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Innovation in China and India

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Economic Research Department

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Innovation in China and India

The growth performance of India and China has been astonishing. Within two decades, both economies rose out of poverty and transformed into (low) middle-income countries. Whether high growth rates will be sustained in the future, in part depends on each country's ability to transform into an innovative economy. This paper considers their innovative performance, now and in the future. It looks at the various factors driving innovation, as well as the obstacles that China and India need to overcome.

The need for new ideas

China's emergence as a global economic and political power has in part been the result of the government's ability to reap the fruits of decades of innovation in the rest of the world, while putting to work a reservoir of cheap labor. Up to now, copying, rather than inventing, products has been the main strategy towards developing the economy. However, in the long run, the copycat growth model will prove unsustainable. For one, China's labor force is ageing, reducing the country's future availability of cheap labor. Secondly, and equally important, in order to stay ahead of other emerging economies and avoid the much-feared middle income trap, China will have to increase its productivity, as well as the value it adds to its exports. This also means that the country should reduce its dependence on imported technologies, which would simultaneously lower its spending on license fees. Finally, China's rise as the world's manufacturer has severely damaged the environment. Continuing in the same pace, without limiting its impact on the environment, will have catastrophic results.

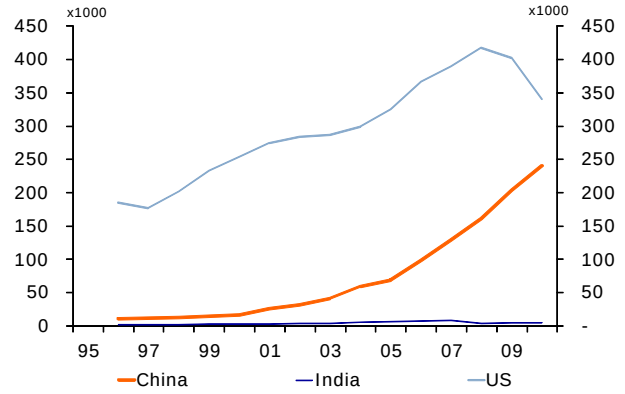
In light of the above, China's forward looking government embarked on a road to increased welfare through innovation. Innovative techniques and processes are to resolve the many bottlenecks that China is currently experiencing, including the environmental and resource constraints addressed above. In addition, innovation is to spur productivity and competitiveness of the manufacturing sector (including the automotive sector) and the pharmaceutical industry. China's ultimate, long term goal is to be able to compete in the world's most innovative industries.

India's growth model has been different from that of China. Instead of exporting low-tech products, it derives its economic growth from the services sector in general and the IT sector specifically. In fact, the services sector (which includes the IT and outsourcing industries) accounts for roughly 59% of GDP. Next to IT, India's pharmaceutical and health care industries are also important drivers of growth.

However, notwithstanding the enormous achievements in these areas and despite the fact that years of high economic growth have created a significant middle class, almost half of the population still lives in poverty. This underlines the fact that while productivity growth in some sectors has been astonishing, productivity in many others, including agriculture, lags. More than China, India needs innovations to foster social economic development and raise agricultural

productivity. In addition, India's government hopes to consolidate the country's position as a major IT centre, while further developing its health care industry. Innovative processes and techniques could help both sectors to become more productive and competitive.

Figure 1: Number of patents



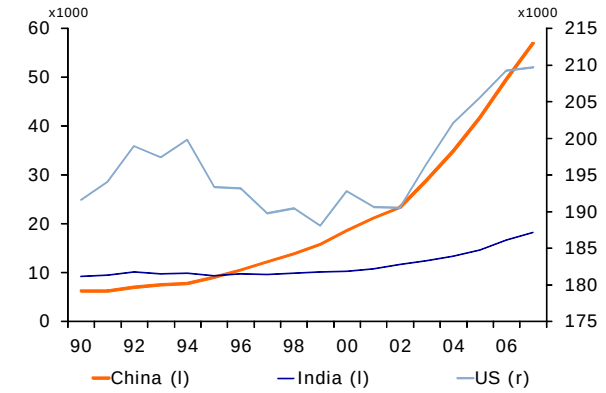
Source: WIPO, 2011

We observe that for both countries the need for innovation stems from two distinct goals: the first is to upgrade traditional industries and resolve many of the bottlenecks that are currently obstructing development. In order to reach this goal, both countries will need to find new ways to apply existing technologies and processes to their unique problems. The second goal is to be able to compete with the world's most developed countries. Doing so will require the creation of new technologies and processes. The last goal describes a move towards the front of the technological frontier, which necessitates a greater degree of innovative capability.

Achievements and challenges

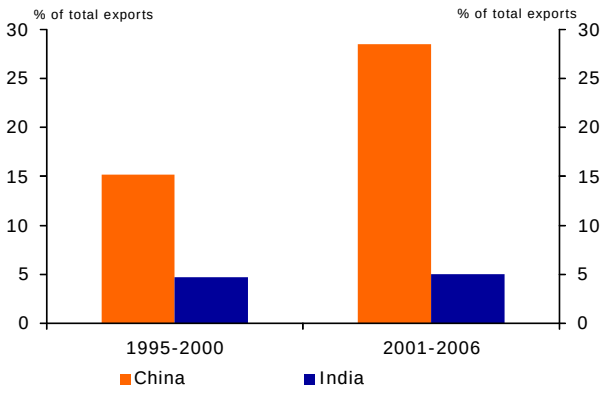
Both India and China already made great strides in improving the innovative capacity of their economies. Between 2000 and 2009, the number of patents awarded to Chinese applicants multiplied by 8, while the number of Chinese publications in international science and technology (S&T) journals doubled. Moreover, expenditure on research and development (R&D) as a percentage of GDP rose from 0.8% on average between 1996 and 2001, to 1.3% on average between 2002 and 2007. In comparison, in the US expenditure on R&D remained stable at 2.7% of GDP. Finally, China's increased focus on innovation is

Figure 2: Number of S&T Publications



Source: OECD

Figure 3: High-tech exports

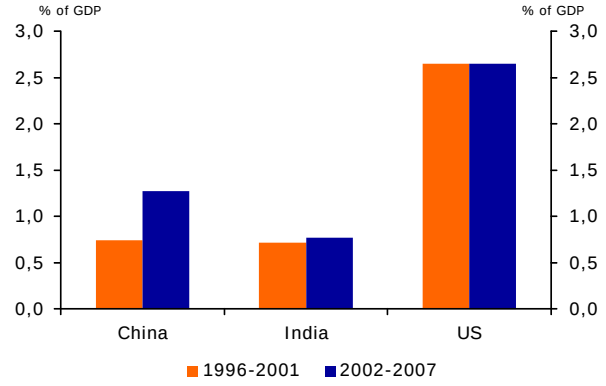


Source: OECD

also evident in the fact that high-tech exports have risen as a percentage of total manufactured exports.

India's performance is somewhat less impressive, but still remarkable. The most notable result is a 77% increase in the number of scientific publications (between 2000 and 2007). And, between 2000 and 2009, the number of patents awarded to Indian companies grew by 43% (see figures 1 to 4). Moreover, India's innovative capabilities recently received some attention when Tata Industry announced its invention of the world's smallest car, the Nano. India is also responsible for the creation of the world's smallest laptop.

Figure 4: R&D Expenditures



Source: OECD

Despite these remarkable achievements. China and India still have a long way to go. Both countries rank below the US in every aspect mentioned above. This helps explain why the INSEAD's Global Innovation Index ranks China 15th and India 21th, while our own Rabobank Innovation Index ranks China 15th and India only 20th, out of 22 (Kamalodin and Piljic, 2011).

Moreover, what the numbers above do not show is the quality of the articles published, the level of innovation behind the patent applications, or whether high-tech exports stem from multinationals or nationals. For instance in China, patents are often applied for products or techniques that only differ marginally from older versions. In India, innovation is mostly derived from large and well-established companies, suggesting that the opportunities for startups are limited.

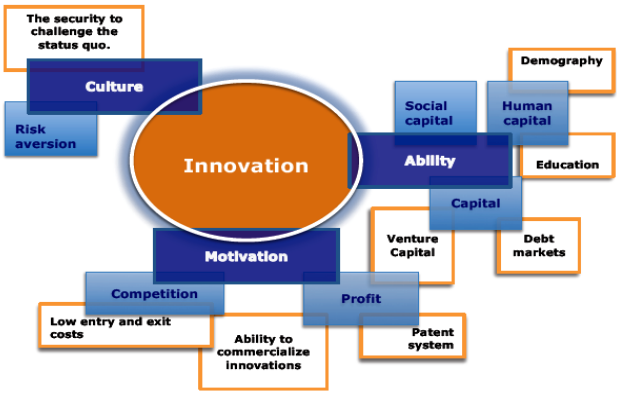
What is lacking in both China and India is an encompassing and accommodating environment in which innovation is enabled by an educated work force, the availability of finance and the opportunity to share knowledge. In an ideal world, innovation is not just a possibility, but individuals and businesses are actively motivated to develop new technologies, in a culture that rewards those that challenge the status quo. The characteristics of such an environment are depicted in figure 5.

The need for high skilled labor

Only a high quality education system will allow for the accumulation of the human capital needed to foster innovation. Unfortunately, in both China and India, education systems are lacking in more than one aspect. With respect to China, the problem is not in the number of graduates, but rather in the quality of education provided to the scores of students graduating each year. While Chinese universities churn out more S&T graduates than their counterparts in the US, only six Chinese universities rank on the Times' World University

Ranking (top 200). In comparison, 72 American and 10 Dutch universities are listed in the top 200. Complaints about skill shortages from especially multi-nationals further illustrate the underperformance of Chinese universities.

Figure 5: Innovation Framework



Source: Rabobank

Graduates are said to be too young and too inexperienced to be employed. They often lack the management skills needed to succeed in a global market. Therefore, despite high demand for skilled labor, unemployment among graduates remains high. Clearly there exists a mismatch between the skills acquired in the classroom and the skills demanded by em-ployers (The Economist, 2007).

A closely related and frequently cited reason for a low return to education is the style of teaching in China. In contrast to education in the US or Europe, the Chinese educational system rewards good memory and obedience over critical thinking (Dennis et al. 2008). This while critical thinking and the ability to think outside the box are widely regarded a prerequisite for success in innovation and science. In contrast to China, India's rapid population growth makes for a fast growing supply of labor. Nonetheless, the idea that India holds a seemingly endless labor reserve is misleading. Especially high skilled labor remains in short supply. India's dualistic economy means that a small elite is responsible for most of the country's growth performance, while 41% of the population still lives in poverty. Therefore, the immediate challenge facing India is to increase the quality of primary and secondary schools, in order to create the human capital needed to lift this group out of poverty and increase the country's literacy rates. At this moment, only 45% of all women and 75% of all men over the age of 15 know how to read and write. Moreover, the low quality of secondary institutions leaves students ill-prepared for the university entrance exams.

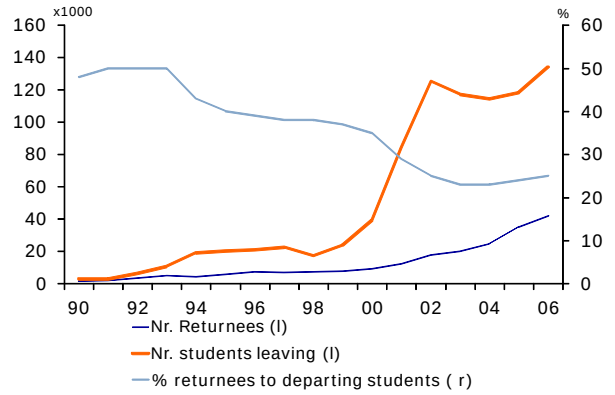
The second challenge is to improve the quality of Indian universities and reduce the staff shortages that are currently blocking many eager students from gaining a university degree. A lack of funding, low teacher salaries and a heavily politicized and bureaucratic system are all obstructing the development of high quality tertiary institutions. In fact, none of India's universities rank on the Times' World University Ranking. As a result, many companies are establishing extensive teaching programs to substitute university degrees.

India's government is aware of the problem and has allocated funds to improve the quality and capacity of its universities. But, more is needed. Whereas up-grading the hardware is relatively straightforward, improving the software (i.e. training new teachers) will take more time and effort. In addition, enhancing the quality of education also implies a significant change in teaching methods.

Also in India, active, rather than passive, learning should become the norm. In this aspect, China and India suffer from similar shortcomings.

Another problem that both countries share is that of a brain drain. After the Cultural Revolution, China's government hoped to spur the accumulation of human capital by encouraging students to study at Western universities. This has since become a common practice, with many students choosing to stay abroad upon graduation (see figure 6). A similar brain drain can be found in India. Given the low quality of India's universities, many talented people choose to migrate to Western countries, most notably the US. As these are often the most talented people, the brain drain not only reduces the quantity of high skilled labor, but also the average quality.

Figure 6: Brain drain China



Source: Dennis et al. 2008

On a brighter note, since the global crisis dried up employment opportunities in the US, many Chinese and Indians are remigrating to their home countries, where jobs are readily available. The Chinese government is further supporting this trend by handing out rewards to those that return home.

The need for capital

Efficient and well-regulated capital markets are a vital factor in the creation and growth of innovative businesses. Angel investments and venture capital (VC) enable innovative businesses in the first stages (see box 1) band debt markets play an important role in the expansion of existing businesses and research facilities.

Unfortunately, VC markets in both China and India are relatively immature and mostly benefit existing businesses, rather than startups. As shown in figure 7, VC investments in both countries fall far below those in the US or the EU. In fact, VC investments are only 0.11% and 0.004% of GDP in China and India respectively (2009). In the US, VC investments stood at 0.4% GDP in 2009. Hampering the development of local VC markets in India and China is the lack of proper regulation, as well as transparent judicial systems. Moreover, in the absence of entrepreneurial skills, as detailed above, investors are often reluctant to invest in start-ups whose owners lack the skills to successfully develop a business.

Another bottleneck is the want for large and efficient Initial Public Offerings (IPO) markets, or Merger and Acquisition (M&A) opportunities. These form the exit mechanisms without which VC investors will be hesitant to invest. In fact, a survey by Deloitte shows that 83% of the questioned VC firms in China and 33% of their counterparts in India believe that an active IPO market is vital for the development of a VC market, as it "provides superior returns" (Deloitte, 2010).

However, while the majority of the Chinese respondents said that the IPO market in their country was adequate to support VC development, only 43% of the Indian respondents felt that the Indian market was sufficiently developed. Moreover, in India, a cap on foreign investments obstructs the opportunity for M&A.

Box 1: Venture Capital

Venture capital gained importance in the 1990s and has since become an important driver of innovation. Rather than bankrolling the research phase, VC investors step in to help a start-up through the development phase, or the 'D' in R&D. In this stage the risks are high, but the potential returns could be enormous. As noted by Haemmig: "In VC failures occur very early on; however, successes can last a long time. It becomes evident that these are the companies that drive economic growth, innovation and progress" (in: Davila et al. 2007). Indeed, many of today's largest and most influential companies, such as Microsoft and Apple, may not have existed without VC.

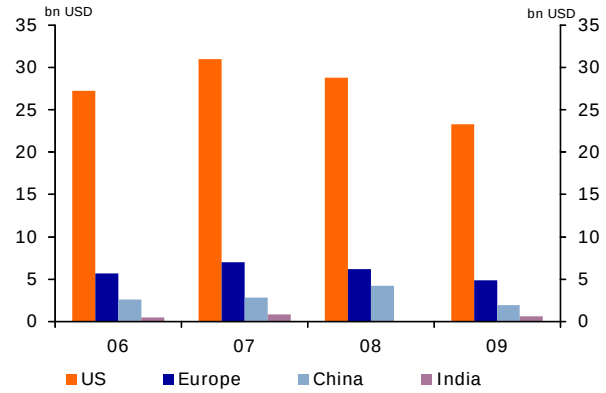
Nonetheless, despite these obstacles, growing domestic economies and better business climates in both countries have started to attract international VC firms. Another survey by Deloitte shows that a large majority of firms believes that VC markets in India and China will grow over the coming years, whereas VC markets in the US and the EU are expected to contract. This development is most notable in China, where every major US VC firm now holds an office. Moreover, VC firms in China are generally larger and cater to the domestic market. In contrast, in India, VC firms are smaller and often concentrate on global markets.

As VC markets, Indian and Chinese debt markets are also underdeveloped and contribute very little to economic growth. Although the Chinese bond market is somewhat more developed than its Indian counterpart, there is still enormous potential for growth. Most bonds are issued by the government and, as a result, corporate bonds only account for 4.5% of total outstanding bonds (2008). Consequently, investors have difficulty finding productive investments. Overinvestment in China's real estate market can be viewed as a symptom thereof. It encourages the idea that the expansion of China's bond market would significantly add to the country's economic performance and stability. Already, the government has made some improvements, such as the abolishment of the more restricting requirements for issuing bonds (e.g. the requirement of a AAA rating), which should help spur corporate bond issuance.

While India's financial market is relatively mature, its bond market is small. Corporate bonds add up to 200bn, or 3% of GDP, which is roughly 30% of all Chinese corporate bonds. One obstacle to the creation of more liquid bond markets is the fact that corporations are often constrained by heavy regulations that drive up the cost of issuing corporate bonds. At the same time, foreign investors are discouraged from buying bonds. The cap on foreign involvement, mentioned above, means that foreign investments cannot exceed a benchmark which for most sectors is set around 50%. On the bright side, India's government has embarked on a path of financial development, which so far

included a reduction in the number of procedures and regulations, as well as the creation of a CDS market that allows investors to better determine the risk attached to bonds.

Figure 7: Venture Capital Investments



Source: Ernst and Young, 2010

Aside from private capital, companies can also finance their innovative projects through subsidies. The Chinese government is heavily committed to supporting companies whose innovations support the country's main policy goals. Such support takes the form of tax cuts, or grants. However, it has been observed that most grants favor state-owned enterprises. This while private sector enterprises are far more innovative. To illustrate, the only two Chinese companies that ranked in Fastcompany's World's Most Innovative Companies 2011 Index, were privately owned. Also in India, most grants flow to the public sector, while the country's high corruption rate obstructs the efficient allocation of public funds.

The need for knowledge and technological transfers

Innovation is unlikely to come about in isolation. Instead, companies that are tapped into global markets are better able to reap the benefits of existing knowledge and technologies. Likewise, by importing high-tech goods, domestic markets gain familiarity with innovative products. We therefore argue that open economies are better equipped to spur innovation domestically.

As mentioned above, opening the economy in order to exploit foreign expertise has been one of the most notable achievements of the Chinese government. And, as shown in figure 6, between 2000 and 2010 FDI grew considerable, reaching roughly 3% of GDP in 2010. What makes the Chinese experience unique, is the fact that the Chinese government was able to open its economy to foreign knowledge, while still sufficiently protecting its infant industries. In addition to reaping the fruits of inward investments, Chinese state-owned enterprises (SOE) have also started to acquired foreign companies, with the goal to obtain vital technologies. Consequently, between 2000 and 2010, outward direct investments have risen sharply as well, peaking at 1.5% of GDP in 2008 (figure 9).

In India, three decades of trade liberalizations have had a significant impact on the country's openness. Between 2000 and 2010, good exports and imports nearly quintupled, while inwards FDI mounted (figure 11). Still, with imports plus exports only accounting for 45% of GDP, India is considered relatively closed. In comparison, exports plus imports of other Asian countries, such as Malaysia, Vietnam, Taiwan and Thailand, record well over 100% of GDP.

Furthermore, in absolute levels, India lags behind China. An example is FDI flowing to India, which only accounts for 13% of all FDI reaching China. Further increases in foreign investments are hampered by infrastructural bottlenecks, excessive red tape and the mentioned cap on FDI. Removing this cap and improving the business climate should go a long way in promoting foreign investments and the consequent transfer of knowledge.

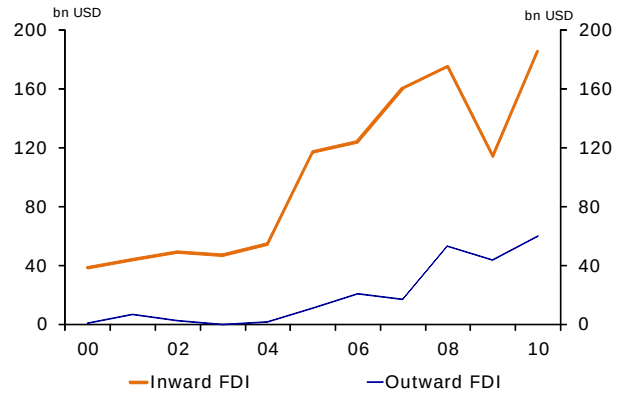
Next to global networks, domestic networks are also important to spur innovation. For instance in China, publicly sponsored science parks bring together research facilities, finance opportunities, researchers and businesses. The outcomes have been remarkable, with almost half of all patent applications deriving from these science parks. In India, technological institutions provide similar functions. The next step for both countries is to expand these facilities and further integrate them with the overall economy.

Safeguarding the carrots…

Even when companies are fully capable of innovation, they need proper motivation to actually innovate. Likewise, even when investors are able to invest in innovation, they too need proper incentives. The most important incentive for both is, of course, the prospect of exploiting an invention and turning a profit. Patents allow innovators to do so. A well governed patent system is therefore considered a vital prerequisite for innovation.

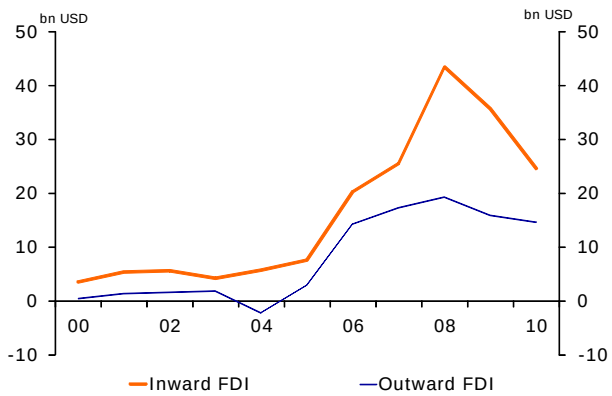
When, in 2002, China became a WTO member, it brought its patent laws in line with international standards. However, the main problem of China's Intellectual Property (IP) system is not the laws, but rather the enforcement of IP regulations. As a result, the infringements of IP rights remain a significant problem that deters especially foreign firms from transferring knowledge to China, out of fear that their products will be copied. But, once China's own companies become more innovative, they, as foreign firms, will be hurt by the lack of enforcement. Hopefully, this will compel the government to channel resources towards the enforcement of property rights.

Figure 8: FDI China



Source: EIU

Figure 9: FDI India



Source: EIU

India's performance in the area of patent law also leaves much to be desired. As in China, enforcement of IP rights is lacking. Next to that, excessive red tape and an enormous amount of procedures render the patent application process a cumbersome undertaking.
Closely related to the ability to exploit an innovation, and another key incentive to innovate is a competitive environment. Competition not only encourages, but also forces businesses to innovate, just to stay ahead. A good indicator of competition are the entry costs for new businesses, as well as the exit costs to existing businesses.

In China, it takes 38 days and 16 procedures to start a business, but 'only' 1.7 years to close a business. Consequently, China ranks 151st and 68th (out of 183) on the starting a business and closing a business indices. In India, these costs (both in time and money) are considerable as well. Starting a business takes 29 business days (compared to 6 days in the US), including 12 procedures. Closing a business on the other hand, takes seven years. It is no surprise therefore that India ranks 165th and 134th on the starting a business and closing a business indices.

The implication of these high entry costs is that existing businesses are less threatened by newcomers and are therefore less motivated to innovate. The protection of existing and well established businesses over newcomers is indeed a defining characteristic of China's domestic market. State-owned and heavily subsidized enterprises dominate most markets, thereby crowding out smaller entities. In India, the preference of the old over the new is less pronounced and more the result of red tape than explicit policy. Nonetheless, the results are just as damaging. Moreover, the high salaries offered by India's established firms often deter starters from becoming entrepreneurs.

…and removing the sticks

An environment that spurs innovation transcends the various aspects mentioned thus far. A culture that rewards, not punishes, innovation is vital. For example, Google has created an innovative environment by allowing all its engineers to spend 20% of their time pursuing projects that they are passionate about. According to the company's website, this has so far resulted in the creation of products like Gmail and Google News. Arguably, placing confidence in its employees, allows Google to stay ahead.

In this respect, China's political systems harbors a very apparent paradox: while it sets out to foster innovation, it simultaneously rewards obedience and conformation, rather than opposition and critical thinking. From early on, schools teach children to obey, not to ask questions. Then, upon adulthood, China's hierarchal corporate culture implores individuals to obey their managers, as a result, good ideas are unlikely to ever reach upper management. Finally, the

government promotes obedience by compelling its citizens to censor themselves. In India the cultural obstacles are less clear. The country's democratic tradition appears to be a better environment for innovation. However, as China, India suffers from an educational system that promotes repetition and passive learning over critical thinking. Also in India, hierarchical relations are extremely common, not just within companies, but also within society at large. Although the caste system is officially abolished, it is still very present in everyday life and continues to dictate social norms.

This is not to say that innovation is virtually impossible in either culture. However, in order for individuals to take on innovative, but inherently risky projects, a culture that promotes risk taking over risk aversion is preferred.

Conclusion

By increasing their capacity for innovation and by applying existing innovative products and processes to traditional industries, China and India could avoid the middle-income trap and overcome the various bottlenecks that are hampering future economic growth. Whether they will be able to do so is less clear. In both countries, innovative industries are relatively immature.

In China, the presence of a strong political will to create an innovative base is encouraging, as are the numerous public investments in innovation. Nonetheless, the establishment of an innovative economy will require a more far stretching transformation. Basically, the same strategies that have proven useful in developing a large industrial base, are now hampering China's innovative capability. These include the protection of large SOEs over private sector startups, the copycat mentality and, closely related, the poor protection of IP rights. Moreover, China's hierarchical culture and oppressive regime, although functional in spurring economic growth, are now hampering the establishment of an innovative environment. In light of these obstacles, we can only conclude that it will take more time and effort for the label 'made in China', to be replaced by the label 'created in China'.

India clearly lags behind China in almost every aspect discussed. However, in contrast to China, India has been the source of some true innovations, such as the world's smallest car and laptop. One explanation is that India's most pronounced obstacle to innovate is not cultural, but political. Indeed, widespread corruption and excessive red tape make for an ineffective government, the consequences of which are felt in almost every sector. Examples include an ineffectively managed education system, an unfriendly business climate and the number of hoops one has to jump through in order to obtain a patent. Next to these political obstacles, India's innovative capability is further undermined by the fact that it has a large poor population. A problem that requires substantial public funds and attention. Finally, although not the largest obstacle, cultural factors are also hindering innovation. Clearly, the road ahead will be long and bumpy.

Innovation in China and India

However, even if China or India will not be the source of the world's next Ipod, both countries could still outperform other emerging markets, if they succeed in applying existing, but innovative, technologies and processes to their own unique problems. For example, India and especially China are already profiting from their ability to tweak existing technologies and adapting them to local needs. In doing so, companies are better able to cater to their own domestic markets, while simultaneously circumventing costly license fees. Therefore, even if it is not yet invented in China, the label 'tweaked in China' already applies to many products and technologies. For the coming years, this strategy will help China, and to a lesser extend India, to maintain their impressive growth rates. However, in the medium term, economic success will increasingly depend on the ability of both countries to transform their economic cultures and foster true innovation.

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Colophon

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