A New Social and Economic Agenda
for Latin America

Knowledge Economy: Opportunities and Challenges for Latin America

Carl Dahlman

Draft

Do not cite without author's consent

2008

This work was written between 2007 and 2008 as a contribution to the ***A New Social and Economic Agenda for Latin America*** project of iFHC – Instituto Fernando Henrique Cardoso, and CIEPLAN – Corporación de Estudios para Latinoamérica. Support for the project was provided by AECI – Agencia Española de Cooperación Internacional, IADB – Inter-American Development Bank, and UNDP – United Nations Development Program. The information and opinions expressed herein are exclusively those of the authors and do not necessarily reflect the opinions of the institutions associated with the project or entail any commitment on their part.

Project coordinators: Simon Schwartzman and Ignacio Walker.

Executive Team: Sergio Fausto, Patricio Meller, Simon Schwartzman, and Ignacio Walker.

Copyright ©: iFHC/CIEPLAN. 2008. Sao Paulo, Brazil, and Santiago de Chile.

The text, in part or in its totality, may be reproduced for non-commercial purposes within the licensing terms of the Creative Commons 3.0
http://creativecommons.org/licenses/by/3.0/deed.en

Knowledge Economy:
Opportunities and Challenges for Latin America

Carl Dahlman
Georgetown University

I. Introduction: What is the Knowledge Economy and why is It Relevant for Latin America?

A lot is being written and said about the knowledge economy. What exactly is the knowledge economy, and is it relevant for Latin America? This paper explains what is behind the concept of the knowledge economy and argues that it is indeed very relevant for Latin America. Moreover, it argues that Latin American countries need to do a lot more in the area of the knowledge economy in order to perform better in today's increasingly competitive and demanding international environment.

In the last decade there has been a rising interest in the knowledge economy. The term was first popularized by an OECD report in 1996 titled *The Knowledge Based Economy.*[1] In the latter part of the 1990s there was enormous interest on this topic as part of the dot com boom. Many began to talk of the new economy and to claim that some of the basic rules of economics were not adequate to deal with the explosion of knowledge in general, and the information revolution in particular. They argued that increasing returns to scale, network economies, and constantly falling transactions and processing costs, offered endless productivity gains, faster economic growth and ever rising stock markets. This exuberance collapsed with the dot com crash of 2000.

An opposite view challenged the notion of the knowledge economy from the very beginning. Robert Solow, the Nobel prize winning economist who developed the concept of total factor productivity growth to explain growth that could not be attributed to growth in inputs, popularized the notion of the productivity paradox. The paradox in the late 1980s was that "we see the computer age everywhere but in the productivity statistics" (David 1990). Robert Gordon (2000) maintained this skepticism even at the peak of the dot com boom arguing that the dramatic productivity growth of the last half of the 1990s was due more to cyclical factors than to investments in information technology.

The OECD has undertaken many more studies on the knowledge, innovation, ICT and the new economy. While these studies have not fully resolved the Solow paradox they have confirmed that some important structural changes have been taken place. They have concluded that the roles of innovation, education, and ICT have become more important and that they need to be taken into account more explicitly for growth and competitiveness strategies.[2].

There are many definitions of the knowledge economy. They range from those that focus almost exclusively on the ICT aspects, to much broader definitions including the knowledge society. One problem with the concept is that it has been notoriously difficult to operationalize or measure it. This is in part because some of the underlying concepts

[1] This term was probably first popularized by a seminal OECD report in 1996. See OECD (1996).
[2] See in particular OECD 2000 and OECD 2001 focusing on the new economy.

themselves are difficult to pin down. As stated in an OECD report *the science of describing, understanding, and measuring knowledge will always be an imperfect one. The knowledge identified in this forum turned out to be capricious: sometimes sticky, often slippery, rarely tangible, frequently tacit, and extremely heterogeneous.* [3]

A recent initiative by the Work Foundation in the UK is seeking to develop testable definitions of the knowledge economy that can be measured in a robust way. In its first paper it has taken three approaches: and industry based definition, an occupational based definition, and an innovated related definition.[4] Although work is still at an early stage and the results depend on which definition are used, the preliminary results are that 40% -60% of the UK economy is generated by knowledge intensive activities and that this is fairly typical of developed economies. However the study stresses that knowledge intensive industries are not the knowledge economy, as knowledge is important in other industries.

In this context, and thinking about what is most relevant to developing countries the definition developed by the UK's Department of Trade and Industry is worth highlighting: a knowledge economy is *one in which the generation and exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the most effective use and exploitation of all types of knowledge in all manners of economic activity*. (DTI Competitiveness White Paper, 1999)

A key point in this definition is that is not just about high technology, or about creating new knowledge. It is about the effective use of all type of knowledge. This is particularly relevant for developing countries as most of them are not large producers of knowledge. However they can all be much more effective users of knowledge.

This paper will build on that distinction to help operationalize the concept of the knowledge economy for developing countries. A key point is that knowledge has always been an important part of economic activity. The reason for the renewed interest in knowledge and development is that there as been a speed up in the creation of knowledge and its dissemination. That is affecting global trends and the competitiveness of different regions and the international division of labor.

The European Community fully bought into the idea of the knowledge economy. The 2000 Council of Ministers meeting in Lisbon announced the goal to make Europe "the most dynamic and competitive knowledge based economy" by 2010. Progress has been slower than expected, but Europe is still very much engaged in this agenda.[5]

Individual countries, ranging from the United Kingdom to many developing countries, even poor countries in Africa have been developing knowledge economy strategies. Countries in Asia, in particular, have also quickly adopted this concept and have begun to implement ambitious knowledge economy plans.

Why is there such interest? That knowledge is important for development is not new. It has always been important. What is new is that knowledge has become more important for

[3] Report of CERI Washington Forum, June 1999 cited in Brinkley (2006).

[4] See Brinkley (2006)
[5] See Brinkley and Lee (2007).

economic development because of a speed up in the generation and dissemination of knowledge and the greater pervasiveness of new technology and knowledge in economic activity. In addition knowledge and innovation have become more important to international competitiveness and growth.

Most economists as well as policy makers in Latin America do not buy into the notion of the knowledge economy. They argue that there is nothing new in the concept. Many point out that Latin America has made much improvement in its macro situation since being set back by the debt problems and macro instability of the lost decades of the 1980s and 1990s. Furthermore they note that in the last few years Latin American growth has picked up. That is largely due to the increased demand for commodities and Latin American countries strong comparative advantage in natural resource and commodity exports.[6] Moreover they argue that Latin America should concentrate its efforts on continuing to improve its macro parameters and to invest in its areas of comparative advantage (food, fuel and minerals) rather than to divert its attention to the knowledge economy.

This paper agrees that Latin America needs to continue to improve its macro parameters, and to invest in its areas of natural resource strength. However it argues that it needs to do much more. There is a risk that in focusing too much on current allocative efficiency and sticking to its current pattern of production and technological capabilities, it will miss out on innovative (Shumpeterian) efficiency, and growth efficiency.[7] The basic argument here is that what will increase income in the short run may not position the region to grow in the longer run. If Latin America continues to specialize in food, fuels, minerals and primary commodities which have low demand elasticities, it will miss the better growth opportunities that can come from production in products and services which have higher demand elasticity and more possibilities for innovation. In order to improve its growth prospect Latin America needs to invest more in developing education, skills, innovation capabilities and information and communications technology infrastructure and applications—all elements of the knowledge economy.

In addition, knowledge related factors--innovation, tertiary education, and high level skills--have also become more important for international competitiveness and growth. This is very relevant for Latin America because as a region Latin America is falling behind. Part of the reason for its poor performance is that it has not paid enough attention to the increased importance of knowledge in development. Other developing regions, East Asia in particular, have and are doing much better as a result.

The paper starts with a review of the growing importance of knowledge for economic activities. It then surveys key trends in production and trade and the new dimensions of competitiveness. It then summarized the emerging distribution of specialization. It argues that this more demanding international context presents challenges and opportunities for Latin America that need to be addressed. It also reviews the experience of some countries that have risen to this challenge with the objective of providing some examples and drawing implications for the types of actions that need to be undertaken in Latin America.

[6] The share of food, fuels and minerals in Latin American merchandise exports is twice the average for the world as a whole—see table

[7] For an elaboration on these distinctions see Dosi, Pavitt, and Soete (1990).

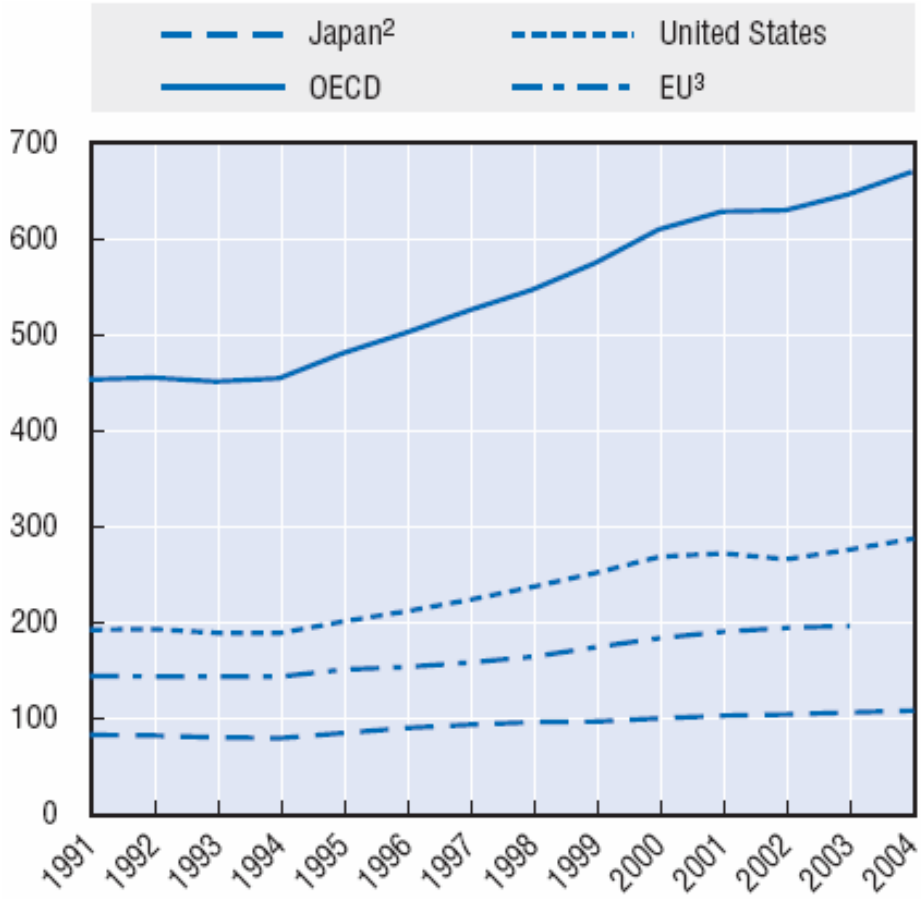
II. The Knowledge Revolution and the Increased Importance of Knowledge

Knowledge has always been an important part of economic activity. The focus on the knowledge economy reflects its increasing importance. This is the result of two factors. The first is the increasing speed in the creation and dissemination of knowledge. The second is its greater share of knowledge related activities in production and trade.

2.1 Increasing speed in creation and dissemination of knowledge

Advances in science, combined with the information revolution (itself a product of these advances), are driving an acceleration in the creation and dissemination of knowledge. It is now possible to codify and digitize much of our understanding of science. This permits modeling and simulation, which in turn further speeds up the understanding of science and the creation of new goods and services. The time between basic scientific discovery and commercial application is decreasing. This is particularly evident in biotechnology. The product life cycle of most manufactured products is also shrinking. This is perhaps most evident in the electronic products industry, ranging from computers and mobile phones to consumer electronics.[8]

Figure 1: R&D Expenditures as % of GDP 1991-2004 (Billion 2000 PPP dollars)



Source: OECD. ***STI Outlook 2006.***

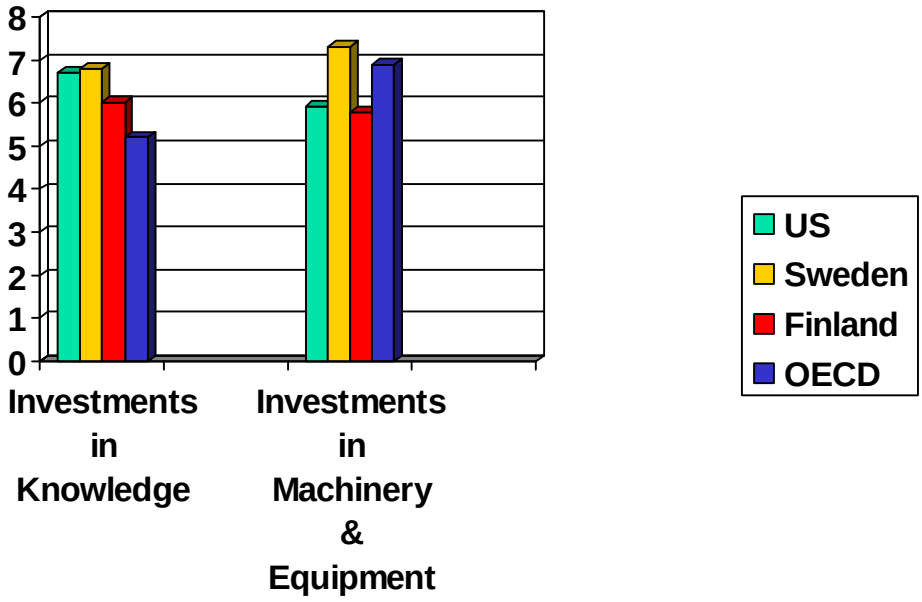
[8] But even in more traditional industries such as cars, there in an increase in the number of variety of products. It is now common for consumers to specify the options on the particular brand and model of car they wants to purchase, and have the car made to order.

World wide there has been an overall increase in spending on research and development. Figure 1 shows the trends for OECD countries which together spent almost $700 billion dollars (in purchasing power parity values) on R&D.[9] Adding the developing countries, the total is close to $900 billion (PPP values) a year. China by itself is now spending about $130 billion, India $40 billion, and Brazil$15 billion--to name just few of the main developing countries. In addition, there has been an increase in patenting all around the world both in developed and developing countries.

The implication of the speed-up in the creation and dissemination of knowledge is that developing countries need to find effective ways of tapping into the very rapidly growing stock of global knowledge. Those that are more advanced also have to invest more in their own R&D in order to compete with new frontier technological advances.

More generally, there has been an increase in investments in knowledge. A simple proxy for this is investments in R&D, tertiary education, and software. In fact, investments in these three intangibles is as much or more than investments in physical plant and equipment in some advanced countries like the US, Sweden and Finland and almost as much for OECD countries as a whole (Figure 2).

Figure 2: Investments in Knowledge are now as Large a Share of GDP as Investments in Machinery and Equipment in Advanced Countries. (2002)



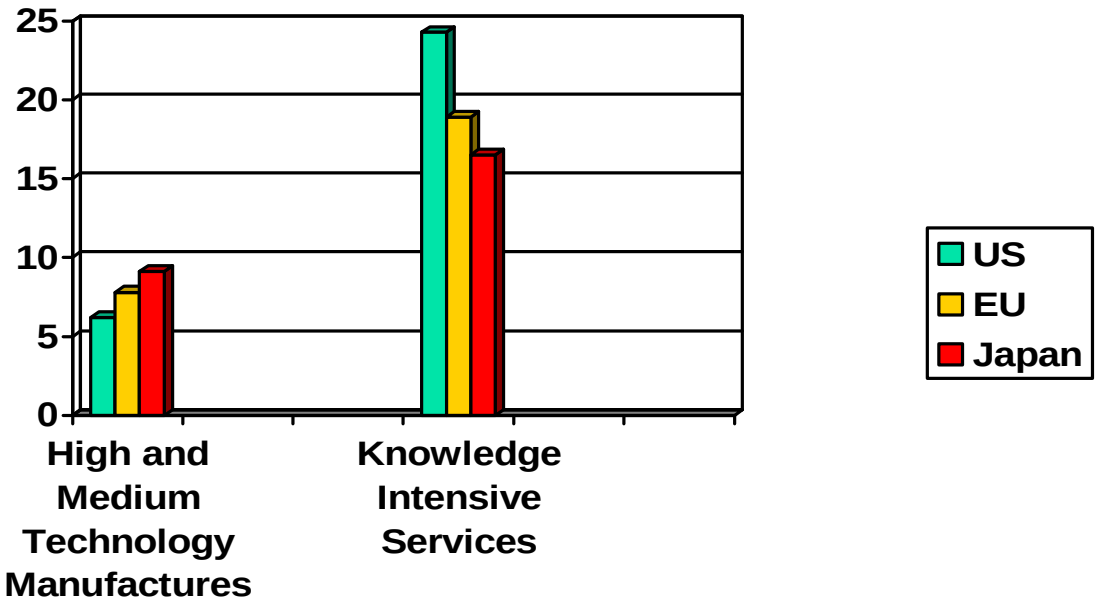
Source: OECD. ***STI Score Board 2005.***
Note: Investment in knowledge is investment in R&D, tertiary education, and software

[9] OECD countries in much of the data discussions because there is more systematic and reliable data on them while data for the whole world is very incomplete. The OECD countries account for almost three quarters of world GDP.

2.2. Increased importance of technology and knowledge in production and trade

As may have been expected, the technology intensity of manufacturing production has been increasing as R&D has become a more important input into most manufacturing activities. However, it should also be noted that R&D and knowledge, in terms of advanced education and skills, are also very important in the service sector. Moreover, services account for 69% of world GDP.[10] In fact, as can be seen in Figure 3, knowledge intensive market service activities are a much higher share of GDP in OECD countries (25%), than the share of medium and high technology manufacturing in GDP (7%).[11] Agricultural and mining activities also have increasing technology content as many advances in production, processing and distribution involve the use of increasing advance research and development. Thus it should be stressed that the knowledge economy is not just about the manufacturing sector, but about the whole range of economic activities.

Figure 3: Knowledge Intensive Market Services Account for higher % of GDP than Medium and High technology Manufactured Products in OECD Countries (2002)



[10] The share of services in economic activity increases as economies become more developed. In 2005 the share of services for low income countries (per capita GDP of $875 or less) was 50%, for lower middle income countries (per capita GDP $876 - $3,465) it was 47% (largely because of the lower share in China [40%] which accounts for about half the total GDP of lower middle income countries), for upper middle income countries ($3,466-$10,725) it was 62%, and for high income countries (per capita GDP of $10,726 or more) it was 72%.

[11] Knowledge intensive market services exclude government services (which do have many knowledge intensive activities) and include posts and communications, finance and insurance, and business services. The technology intensity of manufacturing is ranked according to the importance of R&D as a share of output, taking into account the R&D embodied in inputs, as determined through input output matrices. For more details see OECD data definitions in OECD STI Scoreboard 2005.

The structure of merchandise trade is also moving away from primary commodities to trade in manufactures. As can be seen in Table 1, the share of primary products in merchandise trade has fallen from 23.2% in 1985 to 14.7% in 2004. This is partly because the demand for manufactured products is more income-elastic than for primary commodities. Developing countries that do not have the capability to move into production of manufactured products therefore lose out on the possibility of benefiting from the most dynamic part of merchandise trade. In addition, the technological intensity of trade in manufactured goods is increasing. As can be seen the share of resource based manufactured products in merchandise trade has fallen from 19.4% to 15.6%. On the other hand, the share of high technology manufactures has doubled from 11.6% to 22.4%.

Table 1: Changing Structure of World Exports 1985 VS 2004 (US billion)

Products	**1985**	**2004**	**Annual Growth Rate**	**1985 %**	**2004 %**
All Products	**1,689**	**7,350**	**7.6**	**100.0**	**100.0**
Primary products	**391**	**1,018**	**4.9**	**23.2**	**14.7**
Manufactured products	**1,244**	**6,063**	**8.2**	**76.8**	**85.3**
Resource based	327	1,148	6.5	19.4	15.6
Low technology	239	1,962	7.9	14.2	15.0
Medium technology	480	2,169	7.8	28.5	29.5
High technology	196	1,643	11.2	11.6	22.4

Source CEPAL-TRADECAN 2005

In addition, in part thanks to advances in information and communications technology, there has been a significant increase in trade in services. Between 1990 and 2005 trade in services increased from 7.6 % to 10.8% of world GDP.

2.3 Increasing Globalization

The reduction in communication and transportation costs combined with trade liberalization has led to a dramatic expansion of trade.[12] Imports and exports as a share of global GDP have increased from 40 per cent in 1990 to 57 per cent in 2005. In addition, the reduction of communications cost and the spread of the mass media have virtually created a "real time world", where events that happen in one place are instantly known worldwide.

The implication of this increased globalization for countries is that they are more exposed to everything that is happening worldwide. It also means that everything happens faster, so in addition to facing more competition, they have to develop greater capability than before in order to respond rapidly and adequately to new threats and opportunities

[12] Since the GATT there has been a trend towards increasing liberalization in trade policy among most countries. In developing countries, average tariff levels have fallen from 34.4 per cent in 1980-83 to 12.6 per cent in 2000-2001; in developed countries they have fallen from 8.2 per cent in 1989-92 to 4.0 per cent in 2000.(See UNCTAD 2004.

3. Major Global Restructuring

3.1 The Two Unbundlings

As a result of two major technological changes as well as the entry of new players onto the world export markets major global restructuring is in process. The reduction in transportation and communication costs combined with the digitalization of information has led to the physical **disintegration** of production. Because of lower transactions costs, different components of a final product are now manufactured in several different countries.[13] The product may then be assembled in yet another country and then distributed worldwide. The same applies to some services. This means that, to get products or services to the market, it is now more important than in the past to tap into global supply chains. Even R&D is being commoditized to some extent as it is being outsourced to specialized centers in different countries, including India and China.[14]

This is what is being called the two great "unbundlings".[15] It is useful to distinguish them because they have different trajectories and implications. The first unbundling is the end of the necessity to produce goods close to consumers. This has been going on for centuries but has been accelerated by the rapid decline in transportation costs in the last four decades, particularly since the widespread use of containers and bulk carriers. The impact of this has been that much manufacturing production, especially of the more standard and labor-intensive goods, is being transferred to developing countries with lower labor costs.

The second unbundling is the end of the need to perform most manufacturing stages near each other. This has been made possible by the rapidly falling costs of telecommunications and the possibility of codifying and digitizing tasks. The impact of this has been that many service tasks supporting manufacturing as well as other services have been off shored to countries with lower labor costs.[16]

3.3 The Doubling of the Global Labor Force

Moreover, as the formerly inward oriented economies of China, India, and the former Soviet Union have increased their participation in the international trading system, the net effect is that the global labor force has effectively doubled (Freeman, 2006). This has strong implications for developed as well as developing countries. Developed countries are now facing competition from much lower cost workers, which is putting pressure on labor-intensive industries. Freeman goes on to argue that the doubling of the global labor force has increased the marginal productivity of capital. As a result, that share of value added that is going to capital has increased, while that which is going to labor has decreased. The principal beneficiaries of this globalization and rebalancing of relative wages are the

[13] For a good exposition on modular production as applied to electronics see Sturgeon (2002).
[14] For US MNCs, R&D undertaken by foreign affiliates increased from 11 per cent in 1994 to 13 per cent in 2002. For Swedish MNCs it increased from 22 per cent in 1995 to 43 per cent in 2003. For the world as whole, R&D expenditure by foreign affiliates is estimated to have risen from US$30 billion in 1993 to US$67 billion in 2002 – i.e., from roughly 10 per cent to 16 per cent of all global business R&D, US$403 billion (UNCTAD, 2005).
[15] The use of unbundling for these trends is attributed to Robert Baldwin (2006).
[16] For a current analysis of this based on interviews with over 500 companies around the world see Berger (2006).

multinational corporations which are the most effective agents at intermediating and taking advantage of differences in global factor prices.

The implication of these developments is that there are increased opportunities for those countries that can position themselves to take advantage of the two unbundlings. The major developing country beneficiary of the first unbundling has been China, which is becoming the manufacturing workshop of the world. The major beneficiary of the second unbundling has been India, thanks to its critical mass of higher educated English speaking technicians, engineers, and scientists. Other economies such as the Philippines Vietnam former Soviet republics with critical mass of highly skilled manpower, and some Caribbean English speaking island economies are also benefiting from digital trade made possible by this second unbundling. Most other developing countries without critical mass in the skills base, English language or the advanced telecommunications and other physical infrastructure (including most of Latin America) have not benefited as much and are having trouble competing on both fronts.

Developed countries are also being impacted by increased globalization and the two unbundlings. The first is more in keeping with the expectations of traditional trade and product cycle theory, which postulated that labor-intensive manufacturing would move to labor abundant countries. Under this theory it was expected that developed countries would stay ahead by moving into more skill- and technology-intensive sectors. However, the second unbundling is a newer phenomenon not foreseen by traditional trade theory. It was not anticipated that services could be traded virtually thanks to advances in information technology.

Various economists, including Alan Blinder (2006) and Gene Grossman et al. (2006) are beginning to focus on this phenomenon. Blinder has even gone as far as to call off shoring the third industrial revolution. Its most significant idiosyncrasy is that the dividing line between jobs that can be outsourced versus those that cannot is not related to skills. Many highly skilled and knowledge-intensive jobs can now be outsourced. Blinder (2006) estimates that the total number of jobs susceptible to off shoring may be two to three times the total number of current manufacturing jobs in the US.[17] This is an important new element not anticipated by economic policy in developed economies. It is no longer sufficient for developed countries to invest in higher education to stay ahead. They will need to focus on exploiting advantages in non-tradable services, transform their educational systems to prepare workers for those jobs, strengthen innovation and creativity, and put in place adequate trade adjustment mechanisms (Blinder, 2006).

3.4 The Rise of the Global Company and Global Supply Chains

One of the key drivers of globalization and global restructuring with significant implications for developing country strategies is the increased role of MNCs. They are the key producers and disseminators of applied knowledge. They are estimated to account for at least half of total global R&D and more than two-thirds of business R&D.[18] MNCs disseminate

[17] There is much debate on the number of jobs that might actually be outsourced, and Blinder's estimates tend to be on the high end, but the key point is that as ICT advances and more tasks can be digitized, many more jobs may be at risk.

[18] In 2003, the top six MNCs (Ford, Pfizer, Daimler Chrysler, Siemens, Toyota, and General Motors) spent more than US$5 billion each (nominal $). Only five developing countries came near to US$5 billion or more per year (Korea, China, Taiwan [Province of China], Brazil, and Russia) – see UNCTAD (2005).

knowledge directly through their operations in foreign countries and through licensing agreements. In addition, they often are the first to introduce new products, processes, or business and management methods in many foreign countries, providing examples and ideas for imitation by domestic companies. They also train workers, managers and researchers who may disseminate some of the knowledge and experience acquired while working for the multinational when they leave to work for another company or set up their own.

It is estimated that the value added by MNCs in their home countries plus that in foreign affiliates represents 27 per cent of global GDP.[19] On the trade side, it is estimated that affiliates of foreign firms account for one-third of world exports.[20] However, the influence of MNCs is greater than this. They affect a much larger share of GDP if one takes into account backward and forward linkages, as well as their role in demonstrating new technologies and putting pressure on domestic firms to upgrade production processes. Although there is no accurate estimate, probably more than half of the remaining trade is done through supply chains controlled by multinationals as part of vertical chains or through distribution chains.

In addition, MNCs are now operating much more as independent global agents. [21] Rather than responding to the needs of any country, even their original home country, their objective is to operate globally in the best way to increase returns to their investors, whoever they are and wherever they may be. This will increasingly put them at odds with the interests of their home countries (as they shift even high value, high skill jobs and functions, including research, out of their home base) as well as host countries (as one location is pit against another and resources are redeployed to wherever it is more profitable).

One of the implications of the increased role of MNCs in the generation of knowledge and in production and distribution of goods is that developing countries now need to pay more attention to how to attract and make the most effective use of foreign investment. Even Korea and Japan, which were the countries that made least use of FDI, have had to open up in the 1990s in order to get access to some cutting-edge technology that foreign firms are not willing to license. However, FDI to developing countries is very heavily concentrated in just a few of them. The top ten developing countries account for 65 per cent of the total FDI going to developing countries[22]. FDI goes to where it finds the most attractive profit opportunities, either to supply local markets, or to use those locations as export platforms for other markets. Most evidence shows that offering special tax and other incentives is usually not sufficient to offset major economic disadvantages perceived by foreign investors. Therefore, countries that cannot offer intrinsic advantages to attract FDI are going to have to find alternative ways of getting access to relevant foreign knowledge. These can include buying some of the technologies through arms-length transactions, technical assistance, copying and reverse engineering, and own technological development, but these pose their own sets of challenges.

[19] UNCTAD (2005, various years).
[20] In 2004, the exports of MNCs were approximately US$3,690 billion out of total world merchandise and non-factor service exports of US$11,069 billion (UNCTAD, 2000)
[21] For an excellent perspective on this from no other than the CEO of IBM, see Palmisano (2006).
[22] The economies, in decreasing order of FDI inflows in 2005 are: China, Hong Kong (China), United Arab Emirates, Brazil, Russia, Bermuda, Colombia, Mexico, and Taiwan—see UNCTAD (2006).

Another implication of this for developing countries is that they have to become integrated into global supply chains normally controlled by multinational producers or distributors (like Wall-Mart or other large retailers). Entry into supply chains is usually at the simpler levels such as making simple manufactured goods, producing simple components, or assembling subcomponents. Both getting into and moving to higher value added activities in vertical supply chains can be difficult. For the first, the supplier must demonstrate capability to produce to high standards of quality and timeliness in delivery; for the second, strengthened technological capabilities are required.[23]

Entering supply chains controlled by distributors such as Wal-Mart is also difficult. Usually production runs have to be large. Suppliers must also be able to maintain quality and timeliness. All three of these requirements make it difficult for smaller countries with smaller firms to enter these supply chains.[24] Their producers generally do not have the scale to produce the volumes required (Wal-Mart is sourcing over 25 billion dollars worth of goods from China, cuts out middlemen, and goes directly to the producers). In addition, a buyer like Wal-Mart exerts continued pressure on the suppliers to reduce costs and improve quality and speed of delivery.

It should be noted that there are only a few companies from developing countries which have managed to create and sell globally under their own brand names.[25] This indicates how difficult and expensive it is to develop own brand and distribution systems.

4. A Framework for Thinking About the Knowledge Economy

The implications of all these changes are that it is necessary for economies to be very flexible so that they can deploy their resources quickly and efficiently to rapidly changing opportunities. To do this they must have a good enabling environment in terms of an economic and institutional regime that facilitates rapid adjustment and encourages innovation. Competitiveness used to be based (to a greater degree) on static comparative advantage. Today, competitiveness does not just depend on the cost of factors of production, or on a specific technological advantage. Rather, it depends on continuous innovation, high level skills and learning, an efficient communications and transport infrastructure, and a supportive enabling environment.[26] These are the fundamental requirements of a knowledge economy. Each of these aspects is discussed below in greater detail.

4.1 The Economic and Institutional Regime

In the context of rapid change it is important for countries to be able to react quickly to changing opportunities. They have to have strong elasticity of response. That means that

[23] For a good exposition on supply chains and the difficulty of moving up see Kaplinksy (2005).
[24] For example, according to a recent interview with the handicraft store chain Ten Thousand Villages, the main reason why there are so few handicraft products from Africa is that producers in African countries have trouble producing to the scale, quality, and timely delivery required.
[25] Some of the most famous are companies such as Samsung, LG, and Hyundai from Korea; Acer from Taiwan; China Mobile, China Netcom, Founder, Lenovo, SAIC, Tsingtao Beer, and ZTE Corp from China; Bajaj, Bharat, Cipla, Dr. Reddy' Labs, Infosys, Ranbaxy, Reliance, Satyam, Tata, and Wipro from India; Gerdau, Embraer, Natura, Perdigão, Sadia, and Votorantim from Brazil; and CEMEX, FEMSA, and Modelo from Mexico.

they must have flexible capital and labor markets. They also have to have capable governments that can help to restructure the economy and deal with the adjustment difficulties. That includes the basic institutions such as government, rule of law, efficiency of capital and labor markets, ease of setting up or shutting down business. It also includes the ability of the government to create consensus and the ability to help people who fall through the cracks in the system.

4.2 Innovation

In this context of rapid development and dissemination of new knowledge, innovation is becoming a more critical element of competitiveness. Firms have to be constantly innovating to avoid falling behind. This does not necessarily mean that they have to be moving the technological frontier forward. Only the most advanced firms do that. However, all firms need to be at least fast imitators and adopt, use and improve new technology in order not to fall behind. This puts a great deal of pressure on firms' technological capabilities. Moreover, innovation is not just a matter of new products or new processes and ways to produce them, but also better organization and management techniques, and better business models which facilitate doing business.[27] An example of what is essentially a very simple innovation is containerized cargo, which has greatly facilitated shipping manufactured products and dramatically cut down freight costs. An example of business innovation is the development of consumer product companies such as Dell, which subcontract production according to their design and specifications to third parties, eliminate distributors, and sell directly to the final consumer. Another example of a business innovation is Wal Mart's monitoring of consumer demand from points of sale through electronic cash registers, linking that information to central ordering directly to producers all around the world, thereby eliminating intermediaries in production and distribution.

Innovation in the context of a developing country should be thought of as products or services or forms of organization that are new to local practice, not necessarily to global practice. Therefore it is useful to distinguish three sources of innovation. One is acquiring technology that already exists abroad. A second is the creation of relevant new knowledge. The third is the dissemination and effective use of this new knowledge throughout the economy (this will be developed more fully in the following section.
[add]

The implication of this for companies is that they have to make greater efforts to keep up with new technologies and new forms of business organization and production and distribution networks. This requires more investment in their technological capability to search for, acquire and adapt technology to their needs and in managing production and distribution systems. For those that are closer to the frontier, it means that they need to put more effort into real cutting edge innovations in technology and business.

[27] Palmisano (2006, p.132), the CEO of IBM, for example, writes, "Real innovation is about more than the simple creation and launching of new products. It is also about how services, are delivered, how business processes are integrated, how companies and institutions are managed, how knowledge is transferred, how public policies are formulated - and how enterprises, communities, and societies participate in and benefit from it all".

4.3 Education, Skills, and Life Long Learning

Technological advance is very complementary with higher skills and more education.[28] As a result, education and skills are becoming more important in international competitiveness. MNCs make their location decisions partly based on the education and skills of the local workforces. This means that countries need to make more investments on increasing education and skills. Globally, there has been an increase in average educational attainment. There has been a strong increase in the number of persons with higher education. Because of the knowledge revolution, there is a need for people to learn a diverse range of new skills. This has given rise to what Peter Drucker termed the "knowledge worker" (Drucker, 1994). The knowledge worker is not just the PhD with very narrow and advanced education. S/he is the technician and the graduate of the junior college. In the United States, 35 per cent of students in tertiary education are older than the typical college age cohort of 18-24. Many are workers who are coming back to get their college degrees, or workers who already have college degrees but are coming back to obtain specialized training certificates or more advanced degrees. Thus there is a need to think in terms of systems of life-long learning.

This implies that developing countries need not only to expand primary education, but that they also need to expand the access and quality of secondary and tertiary education. This may be difficult given tight budgetary constraints, so many developing countries will have to rely more on tuitions and private provision of higher education. Increasing higher education may bring the risk of losing people to the brain drain if graduates cannot find good jobs locally. Thus developing country governments have to think through their higher education strategies more carefully. In addition, governments need to think of education and training as integrated systems for life-long learning and to start designing systems that will have multiple providers and multiple pathways to different levels of certification and qualification. They also have to make more effective use of distance education technologies, particularly the potential of internet based education and training services which can be delivered anywhere, anytime at any pace.[29]

4.4 Information and Communications Technologies

Information technology is becoming a fundamental enabling infrastructure of the new competitive regime. "Supply chain management requires speed across global space to accomplish what a factory accomplished internally with the assembly line. Information and communications technologies (ICT) are the tools that allow flexible accumulation to function."[30] ICT is a critical part of what enables the organization and coordination of global production networks and the integration of global supply chains. It is also an essential element for monitoring what the consumers are buying and what they want, and passing that information seamlessly along to producing units which often are not even owned by brand name manufacturers. This real-time information on the changing needs of the market, indeed even direct interaction with the consumer (as in the examples of made to order computers or automobiles), as well as internal electronic exchange and management between different departments and division within firms and among firms, their suppliers and distributors, are becoming essential new ingredients of the global economy.

[28] See for example De Ferranti et al. (2002)
[29] For the broad architecture of the kind of systems that need to be set up in developing countries, as applied to China, see Dahlman, Zeng and Wang (2007).
[30] Ciscel and Smith (2005, p.431).

There are several implications for developing countries. At the national level, there needs to be modern and low cost communication systems as well as good training in the skills necessary to use these networks. For the development of e-business, there need to be appropriate legal and regulatory systems including e-signature as well as secure digital communications and safe payment systems. At the level of the firm, investments in training and hardware as well as in restructuring business processes are also necessary in order to take advantage of the reduction in transactions costs and time that can be obtained through these technologies.[31]

4.5 Logistics, Transportation, and Distribution

In this new context of increased globalization, rapid technical change, and shorter product life cycles, modular production and outsourcing, and the need to get components and products to the customer quickly, logistics (transportation, distribution channels, and warehousing), which connects manufacturing and retailing, is becoming another critical factor for competitiveness.[32] Therefore, transportation infrastructure – roads, railroads, airports, seaports and transportation companies, with coordination enabled by IT – is critical for countries to participate effectively in the global market.[33]

The implication of this for many developing countries is that, even if they can produce competitively, it may still be very difficult for them to get into global value chains because of high transport costs. Typically, developing countries have very poor transportation infrastructure. In addition, they frequently do not have the volume to warrant bulk transport systems nor the frequency of service required to make the transportation costs competitive. This works against small countries far from the main markets. Most countries in Africa have very poor shipping or air links with the rest of the world, and few of these have direct links with key markets. This means that there are usually many stops and several transshipments before products get to their final destination. This increases both transportation costs as well as the inventory costs for goods in transit.

Part of the cost advantage of China is not just low wages and that it has over 200 million underemployed workers in agriculture that can be brought into industrial production, but that it has developed large scale and low cost transportation infrastructure. Combined with frequent shipping and air service to major world markets, it can place its goods virtually anywhere, for a fraction of the costs of most other developing countries.

5. Benchmarking Latin American Countries in the Global Knowledge Economy

There are various methodologies for benchmarking countries. The World Bank developed one explicitly for the benchmarking countries in the knowledge economy.

[31] Studies from many countries show that efficiency gains are much larger when investments in hardware are accompanied not only by training but also by changes in organizational processes and procedures to take advantage of the potential offered by the new technologies (see OECD, 2005).

[32] For an exposition on how the traditional factory production system has been replaced by logistics and the implications that has for workers see Ciscel and Smith (2005).

[33] For a good exposition of this and of how some regions in the US are organizing public private partnerships to create this enabling infrastructure see Kasarda and Rondinelli (1998).

5.1 The World Bank's Knowledge Economy Index

The KAM is based on four pillar of the knowledge economy. These correspond to the factors outlined in the framework above, except that it does not have the infrastructure and logistic factor. For each of the factors there is a set of about 20 indicators. These are structural and qualitative variables that are drawn from the World Bank's own data sets such the World Development Indicators, the Cost of Doing Business as well as external data sets such as the World Economic Forum, IMD, Freedom House, etc. Because the data cover a wide range of values in different units, all the 81 variables are normalized on a scale of 0 (weakest) to 10 (strongest) and the 131 countries are ranked on an ordinal scale.[34]

5.2 Relative Global Position of Latin American Countries

Globally the top five performing countries are the Nordic countries (Denmark, Sweden, Finland Iceland, Norway) followed by the US, Australian, Netherlands, Canada and the United Kingdom. The Latin American countries rank in the middle to low range. The best performing is Chile (39th) followed by Costa Rica (48th), with the worst performing is Haiti (116th out of 132 countries ranked). Thus there is a wide dispersion in the performance of Latin America. As a whole, the Latin American Regions performance has deteriorated slightly in the most recent period compared to its ranking in 1995.[35] Figure 4 show the relative position of ten of the most important Latin American countries for in the most recent period relative to 1995 and relative to the rest of the world. Latin American countries that have made significant improvements include: Barbados, Chile, and Brazil; those that have regressed the most are Venezuela, Paraguay and Argentina.

Table 2 presents the breakdown of the overall knowledge economy index and its four sub-components for Latin America and for the five main Latin American countries, as well as for some comparators. These are Finland, East Asia, and three of the key East Asian economies. Latin America as a region has fallen behind in the overall knowledge economy

---

[34] See www.worldbank.org/kam. Besides the whole range of indicator there is summary knowledge economy index which is the average of three representative indicators for each of the four pillars. These consist of the following:

Economic and institutional regime

- Tariff and non tariff barriers as proxy for competitive pressure
- Regulatory quality as a proxy for government regulation
- Rule of law

Education and human resources

- Adult literacy rate (for age 15 and above)
- Secondary enrollment rates
- Tertiary enrollment rates

Innovation system

- Researchers n R&D per million population
- Patent application granted n the US (to standardize for different IPR regimes)
- Scientific and technical journal articles per million population

Information Infrastructure

- Telephones per 1000 persons (mainlines and mobile phones)
- Computers per 1000 persons
- Internet users per 1000 persons

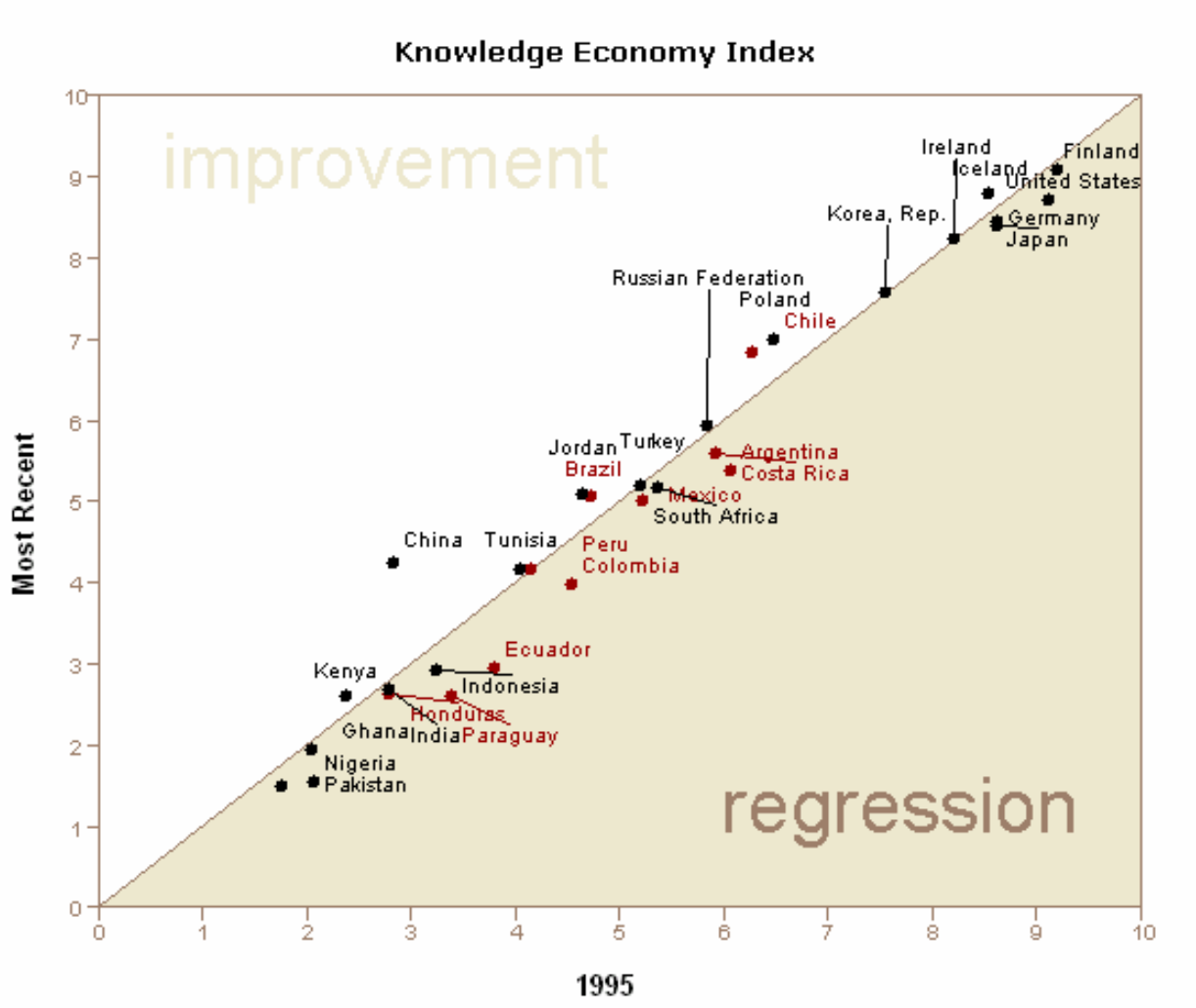
[35] The 21 Latin American countries included in the ranking are: Argentina, Barbados, Bolivia, Brazil., Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Trinidad and Tobago, Uruguay, and Venezuela.

index as a whole in three of the four subcomponents. It made a very slight improvement in the innovation index. Overall it has fallen most with respect to the economic incentive and institutional regime. Among the main countries, Brazil and Chile are exceptions in that they have improved their positions—Chile across all four sub-indicators, Brazil improved in the functional ones but fell back considerably on the economic incentive and institutional regime.

On the other hand, countries in East Asia and the Pacific improved their relative performance although this was not uniform across the sub-indices. Among the large EAP countries, China is the exception in that it improved across all the sub-indices.

Finland lost a bit overall, as the rest of the world began to narrow the lead it had in ICT, but nonetheless remains one of the top global performers.

Figure 4: Knowledge Economy Index for 10 Latin American Countries: Changes Between 1995 and most Recent Period Relative to the World



Note: Countries appearing above the 45 degree line have improved their position in the most recent period (2005-2006) relative to their position in 1995. Countries below the line have lost ground. A country can improve in absolute terms but still fall behind in relative terms if other countries improve faster.
Source: www.worldbank.org/Kam (accessed 6/26/2007)

Table 2: Knowledge Economy Index—Latin America and Selected Countries

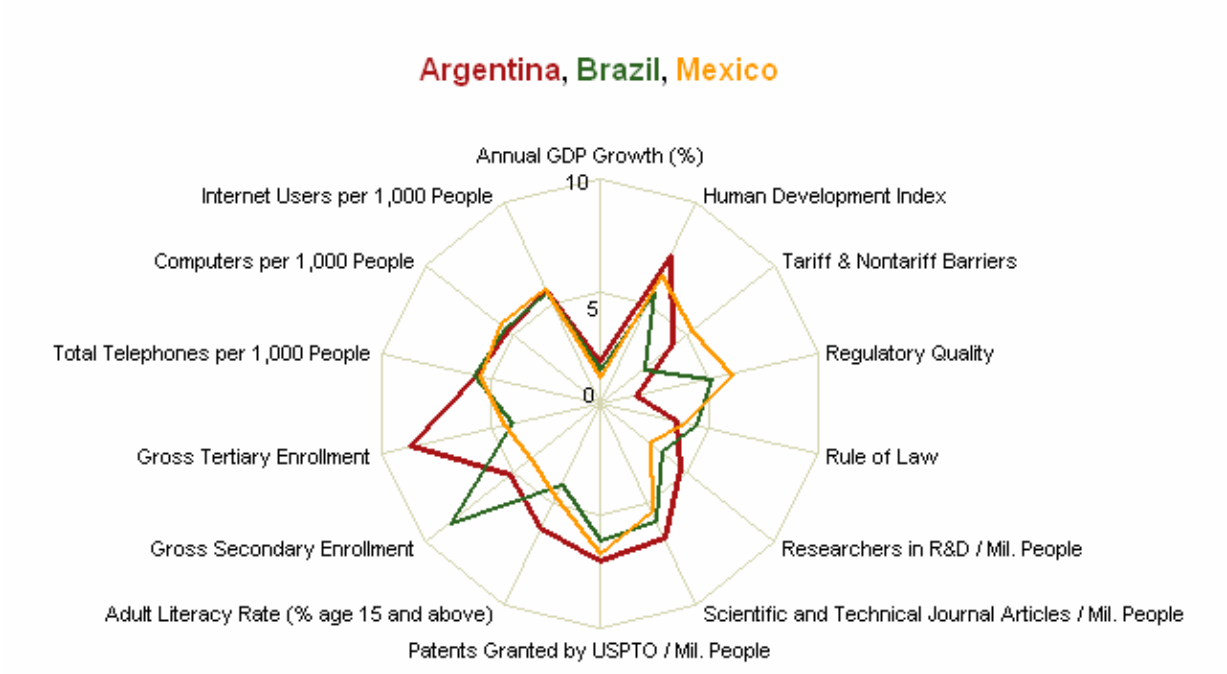
	Overall	Economic & Inst. Regime	Innovation	Education	ICT
LAC					
2006	**4.66**	**4.43**	**4.66**	**4.25**	**5.29**
1995	**4.86**	**4.99**	**4.62**	**4.39**	**5.43**
Argentina					
2006	**5.41**	**3.19**	**6.15**	**6.71**	**5.59**
1995	**6.07**	**5.81**	**6.02**	**6.39**	**6.06**
Brazil					
2006	**5.10**	**4.03**	**5.17**	**5.57**	**5.61**
1995	**4.73**	**4.68**	**5.05**	**3.85**	**5.33**
Chile					
2006	**6.86**	**8.84**	**5.82**	**6.18**	**6.59**
1995	**6.27**	**7.18**	**5.70**	**5.87**	**6.33**
Colombia					
2006	**4.00**	**3.55**	**3.31**	**4.48**	**4.64**
1995	**4.44**	**4.81**	**3.29**	**4.53**	**5.55**
Mexico					
2006	**5.04**	**5.09**	**4.96**	**4.38**	**5.72**
1995	**5.22**	**6.14**	**4.80**	**4.42**	**5.52**
East Asia					
2006	**6.03**	**5.64**	**7.13**	**4.57**	**6.77**
1995	**6.18**	**6.06**	**6.84**	**4.71**	**7.12**
Korea					
2006	7.60	5.70	8.30	7.57	8.82
1995	7.56	6.53	7.59	8.12	8.01
Taiwan					
2006	**8.12**	**7.78**	**8.97**	**6.95**	**8.99**
1995	**8.06**	**8.43**	**8.84**	**6.88**	**8.09**
China					
2006	**4.26**	**4.10**	**4.78**	**3.93**	**4.24**
1995	**2.83**	**2.20**	**3.93**	**3.47**	**1.71**
Finland					
2006	**9.12**	**8.79**	**9.71**	**9.16**	**8.84**
1995	**9.21**	**8.46**	**9.56**	**9.15**	**9.66**

Source: www.worldbank.org/Kam (accessed 6/26/2007

5.3 Preliminary Benchmarking of Five Latin American Countries

Figure 5 presents the basic scorecard for the three largest Latin American Countries[36]. The basic profile is quite similar except that Mexico does slightly better on the basic economic and institutional regime, while Brazil does better on secondary enrollments and Argentina does better on tertiary enrollments. However all three countries have had poor economic growth since the 1980s.

Figure 5. Basis Knowledge Economy Scorecard for Big Three Latin American Countries

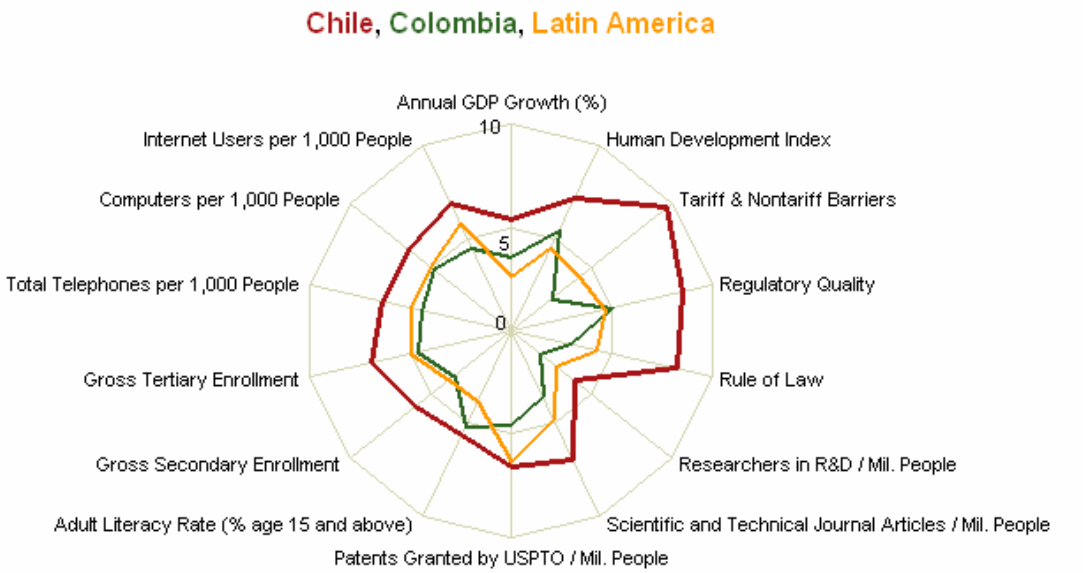


Note: Variables are scale such that higher values are better so the closer the ranking is toward the outside of the circle the stronger the performance of the country.
Source: Source: www.worldbank.org/Kam (accessed 6/26/2007)

Figure 6 presents the basic scorecard for Chile, Colombia, and the average for the 21 Latin American countries in the data base. Chile performs much better than the Latin American average. On the economic and institutional regime it has rankings typical of developed economies. It has also had the best growth performance among the major Latin American countries. Colombia is very similar to the typical Latin American profile although it is weaker on the rule of law and all the innovation indicators.

[36] The basis scorecard consists of the 12 indicators used for the knowledge economy index plus two performance variables: average annual GDP growth 2000-2005; and the human development index (a composite index developed by UNDP which includes per capita GDP, education, and life expectancy). The scorecard is constructed such that being toward the outside of circle represents better performance.

Figure 6: Knowledge Economy Scorecard for Chile Colombia and Average for 21 Latin American Countries in Database



Source: Source: www.worldbank.org/Kam (accessed 6/26/2007)

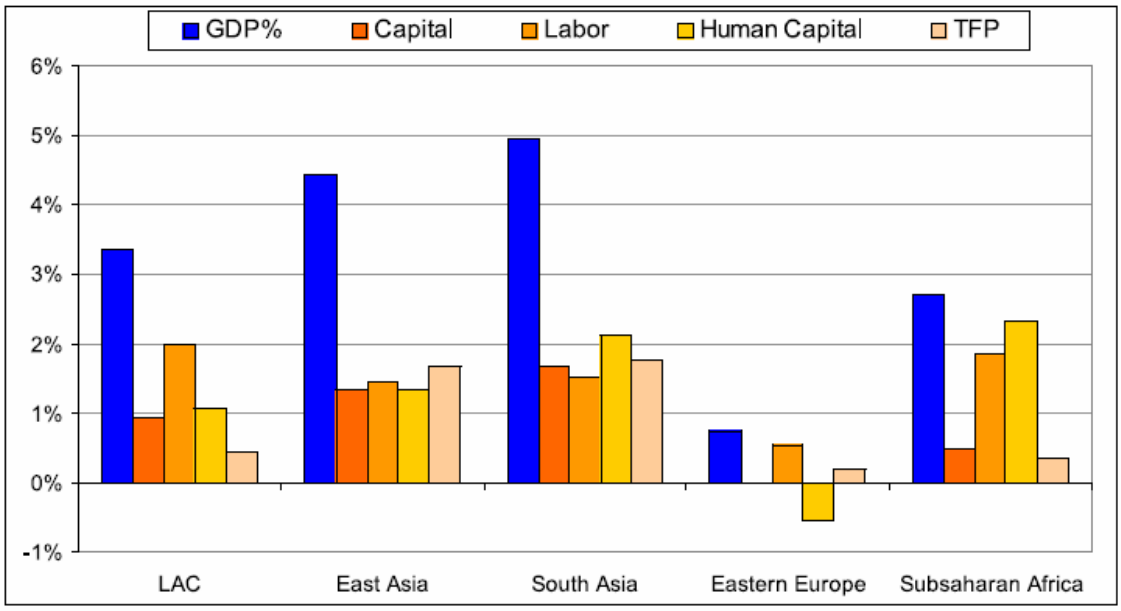
5.4 Growth and Total Factor Productivity in Latin America vs. other Regions

It is also instructive to compare Latin America's overall growth performance with that of other parts of the developing world and to decompose the sources of that growth (Figure 7). Although Latin America has had a better growth performance that the Eastern European countries or Saharan Africa its performance has lagged that of South Asia, and particularly East Asia.[37] Even more significant, however are the sources of that growth. While the contribution of the expansion of the labor supply has been greater in Latin America, that of physical capital, human capital and especially that of total factor productivity have been much lower.[38] The low contribution of physical capital is due to Latin America's low investment rate, resulting from its macro instability. The low contribution for human capital is due to slow increases in the educational attainment of the Latin American population. The low total factor productivity contribution is due to the poor use of knowledge in general. In short Latin American is not keeping up with the world in terms of the use of effective use of knowledge or education.

[37] It should be noted that the very poor performance of the transition countries during this period was due to the collapse of their planned economy during the transition in the 1990s. Between 200 and 2005,, however, they have been growing faster (5.4%) than Latin America (2.3%). African countries have also been growing faster (4.3%) than Latin America since 2000

[38] Total factor productivity is a residual term in an econometric regression that links growth in output to growth in inputs such as capital and labor. In some regressions such as the one on which this figure is based, a distinction is made between labor and education where the latter is called human capital. The residual growth that cannot be explained the growth in the inputs is called total factor productivity. It is a measure of increases in the efficiency in the use of the different factors. It is therefore a proxy for improvements in technology, as well as the more efficient use of existing knowledge.

Figure 7. Growth and TFP—Latin America Compared with Other Regions 1972-2000



Source: IADB (2006)

5.5 Trade Structure and Technology in Latin America vs. Other Regions

On the export side Latin America continues to be relatively specialized in natural resource based industries (Table 3). Between 1980 and 2005 it did increase the share of manufactured in merchandise exports, but at slower rate than developing countries as a whole. China and India, on the other hand have moved mostly into exports of manufactures. These account for 70% of India's merchandise exports and 92% of China's.

Table 3: Changing Structure of Merchandise Exports 1980 VS 2005

	Food		**Agricultural Raw Materials**		**Fuels**		**Ores and Metals**		**Manufact-ures**	
	1980	**2005**	**1980**	**2005**	**1980**	**2005**	**1980**	**2005**	**1980**	**2005**
LAC	32	15	4	2	31	22	12	7	20	54
Argentina	65	47	6	1	3	16	2	3	23	31
Brazil	46	26	4	4	2	6	9	10	37	54
Chile	15	19	10	7	1	2	64	56	9	14
Colombia		18		5		40		1		36
Mexico	12	5	2	1	67	15	6	2	12	77
East Asia	na	6	na	2	na	8	na	3		81
China	na	3	na	1	na	2	na	2	na	92
India	28	9	5	2	0	11	7	7	59	70

	Food		Agricultural Raw Materials		Fuels		Ores and Metals		Manufact-ures	
	1980	**2005**	**1980**	**2005**	**1980**	**2005**	**1980**	**2005**	**1980**	**2005**
Developing Countries	24	9	8	2	35	6	8	17	22	64
World	13	7	4	2	11	10	5	3	65	75

Source: WDI 1998 and 2007

Moreover, the main Latin American countries remain heavily reliant on natural resource and resource based manufacturing exports. Table 4 which uses the same classification as Table 1 shows that Chile (91%), Argentina (76%), Brazil (55%) are still relatively specialized in exports of natural resources and natural resource based manufactures (55% of the total, and very weak on high technology manufactures (7.9% vs. 24.2% for Mexico, and 30.5% for China), and an average of 29% for the world . Mexico is the exception. It drastically reduced the share of oil in its exports and increased that of manufactures. However this was based largely on its special maquila industry exports which was basically a labor intensive assembly and re-export operation using imported inputs and very little backward integration.

Table 4 Exports by Technology Intensity 2004 (% distribution)

	Argentina	Brazil	Chile	Mexico	China	India	World
Natural Resources	51.4	32.6	41.5	14.6	3.2	15.6	14.7
Resource based manufactures	24.5	21.9	49.2	6.4	6.9	29.8	15.6
Low technology manufactures	7.4	11.0	2.1	13.5	39.2	35.5	15.0
Medium technology manufactures	14.1	24.9	5.5	37.5	19.0	12.8	29.5
High technology manufactures	1.7	7.9	0.5	24.2	30.5	5.4	22.4
Other	0.9	1.7	1.2	3.8	1.1	0.9	..
Total	100	100	100	100	100	100	100

Source: CEPAL-TRADECAN

6 Experiences of Some Successful KE Transformations

At the country level some of the most impressive performers have been Finland, Ireland, the Asian newly industrializing countries (Hong Kong, Korea, Singapore, Taiwan,) China and India (see Table 5). This section will briefly review the strategies of these countries for some possible lessons for Latin America.[39]

[39] This excludes Hong Kong and Singapore as they are small city states with very unique geographical and historical positions.

Finland: From Natural Resources to Information based Knowledge Economy[40]

Finland is an example of country that transformed itself from essentially a natural resource based economy to an information based knowledge economy in 15 years. This transformation is remarkable given that Finland went through a severe economic crisis in the early 1990s. This included a major banking crisis, unemployment rising to 15% (from 2-3%), and an explosion of foreign debt. The roots of the crisis were uncontrolled deregulation of financial markets, high inflation, and a rapid increase in foreign borrowing, the problems of which were exacerbated by the collapse of the Soviet Union which wiped out 15% of foreign trade. This led to a recession. Finland's real GDP fell 10% from 1991 to 1993.

Finland's difficulties were also amplified by not being well prepared for economic integration into the European Union, increased competitive pressures from globalization, and lack of export diversity. Exports were dominated by forest related industries (pulp and paper, pulp and paper machinery, and forest industry services).

Table 5 Basic Performance Comparison

	Population	**GDP per Capita**	**GDP (Blns)**	**GDP Growth Rates**	**GDP Growth Rates**	**Exports to GDP**	**Exports to GDP**
	2005	**2005**	**2005**	**1990-2000**	**2000-2005**	**1990**	**2005**
Finland	5	37,530	197	2.5	2.4	22	39
EAP	**1,885**	**1,630**	**3,073**	**8.5**	**8.4**	**24**	**46**
Korea	48	15,840	765	5.8	4.0	28	43
Taiwan			346		3.12		62
China	13	1,740	2,270	10.5	9.6	19	38
LAC	**551**	**4,045**	**2,228**	**3.3**	**2.3**	**17**	**26**
Argentina	39	4,470	173	4.3	2.2	10	25
Brazil	186	3,550	662	2.9	2.2	8	17
Chile	16	5,870	98	6.6	4.4	34	42
Colombia	46	2.229	105	2.8	3.5	21	22
Mexico	103	7,310	753	3.1	1.9	19	30
World	**6,438**	**7,011**	**45,135**	**2.9**	**2.8**	**19**	**26**

Source: WDI 2007

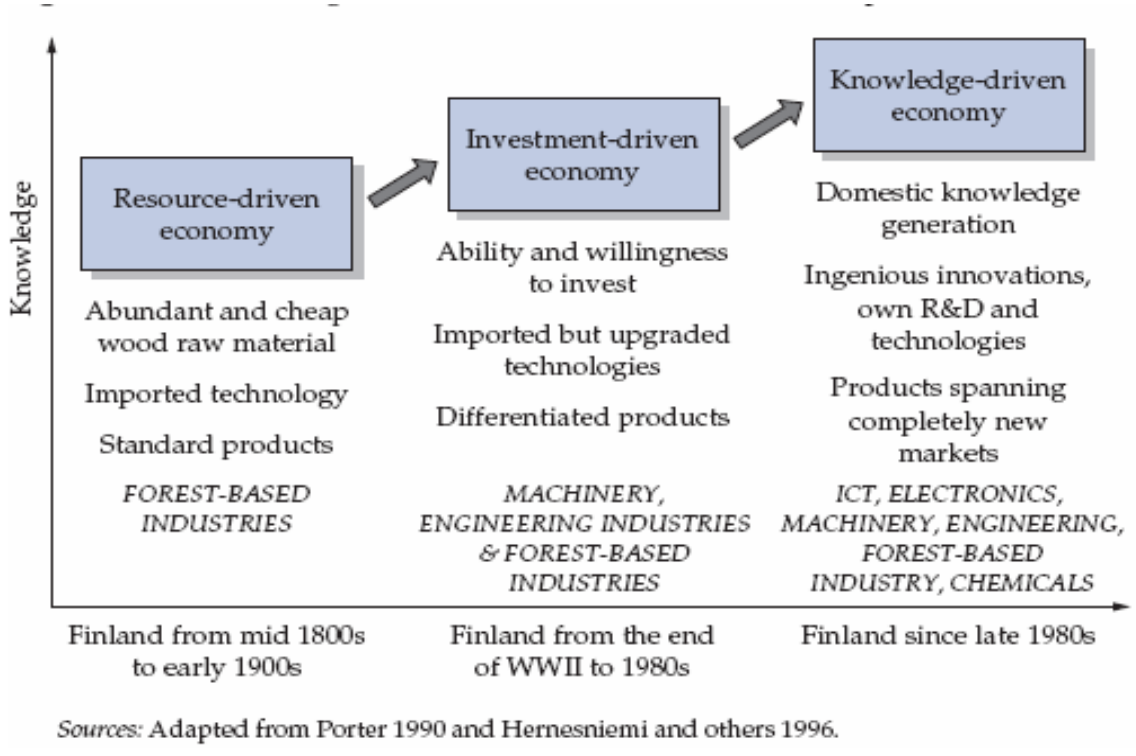
However, by 2000 has transformed itself into a knowledge and innovation driven economy and once the most IT driven economies. Since 2000 it has been ranked four years as the most competitive economy in the world by the World Economic Forum. It is a the second largest spender on R&D as a share of GDP (3.5%, just after Sweden). Its students also score the highest and have the lowest variance among all OECD countries in the PISA tests of the functional skills of 15 year olds.

[40] This section draws on Dahlman, Routti, and Yla-Anttila

How did Finland make this transformation? There are many factors, including some very specific to Finland including its very homogenous population, strong

However one factor that stands out is that during the crisis of the early 1990s there was strong vision and commitment by the government. In consultation with the private sector they decided to go for the information economy. The government cut back on all expenditures, except R&D which it increased. This lead to major R&D push and move into information and communications technology, electronics, machinery and chemicals in addition to the traditional focus on forest based industries. A large part of the success was also due to Nokia's success in restructuring itself from a nearly bankrupt company that had overextended from natural resources into to many disparate industries into telephones.[41] Figure 8 summarizes Finland's stages of economic and industrial development. It has gone from a resource driven economy from the mid 1800s to the early 1900s, to an investment driven economy from the end of World War II to the late 1980s, to a knowledge driven economy in the last 15 years.

Figure 8: Finland's Stages of Economic and Industrial Development



Source: Dahlman, Routti, Yla-Antilla et al. (2006)

However, the transformation over the last 15 years did not occur in a vacuum. They were preceded by changes in economic and social structures. The origins of the Finnish knowledge economy can be traced back to user producer linkages between the forest based industries and early users of high technology, and to the emerging engineering, electronics, and ICT industries in the 1960s and 1970s. There was also a strong spirit of technological

[41] Although there were many other firms, Nokia was the industrial engine behind the increase in R&D and the development of the ICT industry in Finland. In 2003 it accounted for 25% of Finland's total R&D spending.

self reliance given Finland's remote location, and a strong interest in technological tinkering. Also Finland developed a strong capability in the telecommunication area because of early deregulation of the sector and very strong competition among many providers with different technologies. This capability was part of what Nokia put together during the crisis to chart its new course into the telephone business which was crucial for its success.

In addition, the economic liberalization which lifted remaining restrictions on capital flows in the 1990s, and the trade liberalization associated with entering the EU were also important to create a more competitive and demanding environment. However, Finland's successful transformation was also due to a shift in focus and content of industrial policies in the 1990s away from macroeconomic policies and industrial subsidies towards micro-economic "conditions providing policies". The Washington Consensus polices were necessary but not sufficient. Some of the additional policies involved a strong focus on coordination of policies among key government agencies and between them and the productive sectors. Another was the strong focus on R&D and innovation. A thirds has been a very strong focus on education.. A final one has been a strong focus on being prepared for the future.

An example of explicit mechanisms for coordination is the Economic and National Policy Programs organized by the Finnish National Fund for Research and Development. SITRA itself is a very interesting institutional innovation. It was created in 1967 in the Central Bank to celebrate Finland's independence. Since 1991 it has been operating under Parliament with a Board consisting of the highest level representatives of the central ministries. Its function is to experiment with and start new activities without the budgetary delays and political commitments usually necessary to start new things. In many areas such promoting super computer based modeling techniques, environmental studies, venture capital for high technology industries, the pilots have resulted in the creation of dedicated permanent organizations. One of these initiatives was an economic policy and management course started in 1977. Participants have been most members of Parliament, business and labor leaders and other opinion makers including the media. It involves one to two weeks of lectures and simulations based on the real needs of the economy. A key exercise is having participants work as a shadow cabinet to define policy objectives and to choose appropriate policy instruments based on the actual issues and data being worked on by the government. The objective is to create awareness about the difficult trade-off involved in running the economy and thereby to lay the groundwork for developing more consensus on critical issues to get concerted action.

The new industrial policy has involved putting R&D and innovation and high level human resources for the knowledge economy at center stage. Public subsidies are now increasingly R&D based and justified in terms of market failure. In addition, R&D policies have been integrated under the umbrella or innovation oriented industrial policies and most R&D funds are allocated competitively to companies and research institutes.

In addition, Finland has developed a strong institutional infrastructure and coordination mechanisms for its innovation policies. The Science and Technology Council is chaired by the Prime Minister and is responsible for the strategic development and coordination of Finnish science and technology policy as well as of the national innovation system. There is a systems view of industrial policy with an explicit recognition of the interdependence among research organizations, universities, firms and industries due to the increasing

importance of knowledge as a competitive asset. There is also an emphasis on responsive long term policies to improve the broader economic environment
for firms, and industries, especially in knowledge development and diffusion and clustering of industrial activities. Tekkes, the National Technology Agency, has a major role in building industry university collaboration. The Technical Research Center of Finland helps develop new technological solutions and applied technologies and promotes technology transfer and collaborative research networks.

The higher education system which is all publicly funded has also been very responsive to the changing needs of industry. For example, when there was a need for more electronics engineers to embark on the new strategy in the early 1990's it doubled the output in four years. More generally the expansion of the Finnish higher education system has followed and supported the needs of economic development. Since the mid 1990s, the number of researchers in the public and private sectors has risen faster than ever before the ratio to general population ranks highest in the world.

Finally there is clear understanding that sustainable competitiveness is built upon constant upgrading and renewal, and of the need to always be anticipating and preparing for the future. The Committee for the Future is an example of this, and is probably the only one of its kind in the world. It is another example of an institutional innovation for creating consensus. It is one of Parliaments 15 standing committees and has representation from the different political parties. Its task is to conduct active and initiative generating dialogue with government on the major future problems, including those related to the knowledge economy, competitiveness, the social impact of technology development.

There are several lessons of the Finnish example that may be relevant for Latin America. First, that it is possible to make a dramatic recovery of GDP, and to use a crisis as an opportunity to undertake major reforms to get onto a new growth path. Second, that it is important to develop vision and consensus making mechanisms to accomplish such transformations. Third, that in today's very competitive world it is important to develop appropriate knowledge strategies by investing in education and innovation. Finally, that it is important to develop flexibility the economy to respond to changing conditions. This requires not only appropriate consensus making mechanisms and implementation capacity, but also a responsive educational system and a dynamic government and private sector/

Republic of Korea: From Autonomous Technological Development to the Knowledge Economy[42]

After the devastation of the Korean War, the per capita income of South Korea in 1960 was just $60, comparable to the levels of poor African countries. However Korea is now an OECD member and a major economic and technological power with a per capita income above $15,000. What explains it success? To a large extent is has been strong and effective leadership which has coordinated and adjusted policies to meet changing challenges and opportunities over the last 50 years. These strategies have involved active technological capability building and complementary human resource development..

Table 6 summarizes the stages of Korea's economic development strategies from 1960 to the present, indicating the changing development goals, major policy directions,

[42] This draws partly on Suh, Joonghae, et al. (2007)

macroeconomic policy framework, human resource development, and science and technology.[43] In the 1960s the Korea embarked on import substitution combined with export promotion. It also invested heavily in primary education to be use technology it acquired from abroad through foreign licensing and imports of capital goods. In the 1970s it sought to develop greater self reliance as it was concerned that the US was not fully committed to protecting it from the North Korean threat. It therefore targeted industrial policy on developing heavy capital goods and chemicals. To accomplish this it increased vocational training and engineering education. It continued to acquire technologyh massively through turnkey plans and licensing. However it also set up a specialized science and technology infrastructure through a series specialized S&T institutions of public research (including Daeduck Science Town) and postgraduate scientific and engineering training (KIST).

In the 1980s it sought to expand technology intensive industries, including getting into th production of integrated circuits to take advantage of the rising potential of that sector. It rationalized industry, liberalized imports, encouraged competition, and sought macro stability after over investment in the heavy industries. It also significantly expanded the higher education system to have the human capital base to support the higher technology industries. In addition, it promoted R&D and established several ambitious national R&D programs in strategic areas including electronics, and communications.

In the 1990s, it focused on promoting high technology innovation and invested further in highly skilled human resources in high technology fields including in addition to ICT now also biotechnology. The information and communications area was very heavily emphasized since 1995 through various master plans to promote informatization, including the Basic Informatization Plan (1996-2000), the Cyber Korea 21 plan (1999-2002), and the e-Korea Vision 2007. As a result Korea is a world leader in broadband and e applications in the world.

In 1997 however Korea was hit by the Asian financial crisis and GDP fell 7% in 1998. The crisis clearly showed the vulnerability of is strategy of reliance on overly leveraged large private enterprises (chaebol) extensively subsidized through cheap government credit, and with poor corporate governance mechanisms.. However, it used the crisis as major opportunity for major wide spread economic and corporate reforms. These setting up a modern regulatory framework to support the more efficient and equitable functioning of markets. They included significant financial and corporate reform, as well as labor market reform and strengthening of the social safety net to help people laid off as a result of the crisis. It also included a switch in strategies from capital intensive growth based on large enterprises to a knowledge economy strategy. By 1999 the Korean economy had recovered and it actually grew at an average annual rate of 4% 2000-2005.

The impetus for the knowledge economy strategy came from bottom up work of Maeil, the largest business newspaper. The owner of the paper had gotten very worried when Mexico has its financial crisis at the end of 1995. He commissioned the consulting firm Booz Allen Hamilton to undertake a study of Korea's vulnerability. The study found Korea was very vulnerable. He commissioned a second consultancy study, this time by McKinsey. That study found that Korea was caught in a "nutcracker" between the rising low wage, low technology competition of China, and the advanced technology of Japan and the West. The

[43] In essence the last three columns are three of the four pillar of the knowledge economy. ICT is not included as it only became relevant in the last 30 years.

crisis hit during this study. The owner of the paper then commissioned a third study to propose concrete recommendations.

This study, called *From Knowledge to Action* was presented at a national conference to the President of Korea, the cabinet and key business and social leaders. As a result of this analysis the Korean President Kim Dae-jung committed to a knowledge economy strategy. Ten premier think tanks were put on the task of developing a comprehensive plan. The plan was launched at the beginning of 2000 and involved coordination across 17 ministries. The met every three months to monitor progress and adjust goals in light of changing circumstances.

Key elements of the knowledge economy strategy has been to promote the growth of small high technology firms, improve the productivity of public and private R&D, and improve the quality, and relevance of higher education.

Korea still faces many challenges in this area These include increasing the efficiency of R&D and the creativity of its college graduates, and the social issue of regional and income inequaity. However, it is working resolutely on them. It is an excellent example of the importance of long term vision, public private coordination, and pragmatism.

Korea's technology strategy initially was close to that of Japan. Like Japan, it relied very little on FDI. Instead, initially it acquired a lot of its technology through trade, copying, reverse engineering and technology licensing.[44] When it became a competitive threat to the countries that were licensing technology, its companies had to begin to invest in R&D to develop their own technology.[45] The government had a strong role in industrial policy. It used success in the export market as the yardstick by which to measure performance. This also led to the creation of large industrial conglomerates known as chaebols. These have been part of the Korean success story because they have had deep pockets to cross-subsidize risky ventures in new areas out of the profits of their more competitive "cash cows". In 1965 Korea spent only 0.5 per cent of its GDP on R&D and 80 per cent of the effort was undertaken by the government. By the mid 1990s it was spending over 2 per cent of GDP, more than 70 per cent of which was accounted for by the private sector, primarily the chaebols, who were having trouble obtaining licenses from foreign competitors. It was only after the 1997 financial crisis that Korea opened up to foreign investment to get foreign exchange into the economy from the sale of failed companies, but also to get access to more advanced foreign technology and to put pressure on domestic firms to perform better.[46] Among the "gang of four" Korea has relied the least on FDI. On the other hand, Korea invests the most in R&D and in higher education. It has one of the highest tertiary enrolment rates in the world.

[44] Westphal, Rhee, and Purcell (1981) have pointed out that Korea acquired a lot of technology from its early engagement in trade. This consisted of design and production technology that was transferred by large foreign purchasers. It also included technical assistance provided by supplies of capital goods and turnkey plants. More generally, the fact that Korean firms were forced to export, made them more aware of the technology used by the competitors and forced them to keep up with new product and process improvements.
[45] Kim (2003).
[46] Kim (2003).

Table 6: Stages of Economic Development in Republic of Korea

	Development goals	Major policy directions	Macroeconomic governmental policy framework	Human resource development	Science and technology
1960s	• Build production base for export- oriented industrialization	• Expand export-oriented light industries • Mobilize domestic and foreign capital	• Prepare legal and institutional bases to support industrialization	• Increase literacy • Establish national infrastructure	• Build scientific institutions, legal and administrative framework
1970s	• Build self-reliant growth base	• Promote heavy machinery and chemicals industries • Build social overhead capital	• Maximize growth, expand policy loans • Intervene in markets	• Increase vocational training • Increase number of engineering graduates from colleges	• Establish scientific infrastructure setting: specialized science and technology (S&T) institutions, Daeduck science town
1980s	• Expand technology-intensive industries	• Industrial rationalization • Decrease export subsidies and expand import liberalization	• Stabilization • Enhance private autonomy and competition	• Expand higher education system • Develop semiskilled labor capacity	• Promote R&D and private research center promotion • Establish national R&D programs
1990s	• Promote high-technology innovation	• Support technology development • Build information infrastructure	• Liberalization • Reform and restructure	• Develop highly skilled labor in strategic fields such as IT • Develop lifelong learning system	• Leading role in strategic area: HAN programs
2000s	• Transition to knowledge economy	• Promote venture business and small and medium enterprises (SMEs)	• Globalization • Balanced national development	• Increase research productivity • Improve quality of university education	• Build national and regional innovation systems

Source: Aubert et al (2007). Building Knowledge Economies based on WBI and KDI 2006.

Taiwan (Province of China): State-directed technological development

Taiwan was somewhat in between the strong industrial policy approach of Korea and the more open trade but still government-directed approach of Singapore. Three special characteristics of Taiwan that are important to understanding its success are the role of the state, the Chinese Diaspora, and the structure of industry. First, the government has had a strong role in its economic development. In the 1950s the key development strategy was import substitution under high tariff walls. The 1960s saw a switch to export orientation. In the period up to 1990, the government had a very active role in the economy. It made extensive use of tariff and non-tariff barriers and selective credit to favor specific sectors and to develop new industries.[47] In addition, the government was very strategic toward the use of FDI and actively encouraged the development of backward linkages and technology transfer.[48] Furthermore, the government set up special
industrial parks, including the Hsinchu Science Based Industrial Park in the vicinity of universities and a large public research institute to stimulate technology development and the creation of new high technology enterprises.

Second, Taiwan has drawn very successfully on the large Chinese Diaspora working in the high-tech industry around the world. The government developed various mechanisms such as wise men councils and periodic meetings to draw on the advice of this Diaspora. It has also actively sought to attract back some of its nationals with high tech experience. A good example of its strong industrial policy as well as the link to the Diaspora was the development of the science based industrial park of Hsinchu and the Industrial Technology Research Institute. This involved a strong role of government in developing the electronics industry and in attracting nationals back to Taiwan[49]. This was very successful in moving its electronics industry from simple assembly of electronic products, often for foreign companies, to developing its own chip making capability, and becoming an important own brand player in the global industry.

A third special characteristic of Taiwan is that, unlike Korea, its industrial sector has been made up primarily of small and medium-sized firms, rather than large chaebols with deep pockets to cross-subsidize risky ventures. The government has thus developed a strong supportive technological infrastructure such as technical information services and specialized public research institutes. It also developed special programs to create technological linkages between foreign firms and small domestic suppliers. As Taiwan's own wages rose, it off shored labor-intensive assembly industry to China, especially in Shenzhen and Guangdong. It kept its high-tech industry home. However, as China deepened its trade reforms and maintained rapid growth, and clearly became a dominant economy, Taiwanese investors started to transfer their high-tech manufacturing to the Chinese mainland. There are now "little Taipei's" all along the Chinese coast.

China: Prospering from Globalization

There have been many building blocks to China's knowledge economy and innovation strategy.[1] The first was massive importation of turnkey plants, mostly in heavy industry, from the Soviet Union in the 1950s as part of its initial industrialization drive. This ended with the Great Leap forward in 1958 when China went on a more autarkic technological

[47] See Wade (1999), and Noland and Pack (2003) for more detail.
[48] See Aw (2003).
[49] See Dahlman and Sannanikone (1991) for an early account of Taiwan's technology strategy.

development strategy ("a furnace in every back yard") and the Cultural Revolution of the 1960s. This was a period of turmoil and relative stagnation. In the early 1970s, Zhou Enlai proposed the "four modernizations" (agriculture, industry, science and the military). This led again to massive importation of technology, primarily from the West and Japan.

Deng Xiaoping's decision to give farmers more autonomy over their production – the rural household responsibility system – was another milestone in China's reforms. This led to a strong increase in agricultural productivity. These reforms were eventually applied to the industrial sector, freeing enterprises to make more of their own decisions and to enjoy the rewards of good ones. The effect of these changes was to create a strong incentive for finding better and more efficient ways to produce. A third initiative, very important for the rural sectors, was the Spark program which aimed to speed the dissemination of agricultural technology. This was subsequently reinforced with the Torch Program aimed at disseminating more advanced technologies throughout the economy.

A fourth measure was to create enclaves open to FDI with a near free trade regime in special economic zones (SEZs). Initially only a few were set up as pilot experiments. These performed very well, so the government expanded them gradually. When China decided to join the WTO in 1997, these were effectively expanded to the whole economy. Besides the SEZs, explicit measures were undertaken during the 1980s and 1990s to liberalize FDI rules.

Thus, China has been very effective at both disseminating knowledge domestically and tapping into global knowledge through trade and FDI. Among the large economies, China is the most integrated through trade. The share of merchandise and services trade in GDP in 2004 was 67 per cent. In addition, China has become the second largest host to FDI. The share of FDI inflows to GDP increased to 7 per cent at its peak and has averaged 5.1 per cent for the last 10 years.

China is now engaged in a major strategy to strengthen its own innovation. In 1998 it was investing just 0.7 per cent of GDP in R&D. Around 2002-2003, however, it decided to put more emphasis on own innovation. Between 2003 and 2004, China increased its investments in R&D by 50 per cent and by 2005 it was investing 1.4 per cent of GDP. For the new five-year plan China announced in December 2005 that it would be increasing its R&D expenditures to 2.0 per cent of GDP by 2010 and to 2.5 per cent (the average for developed countries) by 2025.[2] To put this in a global context, figure 4 presents R&D expenditures of the largest spending countries in PPP terms. The circles correspond to the absolute value being spent, the horizontal axis gives its share of GDP, and the vertical axis shows the number of scientists and engineers in R&D per million people. According to the OECD's latest *Science, Technology and Industry Outlook*, in 2004 China was the third largest national spender on R&D, but given it rapidly increasing expenditures, it probably overtook Japan by the end of 2006. However it is still not as efficient in R&D as developed countries.

A very important element of China's strategy has been investment in education. China increased primary enrollment rates in the 1950s and 1960s. The Cultural Revolution (1966-68) was major disaster for higher education and severely damaged higher education during the 10 year period until roughly 1978 about the time that China opened up to the rest of the world. However China extended primary and secondary education during this period and attained a high level of literacy early. This was very helpful to help it absorb a lot of the

technology that it subsequently acquired through, copying, reverse engineering, trade, direct foreign investment and technology transfer. In 1997, partly in preparation for taking the further step of liberalization and joining WTO, it embarked on a major expansion of tertiary education by increasing new entrants by 50% per year. As a result, enrollment rates that had been as low as 3.5% in the mid 1990s, reached 21% by 2006. China now has the largest number of students at the tertiary level of any country in the world. Furthermore 40% of them are in engineering, math and science. Therefore it is developing a very strong human capital base for the knowledge economy.

In the mid 1990s China also embarked on major expansion of the information technology infrastructure.[50] This included massive investments in communications infrastructure as well as many major projects to informatize the country. As a result China dramatically increased its ICT penetration ratios (telephones, computers and internet users per thousand people). It also expanded rapidly into the production of electronic components and electronic and communication products. As of 2006 it was both the largest electronics and communications market in the world as well as the largest exporter of electronics and communications products.

.The hallmark of the Chinese strategy has been extreme pragmatism. The Chinese often try different policies at pilot level one province and a different policy in another policy. Then based on the results they adjust and scale up the one that gives the best results in China. It is also noteworthy that even though they are a communist country they have adopted many capitalist market policies in order to be competitive. For example they offer stock option plans to researchers in R&D institutes to give them a stronger incentive to be productive. To finance the rapid expansion of the public education system they began to charge students tuitions even at the public universities. These tuitions now cover 40% of the cost of providing the education and that is why China has been able to ramp up tertiary education so quickly.

7. Lessons from International Experience[51]

Table 6 summarizes some the key parameters of their strategies and compares that to the average for Latin American countries. Some of the key lessons from the experience of these successful international performers are the following.

Macro All the countries have relatively stably macro conditions, although in several cases (Finland and Korea) a major macro crisis occurred earlier on and catalyzed a major shift in strategy

Vision In all the country examples there has been a clear long term vision from the government of where the country is coming from and where it is going. In the case of China, the government has always had a long term vision since the reforms opening up the economy and this has been pretty much a top down vision. Science and technology have been a central instrument of how to achieve China's rapid modernization. In Taiwan, the government has had key role in identifying and implementing a development vision- in part in fierce competition to demonstrate its success against the pressure of China, particularly since it was kicked out of most international bodies at China's request when China joined

[50] For more details on Chinas Information Revolution see Zhen-Wei (2007).
[51] For more successful country examples and lessons from experience see Aubert et al (2007).

the international communities in the early 1980s .In Korea it used to be like that under the military dictatorship of Park who was instrumental in starting Korea on its outward oriented development path. However since the democratic governments in the 1990s the vision has been forged by public private consultations, as in the case of the knowledge economy strategy after the 1997 crisis. In Finland, a democratic government from the start, the vision has been developed by strong public private consultations supported by many institutional mechanisms explicitly created to discuss issues and create consensus.

Public Private Coordination All countries have developed various mechanisms for coordinating government action. All but China have also developed mechanism public private consultation. (Coordination in China is achieved not only through the central government, but also the communist party the Peoples Consultative Committee. In Finland there are explicit mechanisms such as the economic policy course and the Committee on the Future. In Taiwan there is very effective use of the Diaspora, including the mechanism of periodically checking in with the wise men councils to get
In Korea a lot of coordination was done through the President Office –the Blue House. Although the days of strong central planning are over in Korea, the Blue House still has some power. In addition, there are multiple government sponsored think tank in virtually any areas of economic activities.

Table 6: Basic Parameters of Knowledge Economies and Latin America

	Finland	**South Korea**	**Taiwan**	**China**	**LAC**
Macro ***Real Interest Rate***	Had macro crisis in 1991 but has been stable since	Had macro crisis in 1997 but has been stable otherwise	Had macro crisis n 1997 but has been stable otherwise	Has not had macro crisis in last 40 years.	Problematic in most countries--distorts focus for short term
Vision	Government instrumental in developing long term vision	Government instrumental in long term vision.	Government instrumental in developing long term vision. Effective use of overseas wise men in developing vision	Government has long term vision	Very few countries have governments with long term vision. Usually focused on short term macro problems
Government Coordination and Public Private Cooperation	Very highly developed. Strong egalitarian and equity consideration	Somewhat tumultuous, but government has promoted the development of large strong groups	Government has worked closely with private sector to provide a very supportive environment especially for smes	Government initially ignored private sector but has grudgingly recognized and eventually promoted it	Some tension between government and private sector.
Education	Very high levels of educational attainment as well as of strong focus on life long learning	Very rapid build of secondary then higher education	Rapid build up of secondary and higher education	Extremely rapid build of secondary and higher education from very low base-catches up with Latin America	Had relatively high levels of educational attainment in1980s for a developing region but relatively little progress since then
Av. years of educational attainment of adult population (2000)	9.99	10.84	8.76	6.35	6.06
Secondary enrollment rates 2005	109	93	99	73	86

	Finland	South Korea	Taiwan	China	LAC
Tertiary enrollment rates 2005	90	90	..	19	28
ICT Indicators					
Telephones	1311	1286	1599	571	616
Computers	481	545	525	41	88
Internet	534	684	657	85	156
Innovation	Very innovative. One of highest R&D expenditure to GDP rations in world	Very innovative. One of highest R&D expenditure to GDP in world, from just .5% of GDP in 1965	Very innovative. One of highest rates of patenting per population or unit of GDP in world (higher than US)	Switching from copying and reverse engineering to innovating on its own. R&E expenditures to GDP increased from .7% in 1990s to 1.6% in 2006 and goal of 2.0% by 2010	R&D expenditures to R&D continue to very low (except in Brazil which reached 1% in `1980s but has not increased beyond that since then
R&D/GDP 2005	3.51	2.64	..	1.44	0.26

Monitoring and Implementation As described in the mini case studies, they also have developed many mechanisms for monitoring and implementation.

Finally as was presented in the case studies and is summarized in table 6 they have all undertaken significant investments in the three functional pillars of the knowledge economy- education, ICT, and innovation8. Summary and Implications

8. Summary and Recommendations

8.1 Summary

This quick overview of the knowledge economy has attempted to explain why the knowledge economy is relevant for Latin America. The basic argument is that the effective creation and use of knowledge is becoming more important in economic activity and therefore needs to be factored in more explicitly into development strategy. This can be seen in the increase in the speed in creation and dissemination of knowledge, and the increasing importance of medium and high technology products and knowledge intensive services in GDP and in exports.

The paper also presented a framework for thinking about the key elements of a knowledge economy. It used a methodology for benchmarking the relative position of countries for taking advantage of the knowledge economy to assess where Latin American countries stand. It found that Latin American countries are in the middle to bottom range of countries, and that the region has been losing its position relative to the rest of world and to East Asian countries in particular.

The paper also found that while the rest of the world is moving towards more knowledge intensive production and services, Latin America is specializing more in natural resources.

The overview also summarized the strategies of various countries that have developed effective knowledge strategies to improve their economic development. Some of the lessons of these successful country experiences are that they had to go beyond the Washington Consensus policies. While these are important, they are not sufficient. They also had to implement explicit strategies as well as coordination across different parts of government, and between government and the private sector.

8.2 Recommendations for Latin America

What are the implications for Latin America? The first is to develop a broader long term strategy in terms of the new context of the knowledge economy. The second is to improve on the four pillars of the knowledge economy The final one is regarding the process of policy formulation and implementation

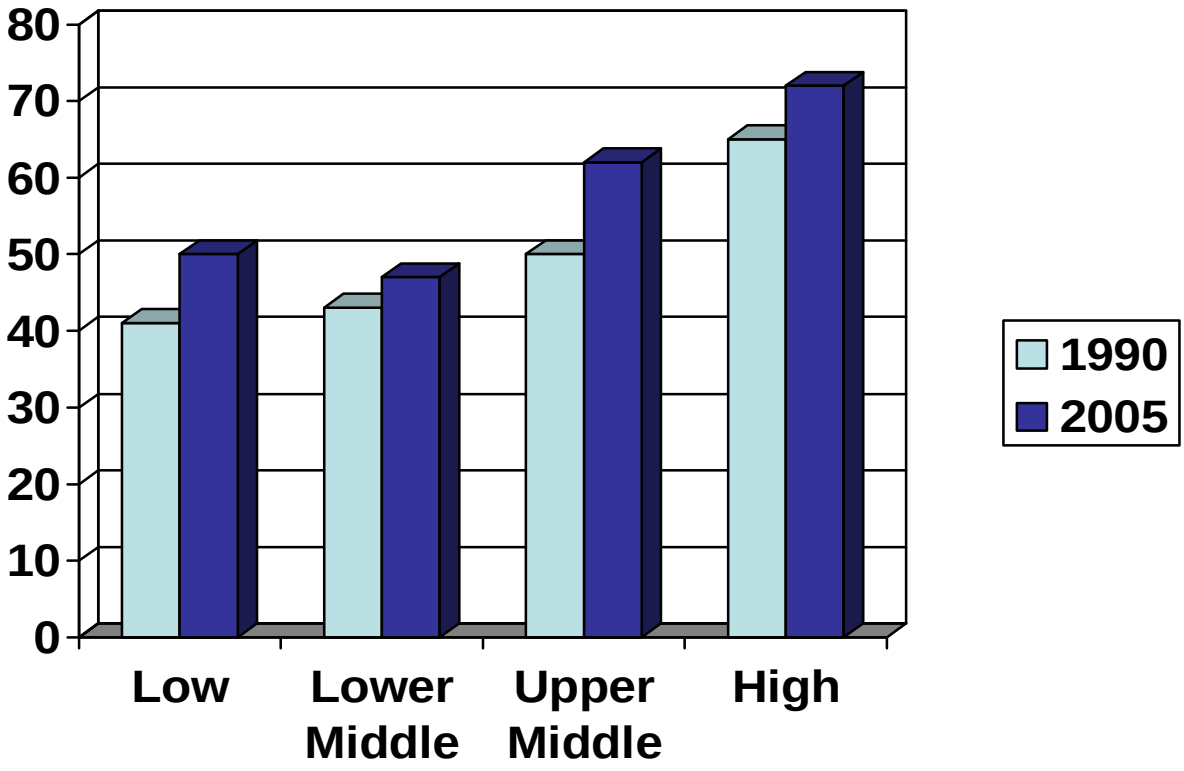
8.2.1 Developing a Broader Long Term Strategy for the New Context

As noted, Latin America is specializing in natural resource and commodity exports.[52] This is in part the result from the recent more favorable terms of trade for such exports that has occurred because of the large demand from China.

There is nothing wrong with taking advantage of favorable prices and a comparative advantage of natural resource endowments. Latin America should continue to take advantage of this strength and favorable terms of trade. In fact Latin American countries should increase the value of these exports by applying more knowledge to enhance their values as has been done by countries such as Finland, Canada, Australia and the United States[53]..

[52] In this section Latin American will be treated as a whole, although as was clear from the benchmarking exercise Latin America is very heterogeneous in the size, level of development, and readiness to take advantage of the knowledge economy.
[53] See for example De Ferranti et al (2002).

Figure 8: Increasing Share of Services in GDP by Per Capita Groupings of Countries--1990-2005



Note: The lower share for lower middle income countries than for low income countries is due to China's very low share of services(which is just 40%). China accounts for almost half the output of the lower middle income group category.
Source: WDI 2007

However natural resource based strategies are not enough. The problem is not just that there are cycles in the prices commodities, but that the income elasticity of demand for natural resources is low. As people or countries' income grow, demand shifts to diversified products and services

Also given the rapid pace of change, increasing globalization and competition, and greater uncertainty in the international environment, countries need the ability to respond to new threats and opportunities. This requires flexible capital and labor markets, more responsive governments, as well as the functional enablers of the knowledge economy- education, ICT, innovation capability, and ability to coordinate across different areas.

Looking at the last 25 years, Latin America missed the ICT wave. The East Asian economies caught it by working their way up the value chain from assembly or consumer electronics to computers and telephones. Some countries like Korea, Taiwan, and then China, also integrated backward into the production of wafer fabrication and achieved very large economies of scale and chip design. It is very hard for Latin America to catch up on ICT hardware because of the first mover advantage of countries in Asia and the very large economies of scale involved.[54] However, Latin America can and must catch up on the

[54] With the exception of the Intel plant in Costa Rica which was a special case, Latin America did not develop integrated chip production, just assembly based on imported components.

application and use of ICT technology throughout their economies. As noted in the KAM benchmarking, in spite of progress in terms of the absolute number of telephones, computers and internet users per thousand persons, Latin America as a region is falling behind the progress in the rest of the world. Latin America needs to increase the penetration ratio of ICT and to increase the effective application of ICT technologies in government, business and society at large because of the benefits that can accrue from the use of this generic technology.

Latin America is still overly concentrated in agriculture and industry and less developed in services. Latin America needs to move beyond the agricultural and industrial economy to the service economy. As noted, the knowledge economy is more about knowledge intensive services than high technology manufacturing. Knowledge intensive services are critical for the productivity and competitiveness of all economic activities ranging from agriculture and mining to industries and the service sector itself. (OECD 2005b)
Latin America needs to plan for a post natural resource, post industrial society. The service sector will be key to absorbing labor productively and to raise the overall efficiency of the economy.

Therefore Latin American needs to invest more in services—particularly knowledge intensive services. Services are generally cleaner, more environmentally friendly and less energy intensive. Latin America need to strengthen knowledge intensive services such as finance, business services, logistics, consulting, education, and R&D However some additional the service areas with great potential in Latin America which can be leveraged with a higher knowledge content include the following:

- Tourism; especially higher value tourism combined with history and culture as well as eco-tourism.
- Health Care: this has great potential as the population of developed countries ages and people seek retirement communities with warmer climates and reliable health care and good hospitals
- Entertainment: literature, theater, movies, songs. This is an area where Latin America has already established a reputation. It must build on this start and project it globally

Latin America also needs to invest more in potential new technologies such as nano-technology, bio technology and genetic engineering which may be the basis of future long cycles (more of this in the innovation section below)

8.2.2 Making improvement in the Four Pillars of the Knowledge Economy

As was clear from the knowledge economy benchmarking exercise, Latin America needs to improve in all four pillars. The priority of different elements within these pillars and across them will depend very much on the specifics of each country. The following comments are generic for the overall Latin American situation and would need to be adjusted to the each country.

Improving the economic incentive and institutional regime. With few exceptions this continues to remain a key priority for Latin American countries. The macro situation in Latin American tends to continue to be worse than in East Asia. The investment rate is low, the cost of capital tends to be higher, and governments and business tend to be much shorter

term oriented because of continued macro weakness. In addition the economies tend to be less integrated into the global system. Thus there is still a ways to go on the conventional reform agenda. However, as noted in the exemplary country cases, it is necessary to beyond the Washington Consensus set of policy reforms. Governments have to be more proactive, as will be developed below.

Investing in Education Latin America used to be ahead of most other developing regions in education, but it has lost ground in the last two decades as other regions, East Asia in particular have made very dramatic improvements. The key challenges in education include the following. Most countries still need to expand access to secondary education and particularly to higher education which is now becoming critical for the greater knowledge based tasks of the knowledge economy. They have to improve the quality of the whole educational system from pre-school to the university. They also have to improve the content and relevance of what is taught in the formal educational system. In addition, they have to move from a focus on just the formal educational system to the development of life long learning system. The half life of knowledge is getting shorter because of the speed up in the generation and diffusion of knowledge. People need to constantly learn new skills throughout their lives. This means that there have to be multiple mechanisms for people to be able get additional education and specialized training after they have left formal education. This can be provided at the work site, or in specialized schools and training facilities, or at home or elsewhere. Latin America needs to move to a system of education and training that is any time, any where, at any pace. This requires developing as system with multiple pathways and multiple providers. That also requires appropriate regulatory, finance and information systems and making effective use of ICT to deliver education and training services[55]

Exploiting ICT As already noted, Latin America is also falling behind in ICT relative to progress made in the rest of the world.. Latin America needs to catch up not only in ICT penetration rates, but even more on the effective use of information technology in government, business, and civil society at large. Information technology has become the basic infrastructure for the knowledge economy. It reduces transactions costs and permits seem less integration of suppliers and production to rapidly changing market needs. It has also spanned the need for a gigantic demand for content ranging from health and education to business and finance data to sports and entertainment.

Strengthening Innovation Although Latin America has made a small improvement in the KAM innovation index, the variables used in that index are limited to narrow input and output indicators for the creation of knowledge. In the broad conception of innovation developed in the knowledge economy framework presented earlier three components are distinguished—acquiring global knowledge, creating and commercializing knowledge, and disseminating and using knowledge. Compared to the East Asia, Latin America is not doing as well in this area.

On acquiring knowledge from abroad Latin America needs to get more integrated into the global trade. Imports of capital goods and components is one of the main ways to get access to global knowledge embodied in goods. Latin America also needs to make more effective use of foreign investment. Even though Brazil and Mexico have received a lot of foreign investment, that investment has not always brought the most advanced technology or

[55] For a detailed application of this to a major developing country see Dahlman, Zeng and Wang (2007).

developed the backward linkages as has occurred in East Asia because that region is more integrated into the global production system (recall the last two columns of Table 5). Thus Latin American needs to undertake more systemic efforts at having its exporters get into global supply chains and move up the value added ladder as has been done by firms in East Asia.

On the creation and commercialization of knowledge, Latin America is also falling behind. It has not raised the share of R&D to GDP as much as has been occurring in East Asia. In addition, it has not developed the supportive infrastructure of technology parks, business incubators, technology transfer centers, and venture capital to commercialize knowledge as much as is happening in East Asia, particularly in Korea, Taiwan, and China.

Finally on the dissemination and effective use of knowledge again Latin America also needs to do much better. There has not been as explicit an effort as in some Asian countries to disseminate (whether acquired from abroad or domestically produced) and use knowledge as effectively as in East Asia. In any country there is tremendous dispersion of firm productivity across any economy sectors. Some Latin American countries, such as Brazil, the dispersion of labor productivity between the most efficient and least efficient firms are several thousand times.[56] This is in part because there is generally a less competitive regime, in part because there are fewer programs oriented toward agricultural, industrial and service extension. Finally it is also due to the lower absorptive capability of enterprises in generally because of generally lower educational attainment. [57] Thus there is a lot than can done to disseminate existing technology through demonstration projects, productivity organizations, technical information, consulting , and training services raise average productivity levels as has been done in many Asian countries.

As a result, Latin American needs to make significant progress on all three dimensions of innovation. Efforts to acquire and make more effective use of knowledge that already exists abroad, or even in the country, will have the highest payoffs in the short run and are less risky than efforts to develop globally frontier technologies. However in some sectors some countries in Latin America are close the world frontier. Some of the large countries also have extensive critical mass in public R&D. For them it makes sense to improve the efficiency in the allocation and use of those R&D resources through better management and monitoring of public R&D efforts. In addition, the private sector needs to be encouraged to undertake more R&D, not only to be able to keep up to date with new developments and incorporate them, but to also carry out cutting edge research in areas critical for their competitiveness. Furthermore while in the first instance it makes sense to invest in the areas where Latin America already has a comparative advantage in order to not just maintain, but also to enhance that advantage, it is also important for Latin America to invest in new technological areas such as genetic engineering, bio technology, nano-technology. The public sector will have to play a greater role in carrying out this type of riskier and more uncertain research. It should be seen as part of an investment portfolio strategy of exploring new areas with potential high returns. These investments are necessary to have the capability to move in rapidly to into those areas that begin to show promising results.

[56] See for example Rodriguez et al (forthcoming 2007) which finds that the average difference between the most productive firms and the median averages ten times even when the most productive is adjusted downward considerably. This compares with an average of five times in India.
[57] For a detailed use of this framework applied to Brazil see Alberto Rodriquez et al (2007)

8.2.3 Developing Effective Processes for Implementing Strategies

The preceding has outlined a broad agenda across a broad range of areas. The risk is that no much will be done for three reasons. One is that there is much skepticism among policy makers and even business leaders of the importance of these areas. A second is that some Latin American countries are doing better in the last few years than they have in the past and do not see a need to undertake more reforms or new investments. This largely the result of the more favorable growth performance resulting from the increase prices and volume of commodity exports due to Chinas huge global appetite for them. A third is that some find the agenda too daunting too long term, and argue that Latin America is not yet ready to be serious about the knowledge economy. To change the mindset of the first objection is will be necessary to create more awareness among government policy makers, businessmen and civil society are large of what is at stake. The response to the second objection is that commodity cycles are just that-cycles. Commodity prices have been going up and will probably go up more, but they will eventually come down. If Latin America does not lay the seeds for diversifying into the knowledge economy now that it is relatively less resource constrained, it will have even more difficulties in the future. The response to the third objection is that a start needs to be made. If not now, then five or ten years from now, people will still be saying that Latin American is not ready and the situation will be even more difficult (particularly if commodity prices have crashed).

Therefore is it important to get a major awareness raising process into motion. This should involve mass mobilization of the public and private media through seminars, discussion groups special workshops etc. Recall the success of the Vision Korea campaign in bringing about a major shift in development strategy in Korea when the 1997 Asian crisis hit. Recall too that the campaign was lead by a private newspaper. Thus it is not even necessary to wait for the government to lead the change. It can be started from civil society.

This section will conclude with some key elements learned from the experience of the successful countries. They are the importance of longer term vision, implementation and coordination, monitoring, and pragmatism

Vision Latin American governments tend to focus too much on the short term. Part of the reason for this is the past history of macro-economic instability coming from the context of debt overhang of the 1980s. Another part is due to the strong focus on the presidential political cycle. Each new team tends to focus just on what can be done in the space of four to five years of each presidential cycle. There is little focus on the medium and long term structural issues—many of which involve difficult political reforms. Latin American countries have to improve the macro conditions so that government, business and society can focus on the longer term issues. They also have to build mechanisms to mobilize people and build momentum. Besides building institutions that can span different political cycles, including think tanks, private sector associations, ngos and social organization.

A useful strategy used by many Asian countries is to develop long term visions. These set longer term goals and capture the imagination and energy of people for attaining those goals. Examples of this are Finland's vision in the early 1990s of moving form a natural resource based economy to a knowledge economy, Koreas Vision Korea, Malaysia's 2020 Vision, even the European Communities Council of Ministers 2000 vision of the EC "becoming the most competitive and advanced knowledge-based economy region in the world by 2010 capable of sustainable economic growth with social cohesion." These are all

mechanisms to outline goals and generate consensus on the broad long term strategy the countries need to follow to improve their growth and welfare.

Implementation and Coordination Latin America has been weak on implementation and at coordination. There are too many feuding interests. They loose sight of broader national goal. That is why there is a need of a vision. Vision has to articulate what is at stake and where country needs to go. Support can then be rallied around that vision.

Reforms have different lengths. Some elements of the economic and institutional regime such as can by changed by the stroke of a pen by a President or minister or committee of the central Bank (such as the prime interest rate), others require changes in legislation that must be approved by congress such as intellectual property laws, still others such as creating a more effective government or a stronger rule of law are much longer term processes. In the information and communications technology area changes tend to be must faster because the industry itself is so dynamic. The innovation area has elements that can be changed relatively quickly, such a making more effective use of knowledge that already exists. Other, such as developing a research culture among the private sector or developing a new globally innovative technology may be longer term , and more difficult. Education also has short term as well as long term elements. Decreeing changes in the number of years of compulsory education, or criteria for accreditation, or even changing the content of the curriculum can be done relatively quickly. However the impact of those changes usually takes many years as new cohorts of students work their way through the education system and enter the working world.

Some of the reforms will have a bigger impact if there is coordination across different parts of government. For example, heavy investments in education and training are not going to produce as much results is the economy is not growing enough to productively employ the new graduates. They will have a greater impact if other reforms such as reducing interest and tax rates also stimulate economic growth. Providing more education with out jobs could even be counter productive. Educate unemployed can create lots of unrest. Likewise investing a lot in public or university R&D with out reforming the incentives and providing the technological legal and institutional infrastructure to get knowledge out of the labs to commercial use will be poor use of resources.

On the other hand one cannot wait for everything to be ready. There needs to be concrete action on implementation. The trick is to seize targets of opportunity and to leverage progress made in those areas to build support for more reform. This also involves combining top down reforms with bottom up actions. The top down reforms may be policy changes at the federal of even state level. The bottom up actions are concrete initiatives at the cluster or regional level. As the bottom up action begin to work they build stakeholder owner ship and generate support for more reforms.

Monitoring The knowledge economy is about a very dynamic and rapidly changing world. Therefore need to constantly monitor how country is doing relative to its goals and to what is happening in the rest of the world. Because of rapid change need to monitor not just how well the country is doing on its original goals, but also whether those goals themselves have to be changed in light of changing opportunities brought about by new technological

developments or the strategies and actions of other countries. For example the entry of China into world trade has had a major impact on the terms of trade between manufactures and commodities, as well as on the areas where other countries can remain competitive.

Pragmatism. In a context or rapid change pragmatism is very important. This is very well exemplified by the pragmatic strategies of the Asian countries, particularly China, as described above.

To conclude, a lot is a stake for the future of Latin America. The knowledge economy is one way to put the global issues in perspective. It is critical to make policy makers aware of how some of the key drivers of the world have changed and what is required to succeed in this much more demanding globalized and competitive international environment. It is hope that this paper helps to contribute to that understanding and that the country examples presented offer some ideas of the type of things that need to be done.

Bibliography

Aubert, J.-E., et al. (2007). *Towards Knowledge Economies - Advanced Strategies for Development,* Washington, DC: World Bank Institute.

Aw, B.-Y. (2003), "Technological Acquisition and Development in Taiwan," in *Competitiveness, FDI and Technological Activity in East Asia*, S. Lall and S. Urata, eds., Northampton: Edward Elgar.

Baldwin, R. (2006), "Globalization: The Great Unbundling(s)", paper contributed to event on *Globalization Challenges to Europe and Finland* organized by the Secretariat of the Economic Council, Prime Minister's Office (June).

Berger, S., (2006), *How We Compete: What Companies around the World are Doing to Make it in Today's Global Economy*, New York: Random House.

Blinder, A. (2006), "Off shoring: The Next Industrial Revolution?" *Foreign Affairs*, Vol.85 (2) (March-April).

Brinkley, Ian (2006). *Defining the Knowledge Economy-Knowledge Economy Programmed Report*. London: The Work Foundation. .

Ciscel, D. H. and B. E. Smith (2005). "The Impact of Supply Chain Management on Labor Standards: The Transition to Incessant Work", *Journal of Economic Issues*, Vol.39 (2), 429-437.

David, Paul. "The Dynamo and the Computer: a Historical Perspective on the Modern Productivity Paradox". *American Economic Review,* 80 (2); 355-361.

Dahlman, Carl J. (2007). Technology Globalization and International Competitiveness: Challenges for Developing Countries," in David O'Connor, Editor, *Industrial Strategies for the 21rst Century*. New York: United Nations.

Dahlman, C. J., D. Zhihua Zeng, and S. Wang (2007). *Enhancing China's Competitiveness Through Life Long Learning*. Washington DC: World Bank.

Dahlman Carl. J.; Jorma Routti; Pekka Yla-Antilla, et al. (2006). *Finland as a Knowledge Economy: Elements of Success and Lessons Learned.* Washington: World Bank.

Dahlman, C. J. and J.-E. Aubert (2001). *China and the Knowledge Economy: Seizing the 21rst Century*. Washington DC: World Bank.

Dahlman, C.J., and O. Sananikone (1991). "Technology Strategy in the Economy of Taiwan: Exploiting Foreign Linkages and Investing in Local Capability." Washington DC: *World Bank Industrial Strategy Policy Series Papers*.

De Ferranti, D. et al. (2002). *Closing the Gap in Education and Skills***.** Washington DC: World Bank.

DTI (1998). *Our Competitive Future Building the Knowledge Driven Economy* .London: Department of Trade and Industry.

Dutz, Mark, et al. (2007), *Unleashing India's Innovation: Toward Sustainable and Inclusive Growth*. Washington DC: World Bank

Drucker, P. (1994)."The Age of Social Transformation", *Atlantic Monthly*, Vol.274 .

Economist, The (2006), "The New Titans: A Survey of the World Economy", Special supplement in September 16th edition.

Evans, D., R. Kaplinsky, and S. Robinson (2006). "Deep and Shallow Integration in Asia: Towards a Holistic Account", *IDS Bulletin*, Vol. 37 (1).

Freeman, R. (2006). "Labor Market Imbalances: Shortages, or Surpluses, or Fish Stories?" paper prepared for Boston Federal Reserve Economics Conference - "Global Imbalance - As Giants Evolve", June 14-16, Chatham, Massachusetts.

Grossman, G. and E. Rossi-Hansberg (2006), "The Rise of Off shoring: It's not Wine for Cloth Anymore," conference paper, Reserve Bank of Kansas, August 23.

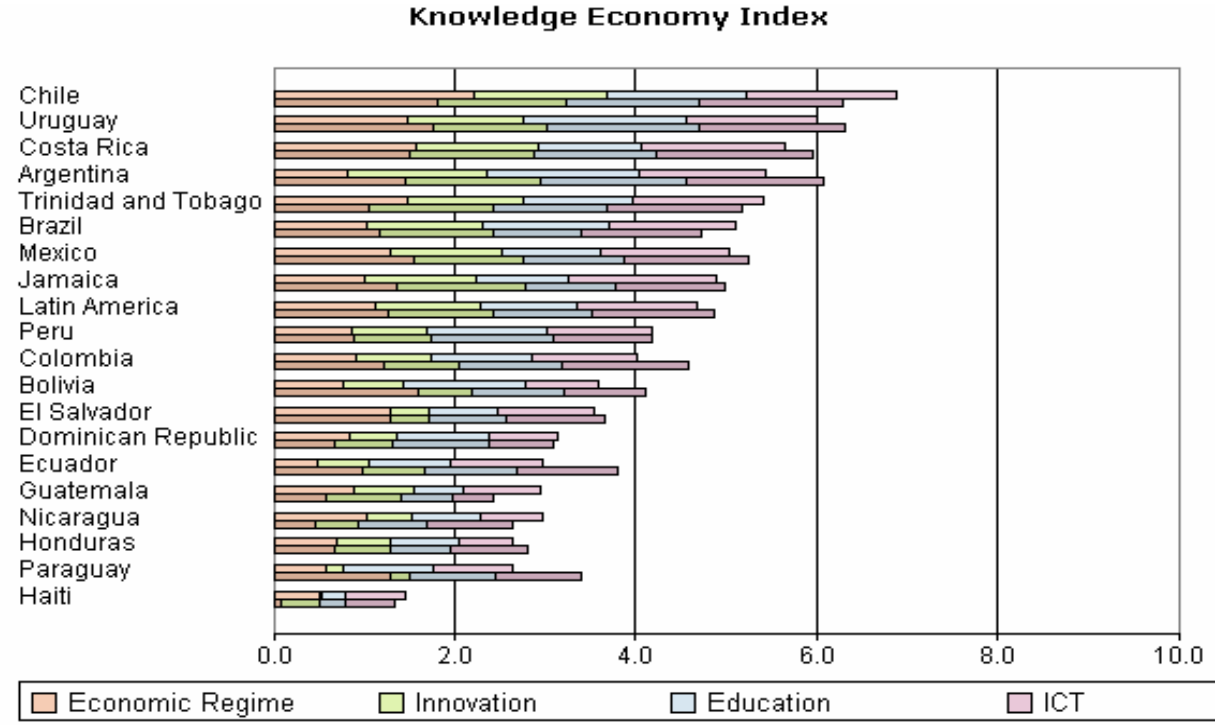
Houghton, John; and Peter Sheehan (2000). A Primer on the Knowledge Economy. Melbourne: Center for Strategic Economic Studies, Victoria University.
Humphrey, J. and H. Schmitz (2006), "The Implication's of China's Growth for Other Asian Countries", Institute of Development Studies, Brighton, UK.
Kaplinsky, R. (2005). *Globalization, Poverty, and Inequality*. Cambridge: Polity Press.
Kasarda, J. D. and D. A. Rondinelli (1998), "Innovative Infrastructure for Agile Manufacturers," *Sloan Management Review*, Vol. 39 (2), 73-82.
Kim, L. (2003). "The Dynamics of Technology Development: Lessons from the Korean Experience", in *Competitiveness, FDI and Technological Activity in East Asia,* S. Lall and S. Urata, eds.. Northampton.: Edgward Elgar.
Lall, S. (2003), "Foreign Direct Investment, Technology Development and Competitiveness: Issues and Evidence", in *Competitiveness, FDI and Technological Activity in East Asia,* S. Lall and S. Urata, eds.. Northampton: Edgward Elgar,.
OECD (2005a), *Science, Technology and Industry Scoreboard 2005*. Paris: OECD.
OECD (2005b). *Education at a Glance 2005* Paris: OECD.
OECD (2004), *Internationalization of Higher Education: Opportunities and Challenges,* Paris: OECD. OECD (2001). *The New Economy: Beyond the Hype.* Paris: OECD
OECD (2000). *A New Economy? Changing Role of Innovation and Information Technology in Growth*. Paris: OECD.
OECD (1996). *The Knowledge Based Economy*. Paris: OECD.
Page, J., et al. (1993), *The East Asian Miracle: Economic Growth and Public Policy*, World Bank, Washington DC.
Palmisano, S. (2006) "The Globally Integrated Enterprise" in *Foreign Affairs* (May- June).
Perez, C. (1992), *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and of Golden Ages.* London: Edward Elgar.
Rodrik, D. and A. Subramanian (2004), "From Hindu Rate of Growth to Productivity Surge: The Mystery of the Indian Growth Transition", National Bureau of Economic Research, Working Paper 10376 (March).
Stiglitz, J. and S. Yusuf (2001), *Re-Thinking the East Asian Miracle*, Oxford University Press and the World Bank.
Sturgeon, T. (2002), "Modular Production Networks: A New American Model of Industrial Organization*." Industrial and Corporate Change*, Vol.11 (3), 451-496.
Tan. W. B.; C. W. E. Lui; and C. M. Loh,(1992), "The Use of Information Technology by the Port of Singapore Authority", *World Development*, December pp.1785-1795.
Suh, Joonghae, et al. *Korea as a Knowledge Economy: Evolutionalry Process and Lessons Learned*. Washington DC: Korean Development Institute and World Bank.
UNCTAD (2004), *Development and Globalization Facts and Figures,* Geneva.
UNCTAD (2005), *World Investment Reports 2005: Transnational Corporations and the Internationalization of R&D*, New York and Geneva.
UNCTAD (2006), *World Investment Report 2006: FDI from Developing and Transition Economies-Implications for Development*, New York and Geneva.
UNCTAD (various years), *World Investment Reports*. New York and Geneva.
Wade, R. (2003), *Governing the Market*, Princeton: Princeton University Press.
Wong, P. K. (2003), "From Using to Creating Technology: the Evolution of Singapore's National Innovation System and the Changing Role of Public Policy", in *Competitiveness, FDI and Technological Activity in East Asia,* S. Lall and S. Urata, eds. Northampton: Edgward Elgar.
UNESCO (2005). *Towards Knowledge Societies.*
Westphal, L., W. Y. Rhee, and G. Purcell (1981), "Korean Industrial Competence: Where It Came From",World Bank Staff Working Paper 469, Washington DC.

World Bank (2007), *World Development Indicators 2007,* Washington DC.
World Bank (2006b), *Latin America and the Caribbean's Response to the Growth of China and India: Overview of Research Findings and Policy Implications*, Washington, DC: World Bank.
Yao, Yang (2003), "In Search of Balance: Technological Development in China", in *Competitiveness, FDI and Technological Activity in East Asia*, S. Lall and S. Urata, eds.. Northampton: Edgward Elgar.
Zhen-Wei Qiang. Christine (2007). *China's Information Revolution: Managing the Economic and Social Transformation*. Washington DC: World Bank.

.

Annex 1

Figure A.1 Knowledge Economy Index for Latin American Countries in KAM Database



Note: Top line for each country is position in 2007, bottom line is position in 1995

[1] For a summary of the earlier stages see Yao (2003).
[2] According to Premier Weng Jiabo's speech on the 15 year technology strategy in December 2005.