

Session 1

## A Broad Overview of the U.S. Innovation System

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Over time, the U.S. economy has benefited from its large size (permitting high levels of internal competition), resource endowments (leading to early wealth accumulation) and history (remaining strong after WWII). As perhaps the innovation system with the broadest strength in the world today, many seek to study the system and adapt useful elements to their own situations. This presentation will give a broad overview of the U.S. system of innovation highlighting characteristics that seem most important for encouraging the kind of innovation in which America excels as well as pointing out some areas of vulnerability.

The analysis of innovation systems can be dominated by canonical examples. Discussion of Japanese innovation often revolves around lean production, total quality control and the car industry, stable long term employment, excellent specialized engineering skills and bank financing. In contrast, discussion of U.S. innovation often focuses on Silicon Valley, highly mobile employees, networked firms, venture capital, university excellence and university spin-off firms. This organizational form was ideally suited to innovation in information technology, and many of these characteristics are also found in the biotech industry, in which California also leads and in which universities play an even more dominant role. These canonical examples provide important starting points and markers of world class success; however, a more systemic perspective reveals that these examples emerged from a broader ecology of organizations and institutions.

The diverse organizations in the U.S. innovation system contribute particular strengths. Many large multinationals are headquartered in the U.S. and they excel at innovation, with the resources to pursue large scale projects and the market share to realize the profits. They are often superbly run, with formally trained managers who have led the way in devising techniques to run large, highly complex firms spread across the globe. The U.S. has a vibrant population of highly innovative small firms, fostered by the ease of setting up new firms, the lack of stigma on bankruptcy, and the strong incentives provided by the high payoffs possible in acquisition, stock market flotation or the dream of becoming the next Microsoft, Google or Ebay.

U.S. universities support both types of firms. Their culture of openness and challenge provides a fertile environment, attractive to the brightest minds the world has to offer, and fosters intellectual development, high achievement and overall integrity. The resulting high quality of the universities is evidenced by their dominance of international rankings. The universities produce a large pool of very well trained university graduates and PhD researchers to the benefit of innovative firms large and small. The university system is heterogeneous, including public, private (not-for-profit) and for-profit institutions. The universities compete, developing specialist strengths to differentiate themselves and flexibly seizing new opportunities. This can foster

entrepreneurial cultures that encourage commercial application of their work, evidenced by the strong growth in university patenting in recent years and the large number of spin off firms.

The institutions that provide the environment for these organizations also have particular strengths. The U.S. market-based economy is very large and has been structured to be highly competitive, forcing firms to innovate to survive and providing rich rewards, and hence strong incentives, to those who do innovate. U.S. capital markets are deep and themselves innovative and risk taking, providing opportunities for financing and strong incentives for successful innovators. Intellectual property rights have been strengthened in the past decade and protect innovators from all types of organizations. In the background are decades of generous federal funding of R&D. This huge investment has resulted in a sophisticated infrastructure of buildings, equipment and trained people unrivaled in its depth and breadth. The payoff to this investment is especially visible in the biotech and pharmaceuticals areas, which have seen especially large growth in Federal funding over the past decade.

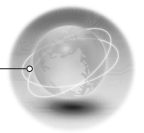
There are vulnerabilities in the system though, and several high level policy reports from organizations such as the Council on Competitiveness and the National Academies of Science have raised an alarm. First, there is concern over the future of the American S&T workforce. White Americans seem averse to pursuing PhD's in science or engineering, perhaps because the economy offers plenty of exciting and lucrative alternatives. Traditionally, the U.S. has relied on foreigners, but that approach became problematic with visa restrictions imposed post 9-11, with the strengthening of foreign research universities enticing more people to stay at home, and with greater competition from other countries for foreign PhD students. Science and technology have traditionally not provided congenial homes for women or minorities, and there is a concern to change this as a way to secure the nations future innovative workforce. Weaknesses in pre-college education ("K through 12") are also of great concern. The administration has implemented its "No Child Left Behind" initiative aiming to identify and improve weak schools. Scientists tend to favor a more elite approach of building more elite schools for the most talented youngsters.

A second topic of concern is the patent system. The system is under strong pressure from an increased load of applications and with Congress taking a chunk of the revenue generated by the office, it has not been well positioned to respond. Quality is perceived to be suffering. The system is also challenged by the need to adapt to new technologies. Reform proposals are in Congress and are contentious because industries such as information technology and biotechnology have opposing interests, for example in the ideal length of the patent term.

A third controversial topic in research policy is stem cell research. There is strong opposition to fetal stem cell research from the President's office on moral grounds and U.S. involvement in this research is restricted because Federal money has limits placed upon it. Consequently, states such as California and New Jersey and institutions such as Harvard are finding their own resources to devote to the work.

A fourth concern of scientists in recent years has been the emphasis on biomedical research and a feeling of imbalance and the need to rectify this with greater funding growth for physical sciences and engineering.

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The situation is changing, with growth in NIH funding much reduced and increases going to NSF and to energy research.

Broader problems in the U.S. system include the high risk of litigation and the health care cost burden. The risk of litigation provides strong disincentives for the risk taking that is necessary for innovation. Research into vaccines and new methods of birth control have been affected. The ever rising burden of health care costs disadvantages firms in comparison to foreign competitors and reduces the resources available for R&D. This will be especially true at the Federal level in coming years as required spending on Medicare and Medicaid grows with the aging population, putting strong pressure on the discretionary part of the Federal budget that includes R&D spending.

As for sustainability, it is difficult to assess the U.S. position. On the one hand, large firms have probably made large gains in for example, making their chemical processes more efficient and less polluting to improve revenue and reduce costs. However, the weak focus on sustainability is evidenced by its absence from the business school curriculum. It is no surprise then that Toyota recently overtook Ford as the number two carmaker in the U.S., partly on the strength of the greater fuel efficiency of its cars, fuel efficiency not being a priority of U.S. carmakers in recent years. However, energy research has once again become a priority of the Federal government with recent high oil prices.