



**MACQUARIE GRADUATE SCHOOL OF
MANAGEMENT**

MGSM WORKING PAPERS IN MANAGEMENT

**World Industrial Development in the 21st Century:
Catch-up Strategies and the Latecomer Effect**

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**Paper prepared while a Resident at the Rockefeller Foundation Study Center
Villa Serbelloni, Bellagio
September 2004**

**MGSM WP 2004-18
October 2004**

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ISSN 1445-3029 Printed copy
1445-3037 Online copy

MGSM WP 2004-18

*World Industrial Development in the 21st Century:
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Abstract

There can hardly be an issue of greater significance for the world today than that of industrial development, and the harnessing of processes of globalization to drive it forward. Without industrial development, whole regions of the world can be expected to fall increasingly into helpless dependence on outside charity, and problems of lawlessness, civil war, disease and illegal emigration will continue to haunt them. As these problems mount, they will invade and contaminate the richer countries as well. Therefore everyone has a stake in the success of the process of world industrial development. This process started approximately two and a half centuries ago, and it has diffused to become a worldwide process. It is currently engaging the world's two most populous countries, China and India, and much depends on the outcome of this momentous engagement.

This paper treats the issue from a strategic perspective, bringing the concepts and frameworks of business strategy to the analysis of economic development. I argue that a secure platform for strategizing around industrial development can be built on the basis of insights from three streams of literature: the literature on the latecomer in history (associated with Gerschenkron), and the special advantages that may be derived from recognition of the latecomer effect; the literature on latecomer industrial dynamics, and in particular the flying geese patterns of industry transfer from country to country, associated with Akamatsu; and the literature on increasing returns, forward and backward linkages and other aspects of disequilibrium dynamics known as circular and cumulative causation, associated in a development context particularly with Hirschman. I argue that these streams can be brought to bear on the issue of industrial development, along with others such as development blocks and clusters, in a generic notion of collective entrepreneurship. This places the emphasis squarely where it belongs – on the initiatives to be taken by the developing country itself.

The paper reviews the experience and trends in development over the past 25 years, demonstrating the success of East Asia and the relative decline of other regions such as Latin America. It then seeks to draw lessons from this practical experience, in the light of the literature streams identified, namely the capture of latecomer effects, the exploitation of latecomer industrial dynamics, and the capture of increasing returns and disequilibrium effects through collective entrepreneurship. The paper elaborates on this constellation of ideas, based on the success of East Asia, through three categories, namely linkage with extant global commercial and trade structures; leverage of knowledge, technology and market access from these links; and the repeated application of such linkage and leverage strategies in a process of industrial learning. The paper concludes with a set of twelve strategies that may be taken as counterparts to Gerschenkron's hypotheses regarding the sources of success of latecomer development in 19th century Europe, and a set of institutions that may be deemed essential in support of a process of industrial learning, and around which firms and countries can strategize their way out of underdevelopment in the 21st century.

Acknowledgments

This paper was written in the beautiful surroundings of the Rockefeller Foundation Study Center at Villa Serbelloni, Bellagio, in Italy, where I was a visiting scholar during the month of September 2004. This is an incomparable location in which to write and think. I would like to thank the Rockefeller Foundation itself, and the Center's manager, Ms Gianna Celli, for wonderful hospitality. I wish to thank in particular Robert Wade, Sanjaya Lall and Mark Dodgson for their ideas that have fed into this paper and for their support.

This paper has been through several transformations, and the ideas discussed have benefited from feedback secured at UNIDO in Vienna (thanks to Frederic Richard), UNCTAD in Geneva (thanks to Torbjorn Fredriksson); the World Bank in Washington (thanks to Vandana Chandra, Yau Ansu and Al Watkins), the Taiwan Democratic Pacific Assembly conference 2003 (thanks to Rong-I Wu); and the South African competitiveness conference of June 2004 (thanks to Nimrod Zalk).

Colleagues who have contributed their ideas and helped me to clarify the issues include: Alice Amsden; Dong-Sung Cho; Wan-wen Chu; Dieter Ernst; Mike Hobday; Haider Khan; Johnsee Lee; Otto Lin; Bengt-Åke Lundvall; Peter Maskell; Rajah Rasiah; Hubert Schmitz; Philip Toner; An-Chi Tung; Linda Weiss; Poh-Kam Wong; Shahid Yusuf and the late Linsu Kim. I would like to acknowledge the valuable research assistance of Ms Mei-Chih Hu.

1. Introduction

There can hardly be an issue of greater significance for the world today than that of industrial development, and its harnessing of processes of globalization. Without industrial development, whole regions of the world can be expected to fall increasingly into helpless dependence on outside charity, and problems of lawlessness, civil war, disease and illegal emigration will continue to haunt them. As these problems mount, they can be expected to invade and contaminate the richer countries as well. Therefore everyone has a stake in the success of the process of world industrial development. This process started approximately two and a half centuries ago, and it has diffused to become a worldwide process. It is currently engaging the world's two most populous countries, China and India, and much depends on the outcome of this engagement.

It has long seemed to me that “strategizing” is the missing element in the development toolbox. The vehicles of development are firms, and the way that firms deal with the world is through strategy. In this paper I seek a way to bring the notion of strategy into play in development thinking. Strategic issues are posed not as general laws of development, but as responses to the moves of others and as moves that create situations from which advantages can be derived. In the case of developing countries, these “others” are the institutions and firms created by and through the process of globalization (such as multinational corporations and global value chains). The developing countries, and the firms within them, can therefore conceptualize their task as one of engaging with the processes unleashed by globalization, and seeking to benefit from the flows of technology and capital generated.

I draw on three streams of literature (or perhaps four) in elaborating on the strategic priorities that have been found to govern successful industrial development efforts of the past half-century. These are, *first*, the stream of work focusing on the *latecomer* in industrial development and the special kinds of institutional initiatives and strategies called forth when a country's latecomer status is recognized. The point is that latecomers face obvious obstacles but can also exploit their position to secure advantages. This is a stream associated with Gerschenkron.¹ *Second*, there is the stream that examines patterns of latecomer industrial dynamics as taking countries from one industry to another, and from one country to another, as exemplified in Akamatsu's *flying geese* patterns of latecomer industrial dynamics. This stream is also associated with product life cycle theorizing, and latterly with the role of global value chains in providing opportunities for latecomers to break into global production systems.² *Third*, there is the stream that is associated with the major development economists of the 1940s, '50s and '60s, which is concerned with non-equilibrium accounts of economic growth and development, involving increasing returns, capital complementarities, and coordinated investment, and which came to be known as reasoning based on circular and cumulative (C&C) causation rather than equilibrium-based causation – as exemplified in the work of

¹ See Gerschenkron (1952; 1962) and elaborations such as by Sylla and Toniolo (1991) and Fishlow (2003).

² Akamatsu completed his studies of Japanese latecomer industrialization in the 1930s and '40s, but the best statements of his results in English are given in Akamatsu (1961; 1962).

Hirschman, in particular, but also in that of Myrdal, Rosenstein-Rodan, and Kaldor, going back to Kaldor's teacher at the LSE, Allyn Young.³ One considerable mystery of the entire development field is why, after such a brilliant start, developmental C&C theorising declined after the 1960s – just at the time that the development model developed first in Japan, and then in Korea and Taiwan, was starting demonstrably to work along the lines envisaged in the theory. Today, such theoretical reasoning helps us to unravel the reasons for East Asian success, and ties these reasons together in a way not easily achieved by other extant approach in economics – certainly not by rivals such as the now defunct 'stages' theory of Rostow, or the more recent attempts of Krugman et al to bury East Asian success under the slogan 'The myth of Asia's miracle'.⁴

My purpose in this paper is to translate these insights into strategizing objectives for developing countries and the firms within them, bringing the language into the sphere of modern business management. The situation facing countries and firms that arrive late on the industrial scene, is one which combines apparently hopeless drawbacks, difficulties and inadequacies, with advantages that flow precisely from being "late" and not having to go through all the previous steps that incumbents have had to endure. It is convenient to call firms in this position "latecomers" – extending the usage introduced by Gerschenkron to the case of firms.⁵ *Latecomer firms*, like latecomer nations, are able to exploit their late arrival to tap into advanced technologies, rather than having to replicate the entire previous technological trajectory. They can accelerate their uptake and learning efforts utilizing various forms of collaborative processes and state agencies to assist with the process, bypassing some of the *organizational inertia* that holds back their more established competitors. They thus strategize around the possibilities inherent in their latecomer status. The strategic goal of the latecomer is clear: it is to catch up with the advanced firms, and to move as quickly as possible from imitation to innovation. The notion of "latecomer firm" is couched in general terms, but it can be seen to include examples of firms from East Asia, as well as examples from other developing countries, present and future.

In the context of globalization, latecomer firms are faced with new opportunities for linking up with emergent institutions and networks. Global value chains, for example, are being formed by leading firms in the advanced countries, as they seek to cut costs and enhance flexibility through outsourcing. This creates opportunities for latecomers, to link up with these global value chains as suppliers.⁶ To take one of numerous examples, consider the case of Mexican apparel suppliers. Their earlier involvement as subcontractors by leading retail chains or wholesalers in the U.S. was widely seen as exploitative. But in the past decade, partly under the influence of NAFTA, many more activities in the value chain have been sub-contracted, resulting in what is called "full package" subcontracting.⁷ This is seen by scholars as offering Mexican firms much greater scope for enhancing their skills, and enabling them to bid for further work, and to employ people with higher skills levels. Thus the linkage in this case enables the firms to

³ See Hirschman (1958; 1968; 1981) for major statements of his position as it evolved; Myrdal (1957; 1968); Rosenstein-Rodan (1943); Young (1928); Kaldor (1967).

⁴ See Rostow (1959; 1960) and Krugman (1994a; 1994b).

⁵ See Hobday 1995a;-b; Mathews 2001;-2002d, and the discussion below.

⁶ See Humphrey and Schmitz 2000; Ernst and Kim 2002, and the discussion below.

⁷ See Gereffi and Martinez 2000; Bair 2002 and discussion below.

leverage greater involvement and knowledge. Likewise in the case of electronics subcontractors in SEAsia, working with multinationals, what starts as a simple manufacturing subcontracting arrangement (termed Original Equipment Manufacturing, or OEM) can evolve into higher value-adding activities, such as Own Design Manufacturing (ODM) and ultimately into Own Brand Manufacturing (OBM).⁸

The more the global economy becomes interconnected, the more possibilities there are for such *linkage*. And through linkage the latecomer firm can secure more than just a stream of revenue. It can tap its links with more advanced firms to acquire knowledge, technology, and market access – things that would otherwise be beyond the firm's limited resources. It is this capacity to secure more from a relationship than the firm puts in, that we call *leverage*. These sequences of linkage and leverage can be repeated over and over again, until a firm, or collection of firms within an industry, enhance their capabilities and become, potentially, advanced players themselves. The sustained and repeated practice of these strategies by groups of firms can be described as a form of industrial *learning*. My framework for strategizing by latecomers in the context of industrial development turns on the practices of linkage, leverage and learning. Development can be characterized as a process of collective entrepreneurship where opportunities for such linkage, leverage and learning may be seized and put into effect.⁹

Why strategizing?

The process through which countries economically develop is best understood from a dual vantage point. While there has been ample expenditure of effort to understand it as a process of economic causation, there has been much less attention to the strategic dimension. Seen as a process of economic causation, there is an implicit assumption that the process will follow certain laws or regularities, of the kind: If A or B is the case, then development will follow trajectory C. If on the other hand it is a process of business strategizing, then it follows reasoning of the kind: If A or B is the case, then strategy C is likely to lead to one kind of outcome, while strategy D is likely to lead to a different, no less completely described, outcome. The two perspectives are needed to completely account for past successes and to devise successful future strategies.

The greatest writers on development have adopted a 'strategizing' perspective, sometimes without naming it as such. The Japanese grand-master of development processes in East Asia, Kaname Akamatsu, saw the process as fundamentally one involving strategic calculations, despite his developing highly influential 'flying geese' patterns for the overall development trajectory. He noted at the outset of his 1962 article expounding his approach that:

'It is impossible to study the economic growth of the developing countries in modern times without considering the mutual interactions between these economies and those of the advanced countries. When Western European Capitalism began to expand its production and trade on a world-wide scale, it awakened the less-developed areas of the world to modern economic development.'^(1962: 3)

⁸ See Hobday (2003) for a recent discussion of these contracting strategies in a Gerschenkronian setting.

⁹ See the UNIDO report *Industrial Development 2002/03* for an application of these ideas.

Thus Akamatsu at the outset sees the options available to the latecomer countries as being shaped and constrained by the strategies pursued by the advanced countries, or in particular by the firms in these advanced countries.

Likewise Gerschenkron in his 1962 article, 'Economic backwardness in historical perspective' – probably the most influential article on development written in the past half-century – links his propositions concerning latecomer processes to the degree of backwardness they find themselves in, and to the strategies they encounter in the wider world. Gerschenkron's basic position is that latecomers have potential advantages and they must search to find them – otherwise their efforts will be in vain. His set of propositions – such as the hypothesis that the more backward the country, the greater will be its use of substitute institutional forms to make up for missing ingredients -- may be seen as the posing of strategic options as to how latecomers might make best use of their situation.

And Albert Hirschman, the great exponent of the possibilities of development (provided neoclassical idiocies are avoided) actually entitled his crowning literary achievement as *Strategy of Economic Development* (1958). In this book Hirschman emphasized the point that development cannot be viewed as an equilibrium-based, balanced process, with outputs at one stage neatly acting as inputs for the next. Rather, the process is essentially unbalanced, driven by price distortions and input-output distortions that may arise spontaneously but can be created more efficiently by purposeful intervention. His most famous theoretical innovation is the notion of forward and backward linkages, still one of the prime means of evaluating the strategic significance of a development program.¹⁰

We shall develop a general approach to the process of industrial development that brings out these strategic dimensions of the process, emphasizing the choices that present themselves and the constraints that govern these choices. Strategizing is open-ended, as opposed to the closed-loop explanations of economics. The exposition will be grounded in the three great contributions of Gerschenkron, Akamatsu and Hirschman, bringing them up to date and placing them in an entrepreneurial and strategic intellectual. This is not to say that we do not want to know that if A and B are the conditions, then strategy C rather than D is likely to lead to the desired outcome. We certainly want to have a storehouse of such insights. But we do not want to be diverted by discussions over their universality; it is their conditionality that most interests us.

My foils in this exposition are two further theorists of development, one from the past (and thankfully buried) and one from our own Internet-based era: Walt Whitman Rostow (1960) and Paul Krugman (1994a; 1994b). Rostow's 'stages of growth' approach posed industrial development as a process that leads automatically through a series of stages, the second of which is 'take-off' -- as if each country awaits development like so many aircraft lined up on an airport tarmac. Such a conception is patently at odds with both the historical facts of development as well as with the strategic complexities of navigating a country's passage (to switch to a nautical metaphor!) through the process. Rostow was buried by Gerschenkron, as we shall see.

¹⁰ In the recent period, Amsden (1989) has captured the same idea of unbalanced growth in her notion that successful development involves 'getting prices wrong' – in the sense that under-pricing steel inputs, for example, would be needed if it is desired to kick-start an automobile industry.

Krugman is an entirely different matter. Here is one of this generation's most brilliant economists, and at the time of writing, a highly influential columnist for *The New York Times*. His insights are always to be treasured, but he is also quirky and sometimes infuriating – as he himself likes to boast. ('An article has not achieved its effect if it does not infuriate someone!' he says.) But on industrial development he is especially infuriating. First of all, he has belittled the East Asian experience, seeking to discredit it as nothing other than the application of higher levels of inputs in order to achieve a higher level of output. But this comparative static growth accounting misses all the essential dynamic and strategic inputs that carry a country from one point in time to the next – and in particular mischaracterizes achievements such as higher levels of skills of the workforce as mere input expansion. But Krugman has also entered the fray at the theoretical level by belittling development economics itself, which he characterizes as 'not so much wrong as incomprehensible' and singles out Hirschman and his 1958 book, *The Strategy of Development* for scathing treatment – on the quite spurious grounds that apparently, in Krugman's eyes, Hirschman and other development economists did not try to adapt their insights to neoclassical economic assumptions and modelling efforts. Krugman is infuriating in this endeavor precisely because he manages to convey the message that the development task is actually very easy – a piece of cake, just involving the application of extra capital and labor inputs – and that development economics 'failed' because it didn't build simple models illustrating this.

My take on these issues could not be more different. I shall argue that development is the most challenging and difficult task facing us on the planet at the beginning of the 21st century, and that the advanced world would do well to set its best minds to work on the issue. Moreover we have a development model that works – namely the East Asian experience, which has demonstrated how sophisticated strategy combined with strong state guidance can lift a country from poverty to the brink of greatness within a generation. *Pace* Krugman, there is an enormous amount to be learnt from the practical achievements of the East Asians, and a great deal of work to be accomplished in fitting their achievements into parsimonious theoretical frameworks. Moreover, the East Asian approach -- exemplified by the post-war success of first Japan, and then of Taiwan and Korea, with Singapore a smaller variant – worked in the 1960s, 1970s and 1980s when the wider world was different. Now we have the WTO, and TRIMS and TRIPS.¹¹ So the East Asian strategies have to be reinvented and generalized for this new era. It is a matter of extracting their strategic essence, and reformulating it for the new circumstances in which we find ourselves. Krugman may believe that this is an easy task. If only he were right!

In this paper I first briefly review the issue as to why world industrial development is such an important and urgent issue (drawing for example on such classics as the Harvard Address of US Secretary of State, George Marshall, in June 1947) and then review the main data and trends in development from the past 25 years, looking for the successes and failures as guide to the strategies likely to work today. I then get down to the task of discussing the main theoretical contributions to the strategizing question,

¹¹ The World Trade Organization (WTO) was launched in 1995, as successor to the General Agreement on tariffs and Trade. It was accompanied by the Trade-Related Investment Measures (TRIMS) agreement and the Trade-Related Intellectual Property rights (TRIPS) agreement. As a package, they provide the rules-based setting for outward-oriented development strategies today.

drawing on the three streams mentioned above, and framing them in such a way that they can be implemented in strategic fashion by developing countries today. This set of strategies is elaborated as an exercise in collective entrepreneurship, involving initiatives in linking to existing commercial and trade trends, leveraging latecomer benefits from such links, and applying the process over and over again through industrial learning. The threads are then drawn together in a set of twelve strategies that can be taken as counterparts to the six or seven hypotheses formulated by Gerschenkron to account for latecomer success in 19th century Europe, and the exposition closes with a summary of the various institutional innovations observed in East Asian practice and that can be characterized as amounting to a system of national economic learning. My most basic proposition is that such a system is the necessary vehicle for successful latecomer industrial development.

2. Why world industrial development is so important

There can hardly be a more important issue for the social sciences in the first decade of the 21st century than that of bringing the under-developed parts of the world into the orbit of the world industrial system. This can be expected to have pay-offs in almost every sphere of social and economic life – from reducing the horrors of poverty and hunger, to solving problems of public health and disease, of illegal immigration, to resolving conflicts, civil wars and terrorism. All of these issues stem at least in part from absence of development and from the resentment that this breeds. Yet there can scarcely be a topic in the social sciences that has received less attention over the past couple of decades than the strategies through which countries might pull themselves up the developmental ladder. I sometimes wonder whether this would be the case had it been the Latin Americans who had succeeded in the development quest, rather than the East Asians.

Notwithstanding the sources of success, everyone has a stake in the success of the process of world industrial development. While some institutions such as the World Bank claim publicly that global inequalities are declining, the evidence is controversial.¹² Chart 1 shows the shocking state of inequalities in the world today, through some of the social and economic indicators of poverty. These extremes of poverty and wealth in the world today are so obviously unsustainable (Wade 2001). From this perspective, Hernando de Soto is surely correct to identify industrial development as the only long-term feasible defence against terrorism.¹³

Chart 1 about here

Every major statement that launches a major new development initiative starts with recognition of these points. George C. Marshall's brief Harvard Address on 5 June 1947, which launched the Marshall Plan for the recovery of Europe, was couched in exactly

¹² See Wade (2004) for a comprehensive discussion of the World Bank sources of data and statistical techniques. He argues that the Bank currently places emphasis on poverty reduction at the expense of development.

¹³ See De Soto (2002) and his companion book, De Soto (2001/2003) on the need to transform institutional impediments to forming businesses in the developing world and liberating the power of capital.

these terms, noting that a generous approach to the problems of others would redound to the benefit of the US economy. As he put it:

The truth of the matter is that Europe's requirements for the next three or four years of foreign food and other essential products – principally from America – are so much greater than her present ability to pay that she must have substantial additional help or face economic, social and political deterioration of a very grave character. The remedy lies in breaking the vicious circle and restoring the confidence of the European people in the economic future of their own countries and of Europe as a whole... Aside from the demoralizing effect on the world at large and the possibilities of disturbances arising as a result of the desperation of the people concerned, the consequences to the economy of the United States should be apparent to all.¹⁴

Almost exactly the same kinds of words are being spoken today in the present Millennial Development Goals of the United Nations, and in recent discussions of the plight of Africa, caught in a poverty trap from which there appears to be no escape short of a new kind of 'Marshall Plan' that will lift the continent out of its misery – to the benefit of the world as a whole, as well as of Africa.¹⁵

Industrial development is thus a pressing issue, for both the countries that have developed, and for those that have yet to achieve it. The case can be made that the issue of development presents itself not just as a moral imperative, but as an imperative for the future of the planet. Things just cannot be allowed to go in the same distorted and polarized fashion. Hence the development challenge has to be confronted as one *that can and must be met*. But to start with, we must be clear about words: is it development or growth that laggard countries should be targeting?

Industrial development or growth?

Mason and Asher (1973), in their magisterial review of the World Bank in its first 25 years of operation, ruminated over whether 'development' could be equated with 'growth' – and amazingly enough, concluded that the two hardly differed at all, and that it was pointless trying to separate them conceptually.¹⁶ While their reasoning may not be faulted from the perspective of a narrow conception of World Bank responsibilities, as regards the tasks of development this is a disastrous approach. It takes the emphasis completely away from the tasks of industry building, which remain at the core of the

¹⁴ Marshall 1947. Available at: www.fordham.edu/halsall/mod/1947marshallplan1.html

¹⁵ See the stirring paper by Sachs et al (2004) on the necessity to lift Africa out of its poverty trap.

¹⁶ The Bank's technical assistance to planning bodies assumes that the objective of the exercise is to increase the rate of growth. And the Bank's attempts to use its leverage to influence domestic policies of borrowing countries make the same assumption. Insofar as income redistribution, effects on employment, urbanization, or other factors that may affect political stability are taken into account, they are, and should be, regarded as inputs related to an output of GNP rather than outputs representing an aspect of development not embraced within the meaning of GNP. This may be an inadequate concept of economic development, but it seems to be the only one appropriate to the Bank and perhaps the only generalized concept to which, for the time being, definite meaning can be attached. (1973: 487)

development experience, and places it on an abstract and general notion of ‘growth’ in a macroeconomic category.

To show how such thinking became entrenched at the Bank, consider a subsequent volume reviewing World Bank experience over the course of the next decade. In this review, Baum and Tolbert (1985) listed ‘industry’ as just one goal of development, along with others such as agriculture, housing and transport, and ‘industrial goals’ alongside goals such as good sanitation, water supply and so on. Again the point is that this completely misses the point that development is all about industrialization – and it starts with the industrialization of agriculture, and of transport systems, and of housing systems, and of course with the building of an industrial manufacturing sector (as opposed to a handicrafts sector). All of these facets of a nation’s economic activities need to be industrialized, through the building of modern systems with modern firms at their core. No wonder the World Bank has been such a poor advisor to developing countries!

The reality is that ‘growth’ is a macroeconomic concept and can be analyzed purely at a macro-level without ever getting down to the grubby reality of advocating this or that industry, this or that technology, or any of the other micro issues that are inescapable in any real industrialization project. And as for placing ‘industrialization’ on the same level as ‘agriculture’ or ‘transport’ – this is to miss entirely the point that industrialization as a process industrializes manufacturing, and it industrializes agriculture, and transport, and – eventually – every aspect of life in the developing country.

So for developing countries in the 21st century, let there be no doubt about the goals. These are to build modern, industrial systems that can sustain manufacturing activities (or processing industries that add value to raw materials) and the firms that embody and contribute to these industrial systems. For the difference between ‘developed’ and ‘undeveloped’ countries lies not just in the absence in the latter of ‘industrial systems’ but in the absence of industrial firms that are capable of allowing local entrepreneurs to raise finance for investment, to build plant and import equipment, to produce output and engage in export activities, to train their employees and to upgrade their technology. The local effort consists in building such firms; they are not created automatically.

Seen from the perspective of the world system as a whole, *the process of industrialization in the undeveloped country is a process of diffusion of modern management and technological systems to the new country*; it is a process of enfolding the new country into these existing systems. Seen from the perspective of the newly developing country, the process is a daunting one of tackling for itself all the aspects of running a business that were previously taken care of by others – whether they be colonial masters, or distant multinationals, or even just local branches of these multinationals.

This is the duality that runs through the entire development experience – between on the one hand the prior existence of a complex world-system of firms, technologies, practices and institutions that any newly developing country can draw on, and on the other the need for local effort to build the firms and institutions that enable these external sources of knowledge to be absorbed without destroying the local efforts. Too much emphasis placed on the diffusion process itself and its origins in the advanced world, results in insufficient effort being made in the developing country itself to refashion its

institutions to make them fit for the rigours of industrial development. And too much emphasis placed on the developing country alone, results in an ‘import substitution’ kind of approach, which leads into blind alleys, or worse, into autarky.

With this in mind, we need to examine the experience of the past 25 years, to see clearly what strategies have worked and which ones have not.

3. Experience of past 25 years: main trends

From whichever angle we look at the data and trends over the past quarter century, the outstanding feature is the rise of East Asia and the relative decline of Latin America. China has made a grand appearance on the world stage, now followed by India. These are the dominant trends in the world development picture today.

Chart 2 about here

Chart 2 shows the shares of global manufacturing value-added, by region of the developing world. Here we find a striking pattern, in that East Asian countries have pulled away from the rest, raising their share of global manufacturing value added (MVA) from 4% in 1980 to 7% in 1990 and to nearly 14% in 2000 – whereas the Latin American and Caribbean countries have suffered the inverse pattern, falling from a share of just over 6% in 1980 down to 5% in 1990 and just under 5% in 2000. Meanwhile the countries of South Asia have ever-so slowly raised their share, to a level still beneath 2%, while the Middle East and North Africa have done little better, raising their share to just over 2%. It is the countries of Sub-Saharan Africa that have done worst, never rising above 1% of global MVA over the past 20 years. *This is a catastrophic result for sub-Saharan Africa*, and for the world, because it means that this region is almost totally disengaged from the circuits of capital, investment and trade that link other sectors of the world economy.¹⁷

We may hypothesize that the countries that have done best over the past 20 years are those that have mastered the intricacies of medium- and high-tech manufacturing industry. The way in which this sector of the manufacturing economy has come to dominate, across all regions, is shown in Chart 3.

Chart 3 about here

This chart reveals how the share of manufactured products in world exports has been rising relentlessly, and in particular how high-tech exports have outranked both medium-tech and low-tech exports over the past quarter century, from 1976 to 2000. Note how high-tech exports had less than 10% of the world share in 1976, but rose relentlessly to overtake both medium- and low-tech exports by the early 1990s, and by the year 2000 occupied the highest share, at just over 20%.

¹⁷ Sachs et al (2004) have recently produced a magisterial report on Africa’s plight, arguing for a huge new push from the world donor community to lift Africa out of its poverty trap, and get it on a development trajectory. This strategy uncannily reproduces that spelt out in 1943 for Eastern and South-Eastern Europe, by Rosenstein-Rodan, as discussed below.

But how have groups of countries compared within this overall pattern? Chart 4 shows in even more graphic form just how great has been the disparity between these parts of the developing world. It reveals that in the 1970s, the East Asian countries (Korea, Taiwan mainly) still lagged behind the Latin American countries in terms of their share of world value-added in medium- and high-technology manufactures – the principal drivers of development. But in the late 1970s and early 1980s they rapidly caught up with and overtook the Latin American countries – mainly through the agency of the electronics industry, which was seen in East Asia as the passport to the future, but was overlooked in Latin America, or pursued, as in the Brazilian efforts with computers, in clumsy ways.

Chart 4 about here

The outstanding conclusion from these data is that East Asian countries were doing something right during the past 25 years, and Latin American countries were by contrast falling behind. There are powerful lessons, then, to be learned by all developing countries today from the East Asian experience. If we take just one of these East Asian countries, such as Taiwan, and look at its experience over the past half-century, we see some of the features that have propelled it to the top of the development experience, and brought the country to the cusp of fully developed status. The emphasis in all these countries has been on manufacturing, and on efforts to constantly upgrade its technological capacities. Chart 5 shows how in Taiwan these efforts led to the industrialization of agriculture, and its reduction as major employer, and the rise of manufacturing as proportion of total value-added up to a maximum of 35% in the mid-1980s.

Chart 5 about here

Chart 6 shows how Taiwan's manufacturing sector has seen relentless shift in structure, from an early emphasis on manufacture of food, textiles and related products (accounting for 40% of value-added at the beginning of the 1980s), to metals and machining industries (which rose from around 20% of output at the beginning of the 1980s and reached nearly 30% by the early 1990s), to electronics, which has been the engine of manufacturing in Taiwan over the past 20 years – rising from just over 10% of output in 1981 to 35% by 2001 – an astonishing change in industrial structure in a country, and one which can be taken to be synonymous with industrial development. Chart 6 shows how the emphasis in electronics has shifted from consumer electronics in the 1970s to PCs and IT products in the early 1980s, to chips and integrated circuits in the 1990s, culminating in recent products like notebook computers and LCD screens.

Chart 6 about here

How then do we square this evidence of the data with the theoretical frameworks developed in the literature on development? It is to this task, the principal goal of this essay, that we now turn.

4. The intellectual roots of latecomer industrial development

Industrial development pursued through latecomer strategies, has deep intellectual roots. There was a ‘golden period’ of development economics, in the 1940s and 1950s extending into the 1960s – and then strangely enough the theoretical front goes quiet while the practical front hots up, and country after country in East Asia breaks through the development barrier. Their successes have of course given rise to fierce intellectual arguments, over whether it was state-led or market-led development, until the World Bank 1993 report, *The East Asian Miracle*, called a kind of truce, declaring that both accounts were needed to make sense of East Asian success. But the insights from these debates, and in particular the ‘revisionist’ accounts of East Asian success, starting with Chalmers Johnson and his account of MITI and the Japanese Miracle, and including Amsden on Korea and Wade on Taiwan, provided a plausible institutional account of the process, but one that remained aloof from mainstream economic theorizing.¹⁸ The same observation can be made with even greater force about the debates over the more recent Millennium Development Goals of the United Nations, which are articulated without any apparent link being made to the theoretical issues of how the *process of development* itself might be advanced.¹⁹

I wish to connect with three important strands of these earlier intellectual endeavors, to make the case that they provide a sound basis for current strategizing around development goals. These are, first, the debate over a ‘latecomer effect’ that Gerschenkron identified as being a material factor in the success of countries that industrialized ‘late’ – that is, after the leaders, and in ways through which they could learn from the leaders’ success. This was opposed in the 1960s to the static ‘stages’ theory advanced by Rostow – a debate that was decisively won by Gerschenkron. I argue that all successful development strategies today start with the recognition of a latecomer effect, and are concerned with finding ways to turn this effect into a source of advantage. Gerschenkron captured his insights in a series of six or seven hypotheses which I here interpret as statements of strategy that applied in the conditions of the 19th century. One of my tasks in this essay is to formulate a comparable set of strategies for latecomers that might apply in the conditions of the 21st century.

Second, there is the debate over latecomer industrial dynamics in an international setting, which is informed by the vision of the Japanese grand-master of development, Kaname Akamatsu. It was Akamatsu who studied Japanese industrial patterns in the 1930s and ‘40s with a view to capturing the latecomer international dimensions, and formulated the wonderful metaphor of ‘flying geese’ to capture the upward and

¹⁸ See Johnson (1982); Amsden (1989); Wade (1990) recently reissued and updated, Wade (2004). Alice Amsden drew on notions of increasing returns in her studies of the Taiwan machine tool industry, and used the phrase ‘cumulative causation’ from Myrdal when arguing that it is essential ‘to try to understand the cumulative causation process involving fast economic growth in newly industrialising economies’ (1981: 282). Wade (1990) claimed to draw on a development economics tradition including Nurkse, Rosenstein-Rodan, Myrdal, Hirschman and Kaldor, all of whom had placed more emphasis on ‘capital formation’ than on equilibrium processes of ‘efficient resource allocation’. But there seems to be no further engagement than this. See Toner (2003) for an illuminating discussion.

¹⁹ This might change as the reports of the UN Millennium project become available. A draft was being circulated at the time this paper was written, in September 2004. See www.unmillenniumproject.org

downward trends of industries, as they move from country to country according to competitive advantages. This vision can be combined with product life cycle insights, and brought up to date with global value chain insights, to provide a second, essential strand to current strategy formulation.

Third, there is debate over the process of development itself, seen not from the perspective of simplistic, comparative static neoclassical models, but from the disequilibrium framework of circular and cumulative causation, with its emphasis on the capture of increasing returns, the exploiting of complementarities, and the full force of path dependence. As a general approach to how the economy works, the C&C framework is associated with Allyn Young (1928) and through a range of contributors up to Nicholas Kaldor (1966) – with again a paradoxical gap in the intellectual record waiting to be filled. But as an appropriate framework for understanding development, it is associated with the grand contributions of Rodan-Rosenstein (1943), Gunnar Myrdal (1957) and above all with Albert Hirschman (1958). It is Hirschman's 1958 book, *Strategy of Economic Development*, that I choose as representative of this school of thought – another essential strand for understanding the success of East Asian industrial development, and thus for any further development successes of the 21st century.

Of the many economists who have opposed these intellectual currents, I choose Paul Krugman as a recent and prominent opponent. I intend to show that Krugman's pessimistic conclusions are not well-founded and attack the wrong targets – and that the foundations of the strategies of industrial development remain intact.

Gerschenkron vs. Rostow: The latecomer effect

The idea of latecomer strategy can be traced back to the work of the historian Alexander Gerschenkron (1904-1978), who first formulated clearly the notion of “latecomer development” based on his studies of 19th century European industrial development, involving the successful case of Germany and the unsuccessful case of Russia.

Gerschenkron was a Russian who survived both the Bolshevik revolution and the Nazi counter-revolution, and ended up in the United States in 1938, where he went on to take a chair at Harvard. It was here that he developed the idea with which he will always be associated, namely that there is a pattern to economic history, associated with the degree to which countries are ‘backward’ when they start to develop – or as we would put it now, the degree to which they can exploit the ‘latecomer effect’.²⁰

Gerschenkron made it very clear that development is a strategic issue, where strategies of latecomers need to vary from those pursued by the early leaders. The latecomers need to make up for lost time and for their lack of resources, but they have certain advantages as latecomers, such as having access to the latest versions of technology, and can utilize new institutions for the harnessing of capital and technology. These institutions were evident in the case of Germany in the 19th century, in the form of a general industrial bank (the Deutsche Bank) and new institutions of technical and scientific training. In the 20th century the same institutional inventiveness, and strategic flexibility, is evident in the case of Japan, through such institutions as MITI, and in the

²⁰ Gerschenkron (1952) was the first statement, in a conference paper; later elaborated in the 1962 essay that appears in the collection *Economic Backwardness in Historical Perspective*.

post-war period, in the case of the East Asian “Tiger” economies.²¹ Now the baton has passed to China and India, both of which, at the beginning of the 21st century, are the world’s leading candidates for industrial development.²² They too face the challenge of inventing novel “latecomer” institutions, and formulating strategies for development based on ongoing processes within the global economy.

In a review of Gerschenkron’s work, by one of his foremost students, Fishlow (2003) summarizes Gerschenkron’s approach as follows.

‘The central notion is the positive role of relative economic backwardness in inducing systematic substitution for supposed prerequisites for industrial growth. State intervention could, and did, compensate for the inadequate supplies of capital, skilled labor, entrepreneurship and technological capacity encountered in follower countries seeking to modernize. England, the locus of the Industrial Revolution, could advance with free market guidance along the lines of Adam Smith. France, beginning later, would need greater intervention to compensate for its limitations. In Germany, the key innovation would be the formation of large banks to provide access to needed capital for industrialization, even as greater Russian backwardness required a larger and more direct state compensatory role. (2003: 3)

Indeed Gerschenkron has been well served by his students, who have risen to important academic positions, and continue to apply his ideas in creative ways. For example, Richard Sylla and Gianni Toniolo (1991) surveyed the field of 19th century European industrialization, and noted the significance of G’s approach:

Gerschenkron’s broad definition of backwardness was meant to supply an explanatory variable in the literal meaning of the word. A backward country not only was less endowed with such factors of production as skilled labour, up-to-date technology, infrastructure and financial capital but was likely to be burdened with a ruling class whose very interests would be at least partially jeopardized by successful industrialization. Such a country was likely to encounter many obstacles on its way to industrial progress. (1991: 7)

Sylla and Toniolo noted, with Gerschenkron, how elements in such a ruling class might look for ‘short cuts’ along the road of industrialization, and might utilize what G. called special ‘institutional tools’ to facilitate such short cuts – that might include ‘a financial innovation such as the “mixed bank” or the very power of the state, according to the country’s degree of backwardness’ (1991: 7).

For this is the power of the Gerschenkronian approach: it invites concentration on the issues that matter most, namely the building of new institutions and the pursuit of fresh strategies, depending on the situation at the time that the country is attempting (or re-attempting) its development push. It is the institutions and the strategies that matter most, and how they are used to best effect to overcome latecomer disadvantages and take

²¹ See Amsden 2001; Amsden and Chu 2002; Wade 1990; Lall 1996; Lall and Urata (2002).

²² On India, see Degnbol-Martinussen 2001; on China see for example Lu 2000.

advantage of whatever latecomer advantages there might be at the particular time that development is being attempted.

With each successive entry by a latecomer country into the ranks of the developed world, the barriers to entry encountered would change, and a different situation would be bequeathed to those coming after. They would have to devise fresh strategies to get around the freshly created barriers.²³

Rostow: Development through replication of identical stages

The ‘negative’ counter-position for this discussion is Walt Whitman Rostow, with his simplistic (but influential) ‘stages of growth’ scenario.²⁴ Recall that in 1960 Rostow shook the world with his ‘non-Communist manifesto’ that argued that all countries would move through his five ‘stages’ of growth, each one successively creating the platform for the next. He argued that certain ‘preconditions’ were needed for ‘take-off’ to occur – and that this would be a quasi-automatic process, with each country replicating the experience of its predecessors. The five stages, to be followed apparently in deterministic sequence, with no allowance made for any learning effects as the torch was to be passed from country to country, were:

1. traditional society
2. transitional stage (preconditions for take-off)
3. take-off
4. drive to maturity; and
5. high mass consumption.

Apart from its superficial plausibility, this is incorrect and misleading in almost every particular. First thing to note is that Rostow used the term ‘growth’ rather than development – thereby confusing the issue of ends and means at the outset. Then he implicitly assumed that successive countries would need the same ‘pre-conditions’ as their predecessors – which is simply ahistorical. But worst of all, he argued that the process would proceed through a series of ‘stages’ with each one succeeding the other in a grand sequence – without apparent need for strategy, for careful analysis, for experimentation. When we look carefully at the successful cases, such as the USA and Germany in the 19th century as large cases, or at Denmark and Switzerland in the 19th century as smaller cases, or at Japan in the 20th century, then we find in each successful case that there is a distinctive strategy being pursued; that there is great creativity in the institutions that are built; that there are different strategies pursued for engaging with the wider, developed world – depending on the strategies being put in place by the incumbents within that wider world.

While Rostow could point to certain irreplaceable features of every process of development – such as, as he put it, a shift in agriculture during the transitional stage from subsistence to a market orientation, and the beginnings of transportation and other

²³ Hobday (2003) puts the matter thus: ‘Gerschenkron argued that there were no automatic stages of development and that countries did not and *could not* pass through the same stages of development that others had passed through before them, precisely *because* others had passed through them.’ (2003: 294) (Emphasis in original)

²⁴ Rostow (1959) is the scholarly exposition; Rostow (1960) is the popularisation. For a decisive rebuttal of Rostow’s work as one of the ‘fabled’ of growth, see Abramovitz and David (1973).

social infrastructure, and the expansion of exports needed to finance the increased capital imports that would fuel the take-off – all these are presented in an ahistorical and astrategic manner. The difficulties that are involved in achieving these ‘preconditions’ and the strategies needed to actually effect a ‘takeoff’ are sidestepped, and in their place is the semi-automatic sequence of five steps.²⁵

But along with his emphasis on the creativity needed in devising substitutes for missing institutions, Gerschenkron emphasized the key to a successful latecomer strategy, which was to identify and take advantage of the sources of *latecomer advantage*. If there were no such sources, then development would indeed be a hopeless task. But Gerschenkron showed – for all time – that the process is not hopeless, precisely because the sources of latecomer advantage keep renewing themselves.²⁶

Gerschenkronian hypotheses

Gerschenkron elaborated on his fundamental thesis with a series of propositions, formulated with respect to the European experience of the 19th century, but obviously with an eye to their more general applicability. Sylla and Toniolo (1991) listed seven of these, referring to patterns of European industrialization. Among them are:

- ‘1. The more backward the country, the more rapid will be its industrialization, i.e. the faster will be its rate of growth of industrial production.
2. The more backward the country, the greater will be its stress on producer (capital) goods as compared with consumer goods.
3. The more backward the country, the larger will be the typical scale of plant and firm, and the greater will be the emphasis on latest, up-to-date technology.
4. The more backward the country, the greater will be the pressure on the consumption levels of the population; consumption levels will be squeezed to promote a high rate of capital formation.
5. The more backward the country, the less will be the role of the agricultural sector as a market for industrial goods and as a source of rising productivity in its own right.
6. The more backward the country, the more active will be the role of special institutional factors – great banks as in Germany, the government ministry of finance as in Russia – in supplying capital and promoting industrialization.

²⁵ The contrast with Rostow was made explicit by Gerschenkron: ‘... this interpretation differs essentially from the various efforts in “stage making”, the common feature of which was the assumption that all economies were supposed regularly to pass through the same individual stages as they moved along the road of economic progress ... Thus, Rostow was at pains to assert that the process of industrialization repeated itself from country to country lumbering through his pentametric rhythm. (1962: 355)

²⁶ There is scant evidence as yet supporting the Gerschenkronian proposition that latecomer advantage enables developing countries to accelerate the diffusion of technologies from the advanced countries, although anecdotal evidence from East Asia is abundant – as discussed in my own Tiger technology (Mathews and Cho 2000). Recent work from two economic geographers in the UK, Perkins and Neumayer (2004), provides some interesting empirical support for the proposition in terms of three different technologies: continuous steel casting, shuttleless textile weaving looms, and digital mainline telephones.

7. The more backward the country, the more important will be ideologies of industrialization in the shaping of policies and events.’ (1991: 5)

Now Gerschenkron has fallen on hard times in the last few years, precisely because of the historically specific character of these hypotheses. In stimulating further research in economic history (as intended by Gerschenkron) they have also thrown up evidence that calls them into question. But the most severe criticism comes from the experiences of the 20th century itself. Interestingly enough Hirschman (1968) also listed these hypotheses (or at least the first six of them) and contrasted their statements with the experience as he saw it of the ‘late’ latecomers of the 20th century rather than the earlier ‘latecomers’ of the 19th century. As Hirschman saw it, ‘late’ latecomers in Latin America in the 20th century faced different conditions from those faced by European latecomer countries in the 19th century, when there were fewer competitors and the capitalist world as a whole was less advanced. Obviously there is some truth to this – but what is gained by the qualification? For Hirschman, it is done so as to query the Gerschenkronian hypotheses, and emphasize their historicity. But I have another suggestion for granting the historical boundedness of these hypotheses.

I shall not follow Hirschman in this use of the term ‘late’ latecomer, or perhaps ‘late’ late latecomer (depending on how ‘late’ it is) but instead go back to the roots of Gerschenkron’s insight, namely that any latecomer has certain disadvantages with respect to the incumbents of its time, but also certain advantages, if these can be identified and teased out.

The point being made here fits exactly with the strategic perspective I am developing in this essay. What G. characterized as provisional hypotheses regarding latecomer development in the 19th century, need to be revised to encompass strategies utilized by latecomers in the 20th century – and, I would add, need to be revised again to accommodate the needs of latecomers approaching *the development challenge in the 21st century*. The point is that the strategies are always different – while the underlying strategic principle, of utilizing latecomer advantage, remains the same. I will turn my attention below to the formulation of some strategies that may be taken as 21st century counterparts to the Gerschenkronian listing above. The difference between myself and Hirschman is that I see it as inevitable that latecomers should always be revising their strategies, in light of the world conditions in which they find themselves – whereas Hirschman was apparently tied to an economist perspective (despite the title of his 1958 book), and saw such variation by ‘late’ latecomers as a criticism of Gerschenkron.

Indeed I wish to take Gerschenkron’s idea further, and apply it to the level of the firm, and not just a country. It is at the firm level, of course, that strategic issues are made manifest. The situation facing firms that arrive late on the industrial scene, is one which combines apparently hopeless drawbacks, difficulties and inadequacies, with advantages that flow precisely from being “late” and not having to go through all the previous steps that incumbents have had to endure. The latecomer has a world of knowledge on which to draw, and a “roadmap” of the future in terms of products and technologies to be mastered. It is convenient to call such firms “latecomers” – extending the usage introduced by Gerschenkron to the case of firms (Hobday 1995a;-b; Mathews 2001;-2002d). Latecomer firms, like latecomer nations, are able to exploit their late arrival to tap into advanced technologies, rather than having to replicate the entire previous

technological trajectory (Brezis, Krugman and Tsiddon 1993). They can accelerate their uptake and learning efforts utilizing various forms of collaborative processes and state agencies to assist with the process, bypassing some of the *organizational inertia* that holds back their more established competitors. The strategic goal of the latecomer is clear: it is to catch up with the advanced firms, and to move as quickly as possible from imitation to innovation (Kim 1997; -1998). The notion of “latecomer firm” is couched in general terms, but it can be seen to include examples of firms from East Asia, as well as examples from other developing countries, present and future.

From a strategic perspective, then, the task of the latecomer is to understand the character and driving forces behind the industrial dynamics that govern the spread and diffusion of industrial processes and technologies around the world.²⁷ This is where the Japanese economist, Kaname Akamatsu, made his extremely important contribution, based on his studies of Japanese industrial sectors such as textiles in the pre-war years. Based on these studies, Akamatsu noticed two conflicting trends – one trend establishing a new industrial sector in a latecomer country, and another trend disestablishing the industry as it moved to other countries further back or down on the development ladder. The struggles involved in these transitions registered statistically as overlapping “inverse-V” patterns of imports, domestic production and exports for each sector in a latecomer country, that Akamatsu described in his immortal “flying geese” paradigm.

Akamatsu: ‘flying geese’ latecomer industrial dynamics

Kaname Akamatsu (1896-1974), the propounder of the famous “flying geese” model of economic development, hit the nail on the head when he declared that latecomer industrial development needs to match the strategic requirements of the advanced world. Akamatsu is a fascinating political economist, more or less contemporary with Gerschenkron (born Japan 1896, died 1974).²⁸ Based on his examination of the textile industry in pre-war Japan, he found that the industry got its start as products and technologies diffused to Japan from the advanced countries. Domestic production then increased, while imports plateaued and started to decline. Exports from Japan started to rise, until they in turn were pulled back as other latecomer countries, such as China, started their own textile industries. The same pattern could be observed with textile machinery (capital equipment), of import, followed by domestic production, and then export, each following an inverted-V process. The implied strategic premise in this case for a latecomer was to grasp the opportunity presented by developing an industry with machinery and techniques already perfected elsewhere, but at lower cost. This was the latecomer advantage. Akamatsu’s paradigm has become synonymous with Japanese-style industrial catch-up strategies – but it actually has much wider application, as I argue below.

Akamatsu predated the product life cycle framework developed by Vernon (1966) by several decades, but the two frameworks are compatible, both resting on the assumption that industries move from country to country, and within a country, from one industrial sector to another, in terms of their comparative costs and the strategies pursued

²⁷ See Maddison 2001; Hu 2002; Lall 1997.

²⁸ For an intellectual biography of Akamatsu, see Korhonen (1994).

by the players. Akamatsu's approach was trade-based, and his variables were countries' imports, exports and domestic production. Vernon took the next step, and introduced the role of multinational corporations. His concern was to trace the industrial dynamics through which a new product is introduced in the advanced country, moves through a buildup of production as the market expands and the product becomes standardized, and then sees production located offshore in lower-cost locations as process efficiencies start to outweigh product innovations (Utterback and Suarez 1993). Thus the perspective of Vernon is on the advanced firm in the advanced country – but this perspective carries implications for the latecomer, in line with Akamatsu's observation that latecomer dynamics complement those of the advanced countries. The Japanese student of Akamatsu, leading economist Kiyoshi Kojima, put the two frameworks together into what is called a flying geese (FG) product life cycle framework (Kojima 2000).²⁹ The Japanese economist Saburo Okita, a foreign minister in the 1980s, made a presentation on the FG paradigm to the 4th Pacific Economic Cooperation Council conference in Seoul, in 1985, utilizing the following updated examples. He explained how the FG paradigm views industrial transformation as moving an industry like textiles in its most basic form from one latecomer country to another in the region (allowing for production of semi-finished goods), then steel likewise migrating from one country to another, followed by consumer electronics, which move increasingly into higher and higher value-adding sectors – as shown in Chart 7.

Chart 7 about here

In fact, while Chart 7 depicts stylised patterns, it is in fact possible to demonstrate FG patterns using real data, and from industries that post-date the time that Akamatsu was writing about. We may capture one aspect of the FG effect by examining export-import data, and measuring Revealed Comparative Advantage (RCA). For East Asia as a whole, the chart for all electronics shows that Japan led the way, with its RCA curve rising and then falling in the 1990s as the other countries in East Asia were catching up with it. The NIEs had by the late 1970s already caught up with Japan in terms of RCA, and were still the leading group of countries in 2001 in terms of RCA. The ASEAN countries followed a few years later, with their RCA exceeding 1 in 1986, and exceeding that of Japan by the early 1990s. China follows on later still, with its RCA for all electronics reaching 1 by the year 1998, and then rapidly increasing.

Chart 8 about here

East Asian exports of electronics: Flying geese patterns

As argued by Tung (2003) these patterns are very much in keeping with the patterns of distribution of trade competitiveness outlined by the Japanese economist

²⁹ Kojima (2000) provides a retrospective and overview of the FG-PLC framework; see also Ozawa (2001; 2002) for useful overviews, and UNCTAD (1995) for an application of the flying geese paradigm. See Schroepel and Nakajima (2002) for an extended review of Akamatsu's work, and the working papers presented to the UNCTAD seminar on East Asian Development and the flying geese model in 1996, following on from the 1995 *World Investment Report*, e.g. Rowthorn (1996).

Akamatsu, in his famous “flying geese” metaphor.³⁰ We do not have to stick with a rigidly deterministic interpretation of this framework to see that it makes sense that countries gain an initial foothold in a new industry through a sequence of steps, from imports to domestic production and eventually to exports, and that they successively upgrade following their competitive advantages – as shown in Chart 8.³¹ Instead we may view Akamatsu’s framework as an early – and profound – insight into the way that the developing economy needs to be linked to the advanced economies, in order to generate its own activities, utilizing its temporary competitive advantages of low costs.

The flying geese paradigm – updated

I propose to utilize the flying geese paradigm as a general way of describing latecomer catch-up industrial dynamics – without any special reference to Japan, or to East Asia generally. As noted above, in the original Akamatsu formulation, there are only trade and production variables, with the clear strategic implication that countries should strive to “seed” new industries when the technologies and capital equipment become available. The means of doing so are left open in the Akamatsu formulation. In the Vernon product life cycle framework, the main actor becomes the multinational corporation (MNC) – and so the strategic issue for the latecomer turns on whether to attract MNCs or not. As we know, Japan adopted a strategy of extreme domestic self-sufficiency in terms of capital, while scouring the world for technology to enable it to build industries that could compete with those of the advanced countries. As traced out in Chart 7, these could move through phases of sophistication from black and white TV, color TV, videocassettes to HDTV – by which time Japan had caught up and was an industrial leader in its own right. The later East Asian Tigers emulated Japan but not in all strategic details; Korea shunned FDI and relied instead on targeted capital equipment imports, while Taiwan utilized both, and Singapore and Hong Kong were much more open to FDI and to MNC investment.

Now we are in a new phase of globalization where the value chains that connect activities around the world are not generally controlled by one multinational corporation, but are disaggregated – the so-called “global value chains.”³² These are sequences of activities producing work-in-progress that can span different countries, whole regions or the entire world. The recent World Bank report on East Asian integration refers to this as “growth of trade in components or partly assembled goods” (World Bank 2003: 3) or “production networks” and “production sharing arrangements” (2003: 60). By 2001, China was exporting more than \$20 billion in parts and components to other production locations in East Asia (Ng and Yeats 2003). The issue is: who is strategically driving these production networks? From the perspective of the advanced firms, such as production houses (like Nike in athletic footwear) or buyers or retail chains (like The Gap or Tommy Hilfiger) the strategic initiative lies in their seeking greater efficiencies and lower costs. But from the perspective of the latecomers, the strategic issue is: how to become inserted in such value chains? Thus the strategic options expand, for both advanced firms and for latecomers. But the underlying latecomer industrial dynamics, of

³⁰ See Akamatsu (1961) for the original exposition in English of the flying geese framework, and Ozawa (2003) for a recent authoritative Japanese exposition.

³¹ See Okita (1985).

³² See Ernst and Kim 2002 for an overview; and the UNIDO *Industrial Development Report 2002/03* (UNIDO 2002) especially chapter six, for a discussion of their potential for latecomers.

shifting production (and more recently, R&D activities) according to competitive cost and logistics advantages, remain in force. It is just their institutional expression that has changed.

I propose that we divorce “flying geese” from Japan, and adopt the metaphor as standing for latecomer catch-up industrial dynamics, where the emphasis is on industrial upgrading and the shifting of competitive advantages from one industrial sector to another, and from one country to another. This gets over any argument as to who might be the “lead goose” and whether the flying geese formation is rigidly imposed, setting one country permanently behind another. I agree with Ozawa (2003) when he characterizes the “lead goose” as the U.S. (rather than Japan) and his emphasis on the role of the Pax Americana during the entire half-century after the Pacific War as providing the conditions within which countries like Japan could climb the latecomer ladder of development and actually catch-up, becoming an industrial leader and innovator in its own right. The clearest country where such “flying geese” latecomer industrial dynamics are evident today, is China – as evidenced by numerous empirical studies of the rise of industries in China patterned on foreign templates, and diffused to China through various channels, or vehicles – including MNCs, FDI and technological learning (to be discussed below).

Six flying geese formations in the world in the 21st century

It would be sensible to envisage at least *six flying geese formations* driving latecomer development in the 21st century. One would be a formation centered on the US, including most of Latin America and the NAFTA zone. A second would be centered on Western Europe, reaching across to Central and Eastern Europe and south into Africa. A third would be centered on Japan, including not just Taiwan and Korea, but also the areas of South-East Asia that are now firmly tied to Japanese producers through supplier value chains, and China. A fourth would eventually be centered on China itself, which in the first quarter of the century is likely to emerge as a huge development force, with its vast hinterland in Central Asia and its trading partners throughout the Pacific. A fifth could be centered on India, reaching up into Central Asia and across the Indian sub-continent. A sixth might be South Africa, reaching northwards into the African continent (with Europe reaching south).

It would make sense for economic geographers to use these six FG formations as framework for studying trade and investment relations among countries, since these are likely to be the dynamic formations driving development in the 21st century.³³

Hirschman et al: Disequilibrium dynamics; forward and backward linkages

³³ In this sense I part company with scholars such as Bernard and Ravenhill (1995) who make the same point, namely that regional production networks have overtaken the MNC- and trade-related frameworks first formulated by Akamatsu and Vernon, and conclude that the flying geese paradigm is therefore exhausted. On the contrary, I view the updated FG paradigm as providing the best intellectual framework for understanding latecomer industrial dynamics, and the one best suited to frame urgently needed empirical investigation of the process of industry creation in China, India and the SEAsian countries today – by UN agencies such as UNCTAD and UNIDO, by public sector research institutions and by private research foundations.

The third of my sources is the school of thought that sees the economy working as a disequilibrium system, according to principles of circular and cumulative (C&C) causation – of whom Albert O. Hirschman (1915-) is a leading exponent in the field of development economics. Hirschman was at the very apex of the economic development debates in the 1950s and 1960s, largely with a focus on Latin America. His 1958 book, *Strategy of Economic Development*, written in his early 40s, was perhaps the high point of this high period. Hirschman was born in Berlin in 1915, the son of a cosmopolitan Jewish family. He was educated in London, Paris and Trieste, where he took his PhD. He fought in the French army in 1940, and managed to emigrate to the United States in 1941. He stayed two years at Berkeley (like Gerschenkron before him), served in the US Army, then at the Federal Reserve in Washington in 1946. His first book, *National Power and the Structure of Foreign Trade*, came out in 1945 when he was 30. He lived in Bogotá, Columbia, from 1952 to 1956, before pursuing an academic career in the US at Yale, Columbia and Harvard before settling at Princeton in 1974 (thereby having a brief 4-year overlap with Gerschenkron before the latter's death).

The *Strategy of Economic Development* is memorable for three great contributions. *Firstly*, its title – it makes it clear that there are no general laws of economic development, but only strategies, that will vary from country to country and from time to time. He makes it clear in this book that he is concerned with strategies that might be expected to work at that time – but not necessarily at another time.

Secondly, because he places the emphasis not on balanced development, as per the reigning orthodoxy of his time (Nurkse et al) but rather on *unbalanced growth*. The idea, as elaborated by Hirschman, is that balanced growth makes sense in growth models that are based on producing balanced growth paths as their output – like Harrod-Domar growth models – but it makes no sense in the real world of a late industrializing country. The output of steel in such a country, for example, might need to be greater than that which can be consumed in the nascent downstream industries, because it has to be built with the latest technology that works through capturing economies of scale – and therefore if such economies are to be captured, then steel exports will also be sought, at prices reflecting the lower costs in the developing country and the greater scale of activities constructed. This was precisely the experience of Korea, which – against World Bank advice at the time – sought to create an upstream steel industry in the 1960s to provide feedstock for the nascent shipbuilding, automobile and construction industries. Alice Amsden later characterized such an approach as ‘getting prices wrong’ as opposed to the neoclassical orthodoxy of getting prices right (i.e. ‘right’ for purposes of optimal allocation, but not necessarily for accelerated catch-up growth).

The lack of balance between upstream and downstream sectors is captured in the notion of forward and backward linkages, which is the *third* great contribution of Hirschman's 1958 book. Such linkages have been fundamental to development strategies ever since. The core idea is that given outputs need to be evaluated for their strategic significances, not just in their own terms (and, say, their revenue-earning potential) but in terms of their upstream and downstream linkage effects, promoting and facilitating further developmental sequelae (and in this sense, having a Keynesian ‘multiplier’ feel to them). Linkages are more than just transactional links with upstream suppliers or downstream users of a given output (i.e. more than entries in a national input-output table, important as such entries might be). There is a subtle notion of minimum efficient

scale built into Hirschman's argument. For Hirschman, an industry exhibits a *backward linkage* when its demand creates sufficient market for an upstream industry to be established at minimum efficient scale. Such backward linkages are strong if they create a high likelihood of an upstream industry getting over the minimum efficient scale threshold; they are weak if the probability of this happening is low. *Forward linkages* involve the notion that downstream industries might have their costs reduced by using the output of the given industry, rather than having to import the materials, and again be thus tipped over the threshold of minimum efficient scale. The existence of forward and backward linkages can be exhibited in an Input-Output table; indeed Leontief has characterized the state of under-development in terms of the presence or absence of such input-output coefficients.³⁴

Increasing returns then are central to the notion of linkages in Hirschman, which are the key to the 'unbalanced growth' that must characterize developmental 'spurts'.³⁵ Here is another reason then for putting such formulations in a strategic rather than economic framework – precisely because increasing returns were not until recently considered 'legitimate' subjects for discussions in economics. Indeed Krugman (1994b) argues that this was one of the principal reasons for the decline of 'developmental economics' as a discipline, after reaching its high point in the 1950s and early 1960s – an intriguing point that we will take up in a moment.

The immediate issue is that Hirschman was not alone in putting forward arguments that the development process is a disequilibrium-based series of spurts that occur in unbalanced fashion and depend on increasing returns (mainly from manufacturing industry). These are all ideas associated with a wider school of thought, associated with disequilibrium dynamics, and employing arguments involving circular and cumulative causation. Where then did this come from?

Disequilibrium dynamics: Circular and cumulative causation

The emphasis of mainstream neoclassical economics has been, since the 1930s at least when Samuelson, Solow et al perfected the 'neoclassical synthesis', on equilibrium-based processes. This banished any consideration of disequilibrium processes – as discussed by Schumpeter and by the business cycles literature – to the outer reaches of respectable enquiry. But the tradition of studying the economy as it actually operates, and not as it may be conveniently represented in models, stubbornly lived on, mainly around the notion of *increasing returns*.

There are many places to start such an exposition; Schumpeter is one, with his emphasis on cyclical dynamics. But it is the American economist, Allyn Abbot Young (1876-1929) who is credited with formulating a view of the dynamic action of economy developing through 'circular and cumulative causation'. Young recast the process of growth and expansion of an economy – or its 'development' – in terms of the multiplication of specialized inputs leading to the capture of increasing returns at the

³⁴ As Leontief put it: 'The larger and more advanced an economy is, the more complete and articulated is its structure ... In a sense, the input-output coefficient matrix derived from the U.S.-European input-output table represents a complete cookbook of modern technology... An under-developed economy can now be defined as underdeveloped to the extent that it lacks the working parts of this system' (1963: 169-70)

³⁵ Hirschman wrote his 1958 book as a critique of the 'balanced growth' approach exemplified in Nurkse (1953). But both approaches were hostile to neoclassical orthodoxy.

level of the economy as a whole. This is exactly the process that any developing economy needs to go through. In his Presidential address to the British Royal Economics Society, Allyn Young, then a professor at the LSE, put the matter in these terms:

‘.. the mechanism of increasing returns is not to be discerned adequately by observing the effects of variations in the size of an individual firm or of a particular industry, for the progressive division and specialisation of industries is an essential part of the process by which increasing returns are realised. What is required is that industrial operations be seen as an inter-related whole. (1928: 538-9)

This is generally taken to be the starting point for a stream of work that distinguishes itself from neoclassical production functions and equilibrium-based models, in its emphasis on the circular and cumulative (C&C) causation processes operating in disequilibrium in the real economy. This line of work reached its apogee in the hands of the Cambridge economist, Nicholas Kaldor, in the mid-1960s.³⁶ But it has remained marginal in the world of formal mainstream economics, where equilibrium-based reasoning remains dominant – long after it has served any useful purpose.

Now the point of this digression is that the field where equilibrium-based reasoning is most pernicious and damaging, is the field of development. For development simply cannot be squeezed into an equilibrium-based framework and represented as a balanced process. This is to recapitulate the Rostow ‘stages of growth’ scenario, but at a more fundamental level. And there were many development economists who understood this perfectly well. They start with the Big Push idea put forward by Rosenstein-Rodan in the 1940s, and extend through Gunnar Myrdal (1957) with his explicit usage of the terms ‘circular and cumulative causation’ and extend to Hirschman, with his *Strategy of Economic Development*.

Development as ‘balanced’ vs. ‘unbalanced’ growth

Already in 1943, during the Second World War, the Polish-Austrian scholar Paul Rosenstein-Rodan had put forward an interesting perspective in his discussion of the problems of industrialization of Eastern and South-Eastern Europe after the war. In an influential article, he had identified industrialization as ‘*the way of achieving a more equal distribution of income between different areas of the world by raising incomes in depressed areas at a higher rate than in the rich areas* (Rosenstein-Rodan 1943: 202) (emphasis in original). His approach came to be known as the ‘big push’ insofar as he argued that a sufficiently strong push forward in investment would overcome many of the problems of lack of balance between the output of traditional sectors and the inputs of a modern industrial sector. Under the influence of prevailing notions of economies of scale, he argued that ‘[in] order to reach an “optimum size” of the industrial enterprises, the area of industrialisation must be sufficiently large’ (1943: 202). He posed two pathways, namely one based on ‘self-sufficiency’ without international investment; and an alternative approach which would seek to fit Eastern and South-Eastern Europe ‘into the world economy, which would preserve the advantages of an international division of labour, and would therefore in the end produce more wealth for everybody. It would be

³⁶ For a book-length treatment of C&C approaches to disequilibrium dynamics, see Toner (1989) as well as his summary statement of the application of C&C ideas to East Asian development experiences in Toner (2003).

based on substantial international investment or capital lending' (1943: 203). Rosenstein-Rodan was essentially arguing that industrialization required a 'big push' that would initiate processes of economic development, in line with the circular and cumulative causation reasoning developed by Young in 1928.

Rosenstein-Rodan envisaged the process of development as one of balancing outputs of one sector with inputs to another, guided and facilitated, if not catalyzed, by openness to world economic activities and in particular to foreign investment and the embedding of the country in a global division of labour. This emphasis on 'balanced' growth was consistent with the then-leading models of economic growth, which emphasized equilibrium growth paths characterized by such balances. But close observers of the processes of development after the War, like Albert Hirschman, noted that in practice the growth spurt needed to push development came from a lack of balance, or through deliberately unbalancing inputs with outputs. A standard example would be pushing a country to develop a steel industry or a cement industry in advance of the demand for steel or cement, but in the expectation that this demand would pick up as these heavy industries became established and new sectors, such as construction, could rely on their outputs.³⁷

The decline of 'economic development' theory

And then, just when the developing world was opening up to new possibilities, and the theory of economic development faced the prospect of being applied in a serious fashion – it withered on the vine and lost the impact that it once had. This is surely one of the greatest conundra in the intellectual history of the 20th century.³⁸

There are two likely scenarios. One is that development economics succumbed to neoclassical orthodoxy, and failed to differentiate itself from the neoclassical mainstream after its original contributions of the 1940s and '50s. This is a line argued by Paul Krugman, which we shall consider in a moment.

A more immediate explanation is that Eastern European and Latin American development prospects, which had been the focus for Rosenstein-Rodan and Hirschman, or Indian (South Asian) prospects, which had been the focus for Myrdal, all declined. The great future for Latin America predicated on the Import Substitution (IS) approach to industrialization, failed to materialize. Ten years after his 1958 book, Hirschman is already deeply disillusioned. In his 1968 article he subjects ISI to searching examination, and compares it at some length with its competitive alternative, EOI (export-oriented

³⁷ How ironic that Rosenstein-Rodan's prescriptions would in fact prove to be still-born for Eastern and South-Eastern Europe, which immediately came under communist influence and joined the Soviet bloc – whereas the more developed Western Europe did in fact receive such international capital transfusion, through the Marshall Plan, to help it recover from the war. But of even greater interest is that East Asia in fact developed more or less along the lines of the 'big push' elaborated by Rosenstein-Rodan, without his ever referring to it, nor even apparently considering it at all.

³⁸ I do not want to be interpreted as implying that good work was not done in the development field in subsequent years. Streeten and his studies in the 1970s (such as *The Frontiers of Development Studies*, 1972), or Hans Singer and his various essays (1975) or 'The Sussex Manifesto' of 1970 on 'Science and Technology to Developing Countries during the Second Development Decade' all come to mind. But the great days of Rosenstein-Rodan, Myrdal, Hirschman, Lewis, Prebisch and Chenery were definitely over.

industrialization) – and yet manages never to make any mention of East Asia in the entire article.

Another decade on (1981) and he is totally disillusioned, writing in *Dissent* of ‘the rise and fall of development economics’. Yet here we come to the strangest feature of Hirschman and of development economics. For at the very moment that East Asian countries like Korea and Taiwan, following on the heels of Japan, are about to register unprecedented development success, Hirschman is already dismissing their achievements, and with them, the field of development economics. At the very moment that development economics is starting to have something to celebrate, Hirschman, and many western observers, are already dismissing it. This is the real tragedy of development economics – not the failures to engage in model building that Krugman identifies as the cause of the decline of the discipline from the 1960s onwards.

The contra view: Krugman – Development without strategy

Krugman (1994b) provides a fascinating discussion of development economics, full of insights yet ultimately deeply unsatisfying. Krugman develops a thesis that development economics reached its apogee from the 1940s to the 1950s, but then unravelled. By the time he studied economics, he says, in the 1970s, ‘it seemed not so much wrong as incomprehensible’ (p. 1) And why was it incomprehensible? Because it wasn’t expressed in the language of mathematical models, as was the case in mainstream economics. But he argues that economists were able to look at development economics with a fresh eye in the 1980s and 1990s, and found ‘that it really does make a lot of sense, after all’ (p. 1) This is an intriguing but in the end purely formal argument – because K. does not discuss actual development strategies. He limits himself to a rough outline of the 1943 contribution by Rosenstein-Rodan, on the ‘big push’ idea, and its neoclassical formalization in 1989 by Murphy, Shleifer and Vishny, and claims that this sheds light on the process of development. This is his only exhibit for the case that neoclassical economics has something to contribute to development thinking.³⁹ Yet Murphy, Shleifer and Vishny (1989) utilize assumptions and procedures based on equilibrium, partial equilibrium and multiple equilibria, and other comparative static ideas, and leave out dynamics, entrepreneurship, and all the disequilibrium features (such as increasing returns) that make development such an interesting topic. Such formalization in fact adds nothing to the elaboration of the ‘big push’ idea, which is designed to overcome the problems of when it might be profitable to invest in upstream or downstream industries.

By contrast, I would argue that development economics withstood the incursions of neoclassical economics (as admitted by Krugman, when he describes Hirschman as leading his followers into the wilderness), and of ‘silly’ models that over-simplify things – but that it declined in the 1970s and 1980s not because of lack of formalism, but because there were no western models of development to celebrate. The only part of the world that was developing successfully was East Asia, and -- with some notable exceptions – it was studiously ignored by most western economists. Hirschman was amongst them.

Krugman tackled the issue of East Asian success in his notorious 1994 article in *Foreign Affairs*, entitled ‘The Myth of Asia’s Miracle’. This is an extended debunking of

³⁹ Krugman himself made a minor effort to reverse these trends in the 1980s, with his flirtation with strategic trade theory and increasing returns – but this appears to be well behind him now.

the ‘myth’ that Asia (actually, East Asia) has developed through a model that is superior to that underpinning western economies. But Krugman seems intent on rebutting a strawman of his own invention. This article, and the follow-up article in 1997, on ‘Whatever happened to the Asian miracle?’ is full of references to the ‘supposed’ superiority of the Asian over Western models, and ‘supposed’ claims that the East would rapidly overtake the West, which Krugman cleverly compares with earlier claims that the ‘Soviet’ East would rapidly overtake the West. But the perpetrators of these claims are nowhere identified (with the exception of one mention of James Fallows). If Krugman had been more careful in his citations, he would have had to admit that most of the claims he is intent on debunking concern the superiority of the East Asian model over other *development* models. I am not aware of anyone – apart from Fallows perhaps and then with strong qualifications – who claim that the East Asian systems are superior to those of the West, period. On the contrary, most observers see a process of convergence on Western models of innovation and democracy once countries reach a certain level of development. But there is no doubt at all – and it should be admitted by Krugman and by many others – that the *development models* crafted in Korea, Taiwan and Singapore, based in their various ways on the Japanese experience, *are development models that actually work*. They enable their practitioners to catch-up with the industrial leaders – no ifs, no buts (to paraphrase Krugman) -- which is, after all, the goal of any development model.

So when Krugman claims that ‘[r]apid Asian growth is less of a model for the West than many writers claim’ (1994: 64) he is, I would argue, hitting the wrong target. What he should be granting is that *Singapore is actually an excellent development model for other underdeveloped countries*. When he argues that Singapore’s achievement of rapid growth over several decades is nothing but the mobilization of resources – with the employed share of the population rising from 27 to 51 percent, and the educational standards of the workforce being drastically upgraded (in 1966 more than half the workers have no formal education, while in 1990 two thirds have completed secondary education), and investment in physical capital being ‘awesome’ -- isn’t this in itself a description of a developmental outcome? What is ‘development’ if it is not the improving of inputs in this way – achieved by reliance on external knowledge captured through technology transfer via joint ventures (Korea) or by public sector institutes (Taiwan) or by inviting in MNCs (Singapore)? But in his 1994 discussion, Krugman pays no attention to the strategies pursued by the East Asian ‘tiger economies’ in achieving these outcomes – and merely belittles their efforts on the basis of some growth accounting calculations.

Now I am not looking to buy into the controversy over the total factor productivity (TFP) growth accounting calculations by Kim and Lau (1994) or by Young (1994; 1995) on which Krugman based his 1994 article. I suspect that there are some strange results in there that owe their presence more to quirks in statistical procedures in the countries concerned than to the underlying realities. But even if one concedes everything in these results, my point is this: it does not advance our understanding of a viable strategy of development at all.⁴⁰ Krugman has given us a controversial and pessimistic argument regarding the outcomes of East Asian development – but has not

⁴⁰ See Young (1994; 1995) and Kim and Lau (1994) for the papers concerned, and explanations of the statistical and econometric techniques used.

advanced in any way at all the crucial issue of what development strategies are likely to succeed in the 21st century.⁴¹

The upshot of these discussions is that we have an intellectual treasure trove in the latecomer development ideas of Gerschenkron; in the latecomer industrial dynamics ideas of Akamatsu and followers; and in the circular and cumulative causation ideas that stem from Allyn Young and the recognition of the centrality of increasing returns, and its deployment by early development theorists such as Rosenstein-Rodan, Prebisch, Myrdal, Lewis and Hirschman. But with the exception of Akamatsu, the actual developmental successes of the past half century were not explicitly based on any of this. The anticipated results in Latin America and India failed to appear – but the unanticipated results in East Asia were actually a vindication, in practice, of these developmental ideas espoused earlier.

This then is the setting for my own contribution. How to find a way of bringing this set of ideas from development economics together with the actual experience of East Asia? I suggest that it can be done, if we adopt a strategizing framework. So – based on these positive and negative sources, how might we characterize the developmental strategies that we know to have been effective, and how might they be generalized for the situation prevailing in the world today?

5. Industrial development as collective entrepreneurship

We now draw these various threads together to develop an account of the process of industrial development as one involving choices at various points along the way, all conceived as exercises in collective entrepreneurship. It is entrepreneurship that provides the correct framework for assessing development strategy, with an appropriate balance between collective and individual facets of the process.

The development process takes place in disequilibrium. It is a series of growth ‘spurts’ characterized by sometimes massive imbalances between sectors, where in order to get production in a new sector started (say, a steel industry) it is necessary to massively distort prices to make it attractive for firms to enter downstream industries, and thus enable the new steel sector to produce at economically efficient scale. This is an insight we owe directly to the great theorists of development, such as Rosenstein-Rodan and Hirschman. In each case, the new industry can get started only in conditions made favorable for entrepreneurial calculation by state intervention to create new, artificial conditions that are relaxed as the industry puts down roots. Massive institutional innovation is needed to successfully effect these industry-creating collective entrepreneurial endeavors.

⁴¹ Lau and Park (2003) return to the issue, and make the very interesting observation that Krugman may have been too pessimistic in his interpretation of the earlier results. They note that according to Krugman, economic growth in the East Asian NIEs is bound to slow down and eventually come to a halt. But Lau and Park extend the dataset and find that indeed there has been a pickup of measured technical progress in the East Asian NIEs, due they argue to improved investments in ‘intangible capital’ (i.e. R&D) since the mid-1980s. Thus they argue that Krugman was too pessimistic in his earlier interpretation.

The process continues, with one new sector after another becoming established – some succeeding, others failing, as the process of trial and error continues. For this is the way with developmental entrepreneurship, as with all entrepreneurship: it is a process of endless ‘testing of the waters’ or to put it more accurately, a testing of market conjectures. As experience is acquired, so one might say that a process of economic learning takes place – or a process of circular and cumulative causation, creating latecomer versions of the path-dependent industrial dynamics observed in advanced countries. We owe this insistence on the disequilibrium dynamics of circular and cumulative causation to Myrdal, to Kaldor, and originally to Young (1928).

As new sectors are successfully established, so they create new growth poles, or clusters, where the key to development is the identification of ‘gaps’ that need to be filled, and of ‘inputs’ that need to be replaced by local initiative. This is an endless process that the Taiwanese describe as ‘import replacement’ but which would more accurately be described as ‘gap-filling’ and ‘input-replacing’ collective entrepreneurship – to use the suggestive language of Leibenstein.⁴² The Taiwanese show how it is accomplished. They create a new industry, such as CD-ROMs, by securing the core technology, in this case pick-up heads and data storage media technology. They then identify the key imports of components and materials from Japan, and seek to innovate around these components, reproducing them or licensing them in order to remove the import-dependence. Once such critical parts or components can be produced in Taiwan, they then serve as the core of a new cluster, and the process of making linkages between this cluster and existing clusters proceeds.

As separate sectors are created, so the challenge becomes one of finding ways to link them together, through firms that overlap two or more sectors. This too is a challenge of collective entrepreneurship. It can be characterized, following Dahmén, as the challenge of creating ‘development blocks’ that serve as the building blocks of the developing economy.⁴³ In the language of the game of GO, it is a challenge of strengthening isolated clusters through connecting them together. This is a process that enables firms to engage in greater and deeper levels of specialization, which can only be achieved (following Adam Smith’s great insight) as the market expands. And for a developing country, ‘the market’ of course means the world market, not just the domestic market.

The point to emphasize in all this is that it is a process that takes place in disequilibrium, which generates opportunities for entrepreneurial initiative, and where criteria of efficiency are going to be outweighed by criteria of development and export success. This is the key to understanding the success of East Asia, where authoritarian governments were able to get economies started on ‘virtuous’ growth paths, with new sectors feeding off existing sectors, through a process that was subjected to the ruthless performance tests of export success. Exports became not just a means of earning foreign currency (important in its own right) but even more significantly, an indicator of success which would legitimate further state intervention to support the extension of such industries, through financial repression (lowering interest rates for targeted sectors) or

⁴² See Leibenstein (1968) for a fascinating exposition, and other contributions to the American Economics Association symposium on entrepreneurship.

⁴³ Dahmén developed his ideas concerning development blocks during his studies of the Swedish economy; for a later elaboration, see Dahmén (1989).

other systems of providing entrepreneurial inducements. This was the ‘discovery’ of East Asia that appears to have been missed completely by theoreticians of ISI and EOI such as Hirschman.

But ‘export’ is a word with multiple meanings. As the global economy grows more interconnected, and denser, so the opportunities for developing firms in developing countries to make connections with these firms in the global system, increases. The opportunities are there for linkages that do not involve the export of completed products, but contractual linkages that arise as the value chain is disassembled, by strategic initiative of the lead firms themselves. These opportunities for becoming linked to global value chains were first recognized and taken up in East Asia, rather than in Latin America. This was another East Asian innovation that has had a big impact, and is now widely emulated in developing countries throughout the world. Such ‘staging’ of development, through OEM to ODM to OBM, was completely ignored as a strategic possibility in theoretical discussions of development, whether of ISI or EOI varieties. We now turn to an examination of the issues involved, taken always from the perspective of the capture of latecomer advantages wherever they may be identified.

6. Capture of the latecomer effect

The industrial learning process: first steps

Firms have to start somewhere. Most latecomer firms in developing countries start with few resources and few connections. They need to acquire a minimal complement of skills, resources and capabilities just in order to be a player. How this is done depends on a variety of circumstances. The firm may be a traditional supplier in some traditional industrial sector, like textiles, and gets taken over by an active entrepreneur. It may be a staid family firm that is taken under new management by the son or daughter who have received a business education abroad. It may be a government-owned enterprise that is privatised, and starts life anew in a competitive world. Whatever the process, the firm has to start with its initial complement of resources, technologies, skills and capabilities. It is what it does with these that counts. And the most important thing that such a latecomer firm can do is accelerate its acquisition of capabilities by linking up with firms in local and, eventually, global value chains. This is what we call linkage. And through linkage the latecomer firm can secure more than just a stream of revenue. It can tap its links with more advanced firms to acquire knowledge, technology, and market access – things that would otherwise be beyond the firm’s limited resources. It is this capacity to secure more from a relationship than the firm puts in, that we call leverage. These sequences of linkage and leverage can be repeated over and over again, until a firm, or collection of firms within an industry, enhance their capabilities and become, potentially, world-class players. This is the process that may be characterized as industrial learning. That such aspirations are feasible is demonstrated by numerous examples, but let us take one from Pakistan, in a traditional industry such as knitwear, to show how far a firm can lift itself through making linkage connections with the wider world.

Box 1: Ammar and Sarah knitwear group, Pakistan

The knitwear group in Pakistan, Ammar and Sarah, was founded in 1982 and since 1988 has been the leading knitwear group in the country. This is a company that owes its leading position to its international connections, with global buyer-led and producer-led value chains, as well as its own commitment to state-of-the-art technology and management. Under its dynamic CEO, Belal Ahmed, Ammar and Sarah (founded respectively in 1982 and 1992) now have a knitted products line encompassing men's and boys' wear, women's and girls' wear, in cotton, knitted tops and bottoms, with and without Lycra, in a broad range of fabric finishes, garment washes and garment dyeing. The key to its success in securing contracts from these global buyers and producers is the use of the most advanced computer-aided technology, whether for washing, dyeing, cutting, knitting or stitching, giving it great flexibility and a lead time of 45 to 75 days in responding to new orders (as opposed to the full-length season lag in traditional firms). The company's major customers are all either global buyer groups, or global producers. Amongst the former are Target, Arrow, Nautica, Haggar, Eddie Bauer, Vantage, Timberland, Alexander Julian Colors, Land Rover, Tommy Hilfiger, Nike and Damani Dada. Amongst the latter are Levi Strauss and Sarah Lee.⁴⁴ Whereas the prospects for the knitwear industry in Pakistan overall look gloomy, for firms like Ammar and Sarah which are prepared to make the international value chain connections, and to invest in state-of-the-art equipment, and to compete in terms of quality and speed of service rather than simply in terms of least cost, the prospects are in fact excellent.

Source: UNIDO (2002)

What can we deduce from the example of the Ammar and Sarah group in Pakistan? First of all, it is a firm in a traditional industry, namely knitwear – an industry apparently full of powerful incumbents with decades of experience. *But the Ammar and Sarah group was able to exploit the new linkage possibilities in the global economy.* It was able to latch on to two kinds of global networks. Firstly there is the network of contractor firms created by a global buyer like Timberland or The Gap or Haggar. These advanced firms create global retail chains (owned or franchised) to sell their global branded knitwear products, where the firm focuses on its core competencies of design and marketing, and outsources all the intermediate activities of knitting, finishing, dyeing, packaging, logistics. It looks for low-cost but highly efficient producers for these outsourced parts of its value chain – which is where a firm like the Pakistani Ammar and Sarah group enters the picture. It can exploit its low labor and infrastructure costs (for as long as they last – which is not long once a country starts to industrialize seriously). It can purchase the most advanced technical equipment to provide flexible and high quality manufacturing services. It can recruit graduates trained in advanced technical institutes in, say, the USA, and its entrepreneurial founders can put their Harvard or MIT business training to good effect. These are all ways in which the latecomer can accelerate its catch-up. Unlike the incumbents, the latecomer firm in a traditional industry is not burdened with technologies and practices inherited from previous eras.

⁴⁴ The full list as of the end of 2000 included Levi's (since 1988); AMC (Target Stores) since 1991; Haggar, since 1995; Nike, since 1996; Tommy Hilfiger, since 1997; Nautica, since 1997; Timberland, since 1997; Vantage, since 1998; Eddie Bauer, since 1998; Alexander Julian Colors, since 1998; Arrow, since 1998; American Eagle Outfitters, since 1999; Land Rover, since 2000; and Damani Dada, since 2000. The Target Stores manager covering sourcing in Pakistan stated to the company: "Ammar and Sarah Group have the largest share of the Target's men's knit division, and are our #1 vendor in South-East Asia."

Secondly a firm like the Ammar and Sarah group can tap into global value chains instigated not by buyers but by producers, like Levi Strauss or Sarah Lee. These are chains or networks of activities instigated by a producer firm that sells its own branded product to retail outlets, but finds it expedient to outsource much of the manufacturing and logistics activities to low-cost but flexible and agile sub-contractor firms. Again the Pakistani Ammar and Sarah group can respond to this kind of opportunity, exploiting its initial cost advantages and investing in the latest technology and management techniques, such as integration of manufacturing and logistics in just-in-time or lean production systems.

The goal is to harness strategic thinking to the development effort, on the understanding that the strategic goal of latecomer firms, and countries, is clear: it is to catch up with the advanced firms in the advanced countries. The idea is to use latecomer advantages in order to overcome latecomer deficiencies, whether these be in resources, market access, technology or knowledge.

In the strategic management literature, there is a clear way of dealing with the lack of resources that prevent firms from reaching their strategic goals – it is to fashion strategies that enable the firms to access these resources, by offering other firms something in return. If resources are lacking, then their leverage from external sources is the obvious way to proceed. The concept of *resource leverage* (Prahalad and Hamel, 1990) matches the requirements of the latecomer firm exactly. The concept was introduced and has been used as a means of explaining how the best competitors in the world stay abreast of new developments, by ensuring that through alliances and various forms of joint ventures, they identify and secure access to the resources needed to keep diversifying their product portfolio. But the same idea underpins the strategy of the latecomer firm. Whereas the economic development literature discusses its strategy in terms of technological diffusion and technology transfer, these are much weaker concepts than “resource leverage.” They place the impetus for the transfer on firms in the advanced countries (rather than on the latecomer’s own strategic calculations) and they ignore the issue as to how the latecomer can shape events so that business arrangements involving “transfer” can be turned into leverage and learning opportunities. So we can appropriate the notion of “resource leverage” as the over-arching strategic concept in which to make sense of the successes of latecomers in breaking into advanced technological sectors.

The originality of this perspective lies in the application of the strategic view to this development problem, and in particular the concept of resource leverage as a viable strategic framework for latecomers to use in evaluating their options. In the case of Mexican apparel producers, for example, such a strategy leads towards “full package” production, and firmly away from simply complying with least cost demands. Firms can thus see themselves as pursuing a particular kind of strategy, namely a latecomer strategy, and can advance their interests by tapping into the resources, technologies and knowledge available in the advanced world – provided they find the strategies of *complementarity* needed to effect this. This is how I see the development task being framed in strategic terms.

The idea of harnessing the processes of globalization to the tasks of development is certainly not new. In 2001 a group of scholars held a conference at Bellagio to discuss these issues, where the focus was on the emergence of global value chains and the issues

they posed for latecomer firms – were they to be seen as engines of development, or as instruments of exploitation (Bellagio Group 2001). This remains the major issue for debate concerning the harnessing of globalization by the development process.

The global network economy

The global economy faced by a latecomer firm is not just a teeming mass of competing firms, but an organized set of interconnected networks of firms linked with each other through multiple interactions and linkages – a “worldwide web of interfirm connections.”⁴⁵ The focus of interest is not just the firms themselves, but the shifting links or contractual relations between them. Firms expand their product line, and expand internationally, according to such a picture, by forming new linkages with firms that are already active in the global economy. They are “drawn” into the global economy; they are “pulled;” they are “integrated.” These are all much more powerful metaphors for describing what actually goes on with latecomers than traditional notions of firms overcoming “barriers to entry” and “pushing” themselves past numerous obstacles to become internationally active. Such pictures belong to the period when the international economy was dominated by trade and trade barriers – whereas today it is dominated by criss-crossing global value chains encompassing R&D, production, logistics, marketing as well as exchange, where all the links are between firms rather than between countries.

Firms can be pictured as engaged in contractual relationships with each other. One industrial firm supplies another with needed components; in turn, it is supplied with components or sub-assemblies by another firm. All this happens in the industrial economy, before final goods get to consumers through retail outlets. In fact this is the bulk of economic activity: retail trade accounts for only a small proportion of the value-added in an economy.⁴⁶

Sequences of such supply links, with each one adding-value to what has gone before (or, working backwards) each one supplying a value-added component or sub-assembly, form value-adding chains. Such chains may be based on minimal inter-firm interaction, and the individual units may be varied frequently. But such variations in linkage constitute a source of transactions costs, insofar as firms have to search for new suppliers or customers, and then search out their capabilities, pricing structures, and availability. Such costs can be minimized by the firms entering into longer-term relations with each other, based on knowledge of their operations and capabilities developed in cumulative fashion over time. Insofar as the firms engaged in such long-term contracting become partners, one can speak of a “value-adding partnership” (VAP).⁴⁷

A picture then of the industrial economy as populated by thousands of firms cross-linked with each other, with chains of linkages constituting a first-order form of aggregation in value-adding partnerships (VAPs) or value-adding networks (VANs), is one which will help us to make sense of the extraordinary growth and evolution of the

⁴⁵ The phrase comes from Mathews (2002a).

⁴⁶ There is a substantial literature on the economy conceived as interconnected networks of firms. See for example Johanson and Mattsson (1988).

⁴⁷ “Value-adding partnership” is the phrase used by Johnston and Lawrence (1990) in their analysis of the multiple linkages making up an industrial economy. Porter (1985) popularized the notion of the value-adding chain as an analytic category.

international economy. The links might run vertically or diagonally and might criss-cross each other where firms belong to more than one VAP simultaneously (which will frequently be the case). The industrial economy, with these multiple linkages and criss-crossing VAPs, then looks as shown in Chart 9.

Chart 9 about here

For development purposes, such a multiply-linked global economy is a rich resource of technology and knowledge, to be tapped by developing countries and by the firms within them. As the World Bank put it in a recent report:

... [T]he successful countries have consistently taken an active approach to integration in the world economy by upgrading the learning capacity of firms, selectively financing R&D, encouraging the licensing of foreign technologies, and extending intellectual property rights and ICT infrastructure – in short, progressively deepening and tuning their national innovation system rather than passively waiting for MNCs or imports to transfer technology. Thus engagement is a long process of undertaking the necessary institutional reforms and needs to start early in the development process.⁴⁸

Global value chains and global production networks

Scholars have captured the opportunities that exist for latecomer firms within these networks in concepts that include global value chains (GVCs) or global production networks (GPNs).⁴⁹ They can also be regional or national in scope, when they play the same role of providing a local latecomer firm with opportunities to be pulled into a wider network of activities through contracting its services to firms beyond its immediate environment. Gereffi, for example, distinguishes GVCs which are buyer instigated and GVCs which are producer firm instigated. The distinction is worth making because the dynamics of the network processes, i.e. *the linkage opportunities*, are different in each case. Even more to the point, the opportunities to *leverage knowledge and capability* from these arrangements differs as well.

The *value chain* describes the full range of activities that are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. Considered in its most elementary form, it takes the shape as described in Chart 10. As can be seen from this, production *per se* is only one of a number of value-added *links*. Moreover, there is a range of *activities* within each link of the chain (only those for product development are detailed in the Chart).

Chart 10 about here

⁴⁸ DeFerranti et al (2002): 200.

⁴⁹ See for example Gereffi (1999); Best (1990), or for the case of China, Grewal, Xue, Sheehan and Sun (2002).

From the perspective of the local firm, or local clusters, *the global value chain already exists*. It is a matter of finding a way for the local firm, or local cluster, to insert itself into this wider network. The UNIDO (2002) report discusses several examples, from such industries as textiles and clothing, leather and footwear, wooden furniture and foodstuffs, all of which represent traditional industries seemingly not susceptible to knowledge-intensive, technology leverage strategies. But leverage can work, at whatever level it is applied.

Leverage and learning within value chains

Capturing linkage opportunities is just half the story for latecomer firms in developing countries. The other aspect is the way that firms can utilize the linkages created to leverage skills, knowledge and technology from the firms which are contracting with them. This is what drives the process of technological upgrading within a networked system.

To see how this is done in practice, consider the case of apparel contracting firms in Mexico, where the opening up of the country under NAFTA, and the appearance of new, global buyers in apparel districts such as Torreón, have transformed the prospects for once struggling garments firms.

Box 2: Full-package exporting in apparel industry, Mexico

Apparel firms in Mexico have been drawn into linkage arrangements with US buyer firms that outsource manufacturing activities across the border under the new trade arrangements unleashed by NAFTA. The region of Torreón is a classic instance, in that it was plunging towards disintegration in the late 1980s, based solely on least cost assembly of apparel such as jeans utilizing all imported components, to a renaissance in the 1990s where a wider range of activities is undertaken, utilizing more advanced technologies and quality standards. La Laguna in the Torreón region is a prime exporter of jeans, and Gereffi and Martinez (2000) who have made a study of the region, attribute its renaissance to technological upgrading and expanding of activities within an international value chain. In turn, they see the creation of NAFTA, and the devaluation of the Mexican peso, as creating the right conditions for these changes to be effected. Those factors have made Mexico a more attractive place for investment and trade.

The Mexican jeans producers in La Laguna have seen employment levels and wage levels rise with these changes, as well as employment conditions improve. They link this directly to the involvement of major international buyers like Levi Strauss, who are prepared to co-invest with Mexican firms in more advanced technologies, and to the spread of related and associated activities occupying more and more positions in the value chain – a situation they describe as “full package exporting” as opposed to partial package or assembly only. As Gereffi and Martinez (2000) say: “The new activities being performed in La Laguna – textile production (i.e. denim), cutting, laundering, finishing and, to a lesser extent, the manufacture of trim and other inputs – are important to the local creation and retention of wealth because they add higher value to jeans than assembly alone, and this offer larger profit margins... Before NAFTA, most Mexican companies only profited from assembly. Today local firms benefit across more stages of the apparel supply chain” (2000: 48).

Source: Gereffi and Martinez (2000); Gereffi and Bair (1998); Bair (2002)

Gereffi and Martinez (2000) insist that it is global buyers that have transformed the prospects for apparel firms within La Laguna, rather than the producer groups that initiated global value chains in the 1980s based on least-cost assembly. The buyer groups tend to leave more initiative to the contracting firms, and insist on higher standards of behaviour (from environmental protection to occupational health and safety) – this last being linked to their sensitivity to poor publicity over exploitative behaviour. It is the higher standards that then drive the technological upgrading of the firms in the local region.

Industrial upgrading: strategic choices

Generally, we may see upgrading through leverage being effected through a variety of linkages within value chains. It is a process that may be described as inserting local value chains within global value chains. The opportunities opened up, for leverage and learning, are thus magnified. What results from the process is *industrial upgrading*. This is the form that innovation takes in developing countries. It depends on efforts made within the firm itself, and within the wider cluster of which the firm is a member.

Upgrading starts at the level of the individual firm – as much of the scholarly literature on the resource-based firm makes clear. The ideas of the resource-based firm (Mathews 2002d) and core competence (Leonard-Barton, 1995) – are based on the idea that firms should concentrate on what they can do best and which other firms find difficult to replicate, and to outsource those activities which do not meet these requirements. Similarly, the literature on dynamic capabilities – focusing on internal processes, firm-based resources and firm path-dependencies – has also tended to be firm focused (Teece, Pisano, Shuen 1997).

But upgrading also involves firms moving into new relationships with each other, and this is where global value chains offer such valuable opportunities for latecomers. It is here that value chain analysis can provide important insights into the totality of the upgrading challenge. It requires actors to focus not only on individual activities within their link in the value chain, but also on the other links in the chain which affect the whole chain's competitive performance. This perspective may induce the firm to improve its efficiency in individual activities, to change its mix of activities (within its link and perhaps to expand into other links) or to work with other firms to improve their joint efficiency. This relates both to new product and process development.

From this it is possible to identify four upgrading strategies within GVCs:

1. **Process upgrading:** A producer can try to refine a given product through process innovations that lead to efficiency gains in manufacturing. Increasing the efficiency of internal processes such that these are significantly better than those of rivals may involve better internal procedures (for example, reducing stock levels) as well as improved inter-firm procedures (for example, more frequent deliveries to customers)
2. **Product upgrading:** Introducing new products or improving old products faster than rivals. Here, too, this involves both internal procedures and product development links along the value chain.

3. **Functional upgrading:** In the long run the producer can also diversify into different kind of products and services that offer higher profits and are located on a higher stage within the value chain. This involves changing the mix of activities conducted within the firm. Some of these may be internal to operations (for example, outsourcing assembly, or taking responsibility for quality), others may be more ambitious and may involve moving into activities formerly undertaken by firms in other links in the chain (for example taking responsibility for design). This requires the capability of managing its own supply chain.
4. **Upgrading into a new value chain:** Moving to a new value chain is certainly the most demanding opportunity but anecdotal evidence shows that many producers especially in East Asia accepted this challenge (for example, Taiwanese firms moved from the manufacture of transistor radios, to calculators, to TVs, to computer monitors, to laptops, and now to cellular phones).

Chart 11 depicts the different upgrading opportunities. Suppose there are three different value chains (I-III) with three links each. A firm on link A' on value chain II can upgrade within A' by introducing incremental product and process innovations. Alternatively, it can move from A' to B' within the same chain (functional upgrading) or move to another chain to B or B''. The two latter strategies are clearly favourable in economic terms but difficult to achieve.

Chart 11 about here

Let us consider these trajectories in a little more detail. As evidenced in the case of the Torreón jeans producers in Mexico, the insertion of a local firm in the global value chain instigated by a buyer, like The Gap, or by a producer, like Levi Strauss, puts great pressure on the firm to meet demanding quality, reliability and logistics standards. This is trajectory No. 1. But the buyer or producer also wants to be able to make rapid product adjustments (eg in response to shifting patterns of consumer demand in their stores) and so there is also great pressure to be able to change product lines quickly and reliably. This is trajectory No. 2; its endpoint is a firm that has attained full “lean production” capabilities in flexibility and agility (Humphrey and Schmitz 2002).

Strategy No. 3 involves the all-important step of moving from one functional specialization to another. The move from production to design might seem a small step in itself – but it is a huge step for a latecomer firm looking to build its capabilities. It is the first step towards self-sufficiency, where the firm might no longer be entirely dependent on the GVC for its survival. This step is sometimes taken by the individual firm itself – as was the case with East Asian electronics firms that moved through phases of Original Equipment Manufacturing (OEM), entirely to the specifications of contracting firms, to Own Design and Manufacture (ODM) where the buyer firm simply gives broad specifications and allows the contractor to fill in the details, to Own Brand Manufacturing (OBM), where the firm is fully fledged and produces its own line of branded products. But the step No. 3 is more likely undertaken by a group of firms acting as a cluster, with one firm adding value in one part of the chain, and another adding value in a related step. This is the pattern that has been observed in Torreón, and in many other cluster-style

developments. The different pathways, involving OEM, ODM and OBM, are depicted in Chart 12 for the special case of the Taiwan electronics sector.

Chart 12 about here

Trajectory No. 4 is the all-important break, from one GVC to another. Of course insertion of a firm or local cluster in a GVC is an important step forward – but the smart firm or cluster does not have to see its horizons limited by this case. The smart firm looking to expand its options and its capabilities is always on the lookout for ways of spreading its involvement across two or more value chains. This both leverages more skills and enhances capabilities, and reduces the risk of being tied to a single GVC. Taiwanese TV producers in the electronics industry utilized GVC's instigated by US buyers like J.C. Penney and Kmart to leverage the skills involved in mass production of TV sets – and then were able to transfer these skills across to produce PC monitors for PC producers such as Hewlett Packard, IBM or Apple, who were building quite different GVC's. It is this cross-insertion that builds a variety of capabilities and provides a platform of independence for the developing firm.

Access to global buyers

Before upgrading becomes an issue a firm has to enter a value chain. New producers wanting to have a presence in final markets need to find some form of entering these global production chains. This may often be an extremely difficult process and affected not just by efficiency considerations since large firms in final markets often control product markets. For example, in the furniture industry it is now widely believed that the dynamic producers are to be found in China, and East Asia and this is where global buyers are concentrating. Given this focus of the global buyers, it is- at least in the short run- difficult even for highly efficient and competitive producers in Latin America or South Asia to gain access to these global buyers. The challenge for developing country producers is to access the chains' lead firms, either directly as a supplier or indirectly as a second-tier supplier. The pivotal role of global buyers is depicted in the diagram. They are the middleman between global consumers and the local manufacturers thereby inserting local links into global chains. Despite the diffusion of Internet based B2C services that allows producers to circumvent the middlemen, the dominance of global buyers is not expected to diminish in the near future.

Models (vehicles) of the leverage process

Leverage can be effected via many different institutions or combinations of institutions and firms. Three such models (or vehicles) are identified in Mathews and Cho (2000). While there are obvious country identifications with these approaches, it is preferable to label them in neutral terms as Model 1, Model 2 and Model 3, in order to inquire into the prevalence of their use, and the limitations that are intrinsic to each.

The three constellations most frequently observed are the following:

- Model A: Indigenous large firms as vehicles of leverage;
- Model B: Public sector agencies combined with clusters of small firms as vehicles of leverage;

- Model C: Foreign TNC's creating linkages with local firms as vehicles of leverage.

Model A: Indigenous large firms

This approach -- pursued by Japan and Korea -- is based on the reasonable assumption that large firms will tend to acquire capabilities of technology leverage more readily than smaller firms less exposed to international competition. In this setting technological learning occurs mainly through the import of capital goods where technology is embedded in process and product technology. In this case of unpacked technology import, efficient utilization of the technology relies on local engineers and technicians and offers both greater risks and rewards. This model was employed in Korea and Japan (Kim 1997; Dodgson and Kim 1997). Relying on large firms has its merits in the phase of knowledge acquisition. With respect to innovation proper (i.e. creation of new knowledge) however it may be better to promote smaller enterprises because size also carries a number of disadvantages. Bigger firms have to be more hierarchical and bureaucratic to manage the larger number of employees. This can impede their innovation potential.

Model B: Public sector R&D institutes and SMEs

In the absence of large firms, or where there is a preponderance of small and medium-sized enterprises (SMEs), there is an alternative vehicle of leverage in the form of public sector agencies working in conjunction with SMEs. These agencies acquire the technology in the first place; they build up expertise in the products and processes; they improve and adapt the technologies and then diffuse the capabilities as rapidly as possible to the private sector, in some cases even creating the companies for the purpose. This model is for example employed in Taiwan (Mathews 2002c). This is a very successful way of utilizing clusters to overcome the diseconomies of scale suffered by small firms -- while capturing the flexibility and innovative potential inherent in small, entrepreneurial firms.

Model C: TNC's with backward and forward linkages

A third variant is to recognize that multinational corporations constitute the world's most abundant source of technological competences, and utilize them to secure access to these competences for local firms. Thus, the approach pioneered by Singapore, is to offer multinationals favourable conditions for location of their activities in the host country, with a view to raising overall skill and technological capabilities thereby, and to set in train a process of upgrading through inducing the multinationals to enhance their own operations and pass on ('indigenize') more and more of their own internal capabilities.

The case of China currently provides an illustration of the use of these different vehicles of leverage, *simultaneously*. China has an abundance of indigenous large firms, in the form of its state-owned enterprises, which if equipped with upgrading strategies, can license technology from abroad and enhance their own capabilities. China also has an abundance of small firms, e.g. township and village enterprises, which on their own can achieve little, but can become vehicles of leverage if linked with China's R&D institutions, many of which have been searching for a new direction with the decline of the cold war. Third, China since the inauguration of the "Open Door" policy in 1979, has

been attracting TNC's and these offer simultaneously a third pathway for local domestic firms to link up with them as suppliers (backward linkages) or as retail outlets (forward linkages). Thus some scholars argue that China is at the beginning of the 21st century an exemplary case of industrial learning through linkage and leverage, utilizing all three models simultaneously (Zhao 1995)

Industrial learning systems

These ideas found their way into the UNIDO report, *Industrial Development Report 2002*. Thus there is already a kind of practical outcome to these discussions, insofar as UNIDO has the framework in summary form in this report. But I believe the potential of this strategic perspective can be further developed and elaborated. The task is to identify the sources of complementarity so that the latecomer firm has something to offer in return for the economic or technology transfer – and this is where the connection with the processes of globalization, and the emergence of novel institutional forms such as global value chains is so important. It could generate a series of field projects for UN agencies such as UNIDO, as well as for private sector firms such as the Hong Kong-based Li & Fung, whose business is the creation of global value chains as it receives orders from buyer firms in the advanced countries.⁵⁰

The point of a strategic perspective is that GVC's are being created, and disbanded, all the time – but under conditions that reflect the constraints and dynamics of the global economy. A framework for development couched in strategic terms, and linking industrial development to globalization processes, would have major practical implications.⁵¹

Latecomer firms can be effective in overcoming their disadvantages and exploiting their potential advantages (eg of technological leapfrogging) only if the country in which they are located builds a set of supporting institutions that guide, shape and channel the linkage and leverage processes. This is a system of industrial learning – and one which itself adapts and improves over time, in a process of institutional learning.

It is the repeated application of linkage and leverage strategies over time that may be constructed as a process of industrial learning. With each iteration, new capabilities are acquired, by an individual firm, or by a group of firms. This then serves as a platform for the next round of linkage and leverage, and further enhancement of capabilities. This process could be repeated several times before a firm, or group of firms, approaches industry leaders in terms of its capabilities.

The best examples of such repeated applications of linkage and leverage are found in the high-technology industrialization experiences of East Asian countries such as Korea and Taiwan. There the strategy being applied is very clear. The coherence of repeated application strongly argues against random adaptations or just plain 'luck' in accounting for East Asian success in knowledge-intensive industries. If the approach to industry creation and industry upgrading works once, why not try it again -- and again, and again? Some examples reinforce this point. Consider first the case of Taiwanese

⁵⁰ See the description of Li & Fung in Magretta (1998) and in Mathews (2002a).

⁵¹ See for example the recent study of a set of clusters in Latin America by Pietrobelli and Rabellotti (2004) where clear policy implications are drawn for the Inter-American Bank.

firms, which have diversified their output in the semiconductor industry to encompass DRAMs and sophisticated communications chips.

Box 3: Taiwanese success in DRAMs and Communications chips.

Taiwanese firms mastered DRAM technology only in the 1990s. Earlier efforts to enter the industry, by firms such as Quasel, Mosel and Vitelec, all failed. (Quasel disappeared as a company; Mosel and Vitelec merged in the 1990s and have since become strong DRAM producers.) The supporting infrastructure and skills -- in a word, the absorptive capacity of the Taiwan semiconductor industry -- was not at that time able to support the demands of advanced DRAM fabrication. Absorptive capacity was being enhanced by the activities of semiconductor firms in various non-memory devices, which rapidly deepened their experience through the various stages of developmental resource leverage in the 1980s. At the same time, judicious targeting by the Taiwan public agencies (such as the Industrial Development Bureau and ITRI) ensured that as many of the steps as possible in the semiconductor value-chain were being covered (such as IC design, mask production, and supply of specialist materials and equipment). The decisive contribution to raising the industry's absorptive capacity to produce DRAMs was made by the industry research institution ERSO with its Submicron project, in which a major pilot fabrication plant was built and subsequently passed across to the private sector (thus accounting for the launch of the new firm, Vanguard International Semiconductor Corporation). In the 1990s, one Taiwan firm after another announced the intention of becoming a DRAM producer, based on technology transfer agreements with US or Japanese firms. By the late 1990s, these Taiwanese firms were established as serious and highly competitive DRAM producers, putting great pressure on their Korean, Japanese and US counterparts. (By the late 1990s the Europeans had just about given up in DRAMs.) Thus the initiative for moving to the next stage of semiconductor capabilities was taken by both the private and public sectors, with the initiative for technology leverage gradually moving to the private sector as the industry matured.

Likewise in the communications chips sector, Taiwanese firms utilized various forms of technology leverage to become players in this most sophisticated segment of the IC market in the 1990s. Here the technological challenge is to meet international standards for data transmission protocols. In the 1980s, before the industry's absorptive capacity had reached the appropriate level, some small firms tried to enter this industry as 'knock off' practitioners, taking US or Japanese products and copying them to sell for a lower price. Strict enforcement of property rights put a stop to this. A new wave of Taiwanese ventures in this sector emerged in the 1990s, driven by technology leverage taking place through both the public and private sectors. In the private sector, firms like Silicon Integrated Systems entered the fast Ethernet data switching IC business by licensing technology from one of the leading US firms, National Semiconductor. In the public sector, ITRI's ERSO and CCL have developed Ethernet switches and the ICs to drive them, and then formed R&D alliances with small firms to pass across the technology for rapid commercialization. Firms such as DLink and Accton have prospered through this process.

The point to emphasize here is that there is a coherence to these continuing leverage processes. They evolve as competences are accumulated. The earlier competences in basic semiconductor fabrication and marketing, which themselves were leveraged mainly via the public sector, serve as a platform for later, more specialized and sophisticated devices, which are leveraged through both the public and private sector.

Limits to applicability: less successful cases

There are limits to the success of leverage strategies. This is an important issue if the strategy is to be generalized as one that least developed countries today can be expected to apply. Both Taiwan and Korea, for example, have attempted to create high technology industries through similar leverage strategies as those which worked in semiconductors, such as in biotechnology and aerospace, with little success to date. While Korea has managed to leverage the ingredients of an automotive industry, Taiwan has been less successful in this sector. The Taiwanese have established several motor vehicle companies, and linked them through technology leverage to Japanese automotive producers -- but they have remained tied to these Japanese firms, producing under their brand for over two decades, with little prospect of breaking free to design and produce cars of their own, as would be the expected outcome of the leverage strategy. So, with certain qualifications, one might say that the leverage strategy has not served the Taiwanese particularly well in automotive products.⁵²

Likewise in aerospace, the attempts by the Taiwanese to launch aircraft projects, through technology transfer from European and US producers, have yet to meet with success. The reasons for these shortcomings are many. While undoubtedly there were failings on the Taiwanese side, in terms of technological or marketing deficiencies, there were also powerful factors working against their success in the very nature of the industry. Whereas the semiconductor industry and electronics and IT generally are characterized by many competitors, fast product life cycles and rapid company turnover, none of these conditions apply in the cases of the automotive or aerospace sectors. These, on the contrary, are characterized by few players, by huge investments in long product development cycles, and by very low company turnover. All are factors mitigating against the prospects of securing technology through leverage other than on the terms dictated by the incumbents for what they perceive to be their own interests (eg some technology transfer associated with OEM contracting), or in aerospace, associated with defence and security issues. In other countries of SEAsia, such as Indonesia, attempts to enter high technology sectors such as aerospace, without the accumulated technological capabilities and 'absorptive capacity' that Taiwan can demonstrate, have been even more controversial and problematic. The Indonesian case demonstrates quite vividly the limits and obstacles to catch-up by latecomers in technologically complex fields like aircraft manufacture (prior to the Asian financial crisis).⁵³ Technology leverage is not destined to succeed without the requisite preparation and investment in absorptive capacity.

Even in the IT and electronics sector, the Taiwanese have had patchy success. While Taiwan firms ride high in PCs and PC components such as motherboards, mouse pointers, monitors and scanners, they have made little headway in such ultra sophisticated

⁵² There are important qualifications. In the mid-1990s, for example, the Taiwanese launched a collaborative R&D exercise to jointly develop a 4-stroke automotive engine (after an earlier attempt in the 1980s to develop a 2-stroke engine ended in failure). Technology in this instance was leveraged from the UK firm, Lotus, under the auspices of ITRI's Mechanical Engineering Laboratory. This has resulted in several participant Taiwanese automotive firms becoming engine producers, through a consortium, the Taiwan Engine Company, now a successful exporter of engines to China.

⁵³ See McKendrick (1992) for an assessment of Indonesia's 'catch-up' efforts in the aircraft industry, where the accumulation of impressive technological capabilities was not matched by managerial competences.

products such as hard disc drives and, until the late 1990s, in CD-ROMs and flat panel displays, while they had in the late 1990s virtually zero penetration in such areas as video cassette recorders and players. It turns out that what is required in these kinds of products is not just digital electronics and video technology, but also capabilities in precision engineering, for the micro-motors and bearings on which these products depend. In the absence of a strong infrastructure of precision engineering firms, which themselves may have been leveraged from supply contracts to incumbent players and multinationals, it has proven to be very difficult for Taiwan to leverage and implement the technologies associated with these precision-drive-based products.

This contrasts dramatically with the case of Singapore, which has been able to develop a strong infrastructure of precision engineering small firms whose business is initiated by servicing the multinationals. The point being made here is that there are clear limits to the likely success of a technology leverage strategy in the absence of the requisite technological foundations ('absorptive capacity') and public technological learning infrastructure and associated industrial clusters.

These examples demonstrate (if such demonstration is needed) that the processes involved in latecomer industrial development are fraught with difficulty. Every step forward is followed by slips back, in a process that can only be characterized as struggle. This underscores why a strategic perspective, which takes such ideas as given, is appropriate. It is only in the world of neoclassical economic models that transitions are seamless and mechanically accomplished.

Institutions of industrial learning

Latecomer firms acquire their competences in the circumstances created by the institutional frameworks and rules within which they operate. These institutions drive firms to make certain kinds of choices, such as allowing them to collaborate with other firms to acquire certain new competences, while remaining fierce competitors in other product markets. Again we find many examples of such institutions in east Asia, where the linkage and leverage strategies have been best developed.

In Taiwan, small firms have been encouraged to overcome their diseconomies of scale, with respect to large firms, by allying themselves in R&D consortia, where technological guidance is provided by a public sector laboratory (usually one of the laboratories of the Industrial Technology Research Institute).⁵⁴ The key organizations within these R&D-promoting institutions are private firms and ITRI. But important guiding and catalytic roles are also played by government ministries, particularly the Ministry of Economic Affairs (for funding and audit), and by trade associations, which play an important role in legitimating the R&D consortia in the eyes of their member firms, and in recruiting firms for membership of the consortia. The linkage and leverage experiences channelled through this particular kind of industrial learning institution, and the development and adaptation shown by the R&D consortia themselves, are described in Box 4.

⁵⁴ In Taiwan firms have also been involved in mergers to form large industrial groups, a process now well underway, and described in Amsden and Chu (2002).

Box 4: Taiwan's R&D consortia

Unlike the cases of Japan and Korea, Taiwan's most significant players have not been giant firms, but small and medium-sized enterprises whose entrepreneurial flexibility and adaptability have been the key to their success – although the situation is changing (Amsden and Chu 2002). Underpinning this success is the efforts of public sector research and development institutes, such as Taiwan's Industrial Technology Research Institute (ITRI) which since its founding in 1973 has acted as a prime vehicle for the leveraging of advanced technologies from abroad, and for their rapid diffusion or dissemination to Taiwan's firms. This cooperation between public and private sectors, to overcome the scale disadvantages of Taiwan's small firms, is a characteristic feature of the country's technological upgrading strategies, and the creation of new high technology sectors such as semiconductors. Behind many of these successes lie some remarkable institutional structures favouring collaborative product development, which is Taiwan's own adaptation of the R&D alliance. Taiwan's current dominance of mobile PCs for example, rests at least in part on a public-private sector led consortium that rushed a product to world markets in 1991. Taiwan's strong performance in communications products such as data switches, which now dominate in PC networks, similarly rests on a consortium which worked with Taiwan's public sector industry research organization, ITRI, to produce a switch to match the Ethernet standard, in 1992/93. When IBM introduced a new PC based on its PowerPC microprocessor, in June 1995, Taiwan firms exhibited a range of computing products based on the same processor just one day later. Again this achievement rested on a carefully nurtured R&D consortium involving both IBM and Motorola, joint developers of the PowerPC, as external parties (Mathews and Poon 1995).

These successes were followed up by many more such R&D alliances in digital communications and multimedia areas. Taiwan is emerging as a potentially strong player in the automotive industry, particularly in the expanding China market, driven by its development of a 1.2 litre 4-valve engine; again, this is the product of a public-private collaborative research endeavour involving three companies, which have now jointly created a new Taiwan Engine Company to produce the product. Thus, the R&D consortium is an inter-organizational form that Taiwan has adapted to its own purposes as a vehicle for catch-up industry creation and technological upgrading. The micro dynamics of the operation of these consortia is therefore a matter of some substantial interest. Some of these consortia have been more successful than others - but all seem to have learned organizational lessons from the early cases where government contributed all the funds, and research tasks were formulated in generic and overly ambitious terms for the companies to take advantage of them. The more recent R&D alliances have been more focused, more tightly organized and managed, and have involved participant firms much more directly in co-developing a core technology or new technological standard which can be incorporated by the companies, through adoption and adaptation, in their own products. The basic model of the Taiwanese alliances is the construction of a process in which R&D costs can be shared, and risks reduced, through bringing many small firms into a collaborative alliance with each other and with ITRI (i.e. with one its operating laboratories); it is ITRI which provides the anchor for the alliance and the principal technology leverage vehicle. Thus, the Taiwan R&D alliances differ from their counterparts in the USA, Japan and Europe, in that their goal is rapid adoption of new technological standards, products or processes developed elsewhere, and their rapid diffusion to as many firms as possible. But their organizational form owes much to the R&D collaborative vehicles developed in the leading industrial centres, particularly in the way that Japan structured many relatively short-lived R&D alliances with clear technological goals - as in the 1976-79 VLSI project.

Source: Mathews (2002c)

One striking feature worthy of immediate notice is the relatively small budgets of these consortia. In all, the twenty consortia have accounted for a budget of no more than NT\$4 billion, over 15 years, with government input of no more than NT\$2.3 billion -- or around US\$100 million, equivalent to just *one year's government subsidy of the 10-year Sematech program in the USA*.⁵⁵ Thus, these figures reveal just what a “David and Goliath” struggle it has been for Taiwan to take on US firms in high technology industries -- and they underscore the significance of the Taiwan achievements, which owe as much to organizational finesse and learning as to dollar subsidies.

Table 2. R&D alliances in Taiwan: 20 cases 1983-1997

| <i>Alliance</i> | <i>Year(s)</i> | <i>Companies</i> | <i>Budget NT\$ m</i> |
|---|----------------|------------------|--------------------------|
| <i>A. Electronics and information technology</i> | | | |
| 1. PC 100 (IBM PC XT-compatible) | 1983-1984 | 5(9) | 40 |
| 2. PC 400 (IBM PC AT-compatible) | 1984-1985 | 3 | 24 |
| 3. Workstation (Sun SPARC-compatible) | 1989-1991 | 2(3) | 150 |
| 4. Notebook PC | 1990-1991 | 46 | 100 |
| 5. Graphics terminal | 1991-1993 | 34(9) | 25 |
| 6. Palmtop PC | 1991-1992 | 16 | 50 |
| 7. Pentium server | 1991-1993 | 2 | 50 |
| 8. Taiwan NewPC (PowerPC) | 1993-1997 | 40 | 250 |
| <i>B. Consumer electronics and communications</i> | | | |
| 1. Ethernet switch | 1993-1996 | 5(8) | 75 |
| 2. Digital loop carrier | 1992-1994 | 3(4) | 60 |
| 3. LCD consortium | 1995-1997 | 4 | 230 |
| 4. HDTV | 1994-1996 | 11 | 250 |
| 5. Interactive TV | 1995-1997 | 21 | 200 |
| 6. V5 Network access standard | 1996- | 12 | 150 |
| 7. High speed loop access system | 1996- | 14 | 120 |
| <i>C. Mechanical engineering/materials</i> | | | |
| 1. 1.2 L engine | 1992-1997 | 4(3) | 1,400 |
| 2. Electric scooter | 1991-1996 | 10 | 500 |
| 3. 250cc motorcycle engine | 1996- | 2 | 600 |
| <i>D. Software/services</i> | | | |
| 1. Java-based Internet products | 1996- | 24 | 250 |
| 2. Electronic commerce | 1996- | 61 | 300 |
| (..) Second-stage participation | | | |

Uptake of resource leverage strategies in other developing and peripheral countries

⁵⁵ On Sematech's budget and its appropriation in the mid- to late-1990s, see Sematech, *A World of Opportunity: 1996 Annual Report* (Austin, TX: Sematech, 1997).

Linkage and leverage is pattern of choice for technology diffusion management beyond the sphere of second generation Asian NIC's and China. It is increasingly evident in the countries of South and Central America, now that they have thrown off the "import substitution" illusions that held them back in the past, and in South Asia as it opens up to world economic influences and opportunities. In West Asia (or the Middle East) the prospects of industrial development are hindered only by constant war, and indeed promise the best alternative to military conflict. Israel has made enormous strides to become a hotbed of technological entrepreneurship, but some of its Arab neighbors were also making great progress, at least until the recent hostilities. One of the most striking features of the Camp David Accords was the provision for an international airport in the Gaza Strip, to facilitate the creation of an industrial export processing zone. This is exactly what is needed to kick-start a process for the poorest parts of the Arab world to finally start catching up with the West – in replication of the way that Europe set about catching up with the Arab world in the 13th and 14th centuries when Islamic civilization was at its height.

Consider how the poorest, peripheral parts of Europe have forged ahead after adopting DRL strategies over the course of the past two decades. Ireland has emerged as a high performing European country through encouraging foreign direct investment on the Singapore model, while in the UK, both Scotland and Wales have achieved great industrial success in new industrial sectors through targeted FDI, reversing the effects of their earlier de-industrialization. Using cleverly crafted "latecomer" strategies, bodies like the Scottish Enterprise and Welsh Development Agency have managed to catalyze industry clusters and supportive industries like those supporting the offshore oil industry in Scotland and in promoting an electronics industry based on FDI -- see Box 5 on Scotland's 'Silicon Glen'.

Box 5. Scotland's Silicon Glen

Scotland has been particularly successful in the electronics and semiconductor industries, through judicious use of FDI and technology leverage. Silicon Glen is the term used to describe the central region in Scotland (running from Glasgow in the west to Edinburgh in the east) which is now home to dozens of major MNC electronics production centers and, increasingly, R&D centers as well. Firms that have invested in such facilities include US, European and Japanese firms, including IBM, Lexmark, Philips, NEC, JVC, Sun, Cadence, OKI, Jabil Circuit, Honeywell, Motorola, Compaq, Solectron, NCR, Raytheon and Polaroid. Just in January 2000 Agilent, the new computing and communications spin-off from Hewlett-Packard, announced that it would open a new research facility at HP's existing production plant in South Queensferry. This is a classic strategy of upgrading that has been perfected in Singapore and emulated elsewhere in SEAsia, and is now evidently being picked up in Scotland as well.

As in the case of Korea and Taiwan there is evidence of repeated application of leverage principles. Take the case of the Alba Center, located in Silicon Glen just west of Edinburgh. This is now a leading center for design of advanced "system on a chip" semiconductors and seeding the development of a new industry in Scotland based on the leading edge semiconductor technology. The Alba Center is a broad campus of highly focused semiconductor firms, including Simutech Corporation (from Portland, OR), Test Advantage, a global test services company focused on system on a chip processes, Micro Linear Corporation from San Jose, and Cadence, also of San Jose, which kick-started the process by announcing that it would establish its next-generation CAD system-on-chip design center at the Alba campus. Its core is a common design

center, termed the Institute for System-Level Integration (ISLI), for use by small and medium-sized chip design houses which could not afford the expensive computer-aided design (CAD) equipment needed for these advanced products. So Scottish Enterprise formed a development consortium involving local universities and Cadence, a leading Silicon Valley supplier of such CAD equipment, to establish the ISLI at the Alba Center as a common resource.⁵⁶ This is complemented by the Virtual Component Exchange (VCX), the world's first exchange for intellectual property, facilitating the exchange of system design modules between chip design houses.

This is an outstanding case of the use of technology leverage, in this case by a peripheral country, to upgrade industry capabilities and spark the creation of new knowledge-intensive firms at the leading edge of technological development. It demonstrates that linkage and leverage is applicable in any country where the institutional foundations are created and the political will to implement external leverage is well developed.

Patenting strategies: From imitation to innovation in East Asia

The goal of all latecomer countries is to move beyond imitation, to close the gap with the advanced countries, and become an innovator in its own right. Innovation in the case of latecomer countries needs to be understood in a way that is rather different from innovation in the case of leaders. The lead countries are interested in maintaining their lead through “new-to-the-world” innovations, in products, or processes or abstract knowledge generally (such as the human genome). For the latecomer countries whose primary strategic goal is to catch up, innovation means “new-to-the-country” innovation, which involves the management of accelerated diffusion of technologies from advanced to catch-up countries (Amsden 2001; Mathews and Cho 2000; Mathews 2001).

One of the clearest indications of innovation performance is the rate of take-up of patents issued by the US Patent and Trademarks Office (USPTO).⁵⁷ Here it is found that East Asian firms and institutions have made astonishing strides in recent years (Hu and Jaffe 2001; Jung and Imm 2002). Taiwan in particular has risen to third highest in the world in terms of per capita take-up of USPTO patents over the past five years (1997-2001). This is clear evidence that these countries are successfully making the transition *from imitation to innovation*.⁵⁸

The use of patent statistics as sources of information concerning the build-up and diffusion of knowledge is by now well established.⁵⁹ Scholars at the NBER have developed methodologies for studying the flow of knowledge, from one country to another, utilizing patent statistics. In particular data from patents taken out in the USPTO by both American and foreign firms enables researchers to trace the influence of knowledge spillovers and degrees of specialization associated with industrial clustering

⁵⁶ For further details on the Alba Center, see the institution's website: www.albacentre.com.

⁵⁷ The USPTO is itself a product of American catch-up efforts; it was the first government agency established by the federal government in the 18th century, and its charter is embedded in the US Constitution.

⁵⁸ The phrase comes from Kim (1997).

⁵⁹ See Griliches 1990; Trajtenberg, 1990; Dosi, Pavitt and Soete 1990; Jones 2002; and Furman, Porter and Stern 2002.

(Jaffe and Trajtenberg 1998). Studies have also utilized such USPTO patenting activity to examine the experience of individual countries, such as the case of Israel (Trajtenberg 1999).

With all their deficiencies, patent data, and particularly data concerning what the USPTO calls “utility patents” (which represent real inventiveness, rather than repeat patents and other “noise” in the data for patents overall) represent a uniform and time-robust measure of innovative output with an immediate economic significance: the time and trouble involved for firms to seek patents within the USPTO system filter out trivial or idiosyncratic innovations. Moreover, the US market is widely recognized as the largest and the most technologically advanced in the world and the US patent statistics are more reliable indicators because of the common screening procedures imposed by the USPTO (Pavitt, 1988).

Table 3. Country statistics: Averages for 5- and 30-year periods (Utility Patent Only)

| Country | Patents per year | | | Patents per capita | | | Success rate | | | Annual growth rate | | |
|------------------------|------------------|---------|-----------|--------------------|---------|-----------|--------------|---------|-----------|--------------------|---------|-----------|
| | 1968-97 | 1992-97 | 1997-2001 | 1968-97 | 1992-97 | 1997-2001 | 1968-97 | 1992-97 | 1997-2002 | 1968-97 | 1992-97 | 1997-2001 |
| <i>G7</i> | | | | | | | | | | | | |
| USA | 44850 | 56683 | 79717 | 15.5 | 21.5 | 28.6 | 58.9 | 52.2 | 53.2 | 4.9% | 7.9% | 9.7% |
| Japan | 11216 | 22433 | 29949 | 10.3 | 17.9 | 23.7 | 55.5 | 57.9 | 61.5 | 8.6% | 6.5% | 10.2% |
| Germany | 5806 | 6895 | 9387 | 9.2 | 8.4 | 11.4 | 59.5 | 59.8 | 59.3 | 2.7% | 4.3% | 13.0% |
| France | 2432 | 2881 | 3662 | 4.3 | 5.0 | 6.2 | 66.5 | 61.9 | 60.4 | 16.4% | 3.7% | 8.5% |
| UK | 2492 | 2427 | 3469 | 4 | 4.2 | 5.9 | 53.5 | 50.2 | 50.6 | 2.7% | 6.7% | 10.8% |
| Canada | 1380 | 2119 | 3121 | 4.9 | 7.2 | 10.2 | 50.7 | 49.3 | 48.6 | 6.5% | 7.5% | 11.2% |
| Italy | 855 | 1215 | 1548 | 1.7 | 2.1 | 2.7 | 54.1 | 58.3 | 61.5 | 4.4% | 4.5% | 9.2% |
| <i>Reference group</i> | | | | | | | | | | | | |
| Israel | 183 | 400 | 757 | 4.2 | 7.2 | 12.4 | 42.2 | 40.5 | 37.1 | 12.5% | 15.4% | 17.3% |
| Finland | 181 | 370 | 609 | 4.2 | 7.2 | 11.8 | 48.6 | 51.3 | 47.0 | 11.4% | 10.0% | 13.6% |
| Ireland | 31 | 60 | 101 | 1 | 1.7 | 2.7 | 43.0 | 48.8 | 36.1 | 11.9% | 7.1% | 18.9% |
| Spain | 92 | 152 | 237 | 0.3 | 0.4 | 0.6 | 42.8 | 46.0 | 49.3 | 10.0% | 12.0% | 12.7% |
| East Asian 5 | | | | | | | | | | | | |
| Taiwan | 437 | 1535 | 3778 | 2.3 | 7.3 | 17.2 | 35.5 | 39.3 | 45.7 | 26.2% | 21.4% | 27.8% |
| Korea | 267 | 1134 | 3113 | 0.7 | 2.5 | 6.6 | 37.3 | 39.0 | 56.1 | 39.1% | 36.1% | 20.4% |
| Hong Kong | 31 | 72 | 162 | 0.6 | 1.2 | 2.3 | 40.3 | 38.7 | 42.6 | 14.2% | 23.0% | 35.6% |
| Singapore | 16 | 59 | 174 | 0.6 | 1.7 | 4.4 | 40.2 | 41.5 | 33.3 | 44.9% | 26.2% | 33.7% |
| China | 19 | 52 | 108 | 0 | 0 | 0 | 36.5 | 40.6 | 32.8 | - | 12.4% | 34.3% |

Source: USPTO; World Development Indicators database, 2003

Note: (1) The data for Germany include Germany west only before 1990.

The experience of East Asia in patenting with the USPTO is shown in Table 3, as compared with G7 countries and a reference group of comparable countries, including Finland, Israel, Ireland and Spain. Table 2 reveals just how rapid has been the rise of East Asia as an innovative force, shifting from imitation to innovation. In terms of utility patents taken out in the US over the past five years, per capita, Taiwan ranks third in the world behind the US and Japan, as can be seen. Korea ranks as number 8, with 6.6 patents per capita per year, averaged over the past 5 years, while Singapore is rising fast,

to reach 11th on a per capita basis. China has yet to make an impression, while HK is in the top 14.

If we look at the firms and institutions involved, we gain a clearer idea of what has been happening in these latecomer catch up countries. Table 4 shows the world's Top 12 firms in terms of their patenting activity: while each of the top 12 recorded on average more than 1,000 patents per year (with IBM a long way in the lead) the highest rate of increase was recorded by Samsung, increasing its patents at just over 25% per year over the past five years. It is interesting to note that of the Top 12, three are US firms, no less than eight are Japanese, while the Korean firm, Samsung, has penetrated to the top echelons.

Table 4. Top 12 patenting organizations, 1997-2001

| | 1997 | 1998 | 1999 | 2000 | 2001 | Total 1997- 2001 | CAGR 1997- 2001 |
|----------------|------------|--------------|--------------|--------------|--------------|------------------------|-----------------------|
| IBM | 1,724 | 2,657 | 2,756 | 2,886 | 3,411 | 13,343 | 18.60% |
| Canon | 1,377 | 1,926 | 1,793 | 1,890 | 1,877 | 8,863 | 8.10% |
| NEC | 1,095 | 1,627 | 1,842 | 2,021 | 1,953 | 8,538 | 15.60% |
| Sony | 861 | 1,316 | 1,417 | 1,385 | 1,363 | 6,342 | 12.20% |
| <i>Samsung</i> | <i>584</i> | <i>1,305</i> | <i>1,545</i> | <i>1,441</i> | <i>1,450</i> | <i>6,325</i> | <i>25.50%</i> |
| Motorola | 1,058 | 1,406 | 1,192 | 1,196 | 778 | 5,630 | -0.74% |
| Toshiba | 862 | 1,170 | 1,200 | 1,232 | 1,149 | 5,613 | 7.50% |
| Fujitsu | 903 | 1,189 | 1,192 | 1,147 | 1,166 | 5,597 | 6.60% |
| Matsushita | 746 | 1,034 | 1,052 | 1,137 | 1,440 | 5,409 | 17.90% |
| Lucent | 768 | 928 | 1,152 | 1,411 | 1,109 | 5,368 | 9.60% |
| Hitachi | 903 | 1,094 | 1,008 | 1,036 | 1,271 | 5,312 | 8.90% |
| Mitsubishi | 892 | 1,080 | 1,054 | 1,010 | 1,184 | 5,220 | 7.30% |

Source: USPTO: Patenting by Geographic region (state and country), breakout by organization count, 1997-2001 utility patent grants by calendar year of grant

An even clearer picture of what drives the performance of Korean, Taiwanese (and Singaporean) firms is revealed in Table 5, which shows the number of patents taken out in each of the five years 1997 to 2001 by East Asian organizations (both firms and institutions) and the totals. Almost all of these firms and organizations operate in the electronics, IT, communications and particularly the semiconductor sectors. These are the advanced sectors where the East Asian firms have been making their mark, driving the overall totals reported above.

Table 5. Top patenting firms and institutions: Taiwan, Korea, Singapore, China, 1997-2001

| | 1997 | 1998 | 1999 | 2000 | 2001 | Total 1997-2001 |
|---------------------|------|-------|-------|-------|-------|-----------------|
| Taiwan | | | | | | |
| UMC | 149 | 174 | 266 | 430 | 584 | 1,603 |
| TSMC | 130 | 218 | 290 | 385 | 529 | 1,552 |
| ITRI | 153 | 218 | 208 | 198 | 221 | 998 |
| VISC | 53 | 120 | 112 | 131 | 112 | 528 |
| Winbond | 24 | 59 | 115 | 115 | 126 | 439 |
| Mosel-Vitellic | 15 | 32 | 38 | 66 | 68 | 219 |
| Korea | | | | | | |
| Samsung Electronics | 584 | 1,305 | 1,545 | 1,441 | 1,450 | 6,325 |
| Hyundai Electronics | 154 | 212 | 242 | 294 | 533 | 1,435 |
| LG Electronics | 113 | 215 | 229 | 220 | 248 | 1,025 |
| Daewoo Electronics | 215 | 319 | 273 | 120 | 54 | 981 |
| LG Semicond. | 119 | 235 | 311 | 255 | 42 | 962 |
| ETRI | 58 | 120 | 130 | 124 | 72 | 504 |
| KIST | 29 | 44 | 41 | 35 | 35 | 184 |
| Singapore | | | | | | |
| Chartered | 30 | 39 | 44 | 79 | 135 | 327 |
| China | | | | | | |
| WSMC | 0 | 0 | 6 | 61 | 37 | 104 |

Source: USPTO: Patenting by Geographic region (state and country), breakout by organization count, 1997-2001 utility patent grants by calendar year of grant.

Note: Company is included only for the total patent number more than 100.

Korea has been more focused and concentrated in its patenting activities than other East Asian countries. In Korea, the top five *chaebol* account for a large proportion of patents overall (69%) from 1997 to 2001, whereas in Taiwan, the top five firms and organizations, all from the semiconductor sector, account for a smaller proportion overall (27.1%). Patterns established in the realm of production appear to be carried across to the sphere of innovation.⁶⁰ Thus we may argue on the basis of this *prima facie* evidence that East Asian countries, led by Taiwan and Korea, have developed the institutional foundations of *national innovation capacity* – and that they are actively developing these foundations as part of their strategy to move beyond imitation to innovation (Kim 1997), like Japan.⁶¹

⁶⁰ This is an important point and one that is neglected in many of the studies of “national innovation systems.” See Park and Park (2003) for an exploration of this theme, where the intriguing claim is made (based on evidence from East Asian countries) that a threshold expenditure on R&D, amounting to 2% of GDP, is needed before such systemic parallels start to exert themselves.

⁶¹ See Hu and Mathews (2003) for an analysis of the patenting performance of five East Asian countries in terms of their uptake of patents from the USPTO, based on the methodology applied by

What is clear is that all of these firms and organizations have identified the winning of patents in the USPTO system as a critical driver of international innovative performance, and are building their knowledge management capabilities as they deal with ever-expanding international patent portfolios. In addition to providing companies like Samsung, TSMC and UMC with the knowledge represented by the patents, this practice has numerous other benefits, not the least of which is the capacity to engage in mutual “patent recognition” practices with leading established firms, whereby each firm recognizes the other’s patents and agrees not to sue for patent infringement. This is one of the critical but hidden features in the growth of firms and a mark of their “arrival” in an industry as a serious player.⁶²

7. Twelve strategies for industrial development

Let us now pull the threads of the argument together, and identify some strategies that could be expected to work in the conditions of the world economy in the early years of the 21st century, i.e. in conditions governed by the WTO, by TRIMS and by TRIPS. In place of formulating a set of hypotheses regarding development processes, we may formulate a set of strategies, couched in terms of known successes from the past and their generalization in current conditions.

1. Getting started

Latecomers will first establish a development agency, with clear responsibilities for guiding and orchestrating the industrial development process. Initially it will encompass all development-related activities – but as experience is secured, and specialization becomes desirable, certain parts may be spun off, e.g. an investment-attracting vehicle, or industrial development bureau to plan the creation of new industries. The development agency might work with international or UN agencies at first in order to get started, i.e. to make the country ‘development-ready’ – but it will jealously guard its autonomy, and never allow itself to be made subservient to the wishes of an external party.

2. International position

Latecomers will strategize around the circumstances in which they find themselves, with an existing international division of labor and existing capital, trade and technology flows. They will seek to adapt to these and complement them with their own initiatives to secure their incipient latecomer advantage. They will make use of latecomer industrial

Furman, Porter and Stern (2002) to a panel of 17 OECD countries with data covering the period from 1973 to 1996. This paper opens the way to an anticipated series of studies in which latecomer countries will be able to measure their transition from imitation to innovation, utilizing the patenting experience within the USPTO as benchmark. It is anticipated that this framework will be applied to more and more developing countries, starting with China and India, but also encompassing middle-ranking but highly innovative non-OECD countries such as Finland, Israel and Ireland, as well as countries in central and eastern Europe, central and south America, Australasia and, eventually, Africa.

⁶² For example, it was its joint venture at first with Philips that enabled TSMC to get started, with absorption of technology, but also it was Philips’ patent portfolio that protected TSMC from patent infringement suits early in its career. The Korean companies took longer to learn this, and suffered severely in the 1980s from patent infringement suits, particularly from IBM and TI. It is this experience above all that helps to explain the dedication of Samsung et al to the continuing acquisition of USPTO patents.

dynamics, and identify a place for themselves in a ‘flying geese’ formation, where they can leverage capital, technology and knowledge from a ‘lead goose’ and build new industries as cost and competitive advantages can be captured. They will behave as a ‘fast follower’ of this lead goose, and as circumstances permit, imitate the industries, technologies and management and organizational practices of firms in the lead goose country.

3. Changing industrial structure: Manufacturing as source of increasing returns

Latecomers will see their industrial structure as one to be relentlessly changed and upgraded, with an emphasis initially on the reform and industrialization of agriculture, followed by the building of local manufacturing industries to absorb labor displaced from agriculture. Latecomers will focus primarily on manufacturing as the engine of industrial development, seeking to upgrade it to the point where it becomes the primary industrial activity, in the pursuit of increasing returns that are best captured through manufacturing. Latecomers will likely begin their manufacturing operations with light materials and sub-contract activities, but will move as fast as expedient to more demanding activities.

4. Insertion in value chains

Latecomers will view their industrial development as a process of self-insertion in existing value chains, constructed either by MNCs or by advanced firms looking to globalize their value chains of production, logistics and R&D. Latecomers will seek to link themselves to these existing structures in order to secure revenue-generating activities, but also to leverage from these sources the knowledge, technology and market access that will be needed as the latecomer seeks to rise up the development ladder. Such insertion will be subject to upgrading pressures, as local firms seek to move from simple OEM contracting, to ODM where specifications are made more loosely, to OBM where firms emerge as a fully-developed entities. Where production systems have not been disintegrated, and no global value chains have been created, then latecomers will have to look for strategic equivalents, or work with international agencies to create such value chains.

5. Institutional and economic learning

Latecomers will seek to compensate for their shortcomings in technology and market sophistication through institutional innovation, under the guidance of the development agency, creating institutional solutions to problems as encountered, e.g. EPZs to promote FDI in manufacturing activities; or PRIs (like ITRI) to act as technology leveragers and builders of national technological competences. Repeated applications of the processes of linkage with existing commercial structures and leverage of knowledge from such sources, will result in latecomers’ learning to practice development as a process of collective entrepreneurship. This institutional innovation creates what Gerschenkron termed ‘special institutional factors’ which are designed to compensate for latecomer disadvantages, but which can also be exploited as sources of advantage. Institutions and practices will be discarded as soon as they have outlived their utility, to avoid the trap of allowing firms to become dependent on them.

6. Firm creation

Latecomers focus their developmental efforts on the nurturing of new firms, which calls for sustained attention to be paid to the sources of entrepreneurial initiative. A country develops through the creation and sustenance of sophisticated, modern firms that are managed and organized according to the best prevailing practices. This ensures them one source of latecomer advantage, namely that they are not forced to replicate all previous steps in the evolution of business to the point where they make their entry. But many developing countries allow an overgrown bureaucracy to place excessive barriers in the way of business formation, and the dismantling of such barriers, and their replacement with incentives, is a critical feature of successful development.

7. Industry creation

Latecomers build new industries in the way that Toyota builds new cars. Once there is a mechanism in place for producing viable, competitive firms, the latecomer is able to target the industries in which these firms will be encouraged to compete. The preparation and cultivation of such industries calls for state-led efforts by a variety of agencies, from the acquisition of land for the firms destined for the designated industry, the acquisition of technology and the securing of finance, the adoption of nurturing strategies including tax concessions and R&D subsidies, the control of excessive competition at first to allow companies time to develop their products and markets, and a phased opening up to the full force of international competition. There is no better tutor for the developing world in this process of industry design and creation than Japan.

8. Export orientation and import substitution

Latecomers will practice both EO and IS in selection of targeted industries and industrial activities. Export orientation serves to generate foreign currency and exposes domestic firms to the whip of international competition; indeed export performance was found in East Asia to serve as a surrogate for general economic and business performance in assessing whether continued state assistance was warranted. Import substitution serves as a highly selective way of targeting activities for special promotion, to overcome import bottlenecks and to create the core of new industries, thereby propagating and further upgrading general industrial capabilities.

9. Firm formation and selection

Latecomers will give every assistance to new firms as they seek to enter new industries, consistent with international obligations under the WTO such as TRIMS and TRIPS. Pre-competitive assistance of all kinds will be offered to nurture new firms and industries in their formative stages, through the collective licensing of technologies and their rapid dissemination to domestic firms, and the development of new institutional forms, such as R&D consortia, for this purpose. But the aim is to build firms that can stand on their own feet, and once exposed to international competition, the firms must be allowed to find their own level and discover their own strategies. Selection of firms by the market is always superior to arrangements where firms look for assistance during periods of trading difficulties.

10. Formation of development blocks and clusters

Latecomers will selectively choose to develop certain related industrial activities, depending on what already exists and where MNCs might want to make investments. They will aim to create not single firms, but clusters, or development blocks, where increasing returns are captured from inter-firm complementarities and clear targets are created through gap-filling and input-replacement. Such clusters create the best opportunities for local entrepreneurs to find outlets for their activities. The health of clusters should be carefully monitored and self-organizing cluster associations encouraged, to give them a clear sense of collective identity and purpose, which underpins successful strategy.

11. Maintaining the development perspective

Latecomers will recognize that industrial development is a decades-long process that will require the inputs of many agencies, firms and individuals. But a sense of purpose needs to be maintained through this changing cast of participants, and this is best secured through institutional continuity and through generating a clear national ideology grounded in development. As Gerschenkron noted, the later the country comes to its development task, the more powerful has to be its ideology of development to act as cohesive force ensuring that policies pursued across disparate domains, such as housing, transport or infrastructure, are consistent with catch-up development goals.

12. Closing the gap

Latecomers seek to catch-up with the advanced countries, industry by industry, technology by technology, firm by firm. Until such catch-up has been accomplished, the country remains as an imitator or fast follower, not an innovator. The advantage of such a latecomer position is that industries can be targeted, based on their prior testing in the advanced countries. The institutions developed in the process of achieving catch-up may then need to be discarded as the country approaches the leaders; imitation will give way to innovation, and for this, new institutions will be needed. To reach such a state, and leave the institutions of followership behind, is the goal of all latecomers, and of all catch-up strategies.

8. The institutions of economic learning

And finally, let us specify the institutions that need to be involved as a latecomer seeks to implement these kinds of strategies. Latecomer systems of economic learning are certainly innovative, but not in the sense of the fast turnover of new firms and new ideas in a ‘Silicon Valley’ or similar hothouse of innovation. The difference is absolutely critical. Catch-up through linkage and leverage demands a quite different strategy (‘fast followership’) and institutional framework for its implementation than that associated with the conventional approach to innovation. It calls for a Gerschenkronian understanding of the ways that latecomer firms can turn their disadvantages into sources of advantage, through focusing on resources which are most susceptible to leverage, even if this works only for a limited time and ‘window’ of opportunity. And it calls for a sophisticated understanding of the institutional foundations of the processes of

technology leverage and diffusion management. These frameworks are not driving the generation of new ideas, as in a Silicon Valley, but rapid technological upgrading and adjustment to world conditions.

The World Bank's 'East Asian miracle' report (1993) attributed East Asian success to good macroeconomic management and to 'market friendly' interventions. While these elements were certainly present in the rise of new sectors, they do not take us very far in understanding high technology industrialization such as in electronics. Once the central role of learning is acknowledged, the issue of the institutional setting in which it takes place becomes unavoidable. East Asian national systems of economic learning have embodied the following kinds of institutions and agencies. These are what can be generalized from the East Asian experience as applicable to all latecomers in the 21st century.

Overall development responsibility and steering

A prime agency takes responsibility for coordinating and orchestrating the development process, from initial acquisition of land to eventual targeting of industries for imitative 'fast following.' Examples would include the Economic Development Board (EDB) in Singapore or the Penang Development Corporation (PDC) in Penang (Malaysia) – or Scottish Enterprise in Scotland and the Welsh Development Agency (WDA) in Wales. The creation of such an agency serves a valuable function in its own right, as well as advertising to the wider world that this particular country or region is 'open for business'.

Land acquisition and designated zones

In developing countries land that is suitable for industrial activities is frequently the most scarce resource, and public acquisition and development, with the provision of basic services such as reliable power, clean water and waste treatment, and the development of 'soft' infrastructure such as fast customs clearance for designated Export Processing Zones.⁶³ Companies locating in such zones should be given certain minimum performance requirements (such as standards for local supply and R&D levels) and can expect certain concessions in return.

Technology leverage

Some public sector R&D institute whose main mission is the scanning of the world's technological developments and rapidly building a capability in these new techniques, for the purpose of diffusing them to the private sector as fast as possible, has been present in all the successful development efforts so far. Examples are ITRI in Taiwan, with its specialist laboratories such as ERSO and CCL; KIET, ETRI and KAIST in Korea; IME in Singapore and many more such specialist public-sector research institutes (PRIs) – where the emphasis is on tracking and re-creating technologies developed elsewhere, not on seeking to create new-to-the-world product and process innovations.

⁶³ According to the ILO (2003), there were upwards of 3,000 EPZs in 116 countries in 2002 (compared with 500 in 1995, in 73 countries). They employed 43 million workers, 30 million in China alone.

Financial leverage

Some development bank or investment vehicle charged with the mission of identifying worthwhile strategic investments, such as those which further the goals of catching up, and organizing the financing required, has also been present in all successful cases of catch-up. Thus in Taiwan there was the China Development Corporation; in Korea the state-owned or regulated development banks; in Singapore the Singapore Development Bank (spun off from the EDB in the 1960s) and in Malaysia the Bank Industri Malaysia and the Khazana Nasional Berhad (the National Treasury investment arm of the Malaysian government). These operate either through the mobilization of domestic savings, or through mobilizing international bank syndicates and the issuance of debt instruments such as depositary receipts.

Nurturing environment for the formation of knowledge-intensive firms

Apart from the provision of suitable infrastructure for knowledge-based firms (such as the Hsinchu Science-based industry park in Taiwan, and its successors in southern and central Taiwan; the Singapore science parks in Jurong and elsewhere; and the comparable Malaysian developments such as Kulim), as well as taxation and R&D incentives schemes designed to facilitate the formation of new firms in targeted sectors. In the case of Taiwan's ITRI, this has extended in the 1990s to the creation of a multi-storey 'incubator' building on the ITRI campus, designed to house the operations of new technology-intensive firms, started mainly by ITRI staff.

Investment attracting vehicles

Bodies such as Singapore's Economic Development Board or the Penang Development Corporation -- termed, collectively, economic development agencies -- have been central to the process of attracting, and monitoring, investment in high technology activities by multinationals. The East Asian agencies have been so successful in attracting multinational investment that they have been paid the compliment of emulation in other parts of the world, such as Scotland, Wales and Ireland, where the SDA, WDA and IDA have all played major roles in attracting foreign investment to these areas formerly stricken with industrial decline. Their investment-attracting role is part of their orchestrating role, but can be spun off as a separate activity.

Industry self-organization

Bodies such as the KSIA in Korea; the TEEMA and more recently, TSIA in Taiwan, have emerged to provide a means for communication between government and firms, and to fashion a consensus over new directions for the industry to move in. It is such a capacity for an industry to self-organize, for more than merely defensive ends, that is an important factor in the ability of the industry to be continuously upgraded and thereby to sustain its competitiveness.

Industrial upgrading incentives and discipline

In latecomers there must be continual pressure brought to bear on firms to drive processes of continual technological upgrading and enhancement. The world technological frontier moves ahead relentlessly, and firms and agencies need to be focused on keeping up with

these developments, through all the means of open technological communication available. Successful cases of catch-up establish general agencies for this purpose, and deal with firms at arm's length, e.g. through their self-created industry associations, rather than through direct subsidy of individual firms.

Skills upgrading and technical training

Technological capabilities rest on an infrastructure of specialist industrial training which again is not created by markets, but calls for institutional innovations to ensure that firms can employ skilled staff and engineers as they need them. Singapore for example created specialist training centers in alliance with selected multinational corporations for targeted industries. In the 1990s it has underpinned its expansion of wafer fabrication activities with a specialist technical training program funded through the EDB.

Market shaping and creation

Latecomers need to create not just firms and institutions, but in many cases need to conjure markets into existence as well. Thus institutions like the Institute for Information Industry (III) in Taiwan helped to create a public and private sector market for IT products, by driving the associated standards for IT use in government agencies for example. In Singapore a similar role was played by the National Computer Board.

Export promotion

The collective enhancement of export performance through institutions such as KOTRA in Korea or CETRA (China External Trade Association) in Taiwan and the Trade Development Board in Singapore has also been a significant source of institutional support as firms in East Asian countries seek to enter new markets. Such export promotion agencies create offices around the world to promote the country's products, and stage expos and trade fairs at home, attracting buyers there, all in the name of collective industry promotion.

Intellectual property protection and promotion

While Intellectual Property Rights (IPRs) play little role in a latecomer country's early development, they loom larger as the country matures, particularly with the role now played in international trade by the Trade-Related Intellectual Property Rights system (TRIPS) linked to the WTO.

We capture the sense of these institutional innovation and creations that drive economic learning, in Chart 13. On their own, these agencies and organizational innovations are not so remarkable, and easily replicated (as for example, the economic development agencies which have been emulated in Europe, such as the Welsh Development Agency). What is remarkable is the total system formed by their interaction and mutual support. It is this systemic character of the elements that accounts for the capacity of the country to learn. What is learning? It is a process of adaptation to changing circumstances, based not just And it is the adaptability of the total system that counts, with the facility to improve adaptation over time as experience is gained and stored in appropriate institutional form, that generates what might be called 'institutional capacity.' It is institutional capacity and

the economic learning that results from it, that drives successful latecomer economic development.

Chart 13 about here

9. Concluding remarks

Linkage, leverage and learning are strategies of innovation that are available to latecomer firms. They enable the firms to make connections with the wider global economy, and draw from these linkages skills, knowledge and technology resources that would otherwise lie well beyond the reach of the developing firm. These strategies are employed in pursuit of the strategic goal of industrial catch-up. This is an elusive goal that few countries so far from the non-Western world have achieved. Japan was the first, and it was followed by the Asian “Tigers” such as Korea, Taiwan and Singapore. Of the developing countries today, probably China is most determinedly implementing strategies of linkage and leverage in the full pursuit of catch-up with the West as an over-riding national goal.

The effect of applying strategies of linkage and leverage is that latecomers are enabled to overcome their disadvantages, and exploit their few advantages as latecomers to the full. It makes sense for latecomers to utilize all the resources from the advanced world that they can acquire, in return for providing services such as low-cost manufacturing. The trade-off can be exploited to the advantage of the latecomer only if there is a strategic choice to utilize the linkage for purposes of knowledge gain. This is the inescapable strategic choice that must be made, by the latecomer itself.

Earlier theories of industrial development, such as the product life cycle theory, and early versions of global commodity chains, emphasized how firms in latecomer countries were caught up in decisions taken elsewhere, by firms in the advanced countries, and frequently trapped in positions from which they would not be able to extricate themselves (e.g. as low-cost contract producers without any hope of technological upgrading). But the evidence is clear that latecomer firms do not have to adopt a passive stance in relation to global developments. They can make strategic choices like anyone else.

The point is that their choices are made within an institutional setting. Some institutions favour and facilitate firms’ taking the risks of upgrading their technological capabilities. Other institutions leave them free to adopt the easy road of lowest-cost production. Some therefore drive the country up, while some let it sink down. Some institutions such as the Economic Development Board in Singapore have become famous for the unrelenting pressure they put on multinational corporations to continually upgrade the technological level of their operations, and expand the scope of their functions, to the benefit of domestic firms in Singapore. Complementary institutions provide incentives to local firms to become involved with multinationals, as local partners or suppliers. So the institutional framework biases the choices that firms make in certain directions. In Taiwan, cooperative R&D consortia between competitor firms succeed, because they are structured to enable participant firms to fence off their competitive efforts from their

collaborative efforts. This is an outcome of institutional design. Countries on the development ladder, then, need to devote as much care to the growth and nurturing of these institutions, as they do to the firms operating within the context that they create. Institutional learning can take place, from country to country – and within countries, as the institutions created themselves adapt to new circumstances and acquire experience. This is the process that in broad terms we may call industrial learning. It is the key to wealth generation in the developing world, and as such it repays the closest possible study and examination.

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Charts

Chart 1. Global poverty by the numbers: 2002

| | |
|--|-------------|
| Ratio of income inequality North: South | 75:1 |
| People living on less than \$1 per day | 1.2 billion |
| People living on less than \$2 per day | 2.8 billion |
| Annual dairy subsidy in the EU (per cow) | \$913 |
| Annual EU aid to sub-Saharan Africa (per person) | \$8 |
| Gap in infant mortality rate North: South | 10:1 |
| Global HIV/AIDS cases – in South | 96% |
| -- in North | 4% |
| People dying each year from malaria | 1 million |
| Illiterate adults in the South | 879 million |
| Average number of years of schooling received by a girl from family in bottom 40% of income earners in South | 0 |

Source: Drache and Froese 2003, based on World Bank *World Economic Indicators*

Chart 2. Regional shares of global manufacturing value-added, 1980, 1990 and 2000
Source: Lal/UNIDO

Regional shares of global manufacturing value added in 1980, 1990 & 2000

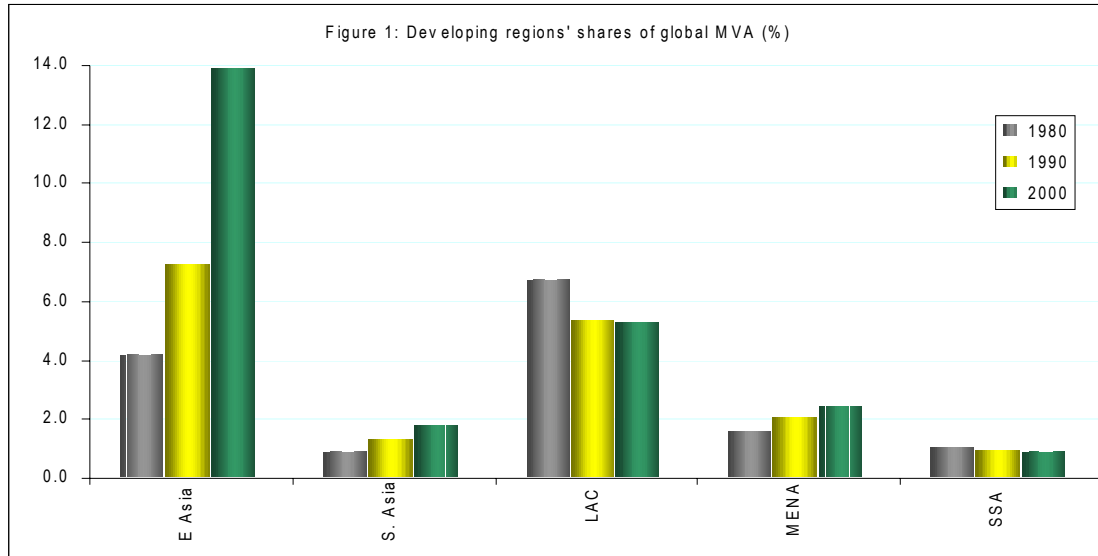


Chart 3. Shares of manufactured products in world exports, by technology levels, 1976-2000

Source: Lall/UNIDO

Shares of manufactured products in world exports by technology levels from 1976 to 2000 (%)

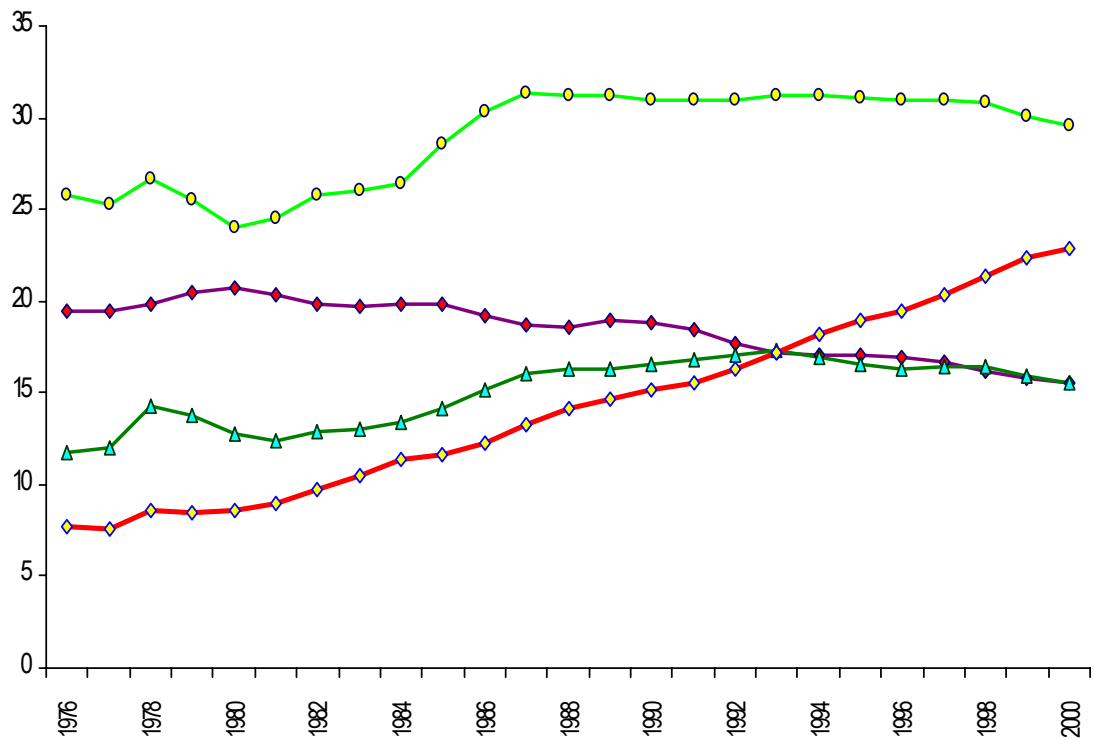


Chart 4. Developing regions: World market shares of medium- and high-tech manufacturing value-added, 1980-2000

Source: Lal/UNIDO

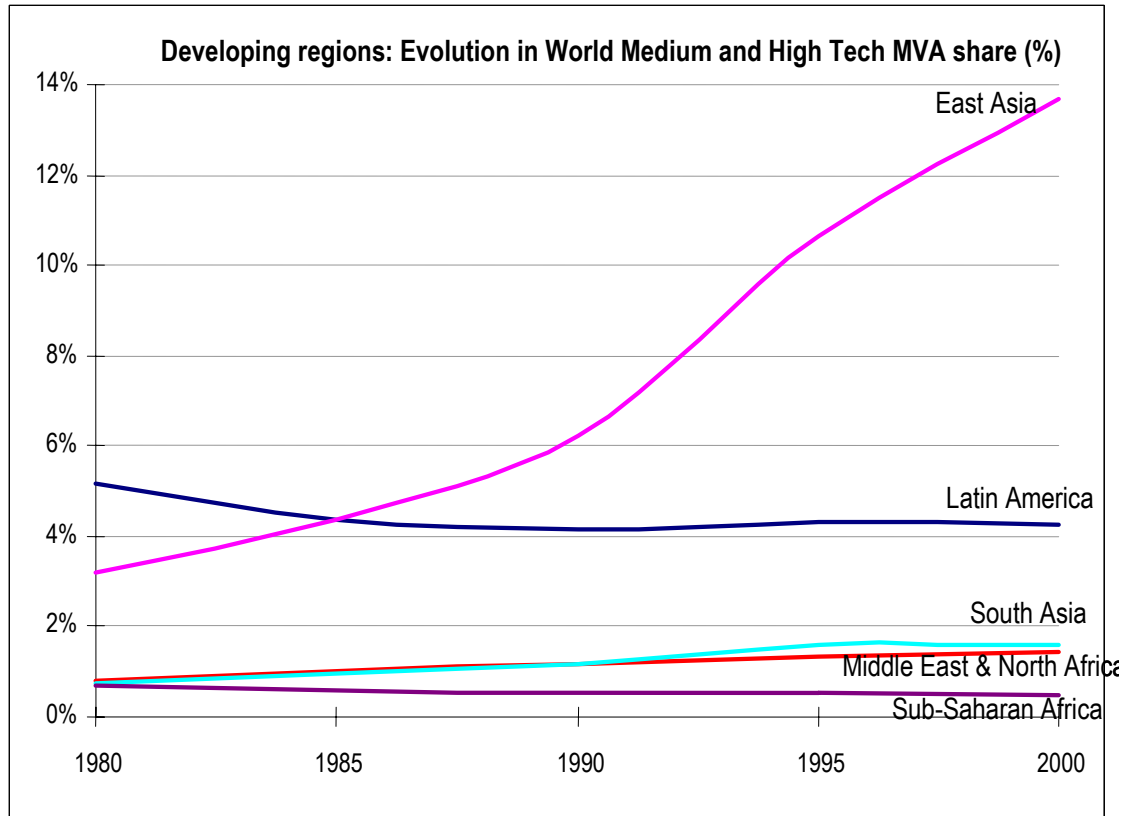
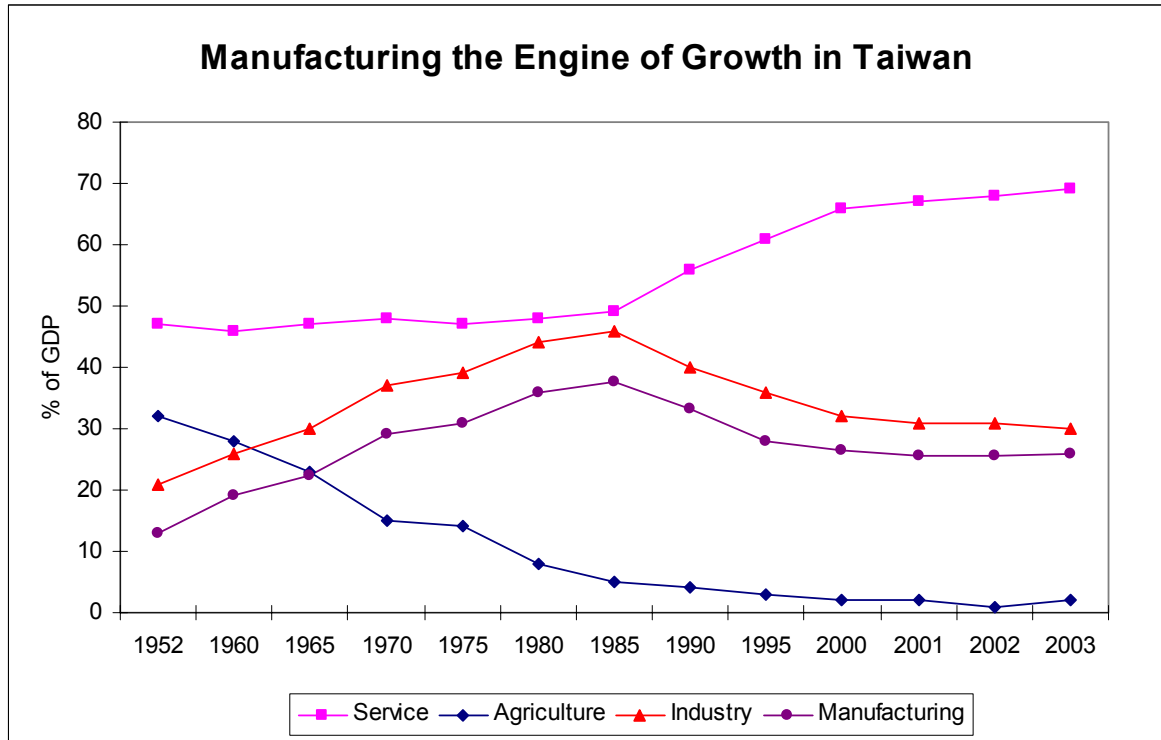


Chart 5. Taiwan: Manufacturing the engine of growth, 1952-2002



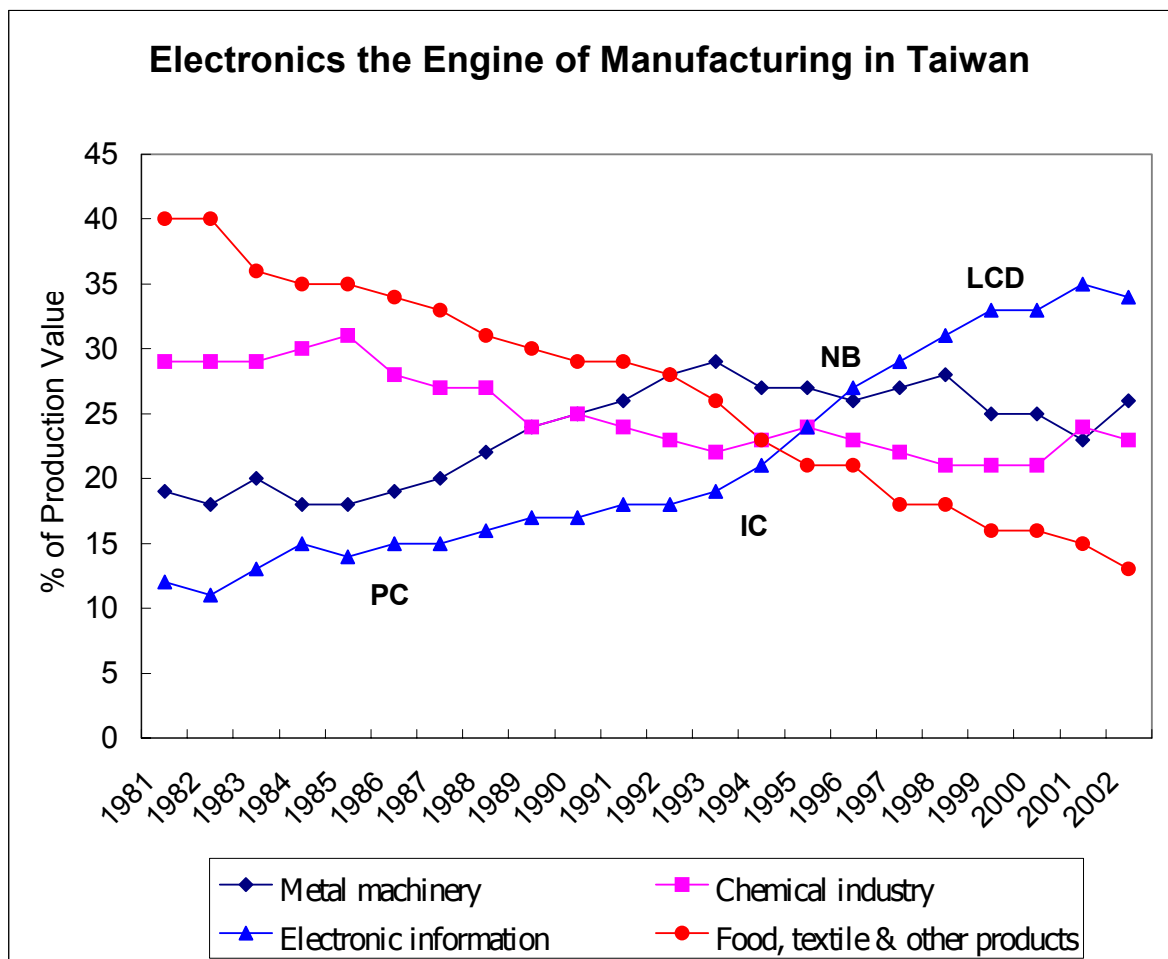
Source: Industrial Development Bureau, Ministry of Economic Affairs, Taiwan

Note:

(1) Industry includes Manufacturing, Construction, and Electricity, Gas and Water sectors.

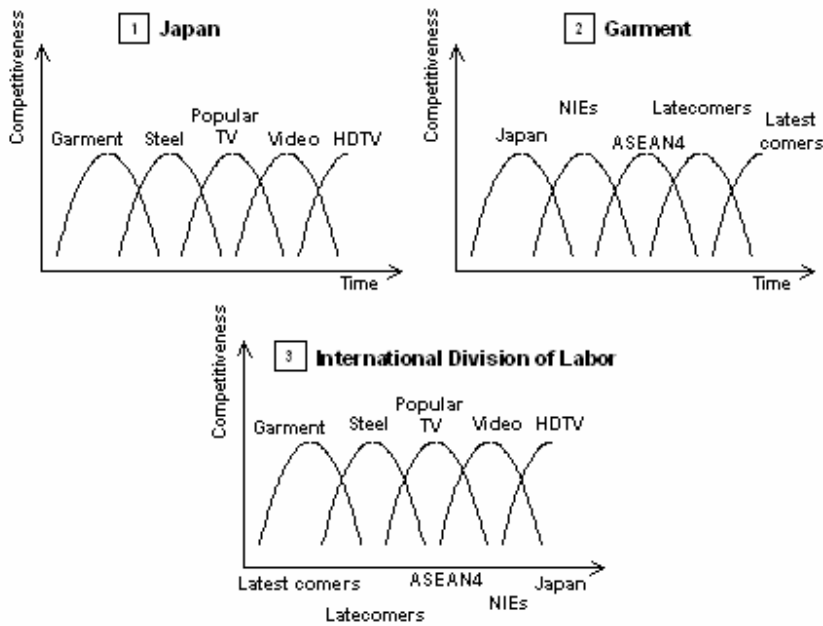
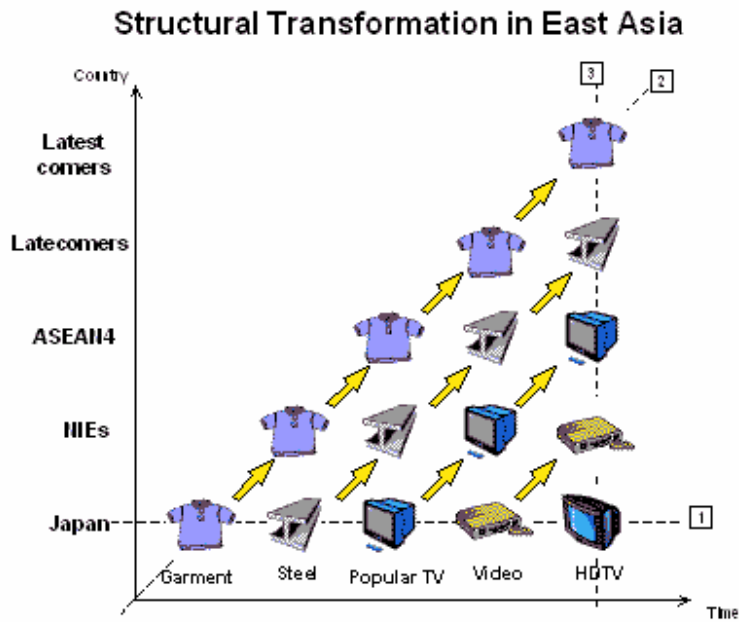
(2) Services include Trade & Eating-Drinking Places, Transport, Storages and Communications, Government Services, and Finance, Insurance & Business Services.

Chart 6. Taiwan: Electronics the engine of manufacturing, 1981-2002



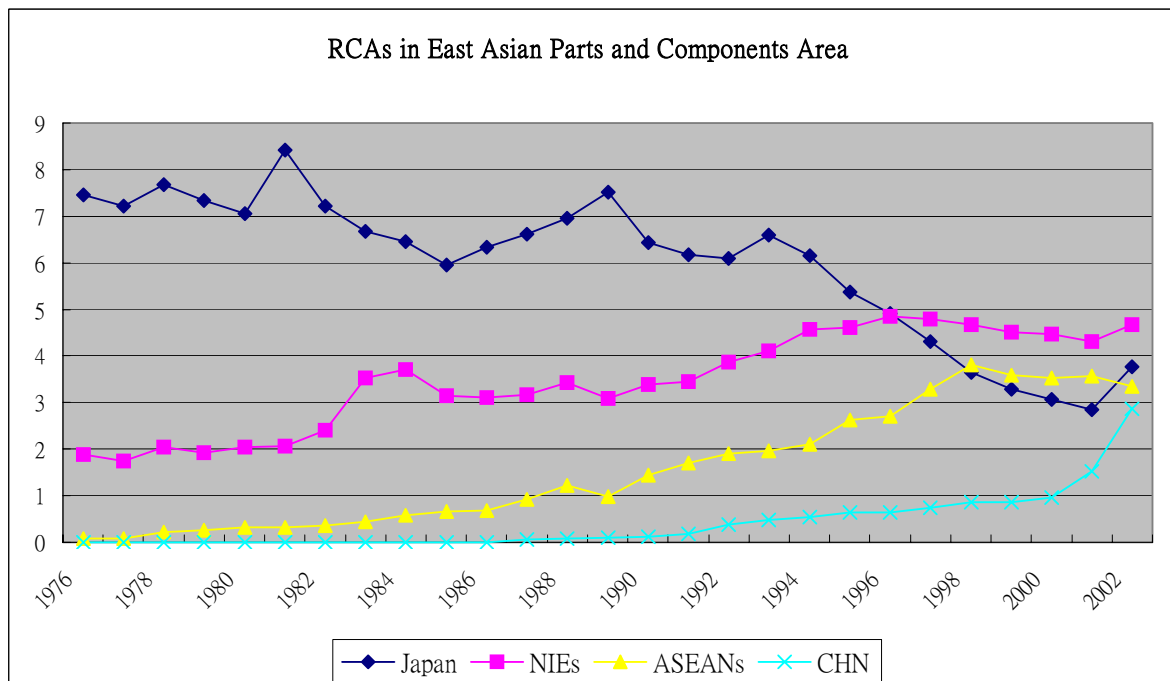
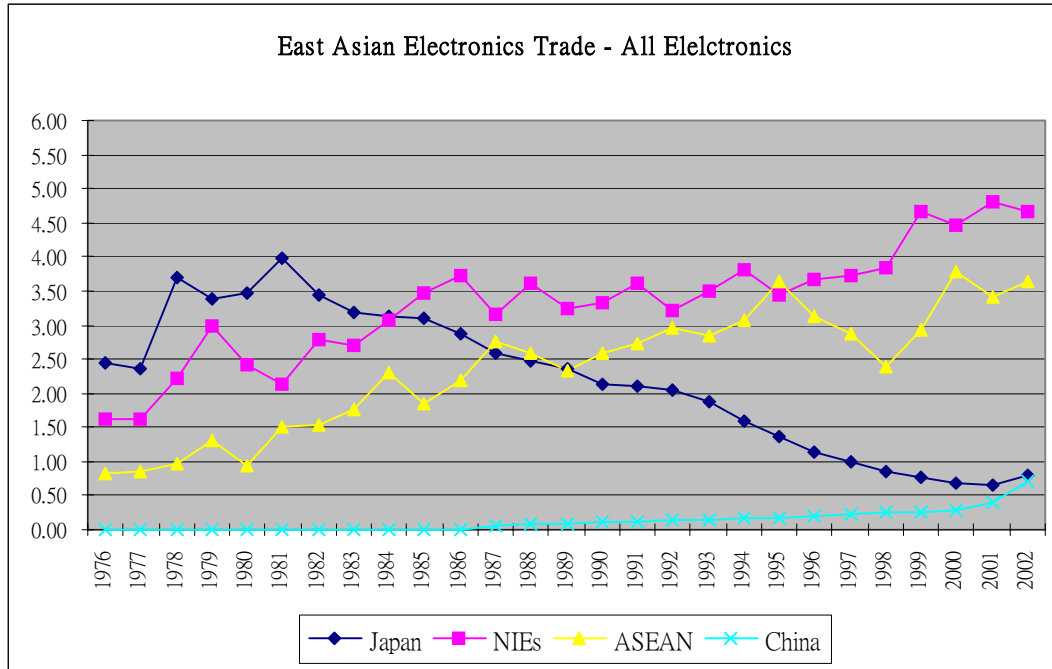
Source: Industrial Development Bureau, Ministry of Economic Affairs

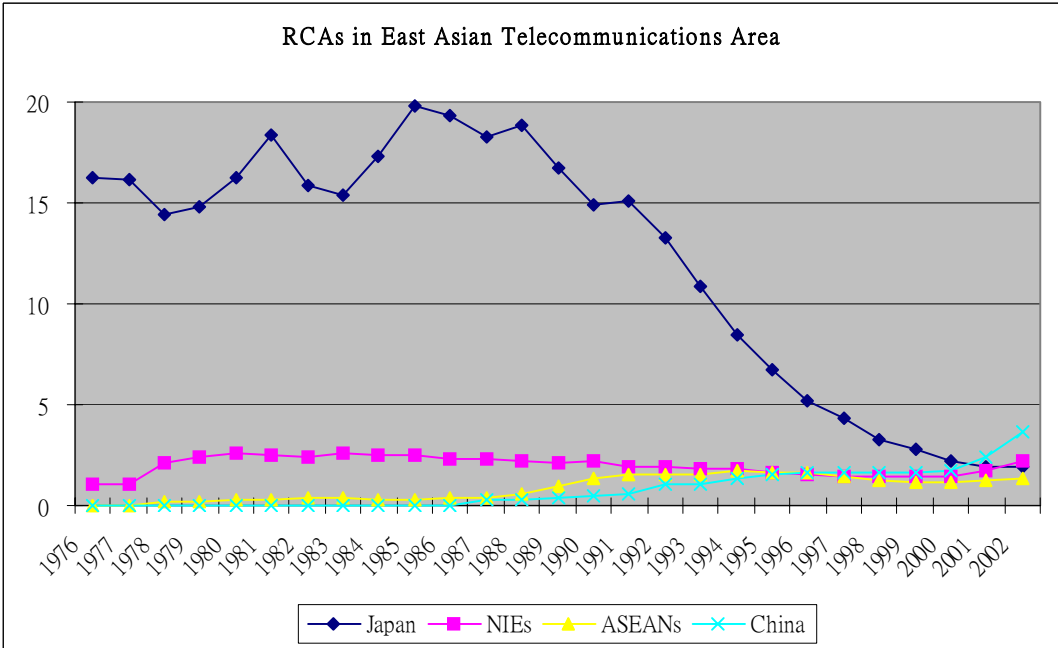
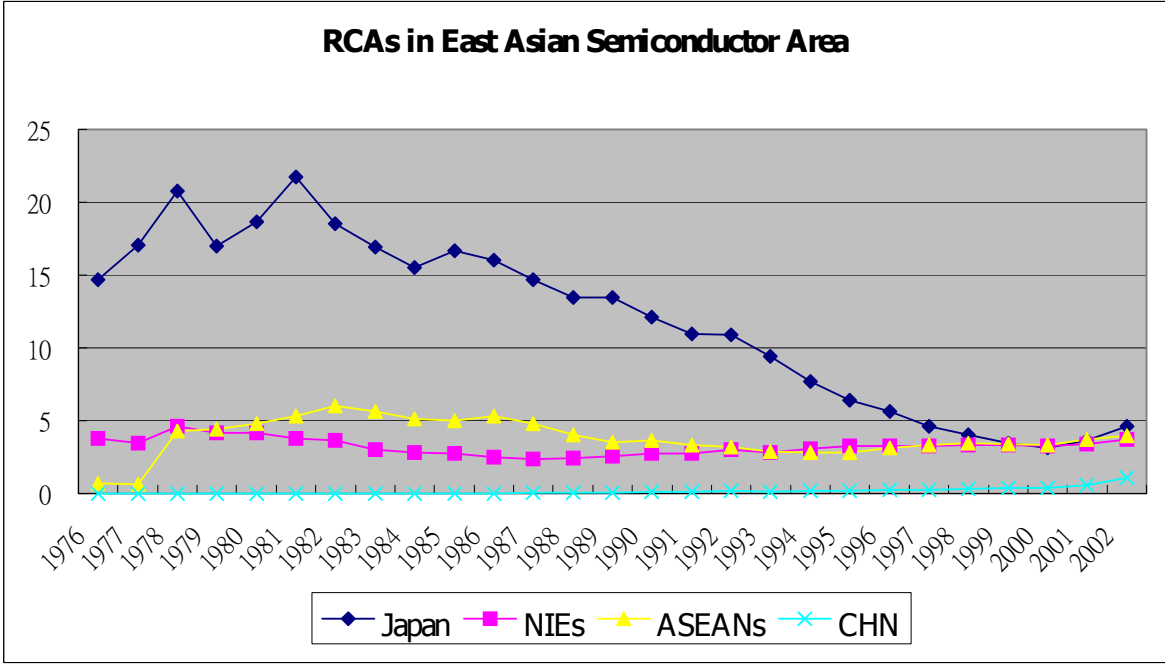
Chart 7. Structural transformation of East Asia

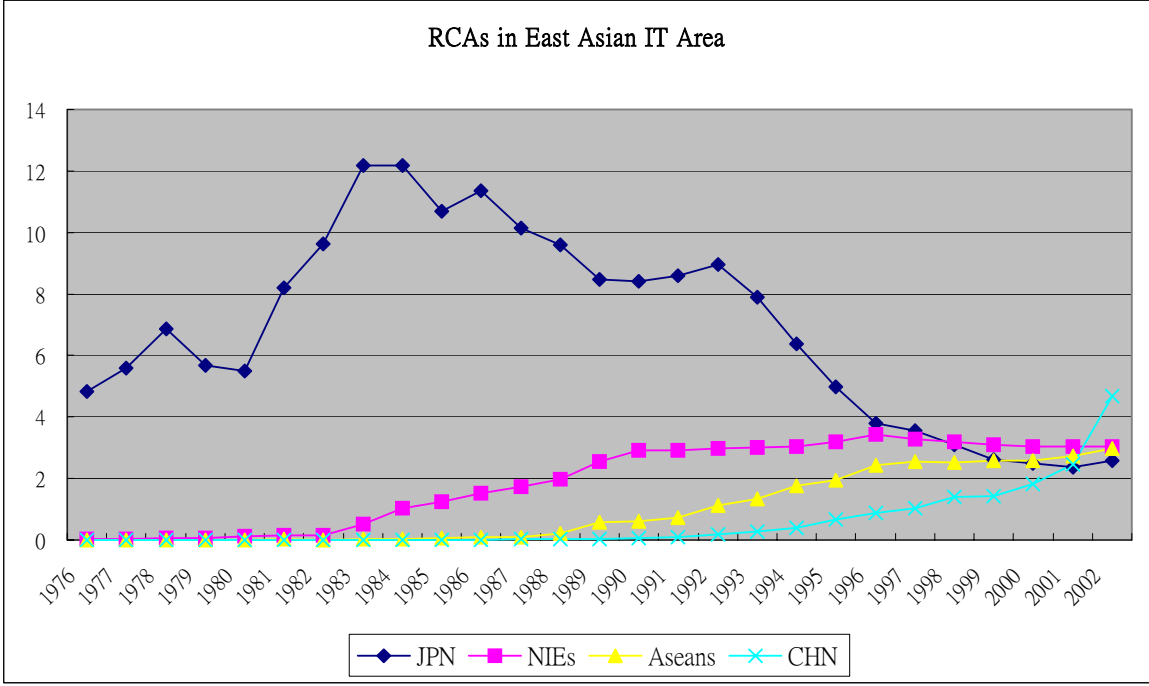


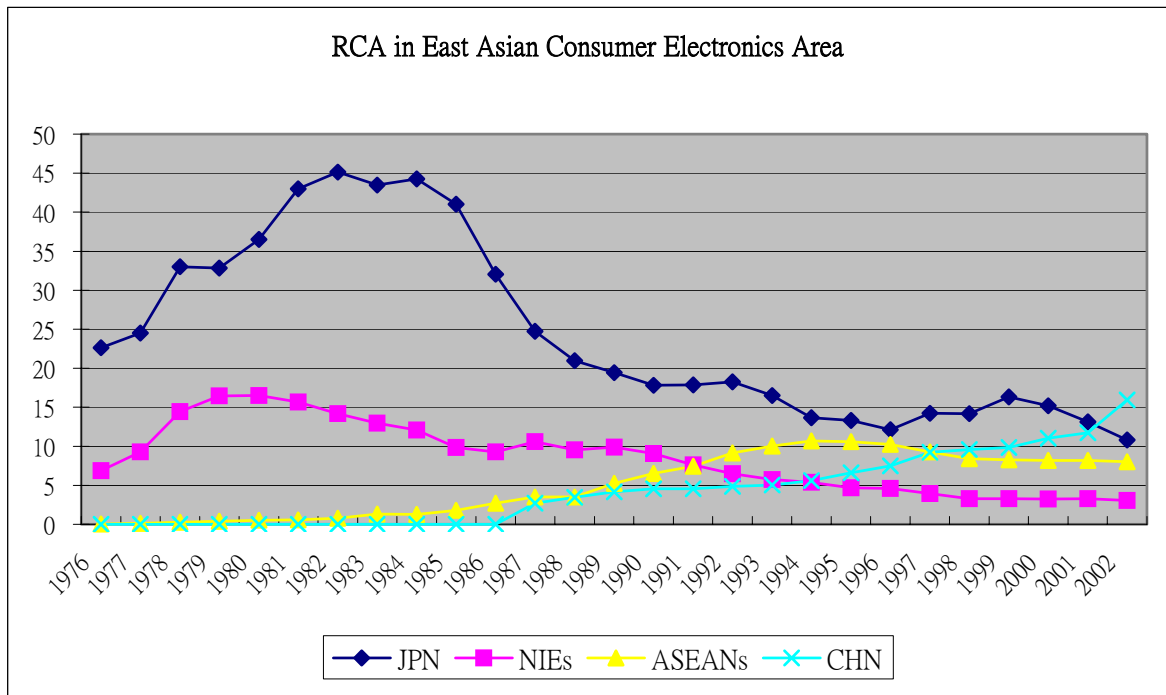
Source: Okita (1985); Kwan (1994): 82; Shroeppl and Nakajima (2002).

Chart 8. East Asian exports of electronics: Flying geese patterns



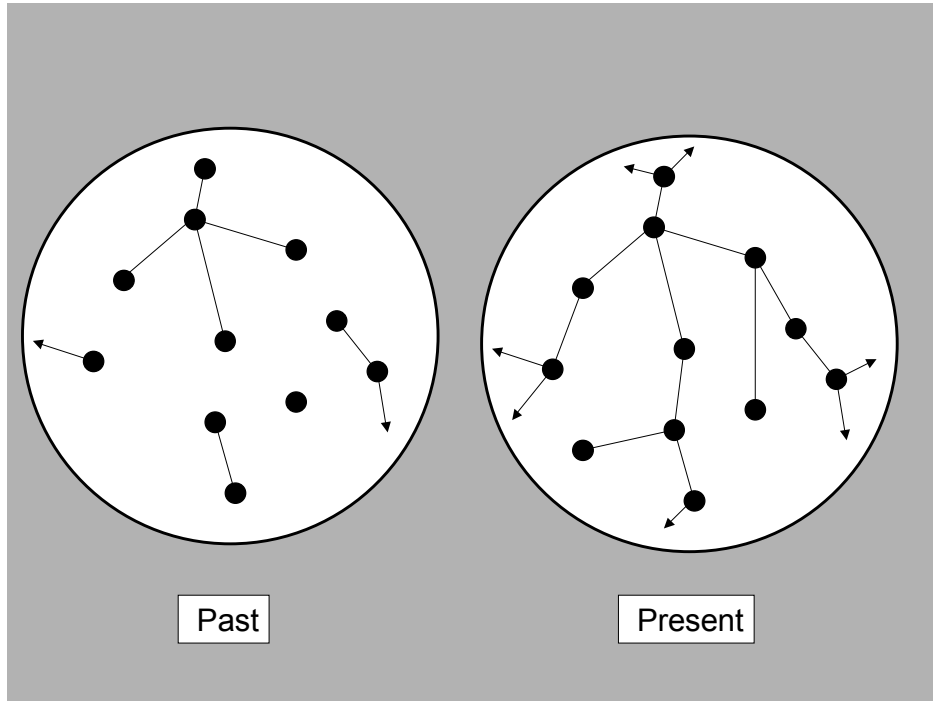






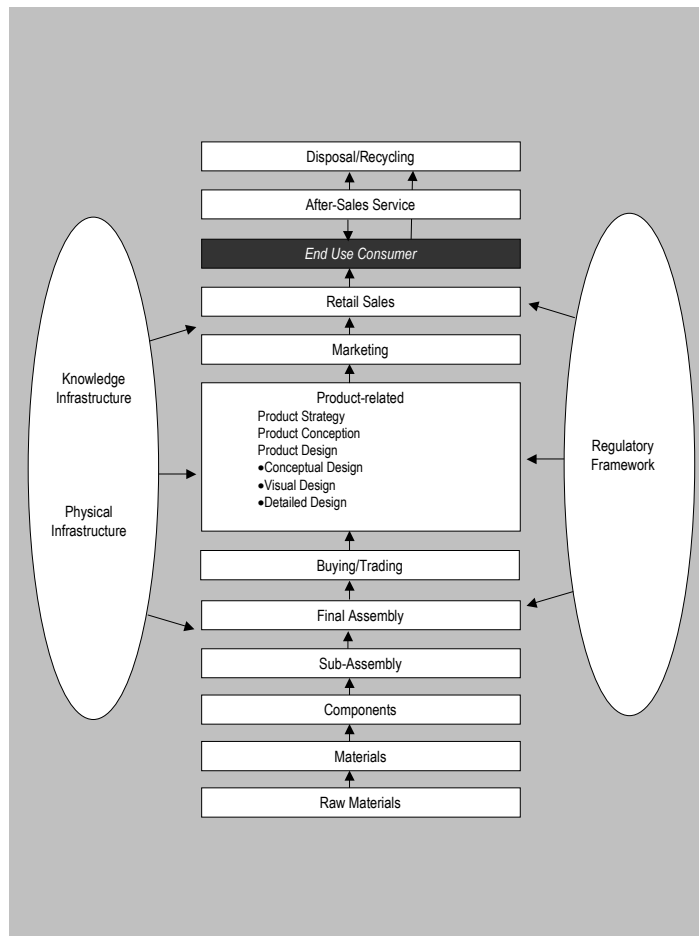
Source: Mathews (2004) based on World Bank data

Chart 9. The global economy: A worldwide web of inter-firm connections



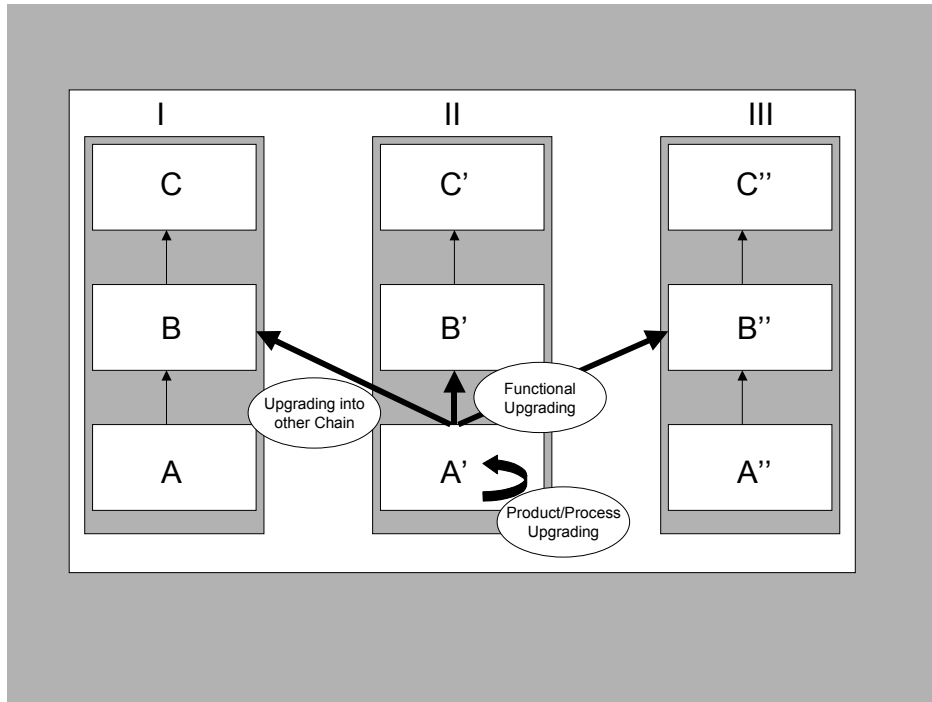
Source: Adapted from Mathews (2002a).

Chart 10. A schematic value chain



Source: Bellagio Group 2001.

Chart 11. Upgrading Strategies



Source: UNIDO working papers, *Industrial Development Report 2002*

Chart 12. Pathways of upgrading in the Taiwan electronics sector

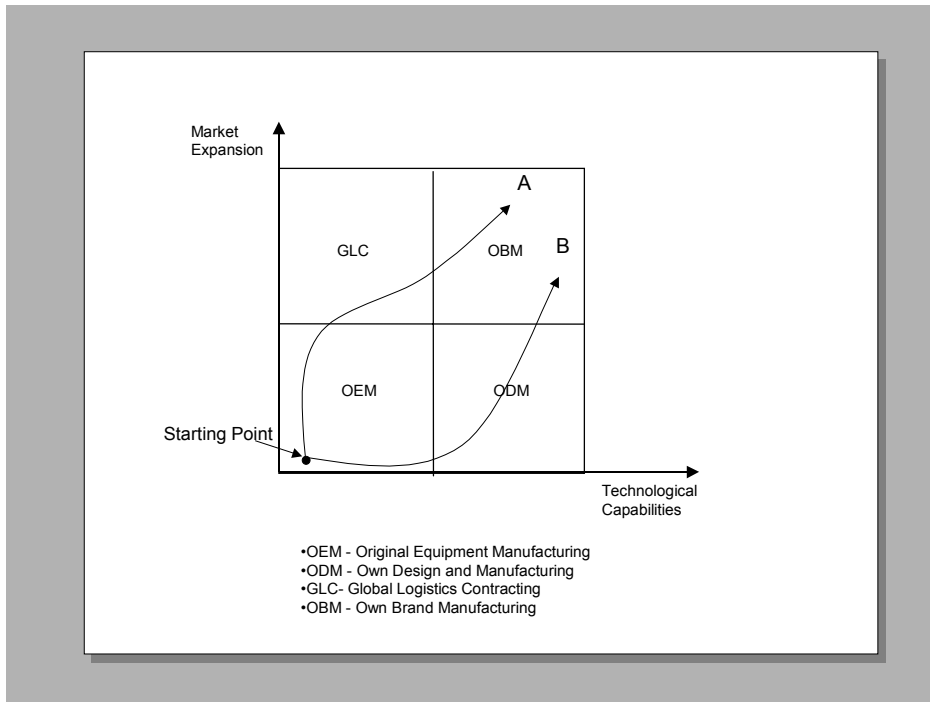


Chart 13. National System of Economic Learning

