granting universities rights to exploit inventions, the number of patent applications exploded. A similar policy was adopted in the UK in the early Nineties, exemplified in the White Paper *“Realising our potential: A strategy for science, engineering and technology”*. A series of government reports followed over the next 20 years, exploring the weaknesses of various aspects of the national innovation system (university-industry collaborations, funding,

IP regulation, knowledge transfer, innovation catapults) and recommending improvements.

With its prior experience of Cambridge Science Park, Cambridge University was the logical choice as the focus of UK efforts to develop an innovation ecosystem driven by academic research. From a starting point of 20 high tech companies in the Cambridge area in 1978, the number steadily grew to 360 in 1985, mainly as a consequence of the entrepreneurship of individual academics and a growing supportive network made available through the Science Park. The university itself adopted a liberal approach in this period, a factor considered to be critical in the emergence of the Cambridge cluster in the formative years. By 1998, Cambridge University began to adopt a more hands-on, entrepreneurial approach, establishing a supportive central structure dedicated to the third mission activities (i.e. social and economic development) including a technology transfer office modeled on that of MIT, a fund for academic spin-outs, a non-bureaucratic policy for protecting intellectual property (IP) rights which granted significant leeway to academics in negotiations, and a liaison office to support external collaborations.

In 1990 the Judge Business School was established, hosting an Entrepreneurship Centre with a strategic focus on promoting innovation. In addition, the Cambridge Institute for Manufacturing launched in 1997, aimed at blending disruptive technology innovation with management and policy research. In 2002, Cambridge Enterprise, was created, aiming “to improve the support available to the academic community to make their ideas and concepts more commercially successful for the benefit of themselves, the University and the UK economy”. By 2007, the Cambridge cluster had grown to 1,500 high tech companies, including the research and development (R&D) facilities of many multinational companies.

The parallels between Singapore and the UK are striking. In the World Intellectual Property Organisation (WIPO)’s latest Global Innovation Index, the UK is ranked second and Singapore seventh globally. A closer look at the sub-indices reveals that Singapore is ranked first in the world for input factors, consisting of elements of the national economy that enable innovative activities, such as human capital and research, infrastructure, and market sophistication.

Unlike many of its neighbouring countries, Singapore demonstrates a strong rule of law, having adopted a common law system closely aligned with English

law. Robust legal frameworks give individuals and companies the confidence to engage in knowledge and technology transfer processes across national boundaries, leading to greater flows of inward investment.

The synergies between the UK and Singaporean innovation systems prompted the establishment of a ten-year Innovation and Research Partnership in October 2014, intended to benefit both nations. But, as is often the case with innovation networks, it is the personal commitment and social connections between people that, together with an adequate level of resourcing, have greater longevity and yield the greatest benefits. A poignant example of this is the fund being established by Fitzwilliam College to support Singaporean students in the memory of its alumnus Lee Kuan Yew, the mastermind behind Singapore's extraordinary evolution over the past five decades.

In Singapore, internationally recognized academic institutions such as the National University of Singapore and Nanyang Technological Institute produce valuable research that needs to find a "home" beyond academia in order to produce economic and societal benefits. A fertile "exploitation home" for valuable scientific explorations is a first element in creating a powerful innovation system.

In the recently launched Research, Innovation and Enterprise Plan, the nation's science and technology research budget will rise to a record \$19 billion in the next five years, with the advanced manufacturing & engineering, health & biomedical sciences, services & digital economy, and urban solutions & sustainability sectors being prioritised. Singapore's Prime Minister Lee Hsien Loong called this "an investment in our human talent, in the possibilities of science and what it can do to change our lives, and in our understanding of the world and human knowledge which can be applied in many areas over many, many years".

More recently, a new agency was announced as part of Budget 2016 alongside a US\$3.2bn plan for innovation and robotics. SG-Innovate's mission is to connect entrepreneurs with industry mentors, venture capitalists and research talent. It will work with "public and private sector leaders in the Singapore ecosystem to help build companies in key sectors such as finance, energy and health," said its head Steve Leonard.

In April 2016, the unit's first collaboration was unveiled with Singapore's central bank and financial regulator, the Monetary Authority of Singapore (MAS), to advise startups on FinTech (financial technology) funding. In May 2016, a delegation of senior officials from MAS visited Cambridge Judge Business School to explore whether the expertise of the Centre for Alternative Finance could be used to inform innovation policy and practice for Fintech in Singapore.

So some of the essential ingredients for the development of an innovation ecosystem appear to be present in Singapore today. However some questions remain... Do the academic institutions have the human capital to bring scientific discoveries closer to commercial application? And likewise, does the private sector possess the skillsets and networks required to access and understand the science base and then translate breakthroughs to prototypes? The WIPO Global Innovation Index suggests that further work needs to be done because despite its high ranking for domestic innovation, Singapore does not feature in the global top 10 for knowledge and technology outputs resulting from those innovative activities.

The Cambridge case offers some pertinent and timely lessons that may help identify where the alignment between managerial and governance mechanisms in Singaporean academic institutions could be improved. Cambridge is a relevant benchmark to achieve the ambition for innovation and entrepreneurship of this "Smart Nation". To this end, we carried out a review of the barriers and enablers of university third mission activities in the UK, using Cambridge as an exemplar, and found the following necessary factors to support the development and growth of a successful innovation system:

- **Human capital:** A motivated body of researchers who can simultaneously pursue academic excellence and knowledge commercialization. For instance Cambridge Enterprise supported 1,320 academic researchers during 2013/14.
- **Relevant knowledge:** A stock of potentially commercialisable knowledge, of interest to external partners and for the market.
- **Business models:** A university business model which aligns its strategy and administrative procedures (e.g. recruitment, performance management and IPR) with its portfolio of formal and informal knowledge transfer and signaling channels.

- **Supportive organisational structures:** Availability of dedicated supportive resources & capabilities (such as technology transfer offices, incubators, science parks).
- **Active networks and network management:** A network of strategically congruent external (often local) organizations with the capability to cross boundaries, to understand and to co-create with academia in an environment where mutual trust and understanding can develop over time (Apple, Microsoft, HP, Amazon and Astra Zeneca all have research facilities located in Cambridge). Active network management, so that a cycle of existing knowledge exploitation and new knowledge exploration is continuously nurtured.
- **Knowledge creation strategy:** A coherent regional knowledge economy strategy, with regional sources of venture capital and dedicated regional support services.

Many of these factors are already being addressed in Singapore's infocomm media sector. Koh Boon Hwee, Chairman of Singapore's Infocomm Media Masterplan Steering Committee has commented that Singapore "will need to groom talent and cultivate a maker mind-set from young as well as encourage greater innovation among our enterprises so that they have the confidence to tackle big, complex and challenging problems." This will require a focus on the internal ecosystem, its attractiveness to talent and inward investment in a highly competitive global marketplace, as well as a more extensive global network linking the city state to innovation hubs such as Cambridge.

Under its Infocomm Media Masterplan, Singapore has ambitious plans to turn the city state into "a living lab to entrepreneurs, growth companies and multinationals in the infocomm media space where they continually experiment and innovate to contribute to sustainable and quality economic growth" within the next decade.

There has never been a better time to connect the global innovation hubs of Cambridge and Singapore. As it has ably demonstrated over the past five decades, Singapore is more than capable of synthesising best practice from around the world in order to maintain its competitiveness. The "Smart Nation" vision will become reality when the rigorous pursuit of new knowledge can be combined with excellence in knowledge commercialization. By encouraging an entrepreneurial culture and allowing progressive managerial and governance mechanisms to evolve in its knowledge creating institutions, these institutions can become more closely aligned with Singapore's ambition

to become a global hub for innovation and entrepreneurship. By learning from each other, Singapore and Cambridge are in a unique position to forge a powerful 21st century partnership.

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