

# **Leapfrogging in Eastern Asia: How the “People Factor” Creates Success?**

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## **I. Introduction**

### **Architecture Building**

An infant can not walk before he or she learns how to through observation. Whether by intellect or by fostering, some children may learn faster than others, but all infants are constrained equally by physiology. Even if the mind has developed and conceived the concept of mimicking this trait, not until the bones and muscles are strong enough to support the body's weight can he or she take his or her first step. Otherwise if the skeletal and muscular development was not strong enough to support the mass of the child, with every attempt to stand, the child would simply fall over. This offers a good lesson for the child, but relating this as an analogy to other models could cause negative economic and/or catastrophic results.

Like an infant's physiology the construction of a card castle, a house, or a skyscraper follows the same process. The architects and contractors follow a bottom-up approach. For a castle made of playing cards, the first step is finding a firm supportive surface to build upon. This foundation acts like the concrete that is poured in the ground under the house or skyscraper before the first hammer is swung or bolt is fastened. Once hardened this foundation becomes the base or physical infrastructure for the frame to be built on. Not until the frame is standing on this base, the walls are constructed, the electrical and plumbing lines are ran, and the welcome mat is placed at the front door can the building pass inspection and become habitable.

Regressing from this hierarchical approach, suppose that an insufficient amount of concrete was laid or the firm surface for the card castle gives away and thus the

structure topples over. Through a scalability matrix, Figure 1.1 shows the varying costs attributed to such a calamity.

**Figure 1.1: Scalability Matrix Related to Costs of a Sampling of Structures Toppling Over**

<b>Structure</b>	<b>Time</b>	<b>Capital</b>	<b>Life</b>
Card Castle	Minimal loss of time and like an infant falling over, a good lesson is learned.	N/A	N/A
House	Significant loss of time, depending on where in the construction process the failure takes place.	Tens to hundreds of thousands of dollars lost, depending on where in the construction process the failure takes place.	Possible loss of life of construction crew or the homeowners.
Skyscraper	Daunting loss of time, depending on where in the construction process the failure takes place.	Hundreds of thousands to millions of dollars lost, depending on where in the construction process the failure takes place.	Possible loss of many lives on construction crew and anybody in the surrounding area from collateral damage

These analogies show the importance of a sound base in any model: whether it is a child standing and walking for the first time; a house toppling over because of poor workmanship; an analog or digital telecommunication system; or a country’s public transportation network. The model’s infrastructure will always relate to the specific outputs attainable.

**Leapfrogging 101**

Consider two models where the innovation of generational technologies and their availability is the independent variable. “Model One” is the United States building up a vast wired-based telecommunications infrastructure dating back to 1892 when the first

wired voice communication line opened between New York and Philadelphia.<sup>1</sup> Over the next century many technological innovations took place that revolutionized the telecommunications industry. Now by using Moore's Law, named after the 1965 declaration of Gordon E. Moore, Co-Founder of the Intel Corporation, that technological innovation doubles nearly every two years and with that innovation prices drop, the U.S. telecommunications' industry has gone through fifty-seven  $((2006-1892)/2=57)$  iterations of doubling its capabilities and reducing prices since AT&T laid that first line.<sup>2</sup>

Through standardization of the U.S. telecommunications market and the Communications Act of 1934 the foundation of universal service was laid and the most advanced, and geographically vast, costly global infrastructure of communications was formed and perfected. This infrastructure came at a great cost of capital and time since lines had to be physically laid to every home and place of business no matter the region's population density.

“Model Two” is any developing nation today that is building a telecommunication system from the bottom-up. Like the sky-scraper analogy discussed earlier, these developing nations must first lay the concrete before making the first outbound call. As Moore's Law shows their have been roughly fifty-seven advancements to the type of concrete/telecommunications technology available to these developing nations since AT&T first opened its wired line from New York to Philadelphia. “Model Two” allows the developing country to learn from the mistakes of its predecessors and benefit from their innovations. “Model Two” allows the developing nation to leapfrog over a

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<sup>1</sup> AT&T: History of the AT&T Network – Overview. 11 June 2006  
<<http://www.att.com/history/nethistory/>>.

<sup>2</sup> Moore's Law, the Future - Technology & Research at Intel. 11 June 2006  
<<http://www.intel.com/technology/silicon/mooreslaw/>>.

century's worth of complimentary and supplementary innovation from other parties with modest costs of investment on their own. They may even skip wired lines entirely and start building their network under a wireless cellular platform, which in many cases would be more economical.

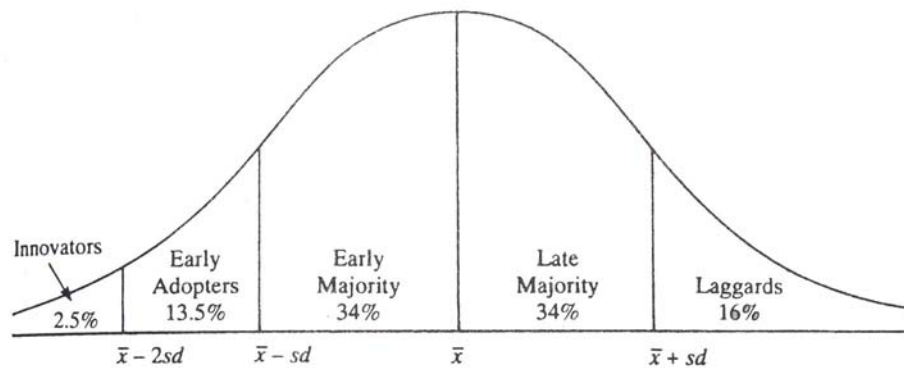
### **Adoption of Innovation**

It is not necessarily the person or group that comes up the technology first but the person that utilizes a technology the best that benefits the most from it. Evertt M. Rogers also further categorizes those that adopt an innovation into five categories: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards.<sup>3</sup> Although certainly the Innovators certainly benefit from the technology first, they may not necessarily be in the best position because of the amount of costs that come from the Research and Development (R&D) to create the innovation.

Furthermore, development is a complex enigma. Thus, a single "big box" approach does not work across the developing world. This can easily be expressed by how Eastern Asian (defined in this report as the East Asia-4 countries of China, Singapore, South Korea, and Taiwan; plus Japan) nation states' development has been far more successful than that of other developing nations in Central America, South America, Africa, Eastern Europe, and the rest of the developing world. In the modern world of globalization, the path-dependency of these Eastern Asian nation states being historically innovative societies allows for easy adaptation of new innovations through leapfrogging mechanisms. The leapfrogging acts to bridge the divide, but it is up to the region to continue building the highway once the bridge connects the digital divide gap.

Figure 1.2 shows Roger’s graphical representation of the five adopter categories discussed earlier and the approximate percentage of adopters distributed to each grouping. The mean is represented as “ $\bar{x}$ ” and the standard deviation is represented as “sd.”<sup>4</sup>

**Figure 1.2: Adopter Categorization on the Basis of Innovativeness**



Source: Rogers

This can be further expressed by drawing on the example of the advanced high-speed railway train systems of Eastern Asia. Like the leapfrogging example of cellular telephony, East Asia has been able to flourish due to being an innovative adopter of transportation technologies through leapfrogging. Shinkansen, the first high speed, “bullet train” opened in Japan in 1964 and was able to reach speeds up to 200 km/h (125 mph). And as Moore’s Law voiced with telephony, it screams with transportation technologies as the same trains can now exceed 500 km/h.<sup>5</sup> Japan’s transportation infrastructure leapfrogged over that of the United States and Europe, while connecting the different regions of the country. Similar high speed train systems have since been put

<sup>3</sup> Rogers, Everett M. Diffusion of Innovations: Fifth Edition. New York: Free Press, 2003.

<sup>4</sup> Rogers, pg. 281.

<sup>5</sup> Railway Technology – Shinkansen High Speed ‘Bullet Train’ Operated by JR Central, Japan. 27 June 2006 < <http://www.railway-technology.com/projects/shinkansen/>>.

in place in China, Korea, and Taiwan. High-Speed trains have also found great success in Europe but have not been successful in the U.S. because of the legacy infrastructure already in place.

Rural and urban regions have benefited from the installation and development of high speed public transportation systems throughout Asia. Similarly in the United States with the development of the trans-continental railroad – the developing nations of the world have become closer to the developed world by reducing the distance and eliminating the geological hurdles that interfered with commerce. These rural developing areas are no longer isolated by geography because of the new infrastructure that builds physical and virtual bridges. Later this paper will delve further into the specific benefits of rural and urban development.

## **Background & History**

Globalization may not be a new phenomenon but through the advancement of technologies, the diffusion of this paradigm has increased significantly in the 20<sup>th</sup> and 21<sup>st</sup> centuries. Rogers states regarding the advent of the Internet, “Clearly, the world in which we live today is a different one than that of sixty years ago, when study of the [innovation] diffusion process began.”<sup>6</sup> The success of the development of Eastern Asia compared to other developing regions, confirms Joseph Stiglitz’s ascertainment that the International Monetary Fund’s (IMF) “one-size-fits-all” approach does not work.<sup>7</sup> Deepa Narayan in a World Bank study from 1999 echoes the same message, but introduces the

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<sup>6</sup> Rogers, pg 216.

<sup>7</sup> Stiglitz, Joseph E. Globalization and Its Discontents. New York: W.W. Norton & Company, 2003.

idea of a “Factor X” that may play a significant role in the success-ratio of any developing nation.<sup>8</sup>

The IMF’s “big-box” economic stimuli package ignores critical cultural and social context. The formal and informal institutions of Eastern Asian nation states create the socio-cultural Narayan “Factor X” that fosters adaptation of new technologies, which are utilized to create or open new markets to the economy. Specifically, China’s path-dependence of being a historically innovative society allows for easy adaptation of technology.<sup>9</sup> This creates a leapfrogging mechanism unseen in other developing regions that do not have the innovative history. The historical relationship of this mechanism can easily be compared to Industrialization; where results varied by region, country, and city. But as Thomas Freidman states in *Lexus and the Olive Tree*, “unlike in the Industrial Revolution, countries today don’t have to be prisoners of their natural resources, geography, or history. In today’s globalization system any country can plug into the Internet, import knowledge and develop its own educational base; any country can find shareholders from any other country to invest in its infrastructure.”<sup>10</sup>

### **Path-Dependent Success**

This research paper hypothesizes the success of the development of several East Asian countries is relational to their historical path-dependence, and ability to innovate internally. This is proven through the success of instituting leapfrogging policies. The focus on the successes of China, South Korea, Japan, et al are due to their State driven

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<sup>8</sup> Narayan, Deepa, *Bonds and Bridges: Social Capital and Poverty* (Policy Research Working Paper, 2167, The World Bank, August 1999).

<sup>9</sup> Putnam, Roberts, Robert Leonardi, and Raffaella Y. Nanetti. *Making Democracy Work*. New Jersey: Princeton University Press, 1994.



concerted broadband, telecom, and Information Technology leapfrogging policies that not just leveled the playing field, but created favorable markets for these developing nations by allowing their human capital to compete in the flattened global market.<sup>11</sup> These policies created industries and expanded existing markets. As many of these policies were instituting to compete or compliment with the United States hegemon, much of the report's comparative analysis is benchmarked against that of the U.S.

## **II. Culture and Education**

Products of China's historical innovation include gunpowder, rocketry, the compass, the printing press, and the mechanical clock. These path dependent examples reaffirm the historical basis of this report's argument. The socio-cultural factors of China, Korea, Japan, and other East Asian nations put an emphasis on Science, Technology, Engineering, and Mathematics (STEM) education.

### **Engineering & Innovation**

According to the U.S. National Science Foundation, China ranks first in graduating engineers throughout all levels of college. Specifically, 21% of the world's engineers are educated in East Asian countries, which is four times more than the United States.<sup>12</sup> And according to the American Electronics Association 2005 report, "Losing the Competitive Advantage: The Challenge for Science and Technology in the United States," Japan graduates twice the amount of engineers compared to that of the U.S. with

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<sup>10</sup> Friedman, Thomas L. Lexus and the Olive Tree. New York: Anchor Books, 2000. Pg. 197.

<sup>11</sup> Friedman, Thomas L. The World is Flat: A Brief History of the Twenty-First Century. New York: Farrar, Straus and Giroux, 2005.

<sup>12</sup> U.S. National Science Foundation, Science & Engineering Indicators (2004), Appendix 2-36.

only half of the population and South Korea with 1/6<sup>th</sup> of the population and 1/20<sup>th</sup> the GDP of the U.S. graduates the same number of engineers.<sup>13</sup>

And as engineers are the lifeblood of entrepreneurship and economic development this is a favorable component to Asia's self-sustainment. Furthermore, these countries do not just graduate more engineers but they graduate considerably better engineers and computer scientists. At the 30<sup>th</sup> Annual Association of Computing Machinery (ACM) International Collegiate Programming Contest (ICPC) World Finals, held April 12, 2006, in San Antonio, Texas, nineteen of the top thirty-nine finishers originated from Asia.<sup>14</sup> Six of the top thirty-nine were from the U.S., but only the Massachusetts Institute of Technology ranked among the top twelve highest finishers.<sup>15</sup> This annual contest, formerly dominated by the United States, pits the best and the brightest from around the world on a level playing field to answer six difficult computer programming problems over a five hour period of time. Although the winner was from Russia and Europe had the highest percentage of schools that placed as top finishers, Asian schools placed second overall. Asian schools placed 19 out of the top 39 schools, only one school behind European institutions whom placed 20 out of the top 39.

## **Scholarly Articles**

Further analysis of East Asia's socio-cultural affinity for STEM education since embracing globalization can be seen by the increase of scholarly articles published. By

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<sup>13</sup> American Electronics Association. Losing the Competitive Advantage: The Challenge for Science and Technology in the United States Washington, DC: 2005.

<sup>14</sup> The ACM-ICPC International Collegiate Programming Contest Web Site. 11 June 2006 <<http://icpc.baylor.edu/icpc/finals/default.htm>>.

<sup>15</sup> "A Red Flag in the Brain Game. America's dismal showing in a contest of college programmers highlights how China, India, and Eastern Europe are closing the tech talent gap." Newsweek Online 1 May 2006: [http://www.businessweek.com/magazine/content/06\\_18/b3982053.htm](http://www.businessweek.com/magazine/content/06_18/b3982053.htm).

comparing data from the U.S. National Science Foundation’s annual *Science & Engineering Indicators* report you find exponential increases in the quantity of scholarly articles published in the East Asia-4 and significant increases in Japan over the last twenty years.<sup>16</sup> Figure 2.1 shows these increases from 1986 to 2003 (the last year that data was available per the 2006 report) as well as figures from 1999, around the time when the diffusion of Broadband technologies emerged.

These engineers benefit from an infrastructure of advanced broadband and cellular technologies built recently from the bottom-up from their Early Adopter or Early Majority adoptions of innovation without the costs of replacing a legacy system. This is a significant benefit to later adaptors who do not need to pay considerable sums of money and time to transition legacy systems into newer technologies. Additionally, the governments do not need to retrain its labor force on the new technology.

**Figure 2.1: Scholarly Articles Published by Eastern Asian Countries**

Country	1986	1999	2003	% Change (1986 – 2003)	Net Change (1986 – 2003)
Japan	32,278	50,392	60,067	86%	27,789
East Asia-4	5,402	21,675	55,324	924%	49,922
- China	3,342	10,070	29,186	773%	25,844
- Singapore	416	1,181	3,122	651%	2,706
- South Korea	625	4,728	13,746	2099%	13,121
- Taiwan	1,019	5,696	9,270	810%	8,251

Source: NSF

<sup>16</sup> National Science Foundation. *Science and Engineering Indicators*. Washington, DC: 2002 and 2006.

## **Human Capital: The People Factor**

These engineers may not necessarily spend their entire careers in a technical field; they may flow into the public sector where their expertise plays an essential role in creating technology policy and filling the gap that many policy makers have in knowing and understanding technology. Richard Heeks discusses the “Seven Elements of Success or Failure” when instituting public sector information technology projects in the 1999 anthology *Reinventing Government in the Information Age: International practice in IT-enabled public sector reform*.<sup>17</sup> The seven principles that Heeks explains in the anthology are 1) Information Factors, 2) Technical Factors, 3) People Factors, 4) Management Factors, 5) Process Factors, 6) Cultural Factors, and 7) Structural Factors. Any or all of these can act as a stop-gap for success in instituting and managing IT projects.

The contributing factor that allowed East Asia to outpace most the developing world was in Heeks’ “People Factor.” The rich history of innovation and scholarly work in the STEM disciplines allows East Asian countries to adopt new technologies and leapfrog. Heeks’ elaborates on this point by discussing the barriers to progress being Skills and Knowledge, Finance, Risk, Suspicion, and Infrastructure. As discussed earlier and for the purposes of this report, let’s focus on how the “Skills and Knowledge” of Information Technology from East Asians is superior to other developing nations. Heek’s states, “senior public officials – both managers and politicians – often lack IT skills and even awareness. They are therefore reluctant to support, or even to discuss reforms that involve information technology.”<sup>18</sup> This reluctance stems from the fact that

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<sup>17</sup> Heeks, Richard. *Reinventing Government in the Information Age*. New York: Routledge, 1999.

<sup>18</sup> Heeks, Pg. 32.

many of these governments have a vertical hierarchy engrained with culture that disallows those at the top to be put into a position to look uninformed or uneducated.

### **III. Technology & Infrastructures**

#### **IT Implementation & Leapfrogging**

The IT gap is much more prevalent in Africa, Central America, and other developing nations. Similar to Stiglitz's stating that the "big box" approach to development does not work; the "big box" IT development approach cannot work either. The developing nations must have the human capital with the "Skills and Knowledge" to properly set up the advanced networks. Otherwise it will fail like the poor workmanship in improperly laying enough concrete in the foundation of the house or skyscraper that topples. Similar to the scalability matrix discussed earlier; with critical Information Technology projects the costs could be much more harmful than a lose of time and capital. Like the lose of a life with the house of skyscraper crumbling, a failed IT project can disrupt the stability of the nation by breaking its infrastructure if redundancies were not in place.

Heeks' shows that 80% of all IT projects fail but the 20% that are successful bring huge returns. These successes, such as the high speed railways or the advanced cellular and broadband networks have expanded markets and allowed for greater flow of trade and knowledge. These successes in East Asia have been brought upon by the human capital which allows the leapfrogging to take place and thus allows for the assimilation of these huge returns.

## **Leapfrogging for Advanced Architecture Building**

As discussed earlier, the engineers graduating from Asian universities benefit from an infrastructure of advanced broadband and cellular technologies built by leapfroggers. For instance South Korea ranks first in the world in Broadband penetration with 22 of every 100 inhabitants being connected to the Internet via a 20 Megabit/second connection that ranks second in the world based on the speed behind only Japan. Japan's Broadband speeds can reach up to 26 Megabit/second. The hegemon of the United States ranks 11<sup>th</sup> in Broadband penetration with 6.9 of every 100 inhabitants being connected, but with only a 1.5 Megabit/second connection.<sup>19</sup> Thus comparing the nations the U.S.'s speed is 7.5% of South Korea and 5.8% of Japan. South Korea and Japan benefit by leapfrogging copper and laying fiber lines and adopting wireless in its densely populated cities.

Other countries in the region have also benefited greatly from leapfrogging practices in developing their own Broadband strategies. Figure 3.1 shows how Korea, Hong Kong, Taiwan, and Japan compare and exceed in certain comparisons with Western nations (Canada and the United States) in their own broadband penetration rates per 100 subscribers in 2002.

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<sup>19</sup> International Telecommunications Union (ITU), The United Nations System, World Telecommunications Indicators Database. 11 June 2006 <<http://www.itu.int>>.

**Figure 3.1: Broadband Penetration 2002  
East Asian Countries vs. Western Countries**

Country	World Ranking	Subscribers per 100 Inhabitants
Korea	1	21.3 / 100
Hong Kong	2	14.9 / 100
Taiwan	4	9.4 / 100
Japan	10	7.1 / 100
United States	11	6.9 / 100
Canada	3	11.2 / 100

Source: ITU<sup>20</sup>

As much of East Asia’s population is located in major urban cities with dense populations, economies of scale allow for greater connectivity at lower costs for laying the infrastructure. As seen in Figure 3.2 the United Nations World Urbanization Prospects, shows that Asia and East Asia have had a sharp population migration from rural to urban areas over the last fifty years which have allowed for the success in Broadband deployment.<sup>21</sup>

**Figure 3.2: Asian & East Asian Urban Population Shift Over 50 Years  
(Rounded in Millions)**

	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
Asia	280	338	408	485	575	693	837	1,011	1,181	1,363	1,553
East Asia	133	160	194	225	256	303	363	445	519	598	678

Source: UN

### Urban/Rural Leapfrogging

Although a large percentage of Broadband subscribers are located in densely populated cities – such as Tokyo, Seoul, and Beijing – it is not just economies of scale

<sup>20</sup> ITU World Telecommunications Indicators Database

that benefit these countries with their Broadband deployment, but a combination of that intermixed with good state driven public policy by knowledgeable government employees. For instance as Figure 3.1 showed, Canada ranks third in the world in the number of Broadband subscribers per 100 inhabitants. Canada's population density is comparable to that of the United States, but the U.S. has roughly half of the broadband penetration of that of its neighbor to the north.

Much of the U.S. penetration is also based on the coastal regions, thus creating a digital divide with the more inland rural areas. This trend can also be seen in China's urban/rural and coastal/interior regions.<sup>22</sup> The Asia Society, an international organization founded in 1956 by John D. Rockefeller III, cites that the "information revolution has come mainly to the eastern part of [China], to places like Beijing, Shanghai, Guangzhou, and the Shenzhen Special Economic Zone." For instance, 12.4% of Chinese Internet users can be accounted from Beijing and 9.0% from Shanghai. Tibet, in Northern China, has statistically 0.0% of Chinese netizens and the Qinghai Province only 0.3%. China as a whole shows that only 0.3% of the nation's Internet users are from the countryside compared to a 740 fold difference in the urban areas.<sup>23</sup>

The diffusion and benefits of certain technologies – such as Broadband – may be more favorable to cities with a higher population density that to the rural countryside with lower population densities, but leapfrogging does not solely benefit urban areas. Rural areas in East Asia have utilized advancements in cellular and transportation technologies to become more connected to the flattened world. Cellular and satellite telephony

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<sup>21</sup> United Nations World Urbanization Prospects: The 2005 Revision Population Database. 28 June 2006 <<http://esa.un.org/unup/p2k0data.asp>>.

<sup>22</sup> Rong, Lin. "Seizing the Opportunity to Cross Digital Divide." *The Asia Society*. 13 March 2001 <<http://www.asiasociety.org/speeches/rong.html>>.



services have connected people from all over the world. These wireless services do not require a physical wired infrastructure because instead the technologies work off of radio waves and low-earth orbiting satellites.

To differ the cost of some of the cellular telephony equipment some mobile communication companies have created specialized leasing programs with women in the developing rural areas. These leasing programs empower the women to run a small business. The business model allows them to rent the use of the cell phone or satellite phone to members of their villages or surrounding areas. Similar programs have also been instituted by Hewlett-Packard with the training of self-help woman's groups in similar developing regions to use digital cameras and printers that come with solar panels in regions where electricity is not available.<sup>24</sup>

HP worked with the rural communities in focusing on their needs and developing these specialized cameras and printers. HP was told by the villagers that individuals had to travel a day to the city to get a picture taken for an identification card and then return later in the week to retrieve the picture before getting the ID card. Since the villages did not have an infrastructure with electricity, the corporation developed solar back-pacs to charge the camera and printers. The women in the village are then able to sell pictures to the villagers and thus repay the leasing fees to HP. Additional social benefits have been gained through these endeavors as more social memories are being recorded for the first time.

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<sup>23</sup> Rong, Lin.

<sup>24</sup> Friedman, Thomas. Pg. 390.

## Asia and Cellular Telephony

Since the 1990s, China's leapfrogging and expansion in the Information and Telecommunications industries is 30% faster than that of their economy.<sup>25</sup> China has diversified its infrastructure and updated from, "manual to automatic, from imitation to digital, small to big volume and single to multiple operations." The diversification included optical fiber, satellite, and mobile technologies. China's knowledge trust of engineers mixed with good public policy of avoiding a one-size fits all model has bolstered the nation's fixed and mobile services dissemination to become the second highest in the world.<sup>26</sup>

Cellular telephony in East Asia has leapfrogged the costly LAN based line networks of yester-year and has become the institutional norm in the region. Taiwan leads the world in cellular telephony penetration with 110.8 cell phones per 100 inhabitants. Through data from 2002, every one person in Taiwan based on population owns an average of 1.1 cellular phones. Hong Kong also boasts a +100% penetration rate. Figure 3.3 shows the penetration of several East Asian countries with the number of cellular telephones per 100 inhabitants compared again to the U.S. hegemon.

**Figure 3.3: Cellular Telephony Penetration 2002: East Asia vs. U.S.**

Country	World Ranking	Subscribers per 100 Inhabitants
Taiwan	1	110.8 / 100
Hong Kong	3	105.8 / 100
South Korea	29	69.4 / 100
Japan	32	68.0 / 100
United States	42	54.3 / 100

Source: ITU<sup>27</sup>

<sup>25</sup> Rong, Lin.

<sup>26</sup> Rong, Lin.

<sup>27</sup> ITU World Telecommunications Indicators Database

In addition to having more phones in circulation many of these are more advanced devices than those in the U.S. Samsung, a Korean company, and NTT DoCoMo, a Japanese company, are considered to be the industry leaders in cellular telephony. DoCoMo telephones lead in the industry in interoperable communication capabilities and double as a personal computer, payment device, and video conferencing tool.<sup>28</sup>

Against previously discussed examples of leapfrogging, these innovative mobile devices were homegrown and not imported. These companies have risen from obscurity to multinational corporation status through heavily investing in innovation through Research and Development. Similarly, the demand for this innovation also came from East Asia; as well as Italy, which holds the second highest penetration rate of cellular devices. Thus far this argument shows that East Asia has become the Innovators and Italy has become the Early Adopters. Contrastingly, the United States is the Laggard in its cellular capabilities.

The market called for innovation and East Asia answered. The market and simple rules of supply and demand work in many ways in underserved rural areas. As discussed earlier much of East Asia is still in its infancy stages of technical innovation. Also discussed were certain leasing programs to make technology affordable and available to the underserved—thus reducing the digital divide. Though the models of cellular/satellite telephony and digital photography/printing were small investments for individuals to enter a market some investments are much larger in scale and scope. For instance the private and public sector fiber optic networks creating advanced broadband networks. The market called for all of these examples and many additional markets came from the creation of them.

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<sup>28</sup> Friedman, Thomas. Pg. 169.

The broadband infrastructure of South Korea allowed for the blossoming of the multi-billion dollar online gaming industry. This gaming industry still required the hardware of having a desktop or a laptop computer and the broadband connection to the Internet. To fulfill the demand of the underserved a network of Internet Cyber Cafes created a means for inexpensive access to the Internet and the social gaming networks throughout cyberspace.

Cyber Cafes are stores or businesses that offer low cost Internet access to their customers. The cost of owning a personal computer and the cost of the Internet in many developing regions can be prohibitively expensive...similar to individual cell phones in the rural village. These Cyber Cafes share the costs of connectivity and hardware through all of their customers. By renting the usage each customer subsidized the great expense of the group.

According to a 2000 survey by the Asia Society, the U.S. ranks first in the world with 164 million computers available for use with the average availability of a computer to any citizen below two. China on the other hand had 15.9 million computers in circulation with an average 0.88% availability rate per citizen.

Although the majority of Cyber Cafes are in urban areas—thus exasperating the urban/rural digital divide—they still give access to the middle and lower classes that could not afford their own personal computers and Internet connections on their own. Since the majority of the developing world's population are priced out of the Internet on an individual basis, the cafes act as the leaser while the customer acts as the lessee. Since the lessees most travel to the leaser, the cost for building the infrastructure is reduced.

And as 44.8% of the world's population is clustered in cities this allows for great access to the underserved.<sup>29</sup>

### **Internet Access/Broadband Technologies**

The U.S. and most of the developed world had a pre-existent infrastructure in place to bring the Internet to the home. AT&T laid the concrete for the foundation with its wired network for telephony and with the advent of the modem to convert digital packets over the AT&T analog line the home computer became an adapted tool for Internet access. The dial-up Internet era included minimal costs as the infrastructure was already pre-built. Dial-up though was slow and limiting. Moore's Law once again took action.

ISDN, DSL, Cable, Electric, Satellite, and T1 connections were the next iterations but again these brought limits due to the technical capabilities of the copper lines that were in place as the infrastructure's back-bone. The short-falls from updating this back-bone would be much more costly. The house would have to be knocked down and built on top of a new foundation. The communication company Verizon is looking at starting this venture and creating a 100% fiber optic network to the home.<sup>30</sup> Due to the physics of fiber optic technology compared to copper, the maximum speed of delivering the bits of information over the Internet become exponentially higher. The U.S.'s costs for broadband access in the home are already among the highest in the world but with that high cost is minimal return. On average Americans pay between \$35 to \$40 a month on

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<sup>29</sup> Scott. Allen J. "Regions of the World Economy: the Coming Shape of Global Production, Competition and Political Order." Oxford, UK: Oxford University Press, 1998.

<sup>30</sup> Caulet, Leslie. "Bells dig in to dominate high-speed Internet realm." USA Today. 3 January 2005 <[http://www.usatoday.com/tech/news/2005-01-03-fiber-cover\\_x.htm](http://www.usatoday.com/tech/news/2005-01-03-fiber-cover_x.htm)>.

Broadband access in the home for speeds between 1 – 2 Megabits/second; compared to in Japan where consumers pay \$15 a month for speeds nearing or in excess of 30 Megabits/second.<sup>31</sup>

#### **IV. Foreign Investment & Development / Conclusion**

This study shows that the formal and informal institutions of East Asia allow for the rapid development and growth for the region through leapfrogging legacy infrastructures and systems. The human capital and the culture that rewards education in the STEM disciplines of these nations allows for the successful deployment and management of these IT projects. This people factor intermixed with strong public policy has allowed for the rampant development of the region and is the qualifying ingredient that is lacking elsewhere in the developing world.

The nations of East Asia, who formerly were isolated by their geographical location, have become global superpowers due mainly because of successful leapfrogging projects. They are not just a piece of the supply chain as a source for inexpensive labor but a credible competitor to the hegemony of the West. The rise of homegrown multinational corporations originating from Asia – such as DoCoMo, Honda, Lenovo, Samsung, Sony, and Toyota – that have become the International leaders in innovation proves this point.

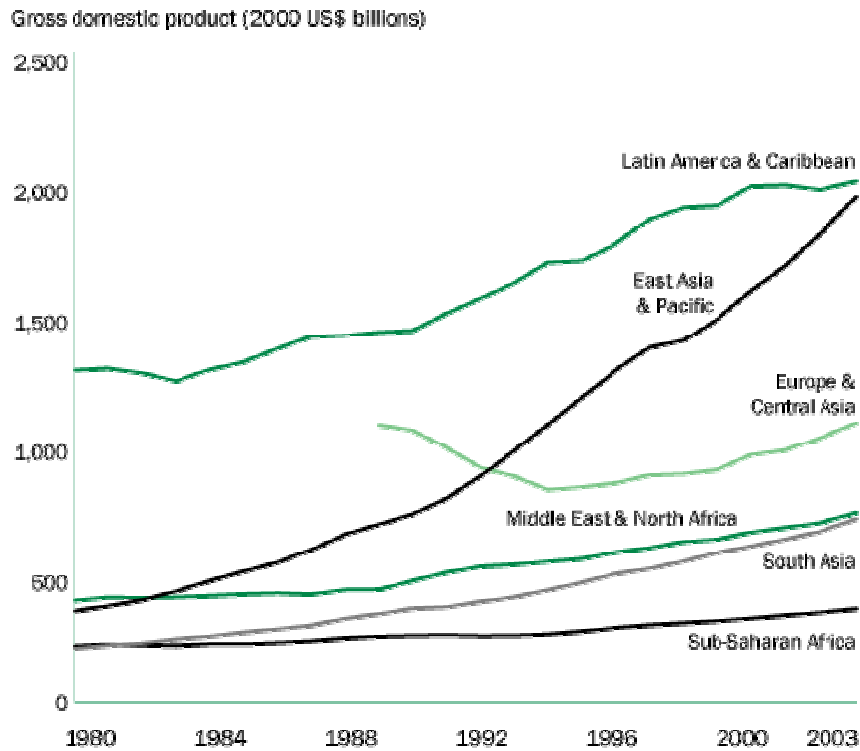
They are credible economic world leaders as shown by their exponential growth in their Gross Domestic Product (GDP) over the last twenty years.<sup>32</sup> As shown in Figure 4.1, East Asia and the nations of the Pacific have increased their economic growth per

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<sup>31</sup> Caulet, Leslie.

GDP by four-fold since 1980. Furthermore, the credibility of China can be shown and best epitomized by the fact that the nation today receives the most foreign direct investment than any other country in the world.<sup>33</sup>

**Figure 4.1: World Bank Gross Domestic Products**



Source: World Bank

Similar to the high-speed railways born in Asia, the region continues to grow at a rate far exceeding that of the West. But like the infant who can't stand on his or her own two feet, the growth of Asia is limited by its "people factor" and their human capital.

Asia and East Asia is now an adolescent, able to stand on its own two feet (in many

<sup>32</sup> World Development Indicators 2005. *The World Bank Group*. 26 June 2006  
[http://devdata.worldbank.org/wdi2005/Section4\\_1.htm#4b](http://devdata.worldbank.org/wdi2005/Section4_1.htm#4b)

<sup>33</sup> Kearny, A.T. "China and India Jockey for the Top Most Attractive Foreign Direct Investment Destination Globally While the U.S. is Challenged by These Rapidly Evolving Economies," News Release. October 12, 2004.

cases) but it is still dependent on the adults of the West. Not until Asia is self-sustaining and not dependent on the capital of the West can it fully be an adult. East Asia will continue to mature partly through leapfrogging practices and partly through internal innovation. Once the region is economically self-sustainable than it will offer further competition to the West and Europe. This competition will bring about a further balance of economic power.



## Works Cited

The ACM-ICPC International Collegiate Programming Contest Web Site. 11 June 2006  
<<http://icpc.baylor.edu/icpc/finals/default.htm>>.

American Electronics Association. Losing the Competitive Advantage: The Challenge for Science and Technology in the United States Washington, DC: 2005.

“A Red Flag in the Brain Game. America’s dismal showing in a contest of college programmers highlights how China, India, and Eastern Europe are closing the tech talent gap.” Newsweek Online 1 May 2006:  
<[http://www.businessweek.com/magazine/content/06\\_18/b3982053.htm](http://www.businessweek.com/magazine/content/06_18/b3982053.htm)>.

Caulet, Leslie. “Bells dig in to dominate high-speed Internet realm.” USA Today. 3 January 2005 <[http://www.usatoday.com/tech/news/2005-01-03-fiber-cover\\_x.htm](http://www.usatoday.com/tech/news/2005-01-03-fiber-cover_x.htm)>.

Friedman, Thomas L. Lexus and the Olive Tree. New York: Anchor Books, 2000.

Friedman, Thomas L. The World is Flat: A Brief History of the Twenty-First Century. New York: Farrar, Straus and Giroux, 2005.

Heeks, Richard. Reinventing Government in the Information Age. New York: Routledge, 1999.

Kearny, A.T. “China and India Jockey for the Top Most Attractive Foreign Direct Investment Destination Globally While the U.S. is Challenged by These Rapidly Evolving Economies,” News Release. October 12, 2004.

International Telecommunications Union (ITU), The United Nations System, World Telecommunications Indicators Database. 11 June 2006 <<http://www.itu.int>>.

Moore’s Law, the Future - Technology & Research at Intel. 11 June 2006  
<<http://www.intel.com/technology/silicon/mooreslaw/>>.

Narayan, Deepa, *Bonds and Bridges: Social Capital and Poverty* (Policy Research Working Paper, 2167, The World Bank, August 1999).

National Science Foundation. Science and Engineering Indicators. Washington, DC: 2002 and 2006.

Putnam, Roberts, Robert Leonardi, and Raffaella Y. Nanetti. Making Democracy Work. New Jersey: Princeton University Press, 1994.

Railway Technology – Shinkansen High Speed ‘Bullet Train’ Operated by JR Central, Japan. 27 June 2006 < <http://www.railway-technology.com/projects/shinkansen/>>.

Rogers, Evertt M. Diffusion of Innovations: Fifth Edition. New York: Free Press, 2003.

Rong, Lin. “Seizing the Opportunity to Cross Digital Divide.” The Asia Society. 13 March 2001 < <http://www.asiasociety.org/speeches/rong.html>>.

Scott, Allen J. “Regions of the World Economy: the Coming Shape of Global Production, Competition and Political Order.” Oxford, UK: Oxford University Press, 1998.

Stiglitz, Joseph E. Globalization and Its Discontents. New York: W.W. Norton & Company, 2003.

United Nations World Urbanization Prospects: The 2005 Revision Population Database. 28 June 2006 < <http://esa.un.org/unup/p2k0data.asp>>.

U.S. National Science Foundation, Science & Engineering Indicators (2004), Appendix 2-36.