

**“Fostering a National Innovation System:
Lessons for Singapore from the US Experience”**

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25 August 2008

Introduction

Innovation is a key contributor to national economies—creating new products and services, spawning new markets, improving the competitiveness of firms and industries, and generating new growth and wealth. It is not an independent activity, but one that occurs in the context of innovation ecosystems—systems that grow and evolve, and comprise multiple players, connections and linkages interacting with the external environment.

Dr Charles Wessner, a renowned policy expert on technology and innovation in the US, spoke at the Civil Service College on the concept of a national innovation ecosystem, and discussed the strengths and weaknesses of the US model. Broadly, he expounded on two key areas: the new realities in innovation, and the US response to the innovation imperative.

New Realities in Innovation

Innovation in the Global Landscape

Dr Wessner began with the observation that although some might think that the present innovation landscape was satisfactory, the reality was that things had changed, and changed rapidly. While the US had devoted significant resources to research, the question was whether that in itself was sufficient for innovation to flourish. In other countries, a key question was whether they had the underlying social norms, attributes and legal framework to support innovators.

Dr Wessner noted that innovation was increasingly global, with competition from other nations. It was also more collaborative. About two-thirds of recent awards involved collaboration, and there was a growing role for public-private-partnerships. US policies should therefore reflect this new reality.

He cited examples of different countries' strengths and approaches to innovation. China benefited from scale advantages, national focus and ample resources; India's innovation efforts were facilitated by policy liberalisation; and Japan was restructuring its innovation system through high-level policy focus and investments. In terms of Research and Development (R&D) expenditure, China had overtaken Japan. He noted, however, that expenditure was an input measure, and was not the best indication of good innovation outcomes.

Innovation Models

Dr Wessner emphasised that the linear model of innovation was a myth. One reason he suggested for the persistence of this idea was that researchers could benefit readily from it. The reality was that innovation was complex. There were major overlaps between basic and applied research, development and commercialisation. Dr Wessner presented a non-linear model in which basic research, applied research, development research and

commercialisation were inter-dependent (e.g., results in applied science could lead to good questions in basic science).

He described the innovation ecosystem as a dynamic set of complex processes and networks that bring new research ideas to market, taking into account that innovation was (a) collaborative, (b) inter-disciplinary, and (c) globally networked. However, he acknowledged that this was difficult. Singapore, in particular, had done well in being globally connected.

Dr Wessner suggested that to support an innovation ecosystem, policy should move beyond input factors, because innovation was neither mechanical nor automated. Policy should also create positive incentives for greater collaboration and integration. He praised Singapore's pragmatic approach to policy and ability to constantly fine-tune policies to re-align them to the changing environment. He suggested that Singapore move its focus beyond MNCs and GLCs to encouraging indigenous start-ups.

US Response to the Innovation Imperative

US Model

Dr Wessner stressed that there was no overarching US strategy to innovation. Instead, there was a diversity of approaches from different sources, such as the congressional councillors, federal agencies, state governments, and strong interest groups. One resulting strength was an adaptive system with multiple sources of experimentation, for example, in the case of funding for stem cell research. One weakness was a lack of coherence that could lead to de facto outcomes that harmed innovation, such as the unintended fall-off in science and engineering education.

The US had advantages in the openness of its society to innovation, the flexibility of its economic and institutional infrastructure to re-deploy resources to their most efficient use, and the large and integrated domestic market. Social norms, such as the acceptance of commercial failure, or judging people by their abilities rather than their nationalities, created positive incentives for entrepreneurship. There were also entrepreneur-friendly policies (e.g. allowing bankruptcies to recover quickly), a strong intellectual property regime, and a regulatory perspective that encouraged local initiative.

Dr Wessner added that small businesses played an important part in the US economy, generating 60% to 80% of new jobs annually over the last decade, and employing 39% of high tech workers. However, he noted that the US government share of R&D was not keeping up. Apart from the National Institutes of Health (NIH), R&D funding had generally stagnated. Another problem was the distribution: 58% went to defence, 22% for health, and 20% for others. Whereas one could expect technological spin-offs from defence research in the 1950s and 1960s, this was less likely now as most defence research funding went into development work rather than applied or basic research.

Thus, there were growing concerns regarding US innovation policies and competitiveness. While these concerns led to the passing of the America Competes Act in August 2007, the provision of funding never came despite the law being enacted.

Assumptions about US Innovation

Dr Wessner explained some myths that affect policies in the US. Firstly, he pointed out that myths were often derived from elementary economics models that relied on too many assumptions. Discussions were therefore not always pragmatic. One myth he particularly

disliked was the myth of American exceptionalism. He felt that much of American success was neither genetic nor cultural as people of all backgrounds started companies. Another myth he shared was that of “if it’s a good idea, the market will fund it”. However, potential investors had less than perfect knowledge. While venture capital (VC) was a powerful tool, VC markets were themselves limited and had inherent problems, such as limited information, herd instincts, a focus on later stage investments and early exits. For every successful VC, there were others that lost money. He acknowledged it was understandable that the market found it difficult to fund at early stages due to limited information on the potential of the product, as well as overhead costs. To address such challenges, the US model had multiple sources (e.g., university research and government sources), including that of the Small Business Innovation Research (SBIR) programme.

Small Business Innovation Research (SBIR)

Dr Wessner explained that the SBIR filled the gap between angel investor and early stage VCs. It was administered locally, but owned by different government agencies. The proposals were industry-initiated. An evaluated concept, SBIR was also adopted by many other countries. The research validation for SBIR’s effectiveness came from a piece of commissioned research (which surveyed 7000 projects), and an independent project (Black & Keller, “Where do Innovations Come from?”, 2008). Both studies found that SBIR awards have a substantial impact in creating companies. The first study showed that SBIR initiated research, and companies which participated also partnered more. SBIR was particularly helpful to women entrepreneurs in the USA as a funding source. The second study showed that SBIR companies accounted for a quarter of US’s top 100 R&D firms.

Dr Wessner said that SBIR success could be observed in many ways, including NASDAQ-type success, the creation of useful new products, the fulfilment of government missions, as well as scientific advances.

Fallacies of Tradeoffs in Research

Dr Wessner remarked that the argument on the tensions and tradeoffs between mission-oriented and curiosity-driven research was overstated. He suggested that Singapore could be accepting of researchers who pursued research in their own areas of interest while making it possible for those who wanted to commercialise to do so. Focus group discussions could be conducted with young researchers to find out what the real issues were.

On the role of the university, Dr Wessner acknowledged the need to strike a balance between its priority for publishing research and its responsibility as a teaching institution. While he agreed that good teachers might not publish much, to have no publications was suspect. He suggested feedback sessions as a way to validate the quality of teaching and thus be a counter-measure to publications. He noted that different approaches had been taken; for example, the University of Texas now required commercialisation efforts to be part of tenure requirements. To encourage commercialisation, he felt that people could be tempted when they saw others’ successes in commercialisation.

Dr Wessner added that the universities also needed to move away from the view that working closely with industry was detrimental. Research has shown that teams that worked with industry also had scientific success. This was true both in the US and Europe. While Science and Technology Parks were useful catalysts for cooperation, suitable monetary and career incentives needed to be in place for innovation to continue to flourish in Singapore.

Small Business Innovation Research in the Singapore Context

On whether the SBIR model would work in Singapore, given its small volume of research, Dr Wessner said that Sweden and Finland had adopted similar policies, with the former using it as a form of government procurement. He noted that if the US had not started SBIR but went directly to large companies, these large companies would have hired small companies to find the solutions anyway. SBIR was therefore doing away with the middleman. He added that multiple pathways could be taken, but noted that Singapore did not have a strong network of VCs.

Dr Wessner observed that Singapore had the infrastructure, talented researchers, a competent government, and the global network as its strengths, and suggested that Singapore might need more patience as research took time to show results. On the need for diversity, he noted that top universities for commercialisation were not the richest ones by endowment. The US system allowed for dramatically different outcomes. As for the VC issue, he suggested that Singapore consider a well-funded experiment to test out the SBIR. While some funding schemes set conditions for commercialisation that were akin to “kicking them out to fly”, his response tended to be “first, attach wings”. There needed to be better market assessment before the decision to spin-off was taken. It was noted that many scientists were not likely to become Chief Executives, and would become scientific advisors and Chief Technology Officers (CTOs) instead.

To encourage entrepreneurship among researchers, Dr Wessner commented that VCs should focus on how best to motivate researchers and allow them to direct their time and efforts to the project. He cited the example of the Google founders, who were reluctant to proceed with their start-up at the expense of graduate studies. They eventually took leave of absence when their professor assured that they could return to college—a useful lesson for universities and research institutions to note, and to welcome failed entrepreneurs back.

Finally, Dr Wessner encouraged Singapore to continue its quest for “high value human capital”. In conclusion, he assessed that Singapore should not let up on R&D given the global competition for talent, and to continue to provide project funding in addition to motivation and encouragement which remain key to innovation.