Innovation and Entrepreneurial Leadership

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1. U.S. Position in Global Competitiveness

Throughout the post-WW II period, the United States has been enjoying the undisputable leadership position in the global economy mainly owing to the vibrant innovation and entrepreneurialism backed up by leading edge science and technologies combined with sufficient financial resources. Since 1960s, however, European and Japanese competitions also have been eager to emulate the U.S. way of innovating to catch up with the productivity and quality of the U.S. manufacturers. As a result, in traditional manufacturing industries such as automobiles, steels, shipbuilding, machine tools, textiles and home appliances, many non-U.S. firms even demonstrated a higher quality of incremental innovations than their U.S. counterparts, and the dominance of the U.S. firms in those mature manufacturing areas has been severely hampered.

In the emerging or rapidly growing newer industries, however, driven primarily by the research capabilities of leading universities, institutions and high-profile

corporations, the U.S. leadership in technological innovation has remained robust as an important source of national resources up until this day. But, lately, it is not rare to observe that American firms begin to lose their steam even in these knowledge and high-tech based industries as well. Also, in spite of heavy investment and high expectations along with the great bustle from the media, biotechnology industry has yet to demonstrate the real technological breakthroughs, while nanotechnology has been so far disappointingly slow in generating substantial commercial value to the market.

Let me share with you a set of interesting shifts in the landscape of global economy and knowledge. When you see this snapshot figures at the moment, you will find that the U.S. is still the dominant leader in the world economy, particularly in its knowledge base.

- Over 20% of World GDP
- Still enjoying the highest productivity
- 37% of World R&D Investment
- 38% of OECD Patented Inventions
- 37% of OECD Researchers
- 63% of Highly Cited Publications
- 58% of World's Top 100 Universities
- 70% of Nobel Prize winners employed in U.S.

This persistent leadership is also reflected in its top-ranked position in the global competitive index and innovation index. In addition, U.S. shows the greatest total amount of R&D expenditure although its "R&D intensity," or R&D expenditure as a percentage of GDP, is ranked a little bit lower than Japan.

R&D Investment (2006)

Country	R&D Investment (US$)	
USA	343 billion	(2.62% of GDP)
EU	231 billion	(1.80% of GDP)
Japan	130 billion	(3.20% of GDP)
China	115 billion	(1.43% of GDP)
Korea	28 billion	(3.13% of GDP)

Global Competitiveness Index 2008-2009

Country	Overall Index	Innovation Factors
USA	1	1
Singapore	5	11
Japan	9	3
Hong Kong	11	21
Korea	13	10
Taiwan	17	8
China	30	32
India	50	27

But, when we see from different angle, we can reach a signal that the U.S. cannot rest on laurels any longer. As shown in this table, the U.S. shares of global knowledge bases are diminishing across all dimensions.

U.S. share of Global Annual Total (%)	1986	2003
R&D Investment	46	37
Science Publication	38	30
Researchers	42	29
Bachelors, S&E	38	29
PhDs, S&E	52	22

Moreover, the global competitiveness of U.S. increasingly relies upon immigrant talent as indicated by the growing number of all levels of degrees in science and engineering conferred on immigrant students. Further, it is projected that China will produce more PhDs in science and engineering than the U.S. by 2010.

Importance of S&E immigrants (% share of U.S. S&E labor force)

Degree Level	2000	2005
Bachelors	16.5	19.1
Masters	29.0	32.7
Ph.D.s	37.6	41.1

Percent of Undergraduates receiving S&E degrees (2002)

China	52%
Korea	41%
Taiwan	38%
Japan	24%
U.S.	17%

It is also notable that many science and engineering undergraduates from the prestigious U.S. universities prefer to join the financial or legal service sectors for their career paths.

Number of S&E PhD degrees earned (2004)

EU			45,400	
Asia:			34,320	
China	(14,860)	(*1)		
Japan	(7,660)			
India	(6,320)			
Korea	(3,500)			
U.S.			27,970	(*2)

*1 *China will produce more S&E PhD's than U.S. by 2010.*
*2 *More than 50% of these are foreign students.*

2. **American Dilemma**

As seen from the numbers above, the influence and dominance of the United States in the world economy, particularly in the creation of knowledge-based intellectuals, are on the way to erode and hopefully this trend may change under the right leadership. Currently, however, the funding for innovation will be scarcer than ever before across all research institutions, including companies and universities, especially owing to the current financial crisis. In 1960s and 70s, the U.S. government funded the development of the Internet for roughly 24 years, which is remarkable for any single program. This sustained funding made a huge contribution to facilitating a series of innovations in the U.S. information technologies. President-elect Barack Obama promised in his campaign platform, "Ensuring that the U.S. continues to lead the world in science and technology will be a central priority for my administration." But I am very skeptical as to whether he will be able to keep this campaign pitch under the ongoing adverse economic circumstances.

In addition, the U.S. education system in general is deteriorating as well, especially in elementary and secondary levels. 10^{th} graders' math and problem solving rating was 7^{th} out of G8 countries (2003), and 15 year-olds' math rating was 24^{th} out of 30 OECD countries (2003).

In fact, many had raised red flags and sent warning signals that all these problems will rise to the fore and deal a severe blow to the nation, including a

well prepared report, “Rising Above the Gathering Storm” by National Academy of Sciences (2003), two books, “Innovation Nation” by John Kao (2007) and “Closing the Innovation Gap” by Judy Estrin (2008) just to name a few.

3. Long Term Planning and Funding

When the Soviet Union successfully launched the first Sputnik in October 1957, America was in panic. Then, the U.S. Congress demonstrated its strong commitment to investing in the future of the nation by increasing scientific and technical talent pool by passing the National Defense Education Act. In 1958 NASA was created, and Department of Defense established the Advanced Research Project Agency (ARPA) to strengthen the nation’s lead in military technology. This Agency’s mission was to fund high-risk and long-term research, with a focus on large-scale projects, and particularly concentrated much of its computer science related projects of top-level universities including MIT, Carnegie-Mellon, and Stanford. All these supports were initiated by the Agency’s recognition of the crucial role of innovation for the achievement of their goals. A chain of entrepreneurial innovations developed by ARPA, whether successful or not, eventually drove much of the computer and networking applications behind Silicon Valley firms and other innovation hubs throughout the United States and world.

It is a good example, in history, that these long term projects had eventually made the United States flex its muscle over Soviet Union, and that the U.S. could maintain the advantageous position during the cold war era until Soviet Union collapsed in 1991. As mentioned above, today we see the American

education system and R&D activities deteriorate, which are discouraging. However, under the right leadership and proper funding, there is a good possibility that America will regain the leadership position in science and technology in the coming years.

4. Lessons from Japan

Over the past 10 years in Japan there had been repeated warnings that the Japanese economy had to shift from "catch-up business model" to "front runner mentality/business strategy", otherwise Japan could not expect the economic success in the face of ever increasing pressures coming from the emerging economies. For Japan there are not much there to catch up. Japan has been very successful in the global market with the business model, which has been based on somebody else's theory and someone else's concept of ideas, products or even technologies, by way of certain functionality additions to the products or services, some design changes or reducing the manufacturing costs.

However, this business model has later been copied by the emerging economies like Taiwan and Korea, who have had the same economic goals as Japan did. But today, China arrived in a humongous magnitude, that cannot be compared with Taiwan or Korea, to conquer the global market with sweeping sea changes.

When you look at the Japanese products in the global market which are enjoying the commanding market shares, some of them are still those "me-too products." But, lately in a few years of time, we could find a new refreshing trend, i.e. we see more and more Japanese goods on the global market based on

the unique concept, design and technology, which are highly innovative. We find these products as radically innovated, and this means that Japan has been aggressively investing in R&D for the continued development in technologies in the past decades to reach the status of the "front runner."

One good example has been Toyota, who is well known for their "on time delivery" and "lean manufacturing practices" in the production process. Toyota is an undisputable world leader in the automobile industry in terms of the production volume as well as the customer satisfaction. We all congratulate Toyota for their performance. We all know, however, Toyota was not the first car manufacturer, who developed the concept of an automobile from the old means of transportation, such as the horse carriages. Toyota was not the first company in inventing the automobile engines either, nor did they develop the tires out of the rubber. The answers are no!

But, Toyota has been outstanding and excelled anybody else in the auto industry in making the car more comfortable and user-friendly, much lighter in weight for better gas mileage, better in design, in prices and in overall services than their competitors. Toyota started with a "me-too product" like anyone else, but ended up sweeping the world market with all those most cherished product qualities. Toyota has been the envy of all the competitions, including those even from the other Japanese automobile manufacturers. However, when you see Toyota from the technological point of view, there has been not much to revere other than the excellent quality and successful commercialism. In today's automobile market, it is very scary to go without new technological breakthrough. Today, though, there is a good chance for Toyota to become the

true leader technologically with unshakeable and solid number one position, if the improved second generation hybrid models, which are already on the market, turn out to be a real technological invention.

5. Asian Model Innovation

When we look back into history, we can see a lot of outstanding breakthrough innovations from the traditional societies in Asia like China, Japan and Korea. For more recent centuries, however, Asian innovations went into a long hibernation period. But I sense that Asia's long dormant innovative spirit has shown signs of life during the last half century, and it is now about to flourish, while the West is staggering to maintain their traditional leadership in innovation over the globe.

In connection with this new revival of the Asian innovation movement, especially after having seen all the pros and cons of the Western method of innovation in the past, these are a few points I would like to go over with you.

(a) Effective Collectivism as Asian Virtue:

According to many scholarly works on the relationship between culture and innovation, Asian collectivism is more detrimental to innovation than the Western individualistic approach. This certainly makes sense, but I do not think it is always true. In his study of the biotech industry, Professor Walter Powell at Stanford University reports that quantum innovation comes not from individual scientist but from the synergic networking among scientists, laboratories, and firms, and that the synergic networking cannot be achieved without strong trust between scientists. Probably trust-based networking has

long been the symbol of Asian collectivism, so Asia should be able to sublimate the century old Asian virtues into the modern limelight. Of course, we should also recognize the flip side to this bright aspect of collectivism. A collectivistic relationship within a network can also lead to the ethically questionable behaviors such as corruption and fraud. A good example is Dr. Hwang's stem cell research team in Korea, which blew up a couple of years ago in a big scandal. His team was built upon the collectivistic collusion of imposture, not upon the collectivistic building of trust.

(b) Long term planning with sustained funding:

Asian countries have been accustomed to the government-led economy, so they may be situated in a more advantageous position to utilize the benefits of government-led innovation policy. I would like to stress again that quantum innovations are obtained only when sustained funding is secured for the fundamental science research with less concern about the inevitable failures. The long term planning and funding from the government will allow for greater exploration of possible alternatives, which is a necessary path towards the creation of disruptive technology.

(c) Soft Infrastructures:

Government's control over the private sector will need to be readjusted and well balanced to allow liberal atmosphere and open minded entrepreneurial spirit to flourish. As in the natural ecosystem, the performance of innovation is proportional to the development of business habitat or ecosystem that houses the innovation. In particular, Asian governments need to improve the ways in which their policies boost the motivation of private sectors to engage in

innovation. For example, Intellectual Properties must be strictly protected to encourage the R&D activities, which are the backbone of the sustained innovation. Corporate governance, tax credits and flexible labor laws are another areas that are linked to long-term performance in innovation, not to mention about the readily available financial funding.

(d) International Collaboration:

Innovation is not a zero-sum game, which assumes that a gain in a country is a loss for another, leading to more barriers between the nations. On the contrary, innovation is likely to occur through complementary resources and capabilities from different mentalities and cultures. Moreover, firms can also strengthen their own innovative ability through international collaboration as they lean from their counterparts' experience and resources in innovations. I believe the Asian tradition of humility can enhance the receptiveness of Asian firms to learning from others. We all know the famous story about the formation and breakup of NUMMI, a joint venture between Toyota and GM located in San Francisco Bay Area in 1980s, where Toyota successfully learned marketing know-how for the U.S. market form GM during the collaboration, while GM somehow failed in learning manufacturing technology from Toyota, which is the best in the world.

6. Leadership Education

Let me conclude my presentation by emphasizing the importance of the leadership education. In order to continue the technological innovation during the coming decades, we need to train more Knowledge Innovators and

Entrepreneurial Leaders from the leading research universities in Asia. The goal should be to produce the highest quality scientists and engineers, believing that only the best talent will bring in the best results. First of all, they must stand out in their own disciplines in comparison with the peers of the global quality. On top of that, they must have flexible, well-rounded and open minded personality. Unfortunately, it is well known that there are a certain stereotype of views on Asian engineers, being very smart and bright but narrow minded and not very creative, who are sometimes pretty difficult to work with. Thus, you would probably like to review your curriculum and emphasize more on shaping versatile "T-shaped people" with deep knowledge in at least one discipline and broad knowledge about creativity and entrepreneurship, which will allow them to effectively exchange with people in other disciplines to bring their ideas to life.

KAIST in Korea has recently implemented such interdisciplinary curriculum under the leadership of President Nam Pyo Suh, who has spent most of his career at MIT as the Chairman of Department of Mechanical Engineering. I am sure that many other Asian universities are also developing similar curricula that help transform the stereo-typical Asian students into genuine innovative leaders or knowledge creators. I believe the graduates, who have been educated by these curricula, will be more likely to have firm conviction and clear vision for the future, and have the ability to communicate better with the others.

Since I believe entrepreneurship education for the science and engineering students is imperative in a knowledge-based society, I have been fortunate to

be actively engaged with Stanford Technology Venture Program (STVP) at Stanford School of Engineering. Every year STVP is holding Roundtable on Entrepreneurship Education conferences several times in different continents. The main theme of these conferences is entrepreneurship education, which emphasizes on the innovative entrepreneurial leadership.

I sincerely hope that this Conference will bring about a series of excellent ideas on how to revitalize the innovation landscape of the East Asia. After all, this is the Asian Century, and you are the major players to lead it. I wish you a good luck and heartfelt congratulations to the organizers and all the participants for the success of this valuable opportunity.

Thank you very much.

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