

Three Potential Role Models for the Korean Innovation System: USA, Japan and Germany

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This article analyzes the Korean innovation system and presents suggestions for its further improvement on the basis of three other country models, that of the US, Japan and Germany. We suggest that innovation systems are embedded in their respective managerial, economic, socio-political, and ultimately cultural context and that those contextual factors exert a significant influence on a national innovation system. Furthermore, we propose that the influence of those contextual factors result in innovation systems that are either more transformational or incremental in nature. We conclude that Korea has (like Japan) due to its societal context a particular strength in incremental innovations but will increasingly need to build up its ability to generate also transformational innovations (a particular strength of the US model). Due to distinct differences in the societal context, it might be difficult, however, for Korea to follow the US model. We suggest, therefore, that Korea might find some valuable lessons in the German innovation system, particularly regarding small and medium enterprises.

I. Current state of the Korean economy

The growth rates of the South Korean economy over the last decades represent one of the most impressive economic success stories of the 20th century. As late as 1970, living standards in Korea¹ were roughly comparable to those in Ghana (\$260 GNP per capita compared to \$250). By 1995 the situation has changed dramatically. Korea had a GNP per head of \$ 9,700, while Ghana's was still at only \$ 390, reflecting vastly different degrees of innovativeness of both economies and resulting differences in growth rates. While Ghana had between 1968 and 1995 annual growth rates of under 1.4 percent, Korea achieved in the same time span an average annual growth of about 9 percent (Hill, 1999) in a process commonly known as the *Miracle on the Han River*. Over the last 40 years Korea experienced only three years of negative growth: 1980, 1998 and 2009. Today, Korea is a developed country, the fourth largest economy in Asia and the 13th largest in the world. Its GDP of \$1.3 trillion (2008) is comparable to that of an average EU country² and its per capita GNP of \$27,700 (2008) is similar to Italy's and higher than Poland's or Turkey's. Furthermore, Korea's growth rates are still significantly higher than those of Europe³ or the US.⁴ The growth rate for 2010 is predicted to be between 2.5 and 4 percent.⁵ Nevertheless, the current economic crisis has impacted Korea as well. The Korea Development Bank recently published, for example, a survey which indicated that small and medium enterprises (SMEs) in the manufacturing industry will decrease their investments for assets and equipment by 40 percent, large enterprises by 12 percent and the automotive sector by 25 percent.⁶

¹ When we mention here and in the following Korea, we refer only to the Republic of Korea, better known as South Korea.

² International Monetary Fund (IMF)

³ "Wachstumsrate des realen BIP pro Kopf – [tsdec 100]" (Luxemburg: Statistische Amt der Europäischen Gemeinschaft (eurostat), 2010), <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=0&language=de&pcode=tsdec100> (file accessed March 16, 2010)

⁴ "Gross Domestic Product: Fourth Quarter 2009 (Second Estimate)" (Washington, D.C.: Bureau of Economic Analysis: National Economic Accounts, 2010), <http://www.bea.gov/newsreleases/national/gdp/gdpnewsrelease.htm> (file accessed March 16, 2010)

⁵ "Korea (Republik Korea, Südkorea): Wirtschaft" (Berlin: Auswärtiges Amt, 2009), <http://www.auswaertiges-amt.de/diplo/de/Laenderinformationen/KoreaRepublik/Wirtschaft.html> (file accessed November 17, 2009)

⁶ "Wirtschaftstrends kompakt Korea (Rep.) Jahresmitte 2009" (Berlin: Germany Trade and Invest, 2009), <http://www.gtai.de/DE/Content/SharedDocs/Links-Einzeldokumente-Datenbanken/fachdokument.html?fid=MKT200906178016> (file accessed November 3, 2009)

II. The input-based economy of Korea and its consequences for innovativeness

Korea's impressive economic surge over the last decades depended to a large extent on two factors: the input of capital and the input of labor. The strong focus on capital input is demonstrated by Korea's rate of business investments which is the highest of the entire OECD area (Jones, 2007). As for labor input, Korea is the country with the longest working hours per year in the entire OECD (over 2300 hrs), significantly ahead of the US and Japan (less than 1800 hrs) and Germany (approximately 1400 hrs).⁷

We would argue that while this input-based strategy served Korea very well during the decades of catching-up with more advanced economies, it has lost much of its merits since Korea has reached the status of a developed country. With Korea now already possessing an advanced and modern stock of capital goods, the growth potential stemming from further capital investment is limited. This is in particular so as Korea will soon hit the international technological frontier, leaving little room for further growth simply by bringing its technology up to already elsewhere existing standards. A survey, conducted in cooperation with 6000 Korean companies, has shown that the majority of the sample has reached the international technological frontier to at least 80 percent (ibid). Consequently, the opportunities for easy technological "catching-up" by imitation or reverse engineering are continuously diminishing. As a result, the share of capital input has already declined from 37 percent of GDP during the 1990s to less than 30 percent in the past few years.

As for Korea's second source of economic development, the input of labor, demographics are restraining its further growth potential as Korea is becoming an increasingly aging society, resulting in a decreasing share of its working population. In fact, Korea has the lowest birth rate of the OECD area with 1.1 children per woman (1.4 in Europe and 2 in the US). As a

⁷ "Workforce: The World's Hardest Working Countries" (New York City: Forbes, 2008), http://www.forbes.com/2008/05/21/labor-market-workforce-lead-citizen-cx_po_0521countries.html (file accessed November 25, 2009)

consequence, its labor force will reach its peak in 2015. The percentage of the population over the age of 65 will double from seven percent to 14 percent in 2018 and increase further to 20 percent in 2026 (ibid).

Physical capital and hard work can lead a country only to a certain point. As an economy approaches the technological frontier and labor, in particular cheap labor, is reaching its limit as a source for continued economic growth as well, an economy has to redirect its strategy and focus more on innovation, effectiveness and efficiency. Korea is a case in point as it needs to move beyond the sheer accumulation of capital and work. It needs to leave this input driven economic growth strategy and its still prevailing developing country mentality and reflexes behind and redirect its energies towards increased productivity and efficiency. A survey conducted by the OECD indicated that the output per hour worked in Korea was only 46 percent of that in the United States, 50 percent of that in Germany and 65 percent of that in Japan, making Korea (only) as efficient as Hungary, Portugal or Poland.⁸ From this we conclude that for Korea, with its traditional focus on (quantitative) capital and labor *input*, a transition towards a (qualitative) *output*-based economy will pose a decisive challenge on which much of Korea's economic future will depend. This implies significant changes in the country's industrial policy and innovation system.

Over the decades, Korea entrusted the role of its economic growth engine to its mighty conglomerates, the *chaebols*, such as Samsung and LG, following to a significant degree the model of the Japanese *keiretsu* system with company networks such as Mitsubishi and Mitsui. Much of the initially scarce financial resources were channelled by the government to the *chaebols* and the government continued to put their interests before those of any other stakeholder. The *chaebols* have stood at the forefront of the *Miracle on the Han River*, representing the pride of Korean nation and they continue to be the most preferred place to work for. Only with the Asian crisis (1997-98) the all-mighty position of the *chaebols* started to slowly wane, and, Hanbo and Kia, were even allowed to go bankrupt in 1997.

While the *chaebols* were forced to restructure themselves in the aftermath of the Asian crisis, they continued to preserve, even though to a somewhat lesser extent, their leading role in the Korean economy. With the *chaebols* having adapted to a large extent to a more open and less

⁸ "OECD estimates of labour productivity levels" (Paris: OECD.StatExtracts, 2008), <http://stats.oecd.org/Index.aspx?DatasetCode=LEVEL> (file accessed on March 17, 2010)

protected economic environment, it becomes now increasingly important that also the rest of the Korean economy undergoes a process of restructuring and reform. This is particularly the case with the relatively unproductive service sector (e.g., financial services, retail and real estate).

In fact, the extent to which the productivity of Korea's heavily regulated service sector is lagging the productivity of the industrial sector is, in comparison to other OECD countries, striking. Even though the service sector employs by now three fourths of Korea's workforce (1990 it was only 50 percent), it is responsible for only 50 percent of the economic output (Melser, 2007). Restrictions on competition in several sectors, rigid labor laws and tight retail zoning rules are some of the underlying reasons for the weaknesses of Korea's service sector. As a consequence, Korea needs to focus on productivity gains in particular of its retail, banking, insurance, transportation and educational institutions (ibid). With the gradually decreasing importance of the manufacturing sector, a process every developed country is experiencing, this problem becomes even more acute (Kang, 2007).

III. The Korean innovation system

Studies of Korea's technological development have shown that the country's catching-up during the past 60 years can be divided into three phases: The first phase, which lasted from the 1950s to the 1970s, was characterized by the introduction and imitation of foreign technology, a period during which the country shifted from a mainly agricultural to a mainly industrial economy. As innovativeness meant in Korea at that time mainly imitation and adaptation of foreign technology, the R&D intensity was as low as one percent of GDP (Hemmert, 2007).

During the second phase of Korea's technological development, in the 1980s, Korean firms began to pursue a rigorous R&D strategy, based on the improvement of existing products and the development of new products, mostly in middle tech technologies, through incremental innovation. R&D expenditure doubled during this period to almost two percent of GDP. As with the previous imitation and adaptation phase, also this phase was strongly shaped by the country's major industrial groups, the *chaebols*. During this period Korea continued to rely

heavily on foreign technological know-how, which it sought to gradually improve, still reflecting the country's "catching-up" strategy of innovation.

In the third and current phase of technological development, which began in the 1990s, some Korean companies have achieved global technological leadership in a few R&D intensive industries, such as microelectronics and telecommunications, creating a considerable knowledge base in engineering (ibid). During this phase, R&D expenditures have reached almost three percent of GDP which is one of the highest percentages in the world. In the upcoming years, this percentage is expected to increase to even five percent. The nation's impressive R&D efforts are further supported by the country's strong and culturally deeply embedded focus on education and learning. However, despite pockets of impressive technology leadership, Korea still struggles in many sectors and industries to generate innovations that lead to high value added competitive advantages.

This problem becomes even more acute with Korea's rising wages due to increasing wealth. With resulting rising labor costs, low to middle tech industries, characterized by incremental technological innovations, will be more and more transferred to low cost economies that are equally gaining technological know-how, such as China. With China being able to out-compete Korea in terms of labor costs and Japan still possessing more advanced technological know-how than Korea, the latter finds itself in a very uncomfortable position, risking to be sandwiched between both its larger neighbors. As returning to lower labor costs can't be the solution to this problem, the only way forward for Korea is to improve its innovativeness.

Consequently, despite the admirable progress Korean multinationals were able to achieve, Korea's innovation strategy has not been without pitfalls and continues to need upgrading. Even though it enabled Korea's relatively small number of *chaebols* to gain international competitiveness in several sectors and industries, it also led to a highly imbalanced capital allocation for R&D, given the concentration of spending on few industries by few large conglomerates. A full 60 percent of the corporate R&D spending is done by large companies in information and communication technology and the automotive sector (Jones, 2007). This concentration led to a distinctive and arguably detrimental dualism that is characterizing the Korean economy with few, highly innovative and competitive conglomerates on one side and a large amount of small and medium sized enterprises which are frequently mere suppliers to the bigger companies. The latter are often left with such meagre profit margins that they have

no sufficient resources to invest themselves in R&D in any significant way, thus lacking innovation potential and international competitiveness.

A second imbalance of corporate R&D spending lies in the fact that a full 75 percent takes place in the manufacturing sector, with only 10 percent going to the service sector, a number which is significantly below the OECD average of 25 percent. A third imbalance lies in the distribution of corporate versus university R&D spending. Although 75 percent of the researchers with a Ph.D. degree work for universities, they are responsible for only 10 percent of the total national R&D spending which is only half of the OECD average. This indicates a strong focus in Korea on applied R&D – done by few large companies in few sectors – while basic research – mostly executed by public institutions – is comparatively neglected. In addition, the link between basic and applied R&D is only relatively poorly established, given the underdeveloped cooperation between corporate, government and university R&D activities (ibid).

The narrow and selective focus of R&D spending and the resulting strengths in only a few sectors have their origin in the nation's traditional strategy to promote the development of few industries the government considered of strategic importance. Similar to government support of the chemical and heavy industry in the 1970s, in 2003 the government passed the Growth Engine Plan, supporting ten key industries for the next five to ten years: bio-medical products, next-generation semiconductors, next-generation computer displays, next-generation batteries, future automobiles, digital TV and broadcasting, intelligent robots, next-generation mobile communications, intelligent home networks and finally digital content and software solutions. Only recently, the government decided to invest heavily in green technologies.

While this industrial policy in which government is essentially attempting to pre-empt market outcomes might have worked in past decades, under the complexities of a globalized market it has proven increasingly difficult to outsmart market forces, leading to distortions and sub-optimal capital allocation. As also the more studied case of the Japanese METI has indicated, in the time of rapid global change, the risk of picking the wrong industries to invest in becomes ever stronger. Consequently and similar to the situation in Japan, a frequent criticism of the Korean industrial policy is that government should refrain from choosing industries it thinks should become the nation's growth engines, but invest instead in the development of

human capital and generic technologies, leaving investment and innovation decisions to the corporate sector, thus also avoiding the crowding out of private investment.

Furthermore, government should promote more the integration of innovation activities of applied and fundamental research; of corporations, universities and other public sector institutions; of institutions and individual researchers; and of innovators inside and outside Korea. In particular cross-border cooperation and manpower exchanges in the area of research and innovation among universities, public research institutes and the corporate world are possible ways to promote an exchange of ideas and initiatives with foreign parties. Another approach is the liberalization of foreign direct investment (FDI) policies as FDI in Korea still is relatively small in comparison to other OECD countries (ibid). This would allow for more foreign investments (not only in form of capital but also know-how), providing additional stimuli to improve innovations.

So far this government guided approach has helped certain sectors to grow at the expense of others, thereby limiting entrepreneurship and innovativeness in non-funded sectors and businesses. In particular Korean SMEs, which are due to their lack of global competitiveness hardly present on the world markets, have been the of ones who suffered most from this approach. As SMEs account for 85 percent of employment and 50 percent of manufacturing output (Kang, 2007), increasing the innovativeness and profitability of SMEs should be a key priority. An important step in this direction would be to facilitate access to capital SMEs need to finance necessary investments in R&D. The prospect of additional cash flow based on securities markets, venture capital and equity based capital could help start-ups and already established SMEs to invest in new business ideas and technologies, thus improving their innovativeness. However, so far the Korean financial system is still heavily based on bank lending. In this system entrepreneurs often have to provide collateral, usually in form of real estate. Leaving them with the burden of having to shoulder a great amount of personal risk is counter-productive when it comes to promoting innovativeness. Currently and fortunately, the Korean financial system is addressing this bottleneck factor and is in the process of facilitating the provision of capital to SMEs. In addition, the government could also offer direct subsidies to SMEs in order to encourage them to spend more on R&D. Ultimately, not only market entry barriers (insufficient access to capital) impede SMEs' business, but also market exit barriers play a significant role. Due to strict bankruptcy laws and the incentive for banks to roll over debts lead to high exit costs (Melser, 2007).

Having briefly reviewed the Korean innovation system, important strengths have been identified, in particular concerning incremental innovations by the major *chaebols* in selected industries and technologies. However, as indicated, important sectors and businesses, primarily the service sector and SMEs, still lack sufficient innovativeness and, thus, global competitiveness. Given these shortcomings, the question of potential sources of inspiration for the Korean innovation system becomes of increasing relevance.

IV. Potential role models: the US, Japan and Germany

We have identified three potential role models for the Korean innovation system: the US, Japan and Germany. These countries are the three largest developed economies in the world; the three main representatives of the triad regions which dominates the global economy: North America, East Asia and Europe; and the main representatives of the three leading variants of market economies: the free-market economy of mainly Anglo-Saxon countries (US), the government guided market economy of mainly Asian countries (Japan) and the social market economy of mainly European countries (Germany).

Starting point of our analysis is the assumption that innovativeness does not flourish in a socio-cultural void, but, to the contrary, is in large parts determined by socio-cultural influences. Consequently, potential lessons to be learned from other country models can only be developed under close consideration of such contextual factors. In the following we will demonstrate the extent to which the innovation models of Korea, the US, Japan and Germany are embedded in their respective socio-cultural context. More specifically, we will show how the particular socio-cultural context in Korea and Japan drive the Korean and Japanese innovation systems towards being largely based on *incremental innovations*. These are innovations that are taking place in small, gradual steps, leading only in their sum to larger effects. They are occurring in large parts within the existing paradigm of technology and ways of doing business. By contrast, the entire socio-cultural context in the US is more geared towards an innovation system characterized by break-through or *transformational innovations*. These are innovations that are transforming the previously existing paradigm, leading to radically new technological solutions and business approaches. We will also indicate that the German innovation model stands in many ways between the Korean and Japanese system on one side and the US system on the other side.

V. Innovativeness of Korean, American, Japanese and German companies in their respective socio-cultural context

While national innovation systems are the ultimate focal points of this analysis, we consider them to be subsystems of their respective management system. The management system is, in turn, embedded in the respective economic system which is again a subsystem of the socio-political system which is ultimately a subsystem of the most comprehensive system, the cultural system. In order to describe these four layers of contextual sub- and super-systems and their impact on innovativeness, we will look for each of them at three different criteria. Consequently, in the following twelve contextual criteria and their impact on the innovation systems of Korea, the US, Japan and Germany will be briefly outlined. This will assist us in drawing lessons for the Korean innovation system under specific consideration of the socio-cultural context. The model that underlines our argumentation is depicted by Figure 1 (adapted from Pudielko, 2006a).

Figure 1 about here

It goes without saying that due to space constraints an illustration of such a wide array of topics for four very different countries can only be delivered in a highly stylized and simplified way, largely neglecting nuances and gradations. Nevertheless, we hold that the central thrust of our argumentation, different socio-cultural contexts leading to either more incremental or transformational innovations, will help us to better understand the strengths and weaknesses of innovation systems and how they originate. Only with this deeper contextualized understanding applicable inspirations can be developed.

1. Cultural context

The most comprehensive contextual system determining the innovation system of a country is its *culture*. Culture and its influence of innovativeness will be briefly explained by those three of Hofstede's (2001) dimensions we consider to be the most significant ones in influencing innovation: *power distance*, *uncertainty avoidance* and *individualism*.

Power distance can be defined as the “extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally” (Hofstede, 2005). Countries with a low level of power distance are prepared to question authority systems such as traditionally held beliefs, institutions or individual power figures, something high level power distance cultures prefer to avoid. This indicates that innovations in low level power distance countries, such as the Germany and US, tend to be more transformational, as there is much less reluctance to challenge existing paradigms. By contrast, high power distance countries, such as Korea and Japan, are more hesitant to go against authority systems and prefer, therefore, more incremental innovations which add to existing knowledge and improve existing approaches more than they challenge them.

Uncertainty avoidance is “the extent to which the members of a culture feel threatened by ambiguous or unknown situations” (ibid). People from low uncertainty avoidance cultures, such as the US, are consequently much more willing to take risks and envisage uncertain outcomes, a requirement to engage in transformational innovations (see, for example, Galbraith, 1982). On the other hand, high uncertainty countries, such as Japan, Korea and to a lesser degree Germany, prefer to avoid risk and ambiguity and favor more secure, foreseeable and controllable approaches, something incremental innovations are much more able to guarantee.

Individualism pertains to “societies in which the ties between individuals are loose: everyone is expected to look after himself and his immediate family. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people’s lifetime continue to protect them in exchange for unquestioning loyalty” (Hofstede, 2005). Cultures with high degrees of individualism, such as the US and to a lesser degree Germany, stress the potential and value of ideas emanating from the single individual. This favors transformational innovations which are often realized by few creative individuals and often by outsiders who exhibit strong beliefs in themselves and their abilities. By contrast, collectivistic cultures, such as Korea and Japan, exhibit more trust in group efforts and outcomes. As a result, they show strengths in incremental innovations which are often the results of collective efforts and tend to be more focused on optimizing existing processes than on inventing new ones and, hence, are more status quo oriented (Galbraith, 1982).

2. Socio-political context

The *socio-political context*, as the second sub-system, will be divided into the *overall economic system*, the *legal system* and the *educational system* all of which play a significant role regarding the form of innovation a country promotes.

The **economic system**, as it pertains to free market economies such as the US, is based on individual freedom by which each economic actor decides what is best for him- or herself and a *laissez-faire*-ideology, according to which there should be only little government interference in the market (Dore, 2000; Pieterse, 2003). The social market economy model, for which Germany stands exemplary, also promotes market forces and largely rejects government interference in industrial investment decisions, however, sees a role for government in restraining market forces and the degree of freedom of companies in order to protect weaker market participants. Japan as well as Korea have largely been characterized by a government-induced market economy. The government decided which sector they wanted to support and concentrate financial and intellectual resources in, favoring heavily big companies networks, i.e. the *keiretsu* and *chaebols*, respectively. With this system more and more declining, Korea will need to find a new balance between market forces and government interference (Kang, 2007). Given the different degrees of government involvement in corporate and entrepreneurial decision making, bold investments and transformational innovations are least constrained in the US, followed by Germany but are substantially more constrained in Japan and Korea.

The **legal system** in the US is geared towards promoting entrepreneurialism and risk taking. This becomes particularly evident with the bankruptcy laws which protect mainly the individual entrepreneur from the fall-outs of bankruptcy.⁹ By contrast, in Germany and even more so in Japan and Korea bankruptcy laws are traditionally much more designed to defend the interests of capital lenders. While these countries have recently somewhat adapted their laws in order to stimulate more entrepreneurialism, this difference still remains, in principle,

⁹ "U.S. Bankruptcy Laws Encouraging Risk-Taking and Entrepreneurship" (Washington, D.C.: America.gov, 2006), <http://www.america.gov/st/econ-english/2008/July/20080814223511XJyrreP0.102215.html>, (file accessed November 25, 2009)

intact. This is also reflected in the societal attitude towards bankruptcy. While Americans who went bankrupt easily get a “second chance”, Japanese and Korean entrepreneurs who failed are socially stigmatized. Consequently, high risk transformational innovations are comparatively easy to be implemented in the US legal context. By contrast, in Germany, and in particular in Japan and Korea, the legal system is more geared towards incremental innovations, as they are less uncertain and more controllable.

The **educational system** in the US is characterized by considerable differences in quality among secondary schools and universities. On one hand, it offers at the very top of the pyramid a world-class education to the brightest students from all over the world and produces world-class research at elite universities. The Economist (2005) praises the US educational system for its independence from the state, its competitive spirit and its ability to make academic scholarship relevant to society. According to Salmi (2009) it supports competitiveness, unrestrained scientific inquiry, critical thinking, innovation and creativity, and can respond instantly to the demands of a quickly changing global market. On the other hand, there is a relative neglect of mass-education (Thurow, 1996).

This contrasts to the German, but in particular to the Japanese and Korean educational systems which are much more homogeneous in their quality (while in Japan and Korea major differences exist in the prestige of educational institutions, based very much on the difficulty with which to enter them, we argue that comparatively less differences exist in their de facto quality). Broadly speaking, these educational systems are not providing world-class elite education and only in pockets world-class research; however, they are successful in delivering a solid education to most of their respective populations, whereas the average educational level of US students might not be considered as very high. Furthermore, according to cultural values, the German and in particular US educational system focuses on creativity and the development of independent thinking, whereas the Japanese and Korean educational systems stress more conformity with authorities, memorization and repetition of established truths and imitation of good practices (Whitehill, 1991; Emmott, 1992). In conclusion, the US system is geared towards producing an elite of highly educated, independent-minded and creative individuals who are capable of transformational innovations; the Japanese and Korean systems, by contrast, have their strength in generating a large amount of well trained people who together as engineers or workers are able to achieve collectively incremental innovations; and Germany stands, again, somewhat in between these two poles.

3. Economic context

The next level of our analysis is the *economic context*, which can be divided in the *corporate environment*, *the importance of industrial sectors* and the *drivers of innovation*.

The **corporate environment** in both the US and in Germany is largely characterized by stand-alone, independent companies which have highly flexible relations with suppliers, customers and business partners (Case, 1992). SMEs are, next to large MNCs, in both countries sources of major innovation. For the US this is exemplified by the start-up companies in the highly dynamic IT sector in the Silicon Valley or the Boston area. These companies are generally very much research driven, as also the close connections of these regions with Stanford University or MIT and Harvard University indicate. As a result, they generate highly transformational innovations. The mobility in this sector is so strong that companies are constantly launched, merge, get acquired or are going bankrupt again, depending on the short term success of those transformational innovations. In Germany, SMEs, the *Mittelstand*, are certainly less astounding than the Silicon Valley IT start-ups but are nevertheless considered to be the backbone of the German economy. Many of those companies have been labelled “hidden champions” (Simon, 2009) as they are, despite their small size, often world market leaders (i.e. “champions”) but operate in niches of the investment goods sector, such as machinery, where companies and products are often little known to the public (i.e., “hidden”). These companies are frequently family owned and passed on through the generations. They invest highly in R&D and are, as a result, very innovative. However, given the mature industries in which they often operate, their long-term, even generation spanning time perspective, the little influence of short-term oriented venture capital and their overall conservative business strategies, they focus much more on prudent incremental innovations than on transformational innovations.

The corporate environment in Japan and Korea is, by contrast, very much characterized by a dual structure with, on one side, influential, prestigious, innovative and comparatively profitable large corporate networks (the *keiretsu* or *chaebol*); on the other side are SMEs which are mostly mere suppliers in a rigid supply chain of major companies and which lack sufficient profit margins to invest in innovation generating R&D. The *keiretsu* or *chaebol* companies relied, until recently, almost exclusively on organic growth, based on incremental

innovations, whereas transformational changes such as mergers and acquisitions or even the recruitment of specialists from outside the company network were more the exception than the rule. The constant refinement of products, the optimization of production processes and stable relationships with suppliers largely continue to be the basis of this model and reinforce the incremental innovation approach (Inohara, 1990).

Also with regards to the relative **importance of industrial sectors** the by now familiar pattern re-emerges, with the US on one side and Japan and Korea on the other side, with Germany somewhat in the middle. One might argue that to some extent the strengths of the US are the weaknesses of Japan and Korea and vice versa. The US economy has its comparative strength in high tech and high-value added manufacturing industries, such as IT and biotechnology, and in service industries, such as financial services, legal services, consulting, communication and advertising, all of which involve a high degree of transformational originality in technology, organizational structuring and corporate strategy. This originality is provided by few outstanding and creative high-performers, reflecting the strengths of the aforementioned US educational system (Emmott, 1992).

By contrast, the German, Japanese and Korean economies have their competitive strengths in middle tech manufacturing industries (e.g., mechanical engineering, chemicals and automotives for Germany and consumer electronics and automotives for Japan and Korea), displaying a high average standard of product quality and production technologies that are largely based on incremental innovations (ibid). These strengths mirror the already described high educational standard of the German, Japanese and Korean workforce. German products, even though often ‘only’ from middle tech industries, are frequently positioned in high-end niches (either produced by large MNCs such as car manufactures or the “hidden champions” of SMEs) and can therefore generate high profit margins. By contrast, Japanese and Korean companies often follow a competitive strategy that is based on competing head on with their rival *keiretsu* or *chaebols*, often all operating in the same industries, with very similar products.

The **drivers of innovation** are in the US, since the rise of the IT sector, not only big MNCs anymore, but increasingly also small start-up companies. Since they tend to be more risk oriented, basing their business model on transformational innovations, many of them fail; but some succeed and become highly profitable, due to their transformational innovations. Some

of them are so successful that they become in a relatively short period of time giant MNCs themselves (Google, for example). Consequently, start-ups are increasingly responsible for the creation of new wealth, jobs, and technological but also management innovations. In Germany, large companies as well as SMEs are known for high quality, innovative but also relatively expensive products, mostly in mature, middle tech industries that are less characterized by transformational and more by incremental innovations. SMEs in Germany, in particular the “hidden champions”, frequently employ a strategy that combines product specialization, focusing on a particular market niche, and geographic diversification, being strongly committed to global expansion (OECD, 2001). Despite their small size they often achieve global market leadership in their respective segments. Traditionally, they invest significant portions of their earnings in R&D, assuring their innovativeness and market leadership status. Despite operating in middle tech industries and focusing more on conservative, incremental innovations, they are, given their global market leadership, able to generate high profit margins.

In Japan and Korea, mostly the *keiretsu* or *chaebols* with their well-educated work force drive innovations (Herbig and Jacobs, 1998; Melser, 2007). These large MNCs invest heavily in R&D and are able to dominate through an innovative combination of excellent product quality, efficient production processes and cheap prices certain middle tech sectors, frequently in the consumer goods industries. It is because of their size and their interwovenness in larger company networks that their innovation processes tend to be more conservative. Both, the Japanese and the Korean economy have traditionally been divided between MNCs which drive innovations and the significantly less innovative SMEs. While this pattern is gradually changing in Japan, with more and more SMEs becoming highly innovative and producing not only for one key customer but for customers around the world (Schaede, 2008) it still holds largely true for Korea.

4. Management context

Moving on to the *management context* of innovation, we are able to differentiate between *management strategies*, *corporate finance* and *organizational structures*.

Regarding **management strategies**, both US and German companies employ frequently differentiation strategies, thus offering products to a segmented customer base but reaping

higher profit margins because of the perceived uniqueness of their products (and in particular for the US: services). US firms achieve this mainly through substantial, if not transformational technological, organizational, managerial and marketing innovations, while German companies tend to focus on quality leadership, requiring constant but gradual innovations. Regarding Japan, Porter et al. (2000) noticed that Japanese firms often invest in innovations resulting in the best possible product for the largest amount of potential customers, a strategy which includes adopting features of successful products offered by direct competitors. This strategy leads to reliable, high quality products, which suffer, however, from lack of differentiation, as customers view them as rather exchangeable (in particular in the electronics industry). With little product differentiation, the key differentiator becomes price. As a result, Japanese manufacturers put much emphasis on optimizing operational efficiency which is largely based on incremental innovations. While this helps to reduce costs, given the largely exchangeable character of the products, companies have to pass the cost reduction advantage on to customers. By doing so, Japanese companies might be able to increase their market share, however, they find themselves in a downward spiral of reduced costs, reduced prices and reduced profit margins.

Korean companies are in many instances not quite able to match their Japanese competitors in terms of product quality and product innovation. However, they can usually produce at even lower costs than the already cost-conscious Japanese. Focusing on a combination of product quality of largely undifferentiated products and low costs can be a dangerous strategy, though, if competitors who are able to produce at even lower costs (in particular China) will manage to augment their product quality in the mid- to long-term.

With regards to **corporate finance**, it is in the US for entrepreneurs and start-up companies comparatively easy to obtain the necessary funding for investments in innovations, also potentially transformational ones which are significantly more risky. The financial industry is offering, next to conventional bank loans, a well established range of venture capital, capital partnerships and IPOs (Initial Public Offerings) (Stratos, 2002). Also larger companies don't have to rely on bank loans, as they can refinance themselves on the securities market. The same instruments are, in principle, also available now in Germany and, to a lesser degree in Japan and Korea. However, they are still less accessible to companies, in particular for riskier investments. Consequently, Germany and to a much more significant degree Japan and Korea have to rely much more on bank lending (Kang, 2007). While German banks are willing to

provide also larger credits after a meticulous investigation of the business plan, they are still more risk adverse compared to specialized financial institutions or the financial markets in the US. In Japan and Korea it is even more difficult to obtain the required funding for riskier investments, despite efforts to develop the supply of private risk capital (Imai, 2000). Entrepreneurs often have to provide collateral, for example in the form of private real estate, which is significantly restraining the financial possibilities and making such investments much riskier for the entrepreneur. As a consequence, the rate to which in Japan and Korea innovation-oriented start-up companies are launched is comparatively low. As start-ups are, however, increasingly important sources for innovation, in particular transformational ones, both countries are missing out important opportunities to reinvigorate their economies. Even larger companies have to rely on bank loans due to underdeveloped securities markets.

The **HRM practices** in the US are highly flexible and strongly performance oriented. Due to these characteristics the labor market, in particular in highly innovative sectors, is very mobile. This helps in bringing critical human resources, such as product developers, into those companies and jobs where they are the most needed and will be the most productive. Due to this constant recombination of key personnel, creativity is enhanced substantially which is particularly helpful for transformational innovations. By contrast, German companies are rather long-term oriented, emphasize technical expertise and do not favor the hire-and-fire mentality (Child, 2001). Consequently, in Germany the job market, also for those employees who play a major role in innovations, is much more stable. With seniority still playing an important role next to performance, fluctuation is further constrained. As a result, innovators know intimately the company they work for, the products the company has developed in the past, the market they are producing for, the customers they are delivering to and the rival companies they are competing with. This detailed knowledge does not necessarily lead to groundbreaking new developments, but to a constant flow of incremental innovations which, in their sum, ultimately lead in many cases to technological leadership.

In Japan and Korea the labor markets and the HRM policies are noticeably differentiated, due to the dual structure of the Japanese and Korean economies. In large companies employees still enjoy many privileges, including good training, relatively high salaries, a high degree of job security and a foreseeable career path. The economic malaise in Japan in the 1990s and the Asian crisis of 1997 that affected Korea strongly led to certain changes, in particular an increased performance orientation (Lee, 2003; Pudenko, 2006), but the basic principles of

Japanese and Korean HRM are for large companies still mostly intact. By contrast, in smaller companies, due to their lower profit margins, training is limited, salaries are significantly lower and job security is not provided which also makes career paths much more difficult to plan. As a consequence, employees at major corporations, including those who are in charge of product innovations, feel very loyal to their companies, are well qualified and work hard to guarantee a constant outflow of improved products, while considering at the same time the optimization of production process. By contrast, Japanese and Korean smaller companies mostly don't have the financial and human resources to do proper research and the product development they are engaged in often takes place in very close coordination with their key customers, who are at times even their only customers. Korean SMEs have, like their Japanese counterparts, the difficulty of not being considered as appealing employers in terms of prestige and real benefits. Attracting high potentials who could drive innovations is, therefore, a major challenge for them. Consequently, in Japan and Korea innovations have so far been very much a prerogative of larger companies. In Japan, however, this long held pattern is in the process of change, as more and more smaller companies employ highly talented people, become very innovative and, consequently, "hidden champions" in their own right, quite similar to their counterparts in Germany. This has, however, not occurred in Korea yet to any comparable degree, where smaller companies are mostly still limited to being part of the supply chain of larger companies.

Having provided a brief and admittedly simplified overview of how twelve different contextual criteria, pertaining to the cultural, socio-political, economic and management context, influence the innovation systems of Korea and our three reference countries, the US, Japan and Germany, the following three key conclusions can be drawn:

1. In all four countries, the various contextual systems and sub-systems are closely interlinked and mutually reinforcing themselves.
2. Taken together, these contextual factors have in all four countries a significant impact on the respective innovation system.
3. The combined influences of those contextual factors operate in a way that the US are geared towards transformational innovations; at the other side of the spectrum both Japan and Korea are geared towards incremental innovations; and Germany is located somewhat in between these two opposite poles, with an innovation system that is more incremental- than

transformational-oriented, and this even though it is culturally and institutionally closer to the US than to Japan or Korea.

VI. Lessons and inspirations for the Korean innovation system

Having compared Korea with three reference countries, US, Germany and Japan, it became evident that Korean innovation practices resemble most those of Japan, in terms of both, strengths and weaknesses. This should not come as a surprise, given the relative similarities in the contextual factors of both innovation systems. Consequently, while it would be comparatively easy for Korea to follow even more the Japanese model, the scope for new stimuli from Japan is, due to the already existing similarities, relatively limited. In addition, given that also in Japan entrepreneurship and the capability to generate transformational innovations are (still) rather underdeveloped, it also represents in this regard a relatively poor role model for Korea. Specifically regarding to these criteria, Korean companies could learn by a wide margin most from the US innovation model, at least in principle. However, while in the US the entire network of interlinked cultural, socio-political, economical and managerial context factors is strongly geared towards those transformational innovations, it should not be forgotten that the contrary is the case in Korea.

We would, therefore, propose that arguably the most unlikely, as least known, candidate to seek inspirations from, the German innovation model, might in fact be most interesting source for the Korean innovation system to seek inspirations from. This is particularly the case with regards to the “hidden champions” in the SME sector, and it is in the SME sector that Korean innovativeness needs to catch up most. We are by no means suggesting here that the German innovation model is the “best” of the three reference models we reviewed. However, it is in our view the most suited one for Korea, given the lesser scope for inspirations from Japan, due to already existing similarities, and the largely unrealistic option to adopt the US model, due to the completely opposite socio-cultural contexts in which both innovation systems are embedded. Given that the German model, as its Korean counterpart, is more geared towards incremental innovations, Korea could build on its already existing strengths in this area (instead of building from scratch a completely different set of strengths which would go against the grain of its entire socio-cultural context).

While it is obviously not possible to engage in reforms of *national culture*, Korean society should be aware of the strengths that result from its specific cultural values (for example, orientation towards hard work, learning, improvement, discipline, respect), but also be attentive to competitive disadvantages that can be linked to the Korean cultural value set (for example, risk adversity, status quo orientation, reluctance to challenge authorities, little tolerance for deviations from standards and norms). The acknowledgement of such competitive disadvantages and their linkage to cultural values can be a first step to counteract them, for example in the definition of educational norms, the content of curricula etc.

In terms of the *socio-political context*, Korea's government should refrain from giving preferential treatment to few economic sectors or few companies (the *chaebols*). In the wake of the Asian crisis, the relations between government and *chaebols* already became looser. By not promoting certain industries, government establishes a level playing field, so that market forces can prevail in investment decisions etc. Given the relative weakness of the Korean SME sector, government could, however, provide structural assistance to those companies, while avoiding at the same time to overly influence market outcomes (for example, through changing regulations that would help SMEs to find better access to financial markets; modifying bankruptcy laws that would reduce the risk for entrepreneurs; supporting training efforts of SMEs that would improve the skill set in these companies). Also the educational system could encourage more creativity and independent thinking and more financial resources should be allocated to higher education (Jones, 2007).

In terms of the *economic context*, the dichotomy of large innovative companies and less innovation-oriented suppliers should make way for a more balanced corporate sector in which also smaller companies become more drivers of innovation. This could be in form of US-style start-ups which often generate transformational innovations or, possibly more likely, in the form of German-style "hidden champions" which produce, due to constant incremental innovations, high value-added products in specific niches. Korean companies should play their strengths in middle tech manufacturing industries, in particular electronics, but improve at the same time the so far still underdeveloped service industries where probably the most catching-up can be achieved.

Regarding the *management context*, Korean companies will have to escape the trap of getting sandwiched between undifferentiated high quality products from Japan and undifferentiated

low cost products from China. Differentiation strategies, which target a segmented customer base and are able to reap higher profit margins due to the perceived uniqueness of products, could provide a possible solution to this problem. US companies follow this strategy successfully in high-tech manufacturing and service industries and German companies in middle-tech manufacturing industries. Again, the German example might be probably closer to the Korean reality. While the corporate finance and HRM practices in Korea are all very much geared towards supporting major corporations, they should facilitate more the creation of innovations in the SME sector as well. An increasing degree of flexibility in both areas would assist in the generation of more innovations in this sector.

Our comparative analysis demonstrated that Korea can benefit from seeking inspirations from other countries' innovation systems. However, role models need to be picked carefully, since only those innovation practices can be successfully transferred which are in line with Korea's overall cultural and societal environment.

To conclude, we regard it as a key challenge for the Korean innovation system to prevail against two largely opposite approaches and defend its position in order not to be crowded out by them: the production of undifferentiated high quality products, a strategy best represented by Japan, and the manufacturing of undifferentiated low costs products, an approach followed by China. As Korea will hardly be able to reduce substantially its cost base (i.e., wages), a particular threat will be a significant improvement of Chinese product quality, as Chinese wages will continue to be considerably below the Korean ones. A decisive upgrading of the Korean innovation system appears to be the only solution to this problem. This requires further continued improvements of product quality and production processes (a lesson best be learned from Japan). Yet, in order to pursue more differentiation strategies which should lead to higher profit margins, inspirations from other countries should be more helpful. Such inspirations could come with regards to transformational innovations in particular from the US, but given the largely opposing socio-cultural contexts of both Korea and the US, this will probably only be a realistic option in selected niches. Further and more relevant inspirations might be sought from German companies which tend to pursue, like Korea and Japan, more incremental innovations, but unlike both countries in combination with differentiation strategies. Given that Korea will have to improve especially the innovativeness of its SMEs, particular important lessons might be drawn from the German so-called "hidden champions".

An ultimate lesson to be learned from our investigation is that improving a nation's innovation system is not merely a question of some institutional or technical changes. Instead, this is a challenge going far beyond the narrow domain of product or process innovation or even the entire business sphere, involving ultimately the whole of society with all its complex and interrelated facets. This implies that any inspiration from abroad cannot be regarded in isolation but will need to be adapted, assuring a fit with the own cultural and societal context.

VII. References

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Figures

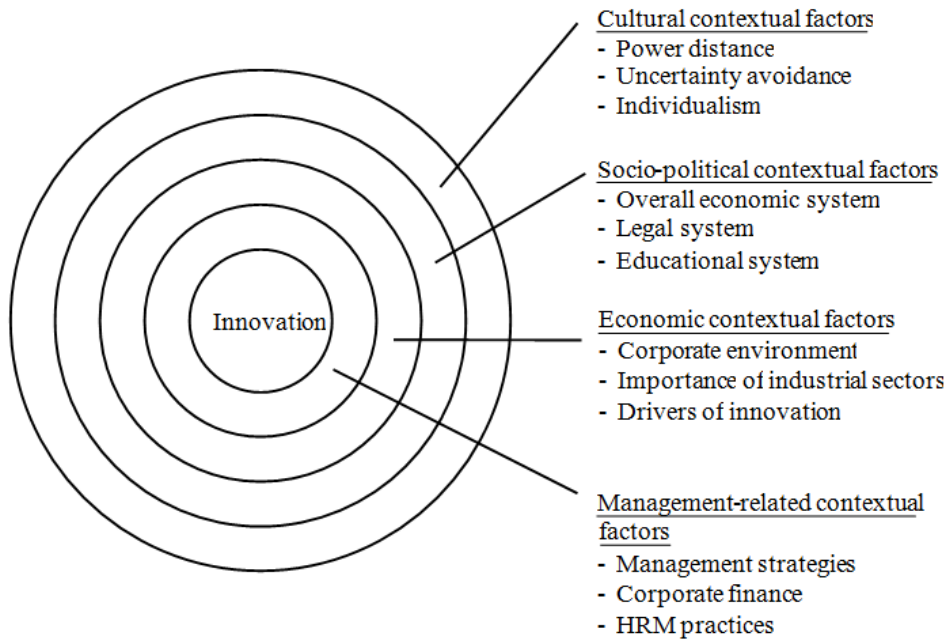


Figure 1: Competitiveness system: Innovation embedded in its socio-cultural context