THE 'ASIAN' PATH TO INDUSTRIAL DEVELOPMENT:

THE INTERLINKAGE BETWEEN JAPAN AND CHINA

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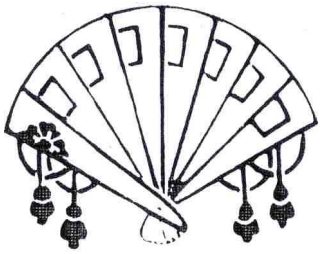

Valedictory address at the occasion of his retirement from the chair *Economics and Management in Pacific Asia, in particular Japan* at Erasmus University Rotterdam.

May 16, 2006

Mijnheer de Rector Magnificus,
Distinguished colleagues, guests and friends,
Ladies and Gentlemen

Introduction

On the 18th of March, 1918, at two o'clock in the afternoon, Johan Alexander Nederbragt defended his dissertation: *"Penetration Pacifique" in China,* here in Rotterdam in the building of the Handels-Hoogeschool.[1] This happened to be the first doctorate ever of the Nederlandsche Handels-Hoogeschool, the predecessor of this university. In his dissertation Nederbragt analyses the steady expansion of western economic and political influence in China, called in those days 'penetration pacifique': quiet penetration. Nowadays such activities are being accompanied by 'shock and awe'. At that time, weak, impoverished and unstable nations were subject to quiet penetration and China in the latter days of the Qing Dynasty, proved to be an easy prey. Nederbragt gives a detailed account of the process of China's gradual subjection to western interests, executed by the triumvirate: the soldier, the diplomat and the banker.[2]

Tempora mutantur, sed non res. Times indeed do change but in effect the issues do not! We still see the same actors, only in a slightly different order and composition. Nowadays the banker, or in broader terms the industrialist, tends to go ahead and he calls in the diplomat when help is needed. The soldier stays home longer and is used for specific purposes. An achievement of modern civilisation?

Nederbragt's dissertation is interesting for a number of reasons. First of all, it provides us with a detailed view of the international economic and political scene at the turn of the 19th century with sketches of the western mindset towards Asia and in particular China. Colonial stereotypes and prejudice in full color. Secondly, he describes the emergence of Japan as an industrial nation, her successful attempt to

1 An abbreviated version has been presented on May 16, 2006 in the Aula of Erasmus University.
2 See Lesage, 'L'invasion anglaise en Egypte: l'achat des actions de Suez', quoted in Nederbragt, *'Penetration Pacifique' in China*, pp. 6-7.

avoid 'penetration pacifique' and the urgent need to find export markets for her products. China turned out to be the place where western and Japanese commercial interests clashed. For Japan penetration of the Chinese market was a matter of life and death and she proved to be a fast student of western colonial practices. Thirdly, Nederbragt concludes that the best way for China to escape submission and domination by colonial powers would be: industrialisation, either through her own efforts (self-industrialisation) or through investment by foreigners. The former he considered totally unrealistic, given the Chinese attitude and mindset; the latter more feasible. And so he reasoned that joint development of Chinese resources, facilitated by western capital and technology, should lead to successful industrial development and keep the yellow peril at bay. We write: 1918!

Now, almost 90 years later, at the occasion of this valedictory lecture, concluding my chair of *Economics and Business of Pacific Asia* at this university, I would like to take up the issue of economic and industrial development in Asia again. Since Nederbragt we have witnessed the rise and fall and rise again of Japan. We saw how China was catapulted into modernity, went through periods of disaster and destruction and now has emerged as the champion of, what appears to become, a new Sino centric order in East Asia.[3]

In this new order players of different size, character, and level of development, like Japan, South Korea, and the Chinese 'Commonwealth', will have to cooperate in new geo-political scenarios and design new economic and industrial structures in the region. But above all, they have to come to terms with the past and solve the remaining problems in a congenial way. And that proves to be a mighty task.

Today I will not go into detail about the geo-political problems in East-Asia but instead I would like to concentrate on issues of economic-industrial development of the region. In particular, I will address the question of Japan's role and function in the industrial development of East Asia, the link between Foreign Direct Investment (FDI) and technological upgrading and the benefit of Japan's experience for China's

[3] Japan Echo, February 2006, p.63

current industrialization. I would like to do that from a regional perspective and look at the issue of interdependency and mutual assistance in East Asia.

In my inaugural address at this university in 1988, I dealt with the internal dynamics of Japans' industrial success; in my inaugural address at Twente University in 1995, I discussed the issue of Japan's technological development and its transition to the status of advanced industrial nation.[4] Today I would like to add another panel and thus complete the triptych by focussing on Japan's contribution to and exemplary function for the technological upgrading of East Asia, in particular China.
I have titled this lecture *The Asian path to industrial development*, not as reference to a unique Asian way but rather as an effective pattern that seemed to be followed by the main players in the region, Japan, Korea and China.

Economic and industrial development

In her recent book *The Rise of "The Rest", Challenges to the West from Late-Industrializing Economies*, Alice Amsden defines economic development as 'the process of moving from a set of assets based on primary products, exploited by unskilled labor, to a set of assets based on knowledge, exploited by skilled labor'.[5] Here we talk about the transformation from agriculture into manufacturing as the heart of modern economic development. The 'knowledge-based assets' which Amsden talks about, are a set of skills which the owner can use to produce competitively in a market. These skills are usually science or artisan-based and the property of an individual or firm. Ingenious application and exploitation of these skills generate the earning power in a market.

In a nutshell we see here what it takes to make the transition to an industrial society: proprietary knowledge to compete in a market and a skilled labor force to execute the processes involved. And in addition we need, of course, capital either generated locally or through investments from abroad. But all these processes have to be set in motion deliberately. The history of economic and industrial development shows

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4 *Japan: Bestel in Beweging*, Inaugural address Erasmus Universiteit Rotterdam, 1988. Management van Technologie en Japan: De leerling volwassen, Inaugural address Universiteit Twente, 1995.

5 Amsden, 2001, p. 5.

different models and looking at East Asia we discern a decidedly important role of the national governments to initiate and coordinate the processes of development.

Take Japan. Hundred fifty years ago Japan's Meiji government started the modernization and industrialization of the country by investing in national firms and national skills. She chose the best available technologies and techniques in the world to build up an industrial base which would secure her independence as a nation and could generate wealth to her people. Between 1868 and 1892 the central government of Japan spent almost 2% of her budget on hiring thousands of foreigners as instructors and advisors for Japan's industry. Simultaneously thousands of students were sent abroad to study the state of the art science and technology and acquaint themselves with the requirements of modern society.[6] Adoption of foreign knowledge and technology as a starting point for modernisation, orchestrated and directed by the government. And she has been successful.

After WW II Japan repeated the whole exercise, albeit under different circumstances. Her success attracted the attention of the nations in the region and Japan's model of development was widely imitated. For instance, by Korea and Taiwan, both former colonies of Japan. They could build upon the manufacturing experience from the colonial period. Not only in terms of production capabilities, the art of transforming inputs into outputs, but also in terms of organising and expanding manufacturing activities and ultimately creating new ones through innovation. Thus, the pre-war Japan-based manufacturing experience has laid the foundations that contributed to the kick-start of post-war Korean and Taiwanese industry. And like Japan, these countries sent their brave and brightest abroad to study and learn.[7]

Catching-up Product Cycle model

This leads us to the question: What has been the dominant pattern used by Japan to catch up with the west, particularly after WW II. and how has this pattern attributed to

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6 See Nafziger, *Learning from the Japanese: Japan's Pre-war development and the Third World*, 1995, quoted in Katzenstein, 2003, p. 216.

7 When I studied in Japan in the late sixties, 90 % of the students of the international dormitory where I stayed were Koreans, invariably all enrolled in the science and technology departments of Tokyo's top universities. And they all ended up in the boardroom of Korea's hi-tech companies. The same will happen to the tens of thousands of Chinese students currently studying abroad.

the economic and industrial development of East Asia? There are many theories, hypotheses and analyses available, but Yamazawa and Ozawa summarize it for us in the phrase: *catching-up product cycle*.[8] As starting point they take Vernon's original *Product cycle* model of industrial development and describe the East Asian pattern of industrial catching-up as interplay between trade and production. Late starting countries typically begin their industrial development by importing new products from advanced countries, followed by import substituting production at home and in due time they are able to produce themselves for export. The sequence of import, production and export has been characteristic for Japan as well as her developing neighbors. A short elaboration.

In the first stage new products are introduced through import from advanced countries and as domestic consumption increases, local production starts through imitation or using borrowed technology. However, the domestically produced goods usually cannot compete with the imported ones, both in quality and production cost. Learning by doing and improving is the hard way out for local entrepreneurs. The second stage, import substitution, is a reaction to the rapidly expanding local demand. Large scale production leads to standardization of production processes and improvement of production technology. Product quality improves and production cost decreases.
The third stage is export of industrial and consumer goods. Domestic industry has matured, enters the stage of mass production and is able to expand at home and abroad. This stage marks the completion of industrialisation.
During the respective stages domestic markets have been effectively closed for foreign competitors in order to allow the local industries to develop. As soon as they are strong enough to withstand international competition product markets can be liberalized.

We have witnessed this development pattern in Japan, we saw it in Korea and to a large extent it is also repeated in China. The driving force in this process of catching-up is entrepreneurship but the basic conditions to succeed in introducing new

[8] Yamazawa, I., (1990), *Economic Development and International Trade. The Japanese Model,* Honolulu: East-West Center, pp. 27-49.
Ozawa, Terutomo, (1995), 'Structural upgrading and concatenated integration' in: Denis Simon (ed.), *Corporate Strategies in the Pacific Rim: Global versus Regional Trends.* pp. 215-246.

industrial activities have been: expanding domestic demand based on increase of available income, decreasing unit cost of production and government protection of the budding industries against foreign competitors. And, of course, this all should take place under favorable fiscal and monetary conditions.

Learning by doing may be one way to master modern production methods and techniques, a more effective one is a deliberate introduction of the required technology and investment in developing technological capabilities. Ozawa analyses Japan's industrial upgrading from low-tech to high-tech during the last 50 years as follows.

Industrial and technological upgrading

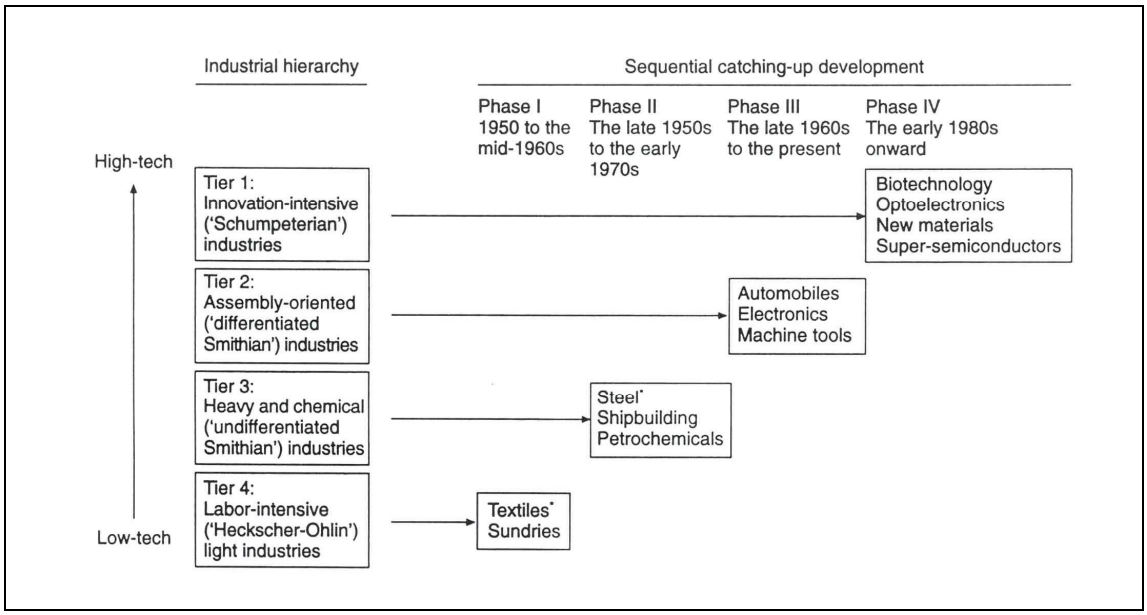
After the devastation of WWII Japan started her re-industrialization with the production of textiles and light industrial goods, the fruits of labor intensive processes, in which she could exploit her relative low-labor-cost advantage. The export of these products provided the resources to import the necessary material and equipment to produce heavy industrial goods and thus progress to the next phase of industrial development: steel production, shipbuilding and petrochemical processes. The technology for these industries has been mostly acquired from abroad through the mediation of the Japanese government, in casu the Ministry of International Trade and Industry, MITI, now called METI, which functioned as gatekeeper for technological acquisition to implement its industrial policy. This phase coincided with Japan's domination in shipbuilding in the 1960's and 70's.

Phase three constitutes the mass-production of automobiles, electronics and machine tools, a stage in industrial development which requires both technological competence and organizational capacity to coordinate complex processes of modern production and compete internationally in terms of quality and price. This phase has been the most outstanding one of all and has inspired western industries to emulate Japanese manufacturing techniques like just-in-time production, total quality management, lean production and the like.

The energy crises of the late 1970's forced Japanese industry to shift from a resource-intensive to a resource-extensive production system and thereby jumpstarted the

innovation-intensive industries, first in the field of micro-electronics but additionally also in biotechnology, opto-electronics, new materials, life sciences.

Sequential technological upgrading of Japan's industry



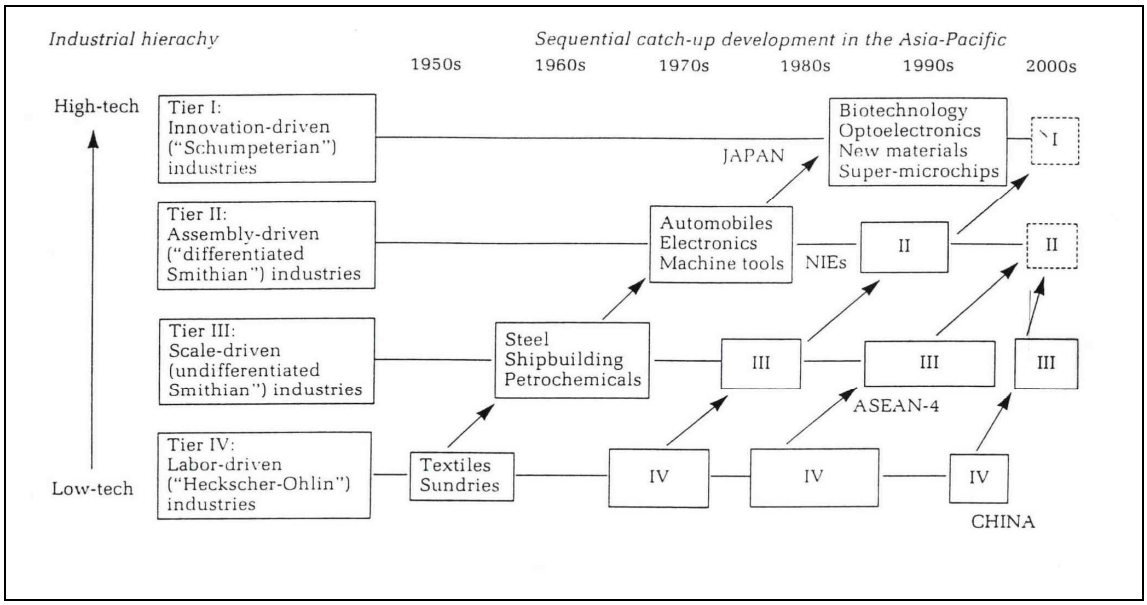
Adapted from Ozawa, 1995

And here Japan stands now in the process of sequential upgrading of her technology and industry. With the arrival at this phase Japan has effectively finished her catching-up and acquired the status of advanced industrial nation. In some domains like automotive technology and opto-electronics she even has gained a leading position. Japanese digital camera industry is one example but Toyota's lead in new engine technology is another. These are examples of strategic investment in R&D in new technologies and markets, consequence of the fact that after catching-up one has to generate new ideas, products and processes oneself. In anticipation of that moment Japan has invested steadily since the 1980's in research and development of new technology at an average of about 3.0% of GNP.

However, in the wake of Japan's success, the economies of East and Southeast Asia followed in her footsteps, using the same pattern of development. First the NIE's, the New Industrializing Economies, Korea, Taiwan, Hong Kong and Singapore but also the ASEAN 4, Malaysia, Thailand, Indonesia and The Philippines and more recently

also China and Vietnam. And more importantly, it does not take them as long as Japan.

Technological upgrading of Asian economies



Adapted from Ozawa, 1995

Here the so-called *Late-Development Effect* applies: countries starting later with their industrialization can learn from their predecessors and do not have to make the same mistakes. Their learning curves are much shorter. A precondition for success, however, is a positive attitude towards learning and the absence of the NIH syndrome, the idea that something not-invented by yourself can not possibly be good. Most Asian countries have a cultural, and some say genetically, inclination for learning and thus are mentally well-prepared to make the development journey. It took Japan after WW II roughly 50 years to arrive at the current point in technological history but for the NIE's this catching up spanned only 35 to 40 years and with the current speed of development in China we can expect an even shorter cycle.

Crucial in these processes of industrial upgrading has been the interlinkage between the regional economies and the 'recycling of comparative advantage'[9]. As soon as production conditions changed in Japan, e.g. higher wages as result of economic growth and increasing prosperity, production of labor intensive, low–tech goods

[9] Ozawa, 1995, p. 226

migrated to the NIE's, first to South Korea, Taiwan, Hong Kong and Singapore, cascading to the location where conditions were still favourable for those production processes. Until growth, progress and higher wages in turn pushed out these activities to the next best location, e.g. Malaysia, Thailand, Indonesia etc. And thus we see a sequential migration of industrial activities of the East Asian economies along a trajectory of steady technological upgrading.

In sum, expansion of trade in the region, overseas investment in each others industries and dynamic entrepreneurship have been the main, mutually reinforcing, ingredients for the structural upgrading of the economies in East Asia. To this all we should add the strategies of national governments in the region to facilitate the upgrading of their industries through deliberate industrial policies , mostly in a market-based economic environment with the stimulus of local competition to improve efficiency.[10]

Firm level upgrading

So far we dealt with industrial development at sector level. At this junction I would like to descend to the level of the enterprise and look at the mechanisms available to individual firms to attain technological upgrading. For, after all, it is the firm which has to create wealth for all stakeholders. Here I would like to introduce the Korean researcher Linsu Kim, who analysed the technological upgrading of Korean industry during the last three decades, from low-tech to hi-tech manufacturing.[11] And we readily will see the analogy between Japan and Korea's upgrading and the current situation in China.

Kim poses that *catching-up countries* need two things: dynamic firms, eager to learn, and sources from which to learn. The latter can be a model firm, set up as an example by the government, or it can be a licensing agreement with a foreign firm or a joint venture, or just a successful local competitor in the local market. Foreign firms investing abroad for whatever reason, transfer technology of whatever kind. By

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[10] An extra accommodating factor has been Japan's lavish spending of ODA in the region, Official Development Aid, to assist East and Southeast Asia in the upgrading of local infrastructure but also pave the road for Japanese industrial investment.

[11] Linsu Kim, 1997, *Imitation to Innovation. The dynamics of K\orea's technological learning,* pp. 85-104.

understanding the technological trajectories involved in these transfer processes, newly industrializing economies can benefit for their own development. But how?

This is Kim's analysis. In advanced countries innovative firms typically invest in the development of new products, based on new inventions or new technology which might be crude, expensive and unreliable, but able to satisfy a specific niche market.[12] Risks are high, so are the potential rewards. While seeking a proper match between market demands and product design, frequent changes and adaptations are necessary and consequently organizations preferably are small and flexible. Venture capital accompanies these early steps in new product markets.

But then, as market demand expands, production scales increase, production technologies are simplified and product design becomes standardized. At this stage mass-production methods set in, systems are consolidated and cost competition starts. *Process innovation* to improve the efficiency of production is the name of the game. Large firms with strong capabilities in production *ánd* marketing *ánd* R&D *ánd* management take over from the small innovative firms, sometimes by absorbing them or sometimes simply by forcing them out of the market. Sometimes small firms are able to survive and may even become big.

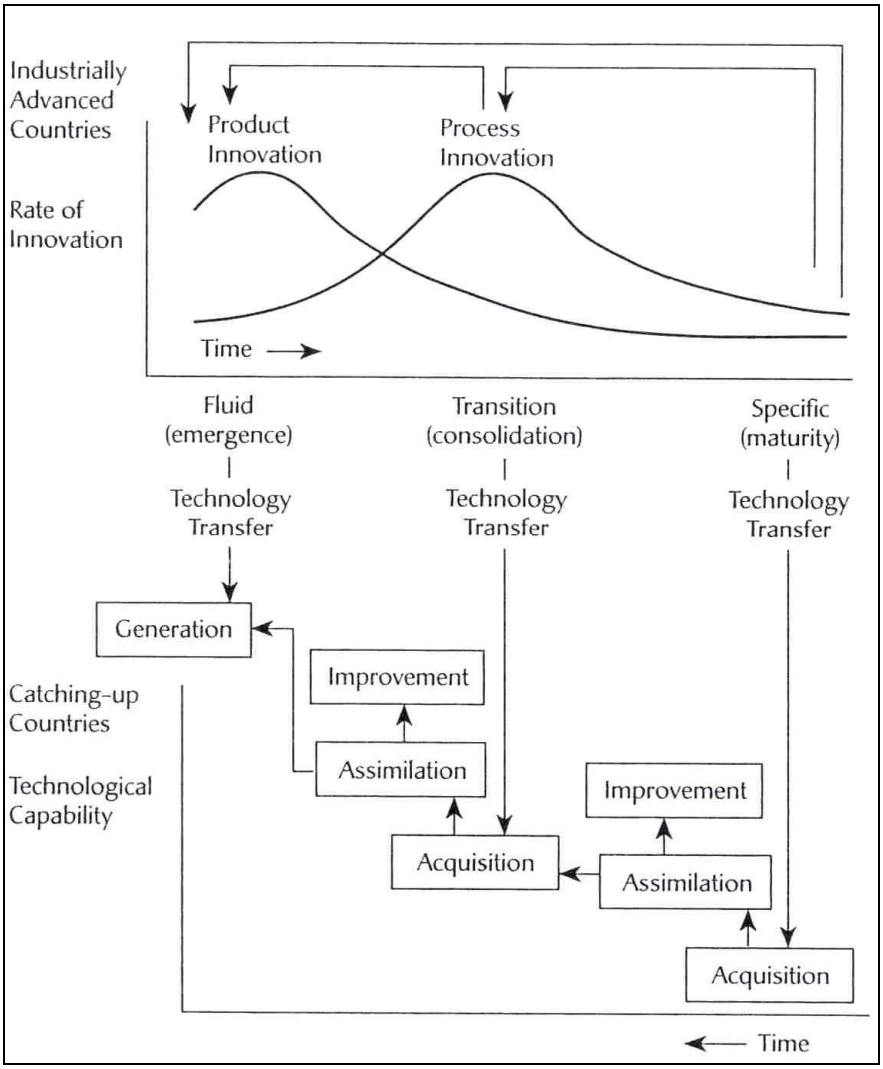
But as all products have a certain lifespan, markets eventually will mature, price competition becomes exhaustive and further improvement soon reaches its limitations. At such a moment companies can decide to step out of the business and try to catch-on to a new cycle, *or* relocate their industry to catching-up countries where production cost are lower. The current large scale migration of traditional manufacturing to Eastern Europe and East Asia is typically an exponent of this strategy.

In this model we see the most radical and innovative activities in the early stage of a product cycle and as time lapses the innovative intensity decreases. However, we should not, of course, rule out the possibility of a regeneration of a mature industry, for instance, through the application of micro-electronic technology, automation techniques or robotization. At this moment in history, migration of production seems

[12] See J.M. Utterback, *Mastering the Dynamics of Innovation*, HBS Press, 1994.

to be the most attractive strategy for survival of mature industries and simultaneously an unique learning opportunity for firms in the receiving countries.

Integration of Two Technological Trajectories



Adopted from Linsu Kim, 1997

Linsu Kim explains how Korean industry has attained technological upgrading and how this similarly applies to the rest of East Asia, including China. Based upon the Abernathy and Utterback analysis of innovation in advanced countries, he developed his three stage model of technological upgrading: first *acquisition* of technology, then *assimilation* of it into local systems and finally further *improvement* of systems and technology to keep ahead of competition.

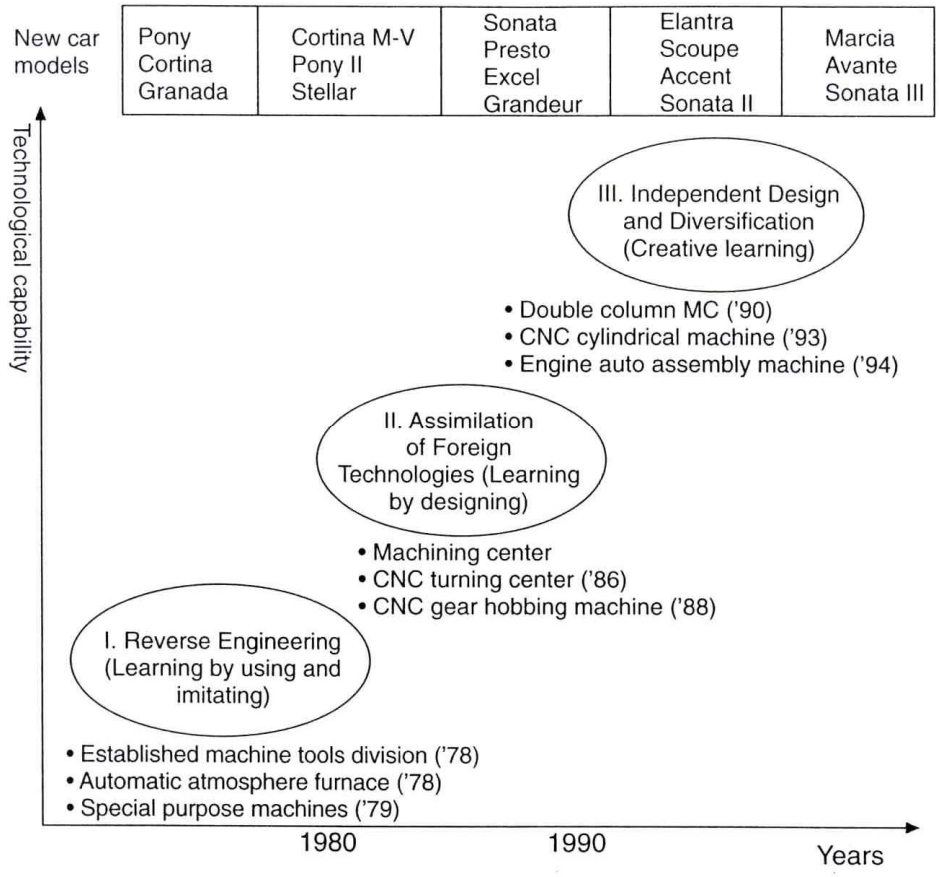
Catching-up countries like Korea acquire mature technology in the early stages of their industrial development. Local entrepreneurs strike a deal with foreign companies and obtain a package of assembly technology, product specifications, production know how and the like. They produce standard products with tested, error-free technology and at low cost. In this stage the *engineering* (E) of production requires the most attention and foreign technical assistance usually comprises the debugging of transferred systems.

Successful implementation of new foreign technology by the local company leads to imitation by local competitors, either through 'reverse engineering', turning a product inside out and copying the parts and components, through theft and espionage or poaching of employees, trained in the foreign technology. In that way the new technologies are quickly diffused.

However, the entry of local competitors to the market stimulates the original company to improve its technological capability and differentiate its product range. Thus, the focus turns to engineering (E) plus (D) product development and product design with an increasing need for support of local technological centers, institutes, universities or assistance from abroad. In the end successful acquisition, assimilation and improvement of foreign technology leads to the next stage where new technology can be generated through own research, the (R) function. At that stage partnerships for joint technology development with advanced industrial companies can be realized and thus the technological trajectories of advanced and catching-up countries are integrated.

A good example is the case of *Hyundai Motor Company*. In the first stage, in the 1980's, Hyundai used the Ford technology to produce the Ford Cortina and Granada, plus a clone called Pony. 'Reverse engineering' was the main source for technological learning but investment in the machine tool division was of strategic importance for further independent development. In stage two the emphasis was on 'learning by designing' and the introduction of high-efficiency production equipment in preparation for mass-production of own designed cars, stage three. By that time the Ford models have disappeared altogether. So in the time span of slightly two decades Hyundai has progressed along the technological trajectory of E + D + R, from plain

reproduction to independent generation of its own cars and car production technology. Similar examples can be found in all other types of industries.[13]



A recent example, involving Japan and China, is the Kawasaki case. On March 3, this year *Kawasaki Heavy Industries* shipped 8 Shinkansen cars to China. Shinkansen is the Japanese version of the high-speed train which operates already in Japan since the Olympics in 1964. These 8 cars are part of a 480 car order which Kawasaki Heavy Industries obtained from the Chinese Railway Department and are intended for speeding up the train service in China on existing rail tracks. The cars are basically state-of-the-art Shinkansen cars currently used in Japan on the Tohoku line, from Tokyo to the north of the country, and cruise at a 200 km per hour speed. KHI and the Chinese Railway department agreed that after receiving 24 cars from Japan, fully

[13] It has been Hyundai's deliberate strategy not to get dependent on one specific source or allow foreign management control. Therefore, she rejected alliances with Ford, Volkswagen, Renault and Alfa Romeo but instead licensed foreign technologies from multiple sources.

assembled, the production will be done in China by a local Chinese firm in Qingdao.[14] For that purpose they set up in December last year a joint engineering firm between two Chinese companies and Kawasaki Heavy Industries (39%) and Itochu, a Japanese trading house, (11%) to assist the technology transfer necessary for this production. A perfect example of technological upgrading, using state of the art foreign technology. Of course, the engineering assistance should lead to mastery over the complicated production of these hi-tech , individually propelled coaches and eventually to an independent designed Chinese version. [15]

Another example of international learning is the Three Gorges Project, the construction of the giant dam in the Yangtze river to generate electricity. In total 26 turbines are required, of which 8 have been installed by Alsthom and 6 by a German-US consortium. The remaining 12 will be modelled after the foreign examples by the Chinese themselves. Or as our Chinese guide said without any qualms: we will just copy them!

The essence is that receiving countries and firms should understand the dynamics of the upgrading process and design their own path of development. Japan has proceeded along that trajectory, South Korea has followed the same path and now we see the process repeated again in China. And thus the technological trajectories of industrially advanced countries are linked to and integrated in the trajectories of the catching-up countries in order for the latter to improve their technological capability. Advanced countries follow the sequence R-D-E, catching-up countries reverse the sequence to E–D–R, until they reach the stage of industrially advanced and close the circle.

Supportive conditions

At face value this pattern of industrial development looks rational and simple but the development process has been facilitated by a number of favourable conditions as well. To start with, Japan, Korea and China have a rich history in arts and crafts which has provided them with an advantage both in material handling and the

[14] □□□□□□ □□

[15] At the same time China exports its own railway technology dating from old Soviet time to Africa, e.g. Angola, in an attempt to improve local infrastructure and unlock the natural resources it needs for its industrial development. Recycling comparative advantage!

organization of production. Secondly, all three countries command a population with strong work ethics and an eagerness to succeed. But this all would be in vain if there were not a deliberate and constant effort to improve the 'absorptive capacity' of the work force through training and education. Exposure to modernity is not enough, assimilation and internalisation should equally receive attention. One might debate the quality and content of education in East Asia but can not deny its high priority in the mind of government, the enterprise and the individual family.

In short, the socio-cultural environment has been very conducive to the national goals of industrial development and modernisation. Add to this the consciously chosen route of macro-economic development through a deliberate industrial policy generating the competitive power to operate in world markets, a science and technology policy more or less in sync with the stage of industrial development, a trade policy stimulating the expansion of domestic industries, a fiscal policy in tune with the development and diffusion of technology and finally a monetary policy in line with the need for stable export receipts, et voila, there we have the main components for successful industrial development. We have seen this recipe applied in Japan, in Korea also in China and although the results have not always been perfect, they were and are remarkable.

Techno-nationalism vs. Techno-globalism

But then, what happens when one is confronted with the frontiers of technological advancement, with the end of *catching-up*? Projected on the framework of Ozawa, what will follow after stage four, innovation-driven industrialisation. Porter posits that we then enter the wealth-driven stage in which quality of life, sustainability of economic activities, care for the environment, health and leisure characterize the nature of human activities.[16] Japan indeed has entered that stage and is facing the question how to satisfy the demands of modern society and simultaneously stay ahead of the surging competition in the region?

At this moment we can observe two distinct tendencies. First of all, Japanese industry deliberately tries to link up to new international technological sources and gradually

[16] Porter, 1990.

moves away from their predominantly techno-nationalistic orientation. Secondly, this strategic adjustment coincides with a policy change towards a regional division of labor and a stronger interlinkage with East Asia. A short elaboration.

Techno-nationalist countries import generic technical information which firms within national borders can share for joint research and development of new products and new technology.[17] Typically, the 'source-information' comes from abroad and serves to enhance industrial development as a matter of national security. Japan is the ultimate example of techno-nationalism but South Korea is a perfect number two with China directly following suit. Imported technology should nurture the local industry and therefore should circulate in the public domain. As they say in Japan: *ichigo nyûyû, nigo kokusanka*, the first time we import, the second time we make it ourselves. All policies, institutions and protective arrangements have been designed to diffuse imported technology. Intellectual property discussions remain for a long time of secondary concern.

Techno-globalists, on the other hand, accept state intervention only to the extent that the state provides the necessary infrastructure, engages in fundamental scientific research and shores up deficiencies in education. They reject collaboration and collusion in industry as something distortive and contra productive. In their mind individual firms are responsible for technical advancement and product innovation. Singapore and Hong Kong are classic examples of techno-globalism where free trade principles stimulated direct foreign investment of the world's leading companies. The ensuing technological spill-over strengthened the local industry and in due course also created an environment for hi-tech manufacturing.

Interestingly, here we are dealing with different choices in technology acquisition strategy within a more or less similar, let us say, Sinic, socio-cultural environment. Apparently, the choice for a nationalist or globalist approach is not predetermined but can be related to size, national interests, development goals or ideology. For instance, in Japan the function of science and technology has been throughout history utilitarian, serving the public purpose. The dominant idea is that R&D should lead to practical

[17] Keller and Samuels, *Crisis and Innovation in Asian Technology*, 2003, pp.10-13.

results which contribute to national welfare and become available in the public domain. During Japan's catching-up period, it was mainly' application-oriented-research'.[18]

Recently, however, we see that Japan starts to actively link up to the international science and technology community. For a number of reasons. First of all, most Japanese top enterprises operate worldwide and thus do not have to depend on the fruits of national-policy-based research. Moreover, as these companies employ increasingly more foreign brains for their operations, at home and abroad, they can no longer adhere to a national-policy-driven-strategy for technological development. Secondly, in order to join international consortia and alliances for hi-tech projects and share the costs and risks of new technology development, explicit capabilities and contributions become the key to entry. The traditional Japanese *keiretsu* networks, once the backbone of national industrial prowess, demonstrate their limitations as source of technological excellence. Apparently, when looking for partners in the hi-tech market specific proprietary knowledge is required.

Take, for instance, Mitsubishi Corporation. This company has extended its function of traditional trading house of the Mitsubishi Group, doing import, export and finance, into becoming an active broker in the hi-tech market. Since the year 2000 Mitsubishi Corporation embarked upon a strategy of R&D+C, *Creating Value through Commercializing New Technology and Intellectual Property* in new strategic hi-tech domains like information technology, nano technology, energy and environment and bio-medical & life sciences. In case of the nano-technology business, MC set up the international joint venture, FIC, Fullerene International Corporation, together with two American partners, RTC, a patent managing company and MER, an application development company, for the further development and commercialization of fullerene, a patented nanotube material for multiple use, e.g. in next generation batteries, for fuel cell technology, nanocristalline diamond and the like, for customers

[18] This Japan has in common with the USA which, until the 1920's, when American industry mastered the art of mass-production, heavily relied on the fruits of European scientific discovery. And even thereafter, the great European scientists, like Einstein, Bohr, Fermi, von Neumann, who all emigrated to the USA, remained the most important source of scientific advancement of the mid 20th century.

like Sony, Toshiba and many other Japanese hi-tech companies. Using its international network, its organizational capacity to operate worldwide and with the aid of its financial means, it linked up all the necessary sources and partners in Japan and abroad for new business development. But Mitsubishi Corporation is not unique; all of its competitors are repeating this pattern in their own way.

Thus, Japanese corporations are moving actively into the international hi-tech market in order to build up technological capabilities and competences to keep abreast of regional competition, of Korea and Taiwan and pretty soon also of China. As company specific, proprietary knowledge has become valuable, it calls for proper protection. Consequently Japan has changed her patent laws step by step and brought her intellectual property policies more in line with American and European practices, and thus facilitated access to the international high-tech business. At the same time Japanese companies have become more restrictive in granting access towards their core technology and even actively defend their intellectual property rights in courts. By Japanese standards, a novelty.

And they have reason to defend their IPR. According to data of the U.S. Patent and Trademark Office, the USPTO, up to 2004 Japan had 591.683 patents registered in the US or 38.6% of all patents of foreign origin. The number of patents awarded by the USPTO to Japanese companies in 2004 alone amounted to 35.350 or 44.2 % of all patents of foreign origin. Although these figures do not indicate the importance of the discovery, invention or innovation, they clearly portray the effort of the Japanese to do their bit in R&D. More revealing probably are the statistics of US patents awarded to individual companies. Of the top 15 performers, 6 companies are Japanese! It is obvious from this list that the strength of Japanese technological advancement is concentrated in electronics and imaging. Which explains the Japanese dominance in these sectors.

Number of Patents awarded by the U.S. Patent and Trademark Office

	All years*		**2004**	
Total patents of US & Foreign origin	3.748.103		164.293	
Subtotal – US Origin	2.216.800		84.271	
Subtotal – Foreign Origin	1.531.303	*(100%)*	80.022	*(100%)*
Japan	591.683	*(38.6%)*	35.350	*(44.2%)*
Germany	276.094	*(18.0%)*	10.779	*(13.5%)*
United Kingdom	116.637	*(7.6%)*	3.450	*(4.3%)*
South Korea	33.865	*(2.2%)*	4.428	*(5.5%)*
The Netherlands	33.251	*(2.1%)*	1.273	*(1.6%)*
China, PRC	2115		404	

*All Years: all patents issued by USPTO up to 2004 (calendar year).

Source: http://www.uspto.gov/go/stats/all_tech.htm#PartA1_1a

US patents awarded to individual companies
All years up to 2004

IBM	42.590
GE	31.293
Canon	***28.202***
Hitachi	***26.369***
Toshiba	***22.888***
NEC	***20.254***
Kodak	19.780
Matsushita	***19.611***
Sony	***17.604***
Motorola	17.541
Siemens	17.095
Philips	16.229
AT&T	16.130
Dupont	15.385

Source: http://www.uspto.gov/go/stats/all_tech.htm#PartA1_1a

Interlinkage with East Asia

This strategic adjustment and active participation in the international hi-tech market coincides with a policy change towards a regional division of labor and a stronger interlinkage with East Asia, in particular China. A short elaboration.

Recently Japan's economic activities with East Asia has grown remarkably. Trade has increased but outward foreign direct investment as well. In 2004 Japan's FDI towards East Asia totalled $ 9 billion. Of that amount $ 4.6 billion was invested in China, an increase of 45.3 % compared with 2003, most notably in the categories iron & steel, electric machinery, transportation equipment and capital goods for mass-manufacturing.[19] Altogether more than 18.000 Japanese companies are active in China but foremost active are Honda, Nissan Motors, Mitsubishi Motors, Matsushita Electric, Sony, Toyota Motors, Epson, etc.[20] But we also see a host of medium and smaller companies try their luck in the promised land, China. According to the MOFA data, more than 75.000 long-stay visa have been granted to Japanese businessmen.

What will be the effect on Chinese industry? The history of Japanese FDI in Southeast Asia might provide some clues.

In the nineteen eighties Japanese enterprises moved off-shore with an amazing speed, spreading technology in a carefully controlled way to the ASEAN economies. This off-shore manufacturing of mainly consumer products involved a substantial amount of technology transfer to local partners but was not free of charge. Like at home, Japanese enterprises overseas operate in networks, and these networks tend to be restrictive if not closed to outsiders. Getting access to them is not easy but once inside, moving out proves even more difficult. The practice of technological licensing and 'adaptive engineering', using exclusively parent company technology, ties the local company to its Japanese mother and prevents it to choose its own path of development.

Japanese corporations have been successful in building up competitive power through these regional production networks but are reluctant in sharing their technology.

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19 Jetro White Paper 2005, p. 18.

20 □□□□□□□□□□)2003 □□ (Chugoku taigai keizai tôkei nenkan, 2003 nenpan) Economic Statistical Yearbook on China , 2003 edition.

Transferring shop floor production technology is of course imperative to improve efficiency and effectiveness, but they are not prepared to unlock the secrets of their advanced technologies to their Asian partners. JETRO even warns Japanese companies to be prudent in sharing proprietary knowledge and protect intellectual property.[21] Organizational interlocking and restricted technology diffusion have been the trademark of Japanese investment abroad and it seems that this pattern is repeated in China again. And yet Japanese industry realizes that there is a limit to protecting one's own technology. Technological upgrading takes place all over Asia. Moreover, China's geographical proximity and cultural affinity might be an advantage to Japan, in the market place China skilfully plays off Japanese against Western industry. Therefore, the idea of off-shore production in East Asia as an externalization of domestic production arrangements will in the end fail as survival strategy.

Instead, regional division of labor has become the new slogan among Japanese enterprises: manufacturing in Asia, where cost advantages prevail, but concentrating at home on strategic, high-value-added activities as research, development, design, marketing and advertisement. And this fits the demographics of the Japanese labor markets as well. Factory work is not popular anymore with a large percentage of highly educated young employees. Instead, clean, specialist jobs are in increasing demand. At the same time we see the re-emergence of highly specialized production in Japan itself, in particular in the precision machine-tool manufacturing, which is mostly the domain of small companies. All the micro-electronic products may be assembled in China, the production of the miniaturized components require a scale of accuracy not yet readily available outside Japan.

In spite of differences in level of development, views, and political sentiments, regional economic integration in Pacific Asia proceeds step by step along economic lines. There has never been an initial concept for integration like in Europe but market forces in the region propel integration and enterprises are the main vehicle to it.[22] East and Southeast Asian governments accommodate these processes with FTA and EPA, free trade agreements and economic partnerships, bi-lateral arrangements, intended to

[21] Jetro White Paper 2005, p. 24.

[22] Ideas about economic integration have been most widely discussed in Japan but always met with suspicion in the region.

maximise the benefits of each others competences and capabilities. It is expected that the coming years this process of integration will widen and deepen and China will be the main catalyst in that process.[23]

But China has a problem. As China is quickly moving ahead, the biggest task is to improve her investment efficiency, i.e. the % economic growth per each % increase in investment. So far improvement of China's productivity has been mainly generated by new technology, directly purchased abroad or introduced by foreign companies. Now it is the turn for local Chinese industries to contribute to productivity improvement. According to Japanese calculations China's investment efficiency amounted to 0.25 per annum from 1991-2004. By comparison: in Japan's hi-growth period from 1956 to 1972, her investment efficiency was 0.34; South Korea's and Taiwan's in the period 1976 to 1990, 0.28 and 0.44 respectively. So success in the end is all about rise in productivity.[24] And the seemingly endless reservoir of cheap labor in China does not help.

In sum, we see many similarities in the pattern of economic and industrial development of Japan, Korea and China. However, there are just as many differences. To name a few: *Place and time in history*. China operates as an *emerging* industrial nation but has a world political clout. Japan has never been in that position. Japan's heydays were during the Cold War under US protection. China has to comply increasingly with the imperatives of global competition. *Scale*. The size of China and her population have an enormous impact on her economy and market. For instance, 10% of China's population (120 million people) are currently already considered serious customers of the French and Italian fashion houses.[25] The Armani's, Dior's and Louis Vuitton's have always handsomely earned in Japan but China will be a bonanza. *Mode of technological upgrading*. Japan and also Korea, chose for endogenous development of technology; China follows a dual route and combines home-grown upgrading with mergers and acquisition of international technology. In electronics upgrading proves to go much faster than in sectors relying on the machine

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23 The 2005 JETRO White Paper on International Trade and FDI proposes to continue technical cooperation and assistance to improve the physical infrastructure, roads, ports, power stations and the like but also invest in human resource development. (p.33)

24 Jetro White Paper on International Trade and Investment 2005, p. 3-4

25 CCTV BizNews, 28 April, 2006.

industry. The Chinese company Lenovo is taking care of your IBM PC but advancement in high-tech machinery, the backbone of industrial production, still depends to a large extent on foreign imports, among others from Japan.

In short, China has embarked upon a deliberate strategy to catch up with the rest of the world, using all sources possible but is set to keep control over the development process, irrespective our complaints, in order to prevent what Nederbragt described nine decades ago as the ‘penetration pacifique’.

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