

Building the Sri Lankan Knowledge Economy



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Abbreviations and Acronyms

2G	Second Generation	MOE	Ministry of Education
3G	Third Generation	NASTEC	National Science and Technology Commission
A/L	Advanced Level	NCOE	National Colleges of Education
ADB	Asian Development Bank	NERDC	National Engineering Research and Development Centre
BPO	Business Process Outsourcing	NGO	Non-governmental organization
BSNL	Bharat Sanchar Nigam Ltd	NIE	National Institute of Education
CDMA	Code Division Multiple Access	NSF	National Science Foundation
CISIR	Ceylon Institute of Scientific and Industrial Research	NSTB	National Science and Technology Board
DoT	Department of Telecommunications	NTT	Nippon Telegraph and Telephone Corporation
EDB	Export Development Board	NRI	Networked Readiness Index
ERC	Economic Review Committee	O/L	Ordinary Level
FDI	Foreign direct investment	OECD	Organization for Economic Cooperation and Development
GCE	General Certificate of Education	R&D	Research and development
GDP	Gross domestic product	S&T	Science and technology
GERD	Gross expenditure on R&D	SEMP	Secondary Education Modernization Project
GPRS	General Packet Radio Service	SLT	Sri Lanka Telecom
GRI	Government Research Institutes	SMI	Small and Medium Industries
GSM	Global System for Mobile communication	SMS	Short messaging service
HDI	Human Development Index	STA	Sri Lanka Telecommunications Authority
KAM	Knowledge Assessment Methodology	STR	Student-teacher ratio
KE	Knowledge Economy	TAI	Technology Achievement Index
ICT	Information and communications technology	TEVC	Tertiary Education and Vocational Commission
ICTA	Information and Communications Technology Agency	TEVT	Technical education and vocational training
IDB	Industrial Development Board	TIF	Techno-entrepreneurship Investment Fund
IFS	Institute of Fundamental Studies	TRC	Telecommunications Regulatory Commission
IP	Intellectual property	TRIPS	Trade-Related Aspects of Intellectual Property Rights
IPR	Intellectual property rights	UNCTAD	United Nations Center for Trade and Development
IT	Information technology	USPTO	United States Patent and Trade Office
LDC	Less developed countries	WAP	Wireless Application Protocol
MDG	Millennium Development Goals	WiMAX	Worldwide Interoperability for Microwave Access
MMS	Media Messaging Services	WLL	Wireless Local Loop

Units of Measure and Currencies

GB	gigabytes	Rs	Sri Lankan rupees
Mbps	megabytes per second	US\$	U.S. dollars

Executive Summary

Knowledge for development

Harnessing knowledge for development is not a new concept. Knowledge has always been central to development. It can mean the difference between poverty and wealth. The knowledge economy is not just about hi-tech industries and creating an innovative and entrepreneurial culture. Recent studies have shown that simply adopting existing technologies widely available in developed countries can dramatically boost economic growth and productivity. This paper highlights the Knowledge Economy (KE) issues that confront Sri Lanka and offers policy prescriptions that will allow the island to take advantage of the opportunities available in moving towards a knowledge based economy.

The knowledge economy consists of four pillars:

- (i) The business environment;
- (ii) Information infrastructure;
- (iii) An innovation system; and
- (iv) Human resources.

When judged against these four criteria, it is clear that Sri Lanka's progress when benchmarked against other countries remains limited. As the economy is shifting away from industry and agriculture towards a more service-based economy and as government is promoting the island as an offshore hub there is great potential for Sri Lanka to benefit from strengthening its KE pillars.

The Business Environment

A good business environment will create strong incentives for the private sector to be innovative and entrepreneurial. Sri Lanka's current business environment remains mixed. While it is relatively easy to open and close a business and it is easy to hire workers, it remains difficult to fire workers, license a new business and register property. Sri Lanka is strong in protecting investors and getting credit. Despite some reforms the commercial courts still take more than four years on average to process a case. And Sri Lanka ranks 158th out of 183 countries in the world in terms of ease of paying taxes.

Although Sri Lanka has made some progress in these areas, so far it is "too little, too late". Other more dynamic countries have improved their business environments at a quicker pace and the country has continued to slip in international rankings that measure the ease of doing business.

Information Infrastructure

In today's knowledge-based world, information and communications technology (ICT) plays a central role in economic growth and productivity. An increase of 10 mobile phone users per 100 people can boost GDP growth by almost 1 percent. And a 1 percent increase in the number of internet users can boost GDP growth by 4.3 percent.

The best way to encourage a high quality and low cost network to develop is by establishing a liberal regulatory structure that allows for competition and private sector participation. Sri Lanka has made great strides in this area since liberalizing the sector in the late 1990s. But Sri Lanka's high prices, low penetration rates and limited competition in certain ICT areas reflect an unfinished reform agenda that government should tackle immediately. Increasing the available bandwidth and bringing down tariffs will spur international investment in the sector and help to encourage the country's nascent Business Process Outsourcing (BPO) industry. It will also encourage providers to go to the rural areas that have so far been neglected.

An innovation system

The first step towards adopting an innovation culture is to adopt existing technologies and adapt them to the local situation. As labor rates in East Asian economies edge upwards, Sri Lanka has the potential to absorb existing technologies and production systems especially in the services industries. Like Singapore and Korea, it can then build on such a base to develop more innovative industries and creating newer technologies.

Although an earlier generation of excellent scientists was created in Sri Lanka, the national science and technology (S&T) system has fallen behind more dynamic countries and it is not able to create credible S&T graduates. The main reason for this is the predominance and lack of effectiveness of the public sector research and technology institutes. The lack of public resources has led to increasingly smaller R&D budgets that are currently less than one-tenth of the 1.5 percent of GDP that the President has pledged to devote to R&D by 2016, in the *Mahinda Chintana* government's ten-year, development strategy.

In addition to increasing public resources devoted to R&D and improving the incentive system in Sri Lanka's universities and research institutes, government can also encourage linkages between academia and the private sector, reduce the level of red-tape in the university system and introduce tax incentives for innovation.

Skilled Human Resources

Sri Lanka's ability to create a demand-driven education system that focuses on lifelong learning will determine the country's capacity to embrace the benefits of the knowledge economy. Sri Lanka has made great strides in moving towards universal literacy. To truly capture the benefits of the knowledge economy it will now need to improve the quality of education and expand access to tertiary education and vocational training.

Existing public sector institutions will have to have more autonomy along with greater accountability. Government can also increase the amount of spending currently devoted to education which has hovered around 2 percent of GDP in recent years.

Expanding participation of the private sector is a key requirement for improved quality, relevance and access to higher education in Sri Lanka. Establishing good quality private sector universities and other educational institutions will also help encourage young Sri Lankans to avoid travelling overseas and spending hard currency in neighbouring countries.

Government needs to encourage English language and increase the number of science and technology courses currently offered. At the lower levels the curriculum could be improved by focusing on how children learn rather than what they learn. Introducing problem solving skills and entrepreneurship at an early age will help reorient future graduates early on. Creating formal linkages between Sri Lanka's universities and the private sector will create a symbiotic relationship that will also help academia become more relevant.

Charting a way forward

This is an opportune time for Sri Lanka to begin its transition towards the knowledge economy. This paper evaluates Sri Lanka's ability to embrace the knowledge economy. It finds that the country has embarked on a new development strategy and is branding itself as an offshoring destination. To support these national objectives the government must focus on investing in key knowledge economy inputs; education, innovation and ICT.

The *Mahinda Chintana*, places employment creation at the center of its development goals. In 2005 Sri Lanka's 10 year development strategy, *Mahinda Chintana: Vision for a New Sri Lanka*, was unveiled and called for rapid growth of the country by providing the necessary support to domestic enterprises while encouraging foreign investment. The program underlies a ten year macroeconomic framework with an 8 percent GDP growth target for next 6 years and a higher target of 9-10 percent thereafter. The strategy also anticipates harnessing the benefits of global integration by strengthening bilateral and regional trade and investment relationships. Sri Lanka is looking to develop a large base of vibrant and competitive world class manufacturing industrial firms generating higher added value, higher profitability and a sustainable environment, while offering opportunities for improved job quality and higher family income to alleviate poverty.

In order to develop the national innovation system, the strategy encourages the development of research communities through the facilitation of dialogue and partnerships. The major goal of Sri Lanka's FDI policy is to attract foreign capital. It is intended that the living standards of the people would greatly improve through; the technology and skills transfer that ensues, the development of technical and managerial competencies, employment creation, public-private infrastructure partnerships, and diversification of exports into the knowledge based industry. To make this goal a reality,

Sri Lanka needs to improve its business environment to attract FDI. It is the basis for which improvement to the other three pillars (ICT, innovation, and education) depend on. The country will be unable to reap the full benefits of its investment in expanding education, ICT connectivity, or R&D intensity unless its broader institutional and incentive regime stimulate the most effective use of resources in these areas, permits their deployment to the most productive uses, and allows entrepreneurial activity to flourish to contribute better to Sri Lanka's growth and overall development.

In order for Sri Lanka to achieve the goals described throughout the paper, the country also will need to invest heavily in its people. The *Mahinda Chintana* states that sound and sustainable investment and growth, access to the benefits of the global economy, supportive public policies and an enabling environment for entrepreneurship and enterprise are what drive employment creation, and these are the factors that will lead the country to growth.

Launching a process: Implementing a 'Knowledge for Development' Strategy. The next step for Sri Lanka should be to formulate a high level strategic group and a knowledge economy task force consisting of leaders from various industry sectors, academia and government agencies to formulate policies that will enable Sri Lanka to build its knowledge economy. This exercise will enhance the interaction between the relevant parties. The task force should highlight the key areas for improvement and develop ideas for knowledge economy-based industries which have potential in the country. Sri Lanka still needs to develop a vision and strategies to address its transition to the knowledge economy. Implementing a development strategy for the knowledge economy will be a progressive step towards growth in all sectors of the economy.

Learning from other countries

The case studies presented in part II of this paper highlight what Sri Lankan policy-makers can learn from Korea, Singapore and China: three countries at very different stages in their KE transitions. Korea is currently seen as a leader in effectively using knowledge for growth while Singapore is in the process of developing its pillars in order to pursue a relatively new strategy in which innovation becomes the new focus of the economy. China is only in its initial stages of developing a new strategy for growth and beginning to invest in knowledge in order to do so.

Despite the fact that all three countries are at different stages there are some common themes that emerge from the case studies. All three countries have invested heavily in education. In Korea a strong cultural affinity to education and government deregulation of the sector in the 1980s allowed it get to a point where more than 50 percent of the population attend a tertiary level institute. In Singapore, education is

government's second biggest item of expenditure. While in China 50 percent of students at university study a science or technology related subject. Singapore has also decided to augment its national HR capacity by opening its doors to foreign born and foreign trained knowledge workers.

All three countries followed an outward oriented export development strategy and all started by adopting existing technologies rather than moving into innovative or new industries. All have gradually improved their business environments climbing several places in international indices in recent years. Despite low adult literacy rates in Singapore (roughly at Chinese levels), the country has more than made up for this by attracting international investment and human resources because of its excellent business environment, most notably the strong rule of law and regulatory quality.

Information infrastructure in all three countries was promoted through a liberalization of the telecom sectors starting with Korea in the 1970s. A solid regulatory structure based around market competition allowed the country to achieve the highest broadband penetration in the world. A dedicated public private partnership fund meant that funding was always available to drive the sector and that government ensured relevance and commercial orientation of the investment whilst also securing public sector backing to achieve social objectives.

Although all three models rely heavily on the private sector, they also involve high degrees of government coordination. Given the areas that the knowledge economy includes; education, ICT infrastructure and the business environment improving the knowledge economy is not a job that can be left entirely to the private sector. However, all three governments have been very selective in their interventions. They have allowed the private sector to participate where competition is possible e.g. education and ICT infrastructure and focused on creating a level-playing field for all stakeholders.

The message for Sri Lankan policy-makers is clear. Government must expand private sector access to finance all levels of education but particularly at the tertiary level. Government must increase its investment in R&D and public sector educational institutions. It should also encourage increased linkages between universities and the private sector.

Since this is a new area for Sri Lanka, this process must start with a dialogue with all stakeholders and commitment from government to achieving the KE related objectives outlined in the *Mahinda Chintana*. It is hoped that this paper will spur this process to allow the country to realise its enormous potential.

PART I

Sri Lanka and the Knowledge Economy

I. The Knowledge Economy - Why it is so important for Sri Lanka?

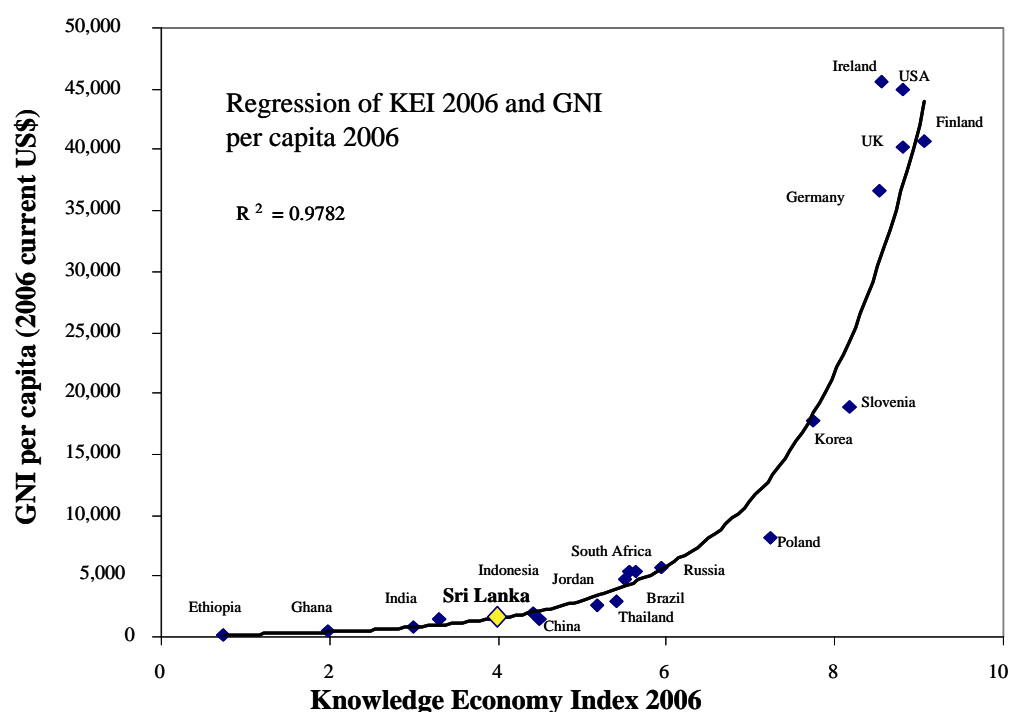
What is the Knowledge Economy?

A knowledge economy is one that creates, disseminates, and uses knowledge to enhance its growth and development. Knowledge is not a new concept and has always been at the core of any country's development process. More recently however, the increased speed in the creation and dissemination of knowledge is making it an even more important ingredient in rapid economic development.

A successful knowledge economy is characterized by close links between science and technology, greater importance placed on innovation for economic growth and competitiveness, increased significance of education, and lifelong learning and greater investment in intangibles such as R&D, software, and education.² Investing in the knowledge economy means investing in strategies that will bring about significant changes in the way a country can grow.

The knowledge economy is not just about high-tech industries. The application of knowledge is manifested in all areas such as entrepreneurship, innovation, R&D, and people's education and skill levels is now recognized as one of the key sources of growth and competitiveness in the global economy. The knowledge economy does not only signify high technology or information and communication technology (ICTs), but how well economies are using appropriate knowledge to improve their productivity and increase welfare. The creation of new knowledge and use of existing knowledge can be relevant in a variety of circumstances, manifesting not just as leading edge scientific discoveries, but more generally, on how to do things better.³ In fact the gains from simply adopting existing technologies and best practices far outweigh the benefits from inventing new technologies.

Figure 1: A strong link between knowledge and growth



Source: Updated from Dahlman, Carl 2003.

² World Bank 2005a

³ Ibid

Knowledge can mean the difference between poverty and wealth. In order to remain competitive in the global economy of the twenty-first century, it will be increasingly important to invest in quality knowledge inputs rather than capital inputs, making each sector of a country's economy more efficient. Figure 1 illustrates the significant returns that such an investment can create. Countries such as Korea, Taiwan, US, and UK which have invested substantially in knowledge factors over the last few decades have experienced rapid and sustained growth and are currently some of the most dynamic and competitive countries in the world.

The dynamic process of knowledge and wealth creation raises tremendous possibilities for enhancing growth and competitiveness. But there is also a risk that countries or firms and organizations that are not able to keep pace with rapid change will fall behind. Countries like Sri Lanka, which are poised to realize faster growth and move into middle income status need to formulate robust national KE strategies and reform the appropriate sectors in order to benefit from this driver for growth.

Sri Lanka is currently embarking on a new development strategy that seeks to bring about rapid and sustained growth. Sri Lanka has made substantial advances over the last few decades, posting solid economic growth as high as 8 percent in 2006 up from 6 percent in 2005, and 5.4 percent in 2004. In addition, the country's new development strategy anticipates even more rapid growth in the coming years. The government's 10 year development strategy *Mahinda Chintana: Vision for a New Sri Lanka*, unveiled in 2005, introduced prospective policies designed to improve growth prospects and further integrate the island into the global economy. The challenge for Sri Lanka is now to formulate KE implementation strategies and decide on which types of inputs to invest in to make this vision a reality.

The time is right for Sri Lanka to begin its transition towards becoming a knowledge-based economy. In light of Sri Lanka's recent and continuing reforms and its ambitions to realize faster growth, it is important for Sri Lanka's leaders and interested stakeholders to evaluate where the country currently stands on its journey towards a knowledge based economy and how best it can take advantage of the KE potential. This paper seeks to answer some of these questions by benchmarking Sri Lanka's knowledge economy against competitors in Asia and elsewhere and highlights the specific areas which the country should improve upon in order to fully embrace the knowledge economy.

What does this imply for Sri Lanka?

Sri Lanka's economy is changing

The sectoral composition of Sri Lanka's economy has changed from that of an agriculture based economy to one dominated by the services sector. By the end of 2004, the services sector was the highest contributor to GDP of 56 percent, followed by the industrial sector at 26 percent and the agricultural sector at 18 percent. Although its significance has declined in recent years, the agricultural sector is still an important determinant of GDP, directly accounting for around one-fifth of national output and employing over one-third of the workforce.

Liberalization, private sector participation, modernization and increased competition have contributed to the expansion of the services sector, including sectors such as transportation, communication, financial services, trade and tourism. In recent years, services growth has been led by telecommunications (27 percent growth in 2005).⁴ The services sector will be of growing importance in the coming years as Sri Lanka is increasingly regarded as destination of choice for foreign investment and offshoring activities. As the country moves into being a major services exporter, the challenge for Sri Lanka in the medium term is to achieve rapid and sustainable economic growth with greater equity whilst

⁴ Board of Investment (BOI), Sri Lanka

managing the process of globalization. Success will depend on realizing practical macro economic management, undertaking necessary reforms, infrastructure development, and human resource development; all of which can be accomplished or facilitated through appropriate knowledge investments.

Box 1: Services Take the Lead in World Employment

The services sector recorded the highest employment share in 2006 of 40%, with agriculture at 38.7% and industry at 21.3%. Services overtook agriculture for the first time in history in 2006. Roughly 22 million manufacturing jobs disappeared globally between 1995 and 2002, with even China losing around 15 million manufacturing jobs. The need to think of innovation in services to keep up with this trend has never been more important than it is now.

Source: ILO Global Employment Trends 2007

Sri Lanka's current advantages in embracing the knowledge economy

Sri Lanka's liberal economy, high literacy rates and emerging offshoring industry will support the country's transition to a knowledge economy. Sri Lanka's economy remains one of the most liberal in South Asia. In terms of education, Sri Lanka possesses a solid base of human capital with some of the highest literacy rates in the region, widespread use of English, and a large number of individuals well trained in the fields of accounting and other financial services. The country also has a free market economy, dynamic private sector, macroeconomic stability, and a democratic system. Sri Lanka's business environment is consistently improving and remains open to foreign investment and committed to private sector competition. In addition, Sri Lanka is increasingly becoming identified as an attractive destination for offshoring activities that go beyond the basic call center activities, including financial, banking, insurance, telecom, and other business services.⁵ These emerging industries, opportunities, and other changes will help support the transition to a Knowledge Economy.

Assessing Sri Lanka's Opportunities and Challenges in the Knowledge Economy

The Four Pillars of the Knowledge Economy

The World Bank Institute has defined the knowledge economy as consisting of four pillars, which if strengthened, can result in growth and development.⁶

1. **The business environment:** An economic and institutional regime that provides incentives for the efficient creation, dissemination, and use of existing knowledge.
2. **Dynamic information infrastructure** that can facilitate the effective communication, dissemination, and processing of information.
3. **Human resources:** An educated and skilled population that can create and use knowledge.
4. **An efficient innovation system** of firms, research centers, universities, consultants, and other organizations that can tap into the growing stock of global knowledge and assimilate and adapt it to local needs, as well as to create relevant new knowledge.

⁵ Economic Intelligence Unit, 2006.

⁶ World Bank, 2005a.

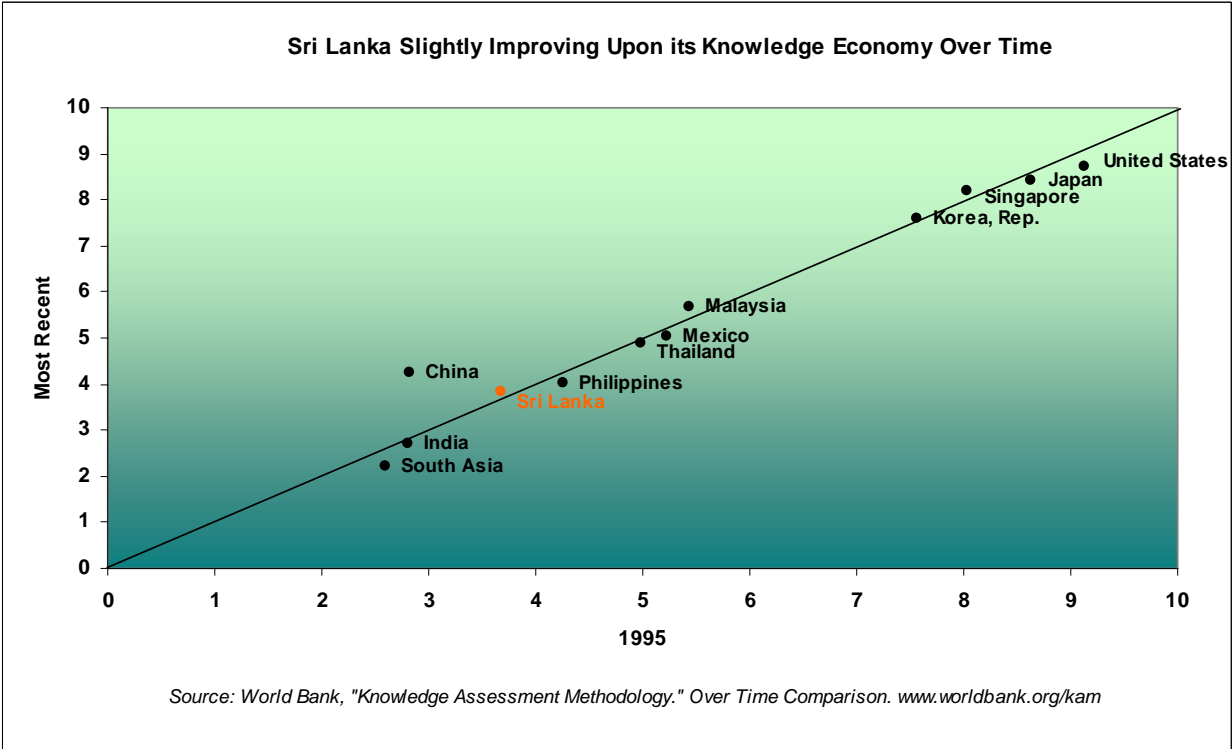
In order to benchmark Sri Lanka’s position in its transition towards a knowledge economy, the World Bank’s Knowledge Assessment Methodology (KAM) will be used throughout the paper. The KAM includes several quantitative and qualitative variables that compare an economy with its neighbors and competitors in order to determine the areas within the country’s economy that are in need of improvement, investment, and reform. Three variables are chosen as proxies for each of the four pillars that constitute the knowledge economy index:

- Economic and institutional regime: tariff and non-tariff barriers, regulatory quality, and the rule of law
- Education and human resources: adult literacy rate (percent age 15 and above), secondary enrolment, and tertiary enrolment
- Innovation system: researchers in R&D, patent applications granted by the US Patent and Trademark Office (USPTO), and scientific and technical journal articles (all weighted per million people)
- Information infrastructure: telephones per 1,000 persons, computer per 1,000 persons, and internet users per 10,000 persons

Benchmarking Sri Lanka’s Knowledge Economy

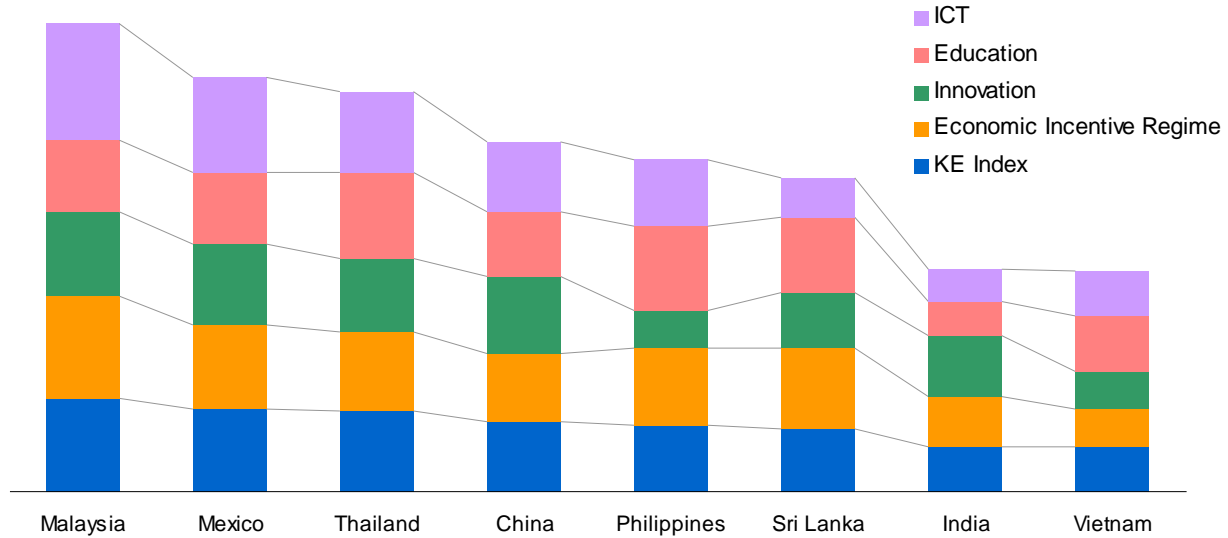
Over time, Sri Lanka has made gradual but limited improvement in its transition towards the knowledge economy. Although Sri Lanka has made small improvements since 1995, other Asian countries have done better including Malaysia, Korea and Singapore. China, in particular has made significant leaps in developing its knowledge economy. If Sri Lanka wants to experience the rapid growth that some of its Asian counterparts have, the country will need to increase investment in developing its knowledge inputs.

Figure 2: Sri Lanka’s overall improvement relative to the world



Sri Lanka lags behind most comparator countries in terms of the Knowledge Economy. Using the KAM methodology it is also possible to benchmark Sri Lanka against comparator countries with regard to specific Knowledge Economy pillars. Figure 3 below represents the aggregate Knowledge Economy Index (KEI) score using the most recent data for 8 countries including Sri Lanka. It is separated into four pillars with each coloured band representing the contribution of a particular pillar to a country's overall knowledge readiness. The figure shows that Sri Lanka lags behind most of these countries.

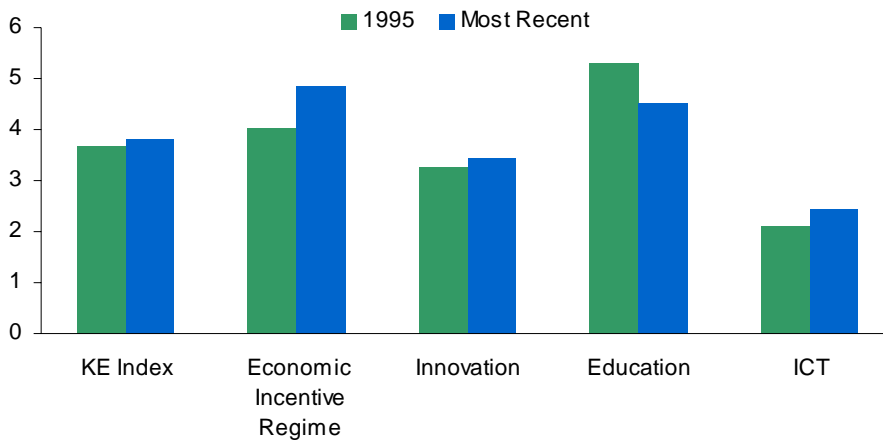
Figure 3: Sri Lanka's Knowledge Economy a long way to go



Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Sri Lanka has made little progress in strengthening its KE pillars over the last decade. Looking at the same pillars Lanka over time we see very slight improvements since 1995 except for education which has declined. The economic incentive regime and ICT have seen more improvement than the other factors.

Figure 4: Sri Lanka's Knowledge Economy pillars show little improvement since 1995

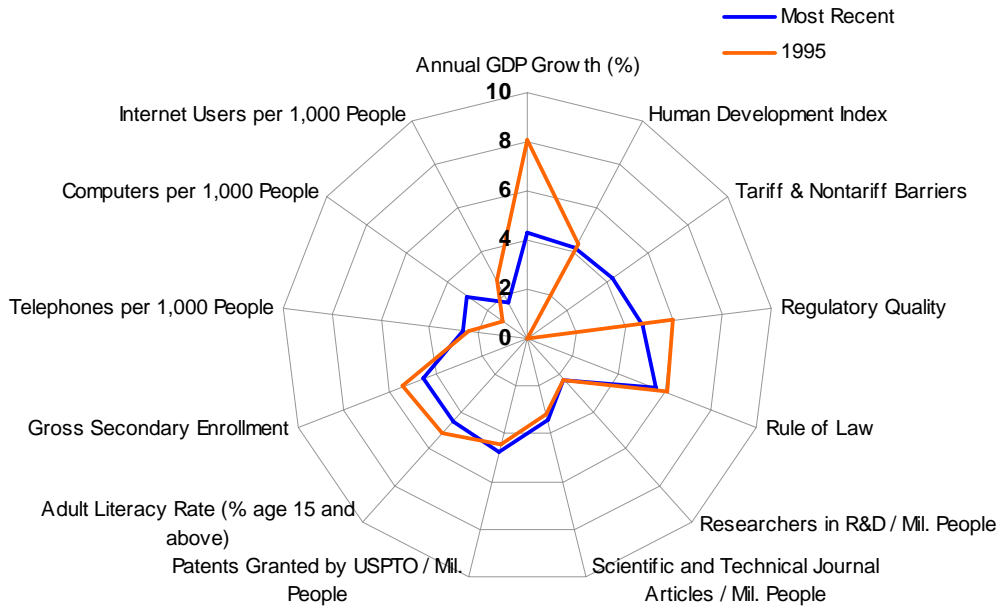


Since 1995, the country has made some improvements in ICT with higher computer usage and increased telephone connectivity. However, Sri Lanka's regulatory regime has not improved significantly. It is

important to note the slight decline in internet users per 1,000 people, indicating that other countries have been able to achieve internet connectivity at a faster pace.

Sri Lanka has made few advances in innovation, which has remained at a consistently low level with regard to patents, journal publications, and researchers. Sri Lanka’s education system also appears to be stagnant with other countries improving secondary enrolment faster. This emphasizes the need for important reforms in the education system in order to be able to produce the educated and skilled population needed for the knowledge economy.

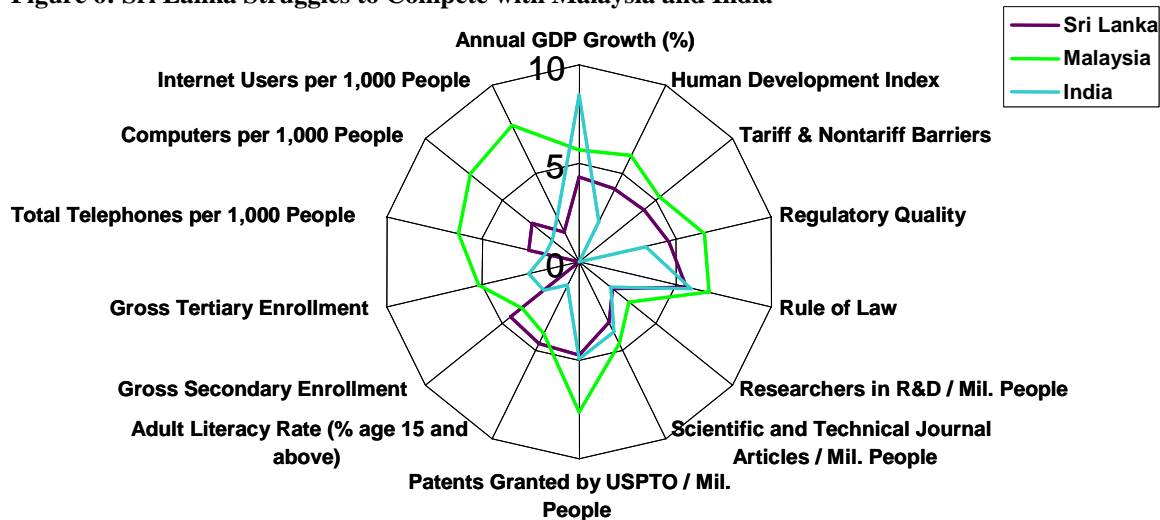
Figure 5: Sri Lanka has made limited advances in R&D and ICT



Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Sri Lanka’s need to improve upon each pillar of the knowledge economy is further highlighted when compared with two of its comparator countries, Malaysia and India.

Figure 6: Sri Lanka Struggles to Compete with Malaysia and India



Source: World Bank, Knowledge Assessment Methodology, www.worldbank.org/kam

Embarking on a Transition to the Knowledge Economy

To make progress on this important agenda, Sri Lanka will need to define its strengths and weaknesses within the four pillars in order to bring about the appropriate reforms in making a successful transition to the knowledge economy. This paper is structured around these four pillars, the business environment, ICT infrastructure, innovation, and education.

The following four chapters identify the specific issues and opportunities facing Sri Lanka in terms of developing quality knowledge inputs. Included in each chapter are various benchmarking assessments, appropriate for each pillar, along with related issues, recent developments, and policy recommendations.

A compendium volume presents case studies of how other successful countries have managed the transition to the KE. These assessments will be useful in helping Sri Lankan policy-makers learn from different methods and models that have been adopted elsewhere so that the island can begin to establish its own strategies in embarking on Sri Lanka's 'knowledge economy revolution'.

II. The Business Environment

Creating a good business environment

The business environment is crucial for innovation and entrepreneurial development. It determines whether there are strong incentives for individuals to identify market opportunities and create wealth, jobs and economic growth. An enabling environment that makes it easy for individuals to start up businesses, run them, sell them and fold them if they are not successful is one that fosters national economic growth. There are numerous indices that can benchmark Sri Lanka's standing in this area. The Economist Intelligence Unit (EIU) Global Outlook Report ranks Sri Lanka at 62 out of 82 countries surveyed. Institutional Investor indicates that Sri Lanka's country credit rating has dropped from 89th in 2006 to 100th in 2007 out of 174 countries covered. The World Bank's doing business indicators similarly rank the island at 101 out of 178 economies covered. This puts Sri Lanka behind the Maldives (60) and Pakistan (76) but ahead of other South Asian countries, most notably India at 120.

It is clear that Sri Lanka needs to improve its business environment – the question for policy makers is, “where to start on this challenging agenda?” Sri Lanka's three most problematic factors for doing business are policy instability, access to finance and the inadequate supply of infrastructure according to the World Economic Forum's Global Competitiveness Report for 2006/7. This view is supported by the World Bank's earlier work on the investment climate in 2005 which highlighted electricity, policy uncertainty and access to finance as the key issues confronting formal sector businesses in Sri Lanka. The World Bank's doing business indicators highlight reform issues around the following themes which are discussed below:

- Starting a business
- Dealing with licenses
- Hiring and firing workers
- Registering property
- Getting credit
- Protecting investors
- Paying taxes
- Trading across borders
- Enforcing a contract and
- Closing a business

Starting a business

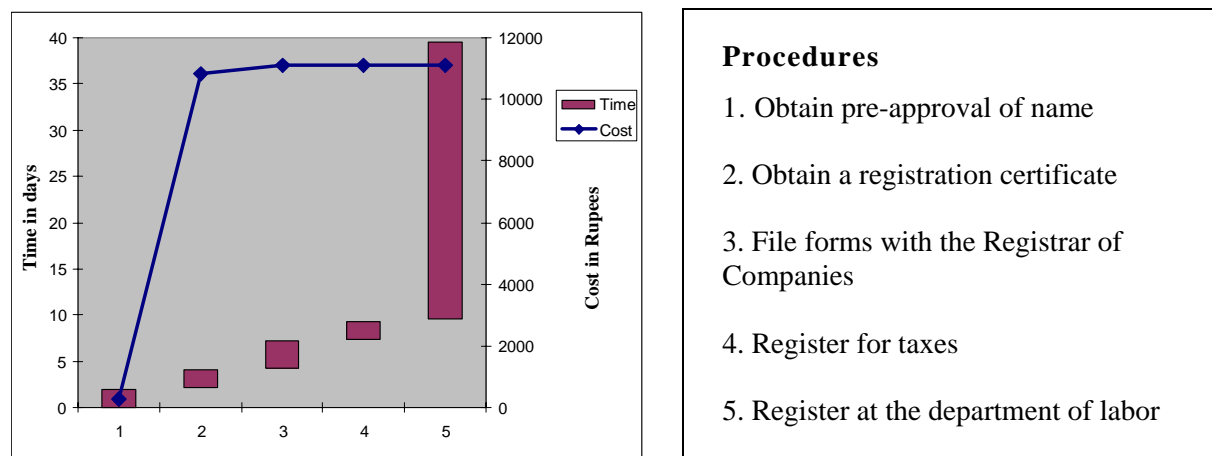
Sri Lanka ranks 29th in terms of ease of starting a new business, up significantly from last year's position 47th. It now takes just 39 days to open a business, (down from 50 days in 2007). Three-quarters of the time taken to start a new business is spent registering at the department of labor.

Although there is no minimum capital required, a new start-up still needs to go through five separate procedures (down from eight in 2007) which costs approximately US\$100. Meanwhile, the South Asian time taken to start a new business has been coming down consistently from 35 days in 2006 to 32.5 days in 2007 and now to 30 days. Sri Lanka needs to continue this reform process simply to remain competitive in Asia.

What to reform

Sri Lanka has made great strides this year in further simplifying business start-up procedures by introducing standardized memoranda and articles of association. This has removed the need for pre-approval and notarization of the documents, as well as the company seal thereby cutting 3 procedures from the process. Nevertheless, Sri Lanka can encourage more entrepreneurs to register their businesses formally by simplifying the start-up process even further. The final procedure—registering at the Department of Labor— takes 75 percent of the total start-up time (Figure 7). These delays could be reduced or even eliminated entirely if the registrar of companies was computerized and connected to the Department of Labor. Similarly, the registrar of companies could also act as a “single window” for tax registration.

Figure 7 Starting a business in Sri Lanka (time in days and cost in Rupees)



Source: Doing Business Database 2008.

Dealing with Licenses

Sri Lanka ranks 160th in the world in terms of dealing with licenses, down from 156th last year. The number of procedures has not changed at 22 neither has the duration (214 days) or the cost. Obtaining the building permit alone takes 75 days on average and accounts for almost one-third of the cost. This makes Sri Lanka the worst performer in the South Asia region and among the worst in the world in dealing with licenses.

What to reform

Reforms should focus on speeding the issuance of building permits and the procedures to ensure conformity, as these are the biggest bottlenecks. Reducing the time to process documents for the permit and the certificate of conformity is a start. Cutting costs is the next step. In Colombo, obtaining the building permit costs more than US\$450. Many other countries charge no fee to issue such a permit. Finally, reforms can target the cost of connecting to utilities. It costs more than US\$600 to connect to electricity and \$220 to get a telephone line in Colombo. Builders should be permitted to install the basic connection themselves if they choose to.

Hiring and firing workers

Sri Lanka ranks 111 in terms of employing workers, up one from 112 in 2007. Employing workers in Sri Lanka remains straight forward but it is the difficulty of firing workers that remains problematic. Recent changes in the legislation governing overtime have provides Sri Lanka with a more flexible and

accommodative environment when it comes to rigidity of hours. Although in large part the change in legislation simply mirrored existing practices and therefore is not likely to have a significant impact in the real economy.

Table 1 : Difficulty to fire workers in Sri Lanka

Cost to dismiss a redundant worker (weeks of wages)			
Lowest		Highest	
New Zealand	0	Mozambique	143
United States	0	Ghana	178
Marshall Islands	0	Zambia	178
Micronesia	0	Sri Lanka	178
Puerto Rico	0	Egypt	186
Palau	0	Sierra Leone	329
Tonga	0	Zimbabwe	446

Source: Doing Business database 2007.

Although it is easy to hire it is almost impossible to fire. Sri Lanka remains at the bottom of the global tables in terms of difficulty of firing workers. In 2007, only three countries in the world paid more than the Sri Lankan mandated severance payment of 178 weeks of wages.

On top of the difficulty of firing, Sri Lanka’s broader labor regulations are extremely complex and rigid. The country has more than 48 labor laws, many of which date to the 1970s—a period in which Sri Lanka had a closed and statist economy. Labor regulations mandate more holidays and leave

than almost any other country in the world. National holidays include every full moon and eight other festivals. Workers also receive 21 days annual leave and 21 days sick leave, which are often taken as an entitlement rather than a fall back.

What to reform

Reforming labor law is perhaps the most important initiative that any government can take to encourage firms to provide more formal sector jobs. The Sri Lankan economy is characterized by repeated shocks including natural disasters and civil conflict and is highly vulnerable to exogenous factors such as the price of oil and terms of trade for commodity exports. As such businesses in Sri Lanka need to respond regularly and swiftly to changes in market conditions. Not being able to take on and shed excess labor easily in such a situation leads to several unforeseen outcomes. Firstly, firms are tempted to recruit more staff on a contract basis implying reduced training and productivity levels. Secondly, employers are driven to pay a lower equilibrium wage-rate than would otherwise prevail. Thirdly, in a down-turn some employers that are hit especially hard and do not have the option of reducing staffing levels are forced to declare bankruptcy thereby letting the entire workforce go.

But perhaps the two most significant impacts are the high level of informality that this creates with more than 85% of jobs in Sri Lanka remaining in the informal sector and the low level of job creation in the country. Resilient growth in recent years has not been matched by a growth in employment or wage rates and more and more young workers are forced to seek opportunities overseas mostly in menial jobs in the Middle East.

Sri Lanka must reverse this trend immediately by reforming the Termination of Workers Act of 1971. Mandated severance payments should be reduced in line with international best practice. The discretion of the Commissioner of Labor should not be required in every separation. These are all stroke-of-the-pen reforms that can be accomplished quickly if government has the political will to do so.

Registering Property

Sri Lanka ranks 134th in terms of the cost of registering property. Registering a property requires 8 different procedures and takes 83 days – while the registration itself costs around 5% of the property

value. Government stamp duties account for 80% of the cost. No reforms to property registration have taken place for several years.

What to reform

The government can encourage formal registration of properties by reducing the 4% stamp duty. Typically reductions in fees lead to more revenues, as more properties are registered and there is less underreporting of property values. In Pakistan the transfer fee is only 2%; in Bhutan, 1%. Procedures can also be simplified by cutting documentation. Currently a business spends at least a third of the time to register just obtaining documents from the municipality. Beyond this, the government can focus on increasing the security of property rights by improving the way that the registry functions. Potential areas of reform include automating the land registry to improve processing time and the accuracy of records.

Getting credit

Access to credit is consistently rated by small and medium Sri Lankan firms as one of the greatest barriers to doing business. Here again Sri Lanka has slipped from 80th to 97th over the past year in the global rankings.

However, Sri Lanka's credit information bureau, a public-private partnership between the Central Bank of Sri Lanka and several commercial banks has started to deepen credit information in the country increasing its percentage coverage from 2.2% of all adults to 3.1% in the past year.

What to reform

Access to credit can be expanded by reforming secured transactions and bankruptcy laws to provide lenders with clear priority to the proceeds from collateral. Improving the quality of credit information is also a priority. Banks currently submit credit information on paper, which is later electronically entered, a process which allows for errors. The credit bureau should require data to be submitted electronically. Moreover, 40% of the bureau's records are missing unique national identification numbers, which makes it difficult for lenders to use the information and also allows for individuals to be attributed with the wrong information. Since banks are required to see an identification or passport number to issue a loan, banks should be required to include this information in bureau records.

The CRIB Board has approved legal amendments in order to; (i) collect data from various new sources (utility providers, retailers, insurers, public domains etc. (ii) extend CRIB services to such data providers, (iii) provide other services such as credit scoring and fraud prevention, (iv) dispute settlement and consumer protection, and (v) purchase the latest ICT and consolidation with software providers. These amendments need to be fully implemented.

Protecting investors

Sri Lanka ranks 64th in terms of protecting investors which places it towards the lower end of South Asian countries, behind India, Bangladesh and Pakistan. Only Bhutan and Afghanistan are lower. In comparisons outside the region, Sri Lanka is behind Indonesia, Thailand and Malaysia. Sri Lanka scores lowest in the disclosure measurements, receiving only 4 out of 10 points on the extent of disclosure index. There are no requirements to immediately disclose transactions with conflicts of interest to shareholders or the general public, nor are inside dealings required to be reviewed by an outside body. Scores are only modestly better on the director liability index, showing that investors have few powers to hold a director liable for misconduct towards the company. The highest score (7 out of 10) for Sri Lanka comes on the ease of shareholder suit—reflecting relative ease with which an investor can take his case through court.

What to reform

Sri Lanka can improve its investor protections by providing greater transparency for company operations. This will encourage investors to take equity stakes in more companies, and will lower the premium on holding a controlling share. The first step toward this could be imposing an immediate disclosure requirement for large, related-party transactions (between a company and individual members of its management). Mandating external audits on suspicious transactions can also reduce improper activities within a company.

It is encouraging that the Sri Lankan authorities are considering undertaking a ROSC report on Corporate Governance. The objective of the ROSC module is to capture the formal and informal dimension of corporate governance; both will determine how corporate governance works in practice. The assessment focuses on shareholder rights, equitable treatment of shareholders, role of stakeholders, disclosure and transparency, and duties of the board of companies. Completing such a study and publishing its results in an open and transparent manner as well as implementing those results will go a long way to improving investor protections.

Paying Taxes

Sri Lanka ranks 158 in the world, and well below the South Asian average in terms of the ease of paying taxes. Investors have to contend with 62 different taxes and spend an average of 256 days to complete the average tax return. But perhaps the biggest sting is the cumulative effective tax rate which at 64% is exceeded by only a dozen countries worldwide. The result is significant tax evasion and avoidance.

In recent years the tax situation has deteriorated considerably. The corporate tax code is now much more burdensome than last year when it took only 42 separate payments and close to 50% of gross profits payable in tax. Additional measures introduced recently include a Social Responsibility Levy at 0.25% of profits and a stamp duty reintroduced in April 2006. Deductible expenses for advertising were reduced to 50% deductible during the past year. Unfortunately the current situation is set to worsen following a recent budget passed in November 2006 which further complicates the tax code and introduces a number of new taxes and reduced exemptions.

What to reform

Several countries have shown that low corporate tax rates can attract potential investors. Two decades ago, Ireland realized that by having a lower corporate tax rate it could position itself as a gateway to Europe. Sri Lanka has a similar opportunity to position itself as a gateway to Asia and re-establish its historical role as a regional entrepot. This would require a considerable streamlining of the Sri Lankan tax code. The number of payments can be reduced by consolidating taxes and eliminating minor ones that significantly increase hassle but not revenues. To be competitive in today's environment the total tax rate payable should be significantly below current rate.

Despite consistent increases in tax rates the total revenue to GDP ratio has dropped from around 22% to as low as 14% in 2005. This is clearly an indication of increased tax avoidance. Larger companies have found ways to avoid paying Sri Lanka's high taxes by establishing themselves in one of the island's numerous export processing zones, run by the Board of Investment, which offers generous tax holidays and concessions - 75% of manufacturing now takes place in the zones. This practice reduces revenues and it creates a non-level playing field between large domestic and international investors in the zones and smaller domestic entrepreneurs that are struggling with government's bureaucratic and punitive tax regime. It also creates numerous opportunities for rent-seeking behavior by domestic and international companies vying for Board of Investment (BOI) status.

Trading Across Borders

A recent investment climate study conducted jointly by the World Bank and the Asian Development Bank demonstrated that Sri Lanka’s ports were more efficient than many of its South Asian neighbours. This competitive advantage is being built on as the island made considerable improvements in this area during 2007 climbing from 94th to 60th place in the global rankings. The number of days required to import goods has dropped from 27 to 21, and the number of documents required has been halved to 6. Exporting is in a similar situation requiring 21 days and 8 documents.

Sri Lanka remains at the top of the South Asian league with only the Maldives ahead in terms of port competitiveness. However as a small island economy dependent on a thriving export sector, it is important that Sri Lanka continues to improve its trade performance to world class levels. Singapore takes only 6 days for imports and 3 days for exports and its container shipments to the United States cost less than half those from Sri Lanka.

What to reform

In improving port efficiency, Sri Lanka need look no further than Colombo for inspiration. The privately built and operated South Asia Gateway Terminal (SAGT) has operated alongside the publicly owned Jaya

Table 2 : Trading Across Borders in Sri Lanka

Rank	60
Documents to export (number)	8
Time to export (days)	21
Cost to export	810
Documents to import	6
Time to import (days)	21
Cost to import (US\$ per container)	844

Source: Doing Business Database 2008

Container Terminal of the Sri Lanka Port Authority for some years now. The private sector terminal has spurred increased competition and efficiency within the public sector, although the publicly run terminals remain behind their private sector counterparts in all metrics. Most importantly labor relations continue to plague the public sector operations. A high profile strike at the Jaya Container Terminal in 2006 threatened to seriously damage Sri Lanka’s key export sectors. The privately run SAGT came to the rescue operating round the clock to ensure that as many shipments as possible went out on time.

Sri Lanka can boost trade and reduce corruption in customs by cutting red tape in the import and export process. More efficient customs and ports are especially important for the garments sector, which depends heavily on imported textiles. There is much scope to improve. Port tariffs remain high, resulting in burdensome shipping costs. Moves per hour could also be significantly increased. One potential reform is to adopt the landlord port model to sharpen the distinction between the management of the port and the operations of the terminals and thereby introduce private sector management without a transfer of assets to the private sector. Another area to improve is customs administration, which remains outdated. Large gains can be made with simple reforms, such as standardizing paperwork and eliminating unnecessary documentation requirements.

Enforcing contracts

Sri Lanka ranks 133rd in terms of the ease of enforcing a contract. It takes 1,318 days and 40 procedures to enforce a contract. Although this is a long time compared to the OECD average which is less than 1 year, in South Asian terms, Sri Lanka is at the mid-point. South Asia is the worst region in the world on

this score. Such a system has two perverse effects on the way business is conducted. Since it will take years to enforce a contract, many businesses will prefer not to resort to the courts even for the simplest matters. On the other hand, some businesses knowing that this is the case are often tempted to bring frivolous court cases against their competitors knowing that although they cannot win they can often effectively tie up their competition for years in acrimonious disputes which will have the desired effect. Such practices result in the formation of large conglomerates that would prefer to internalize such risks by extreme vertical integration thereby forgoing the potential benefits of specialization and contracting out business functions. Lengthy delays in court procedures also throw open the opportunity for rent seeking behaviour amongst the South Asian judiciary.

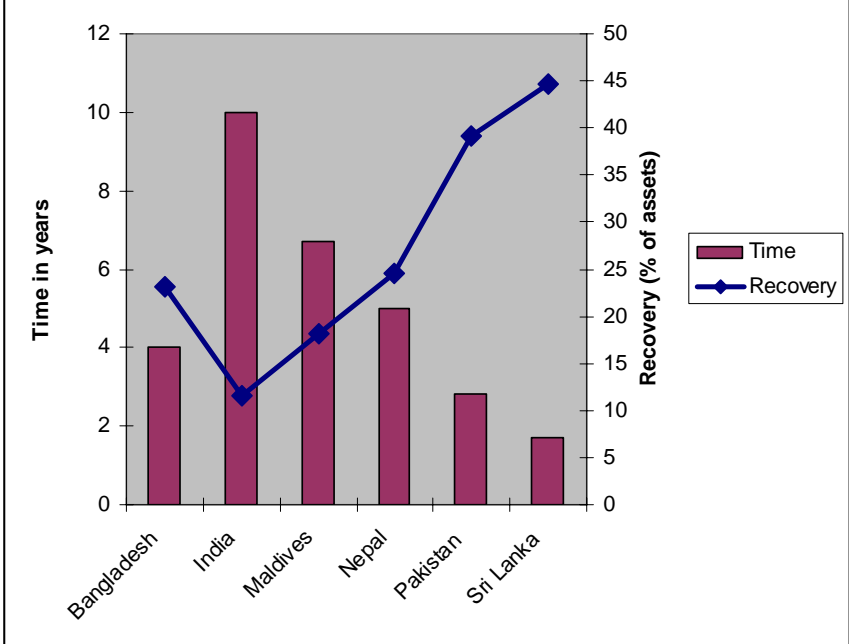
What to reform

Lengthy procedures and limited capacity of the judiciary in commercial law matters are the biggest obstacles to faster contract enforcement in Sri Lanka. The government can start by reforming the appeals process. In Sri Lanka, appeals on procedural matters are allowed at any point during the trial, there is a comprehensive review upon appeal, and once an appeal is made, enforcement is suspended until it is resolved. Not surprisingly, debtors use appeals as a delay tactic. Sri Lanka can follow other reformers—most recently Brazil in 2005—by cutting opportunities for frivolous appeals and allowing cases to continue upon appeal. As a next step, establishing specialized commercial sections of the court or training judges to specialize in commercial matters could also cut delays and cost.

Closing a business

When a firm becomes insolvent in Sri Lanka, the average creditor receives around 45 cents on the dollar, after a process that usually takes 1.7 years on average. This places Sri Lanka in 39th place globally and far ahead of South Asian rivals that take on average 3.6 years and recover only 19.5 cents on the dollar. India in particular exhibits the most inefficient bankruptcy practices in the world taking over 10 years to recover just 12 cents on the dollar. Figure 8 highlights Sri Lanka’s good practice in South Asia with the shortest times to go through bankruptcy as well as the highest recovery rates.

Figure 8 : Sri Lanka leads South Asia in closing a business



What to reform

Terminating employees' contracts is the biggest obstacle, both in terms of time and cost, to winding up a company in Sri Lanka. The government can significantly cut delays in bankruptcy by amending the Termination of Employment Act to speed up the dismissal process and to reduce the severance package that has to be offered at the termination. Reforms to cut opportunities for frivolous appeals as well as provide incentives for bankruptcy administrators to maximize the value of the estate will also increase recovery rates in bankruptcy—and expand access to finance as a result.

Policy Recommendations

Sri Lanka's standings in the global rankings on ease of doing business have been slipping every year since the index was created. It is time that government moved quickly to remove the shackles from private sector activities. This year Sri Lanka has made it easier to start a business and to trade across borders. Both initiatives are important and more needs to be done to ensure that individuals will take advantage of these opportunities.

In particular, government needs to improve labor market flexibility and reduce the difficulties associated with down-sizing labor. Government can reduce the effective tax rate for businesses and streamline the system and process of payments to broaden the tax base and raise additional revenue whilst also providing increased incentives for private sector participation in the economy. Finally government can make it easier to register property to allow developers to take control of urban and rural spaces and develop them commercially.

III. Sri Lanka's Information Infrastructure

In today's knowledge-based world, information and communication technology (ICT) plays an increasingly central role in economic growth and productivity. Recent evidence has shown that an increase of 10 mobile phones per 100 people can boost GDP growth by 0.6% and a 1% increase in the number in the number of internet users can increase total exports by 4.3%.⁷ Rapid advances in information infrastructure are dramatically affecting the acquisition, creation, dissemination, and use of knowledge, which in turn affects economic and social activities, including how manufacturers, service providers, and governments are organized and how they perform their functions. To develop a strong information infrastructure, it is necessary to mobilize the many stakeholders that are involved in its deployment and use: the telecommunications networks, strategic information systems, policy and legal frameworks affecting their deployment, as well as skilled human resources needed to use and develop it.

Sri Lanka has an opportunity to experience substantial and rapid growth with an emerging Business Processes Offshoring (BPO) sector. Over the last few years, many companies have become increasingly interested in setting up operations throughout the country in various fields including accounting, medical insurance, legal work, banking, call centers and others. This sector has already shown immense potential to produce jobs and growth. However, the supply of physical infrastructure and human resources, rather than demand, seems to be the ongoing challenges confronting the BPO industry. Sri Lanka's poor infrastructure has been cited by many BPOs as being a major bottleneck to growth, leading potential investors to look to neighbouring countries like Singapore and Malaysia for more dependable services.

Experience shows that a competitive ICT sector is a prerequisite for improving information infrastructures. Creating a competitive environment is one of the defining factors in the country's ability to embrace the knowledge economy. Improving the country's telecom infrastructure will not only help increase ICT literacy levels, but it will also support sustained economic growth.

The e-Sri Lanka initiative is an excellent step in the right direction. A key government initiative to reap the benefits of ICT while raising living standards and pursuing the MDGs, has been the e-Sri Lanka program which commenced early in 2003. It intends not only to use ICT to develop the economy and alleviate poverty, but also to extend the benefits of ICT to impoverished regions by inspiring and implementing a number of initiatives. These attempts are primarily in developing e-government solutions, creating adequate human resources for ICT, building a dependable information infrastructure, and exploring global market opportunities for local software.⁸ Enabling e-Sri Lanka to bring connectivity to people in underdeveloped regions throughout the country will be a huge step in connectivity, ICT development, and in Sri Lanka's quest to embrace the knowledge economy.

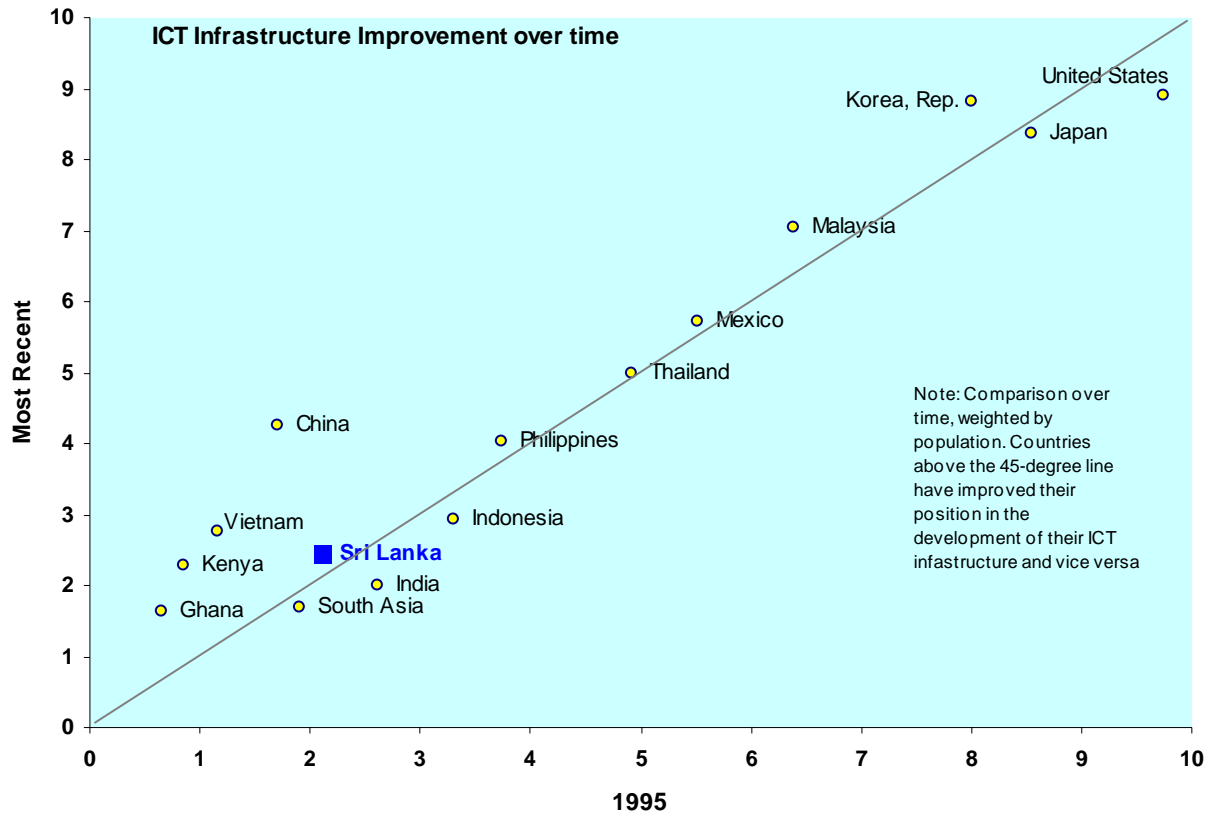
Benchmarking Sri Lanka's Information Infrastructure

Although Sri Lanka has seen slight improvements in its ICT development over time, the country will need to develop at a faster pace in order to take advantage of the knowledge economy. Figure 9, indicates that other countries such as China, Malaysia, and Korea have made significant leaps in the development of their information infrastructures and have done so at faster pace. These countries are already enjoying the benefits of rapid growth brought about by investing efforts in developing their respective telecom infrastructures. The spread of ICT in Sri Lanka is occurring at a slow pace, and will need to be increased if the country wants to benefit rapidly from the knowledge economy

⁷ www.nationamedia.com "World Bank to fund ICT Bureaux in Kenya", 8th February 2007

⁸ World Bank, 2006e

Figure 9: Sri Lanka has made great strides in ICT improvement

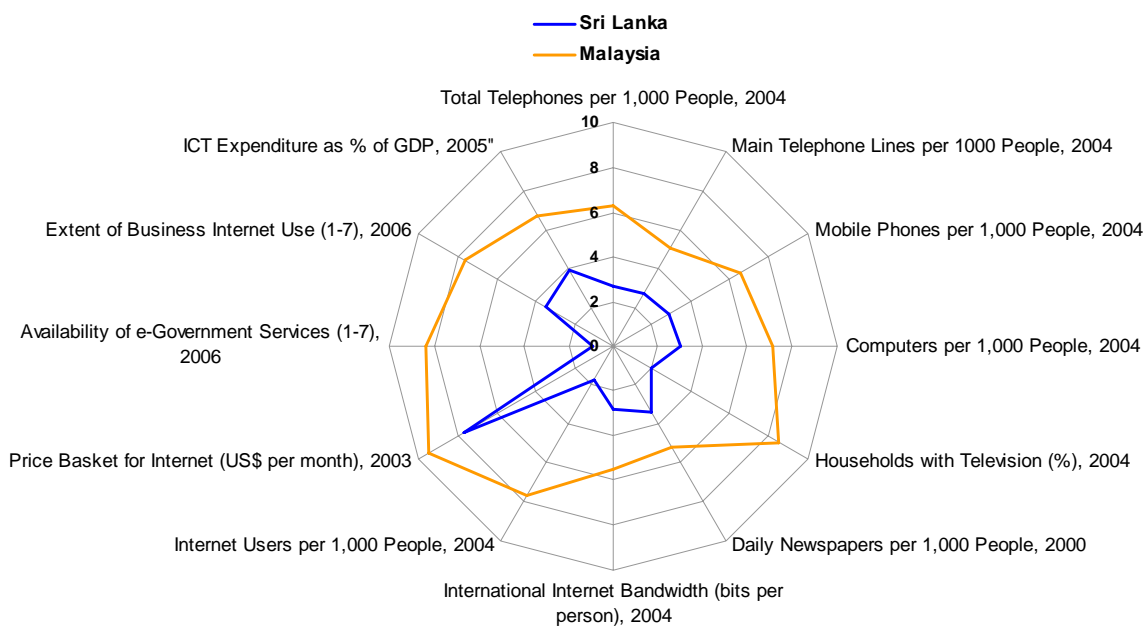


Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Sri Lanka needs to strengthen all aspects of its information infrastructure. Sri Lanka’s ICT scorecard sheds light on areas desperately in need of improvement within the country’s information infrastructure (Figure 10). Within all categories, benchmarked against Malaysia and other comparator countries, Sri Lanka scores in the bottom half in almost every category. Although Sri Lanka has made advances in IT infrastructure over time, significantly increasing connectivity and dependability, the country will need to strengthen this sector further in order to transform itself into a knowledge based economy.

High connectivity prices are the most significant impediment to telecom penetration on the island. The price for internet connectivity in Sri Lanka in 2004 was almost twice as much as the price in India, and more expensive than those in China, Malaysia, Thailand and Philippines. These high prices can be attributed to limited competition among service providers within the telecom industry and the weak regulatory body governing it. Sri Lanka’s high prices limit access to connectivity and restrict IT literacy. The amount of internet users per 1,000 people was 14.40 within Sri Lanka, significantly lower than all of its comparator countries. Although Sri Lanka’s mobile phone industry has grown immensely, bringing mobile connectivity to a large number of people, the amount of mobile phones per 1,000 people is still fairly low at 164.90, with only India and Vietnam showing lower figures.

Figure 10: Sri Lanka's ICT Infrastructure lags behind Malaysia's



Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Global Rankings

The Sri Lankan population is not yet prepared to benefit from developments in ICT. The World Economic Forum's Global Information Technology Report of 2005-2006 highlights its Networked Readiness Index (NRI) of 115 countries. The NRI is defined as the degree of preparedness of a nation or community to participate in and benefit from ICT developments and is composed of three indices, which assess the following: environment for ICT offered by a given country or community, readiness of the community's key stakeholders (individuals, businesses, and governments), and usage of ICT among these stakeholders.⁹ Sri Lanka ranks 83rd behind all of its comparator countries: Malaysia with the highest ranking at 24, Thailand 34, India 40, China 50, Mexico 55, Philippines 70, and Vietnam at 75.

Sri Lanka still has some way to go to create an enabling culture that promotes IT literacy and the use of ICT. The Economic Intelligence Unit's 2005 E-readiness report is essentially a measure of a country's business environment, a collection of factors that indicate how amenable a market is to Internet-based opportunities. E-readiness is not simply a matter of the number of computer servers, websites and mobile phones in the country (although these naturally form a core component of the rankings), but also such things as a citizen's ability to utilize technology skillfully, the transparency of its business and legal systems, and the extent to which governments encourage the use of digital technologies.¹⁰ Sri Lanka occupies the 56th spot, just behind India and China at 49 and 54, respectively. This index demonstrates that the Sri Lankan population has a generally low computer literacy rate. Increased grass roots awareness and ICT literacy is now being promoted by government, most notably through the e-Sri Lanka initiative and it is expected that these rates will improve in the near future.

The partial privatization of Sri Lanka Telecom (SLT) led to a greater level of penetration of both fixed line and mobile phones. In 1997, government divested 35 percent of its stake in SLT to Nippon Telegraph and Telephone Corporation (NTT) of Japan and assigned the company management control. A

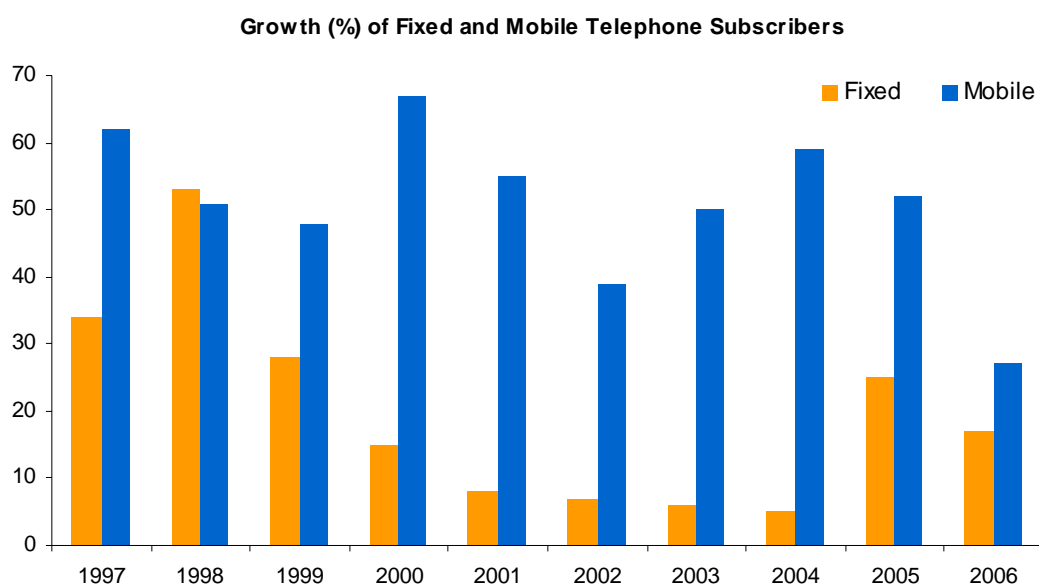
⁹ World Economic Forum, 2005b

¹⁰ Economic Intelligence Unit, 2005

further 3.5 percent of SLT's shares were given to its employees. In December of 2004, the government gave another 12 percent of its stake at an initial public offering, leaving it with 49.5 percent. When partial privatization happened in 1997, the government made the decision not to issue any new licenses, to vest monopoly power in SLT for international voice service operations, and to grant permission for annual tariff increases for domestic services of 25%, 25%, 20%, 15%, and 15% by SLT until 2002.¹¹

The figure below shows that following the privatization of SLT in 1997, the growth rate of fixed line subscribers increased substantially (Figure 2-3). However, due to market saturation and increased prices, subscriber growth steadily declined and it was not until the introduction of Code Division Multiple Access (CDMA) in 2005 that the fixed line sector experienced major growth. The mobile phone market also became heavily saturated in 2004, leading to sharp declines in subscriber growth in recent years. However, the mobile market segment grew significantly, at an average rate of 54.5 percent from 1994 to 2004. It now accounts for 60 percent and rising of the total phone market.

Figure 11: Sri Lanka's telecoms have taken-off in recent years



Source: Telecommunications Regulatory Commission of Sri Lanka, "Financial Analysis of the Telecom Sector"

Although increased competition is present in the mobile phone market, the fixed line market is far from competitive, supplying customers with high prices and long waiting lists. The Sri Lankan mobile phone market is characterized by affordable initial price via prepaid systems, constant improvements in technology, quick supply, rapid expansion of coverage, and a declining number of public payphones. However, in the fixed line market, operators have traditionally concentrated on high volume clients in densely populated areas and until recently due to TRC's discriminatory licensing practices limiting these operators to use only WLL technology. The monopoly right of SLT to provide international services after privatization perpetuated exceptionally high international call tariffs. The removal of this monopoly right in August 2002 resulted in a huge reduction in tariffs by more than 50 percent.¹² However, the number of applicants on waiting lists has been experiencing an upward trend, suggesting that supply is still an issue. The use of internet is also significantly low due to the high rate of local call tariffs and high price of computer equipment although the latter has now come down significantly through the government's launch of the e-Sri Lanka PC.

¹¹ Balasooriya et al. (p. 387)

¹² Balasooriya et al. (p. 388)

An important regulatory issue revolves around the interconnection regime for other users to access the main incumbent's network in a fair and efficient way. In Sri Lanka, the TRC's practice in interconnection matters has been only to intervene when operators are unable to come to a settlement. It will be increasingly important for Sri Lanka to reformulate the current regulatory regime for the TRC to remain independent from government, thereby ensuring that the incentives to create a competitive environment in all sectors of telecommunications are enforced. Private investments will also be a significant factor contributing to the development of the ICT sector, knowledge transfer, and future industry opportunities. In a country like Sri Lanka, which is being increasingly recognized as a destination for offshoring activities by foreign investors, the assurance of transparency and consistency from the telecom regulator will be important to build investors' confidence for future investments.

Increased competition will lead to lower telecom prices that will allow the emerging BPO industry to flourish. In turn this will lead to increased job opportunities, economic growth and increased standards of living. It is estimated that the offshoring industry could easily grow from its current level, accounting for approximately US\$100 million and 5,000 jobs to becoming a US\$1 billion industry employing up to 100,000 middle and highly skilled professionals within the next 5-10 years.¹³

Foreign investors are deterred by the country's high telephone costs. In a study on BPO companies which currently have operations in Sri Lanka found that telecommunications services, although essential in the provision of IT enabled BPO services, were perceived as a major constraint to growth. After human resources, the second highest expense faced by a BPO is telecommunications with costs averaging around 22 percent of total monthly costs. High costs and low penetration of leased line services have been speculated as adversely impacting the expansion of BPO activity. In addition, given that leased line penetration is low outside of the greater Colombo area, BPO businesses are restricted in their ability to expand service centers outside Colombo and thus leverage potentially lower labor costs.¹⁴

Sri Lanka's ICT Infrastructure Achievements and Developments

Technology Development

Once privatized, the Sri Lankan telecom sector has introduced new, faster and more efficient technologies. In the late 1990's Sri Lanka was the first country in South Asia to introduce second generation digital communications systems (2G), such as Global System for Mobile communication (GSM), automatic international roaming, Short Messaging Services (SMS), Wireless Application Protocol mobile internet (WAP) and General Packet Radio Service (GPRS). Since then, operators have introduced new technologies such as dual band and multi Media Messaging Services (MMS).¹⁵ Sri Lanka's telecom sector grew by 32% in 2004, spurred by private sector participation, a rapidly expanding mobile market, new technology and enhanced network coverage.

Sri Lanka introduced CDMA technology in 2005. Soon after, the government allocated CDMA spectrum to the three fixed line operators: SLT, Suntel Ltd. and Lanka Bell. The initial roll out of CDMA services has been a success. Lanka Bell, the first to launch CDMA services, added 100,000 new subscribers within the first 8 months.

Sri Lanka has greatly benefited from access to the Sea-Me-We 4 international fiber optic submarine cable. The Sea- Me-We 4 was launched on November 22, 2005 and connects South East Asia to European countries through the Indian Subcontinent and Middle East. According to SLT, a shareholder of Sea-Me-We 4, the cable provides access speeds four times higher than that of the current

¹³ Radwan et. al.

¹⁴ Lirneasia, 2006b

¹⁵ American Embassy, Colombo

Sea-Me-We 3 cable. Sri Lanka's largest mobile operator, Dialog Telekom, is also a shareholder of the new cable system through its parent company Telekom Malaysia. In addition, a submarine cable system connecting South India to Colombo is also underway. SLT has signed an agreement with Bharat Sanchar Nigam Ltd (BSNL) of India for this purpose. It will improve connectivity between the two countries and provide BSNL with additional international bandwidth through Sri Lanka. It is estimated that the Sea-Me-We 4 cable system along with satellite connectivity will provide Sri Lanka adequate capacity to meet future demand for international bandwidth.

SLT is to launch a Wireless Internet (WiMAX) network within the next two years. WiMAX or Worldwide Interoperability for Microwave Access uses the 3.5 gigahertz frequency band to provide cost effective broadband technologies. The TRC has assigned test frequencies to SLT for a WiMAX project to rollout in Colombo, Kandy, and Galle.

Box 2: The E-Sri Lanka Initiative

E-Sri Lanka has been instrumental in providing affordable connectivity to a broader population.

The Information Communications and Technology Agency (ICTA) was set up in 2003 to function as an apex agency for ICT policy and program implementation in Sri Lanka. One of its most notable achievements has been the establishment of Telecenters (Nenasalas in Sinhala) throughout the country. Nenasalas offer the public access to knowledge and information; internet, email facilities, and e-learning along with training at affordable rates. The program follows a community model in which centers are established in the central location of a village such as a religious institution, public library or community organization. These centers act as a resource to disseminate knowledge, share information and access citizen services through the internet, with the ultimate goal of reducing poverty, peace building, economic and social development and improving the IT literacy of the country.

The e-Sri Lanka program is also supporting mass IT literacy through the e-Citizen program. The program offers two recognized ICT qualifications including International Computer Driving License and e-Citizen. The courses are available island-wide through training partners. The preliminary phase intends to target 100,000 citizens in a bid to increase ICT literacy levels which are currently estimated to be at a low of 10 percent. E-Citizen is expected to increase ICT adoption levels, with an additional 400,000 citizens estimated to master basic ICT skills in the next three years with a view to achieving the national target of a 60 percent ICT literacy rate. It will work towards ensuring uniform standards in quality courses for improving ICT literacy. In implementing these programs in an efficient manner, ICTA and the e-Sri Lanka project have created a national presence and heightened awareness of the benefits of ICT. It has also earned an international reputation within the development community world as a pioneering and innovative development agency.

Source: ICTA Quarterly Newsletter

Increased competition

Sri Lanka plans to expand its mobile phone market to 5 players, in a bid to bring down telephony costs. On January 18th 2007, India's Bharti Airtel Ltd. was licensed as Sri Lanka's fifth mobile phone operator. Bharti has agreed to invest US\$ 100 million within the first year of operation, and will begin commercial operations by 2008, offering 2G and 3G services. Bharti Mittel, Bharti's Chairman said that "the South Asia region offers tremendous growth opportunities and Sri Lanka is a very promising market for telecom services. Bharti Airtel, with its extensive experience and unique business model will strive to

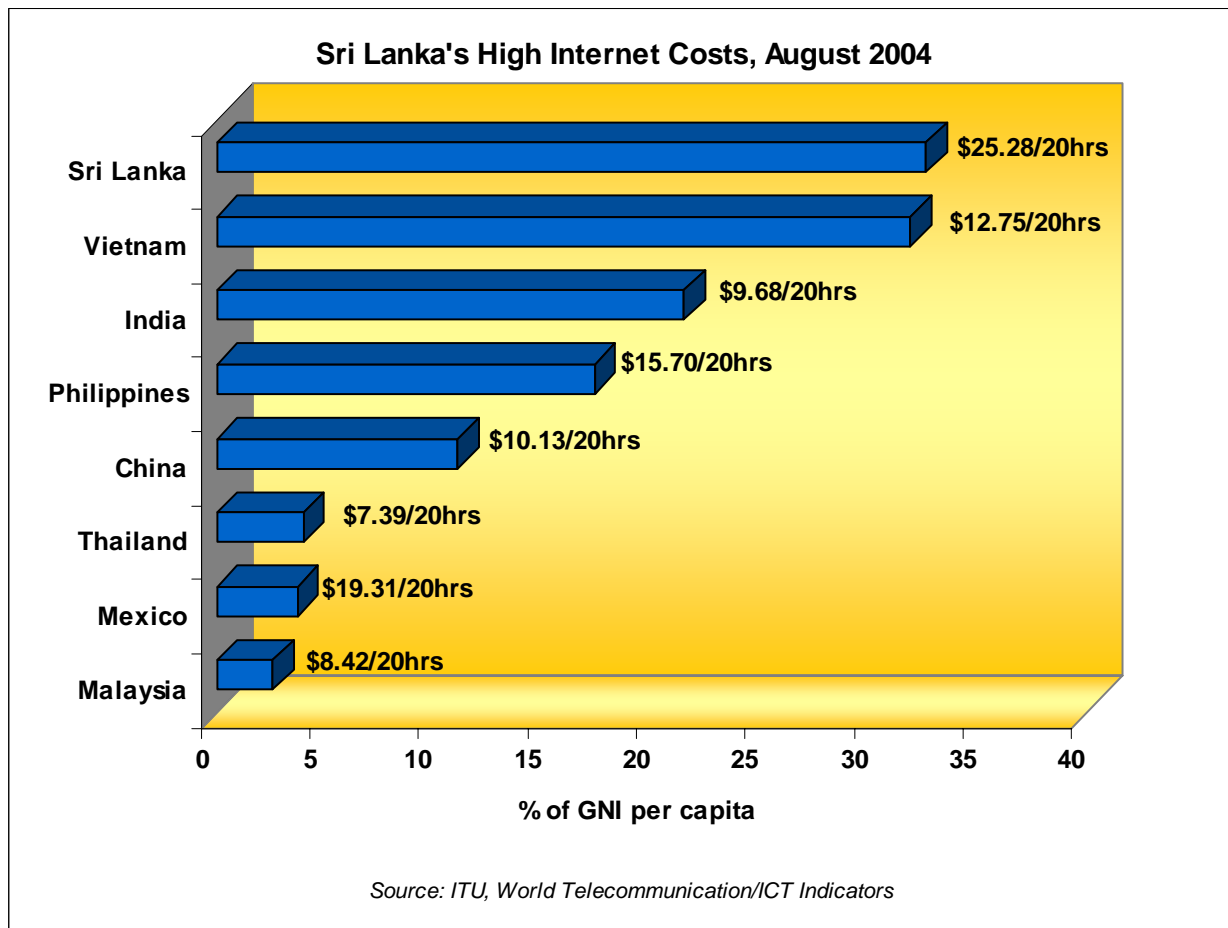
offer world class services at affordable rates to the people of Sri Lanka.”¹⁶ The addition of another player will help bring down the costs and improve the spread of connectivity across regions.

Key Challenges for Sri Lanka

High Costs of Connectivity and Lack of Competition

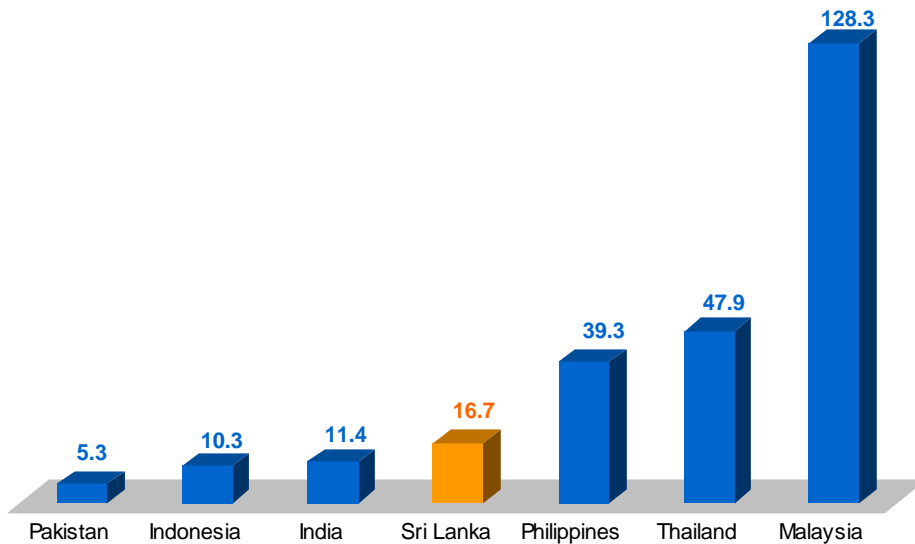
Sri Lanka pays some of the highest costs and receives low quality services for internet connectivity in the South Asia region. The country’s high costs are a reflection of the lack of competition present within the fixed line market. Sri Lanka’s price basket for 20 hours of internet amounts to \$25.28, more than four times the cost of that in Malaysia (Figure 12). What is even more significant and alarming is that Sri Lanka pays these high prices for some of lowest quality services in the region (Figure 13). A more competitive environment is needed to reduce costs and improve coverage and service.

Figure 12: Sri Lanka's Internet Costs remain uncompetitive in relative and absolute terms



¹⁶ Lanka Business Online, January 2007

Figure 13: Sri Lanka's low bandwidth per inhabitant

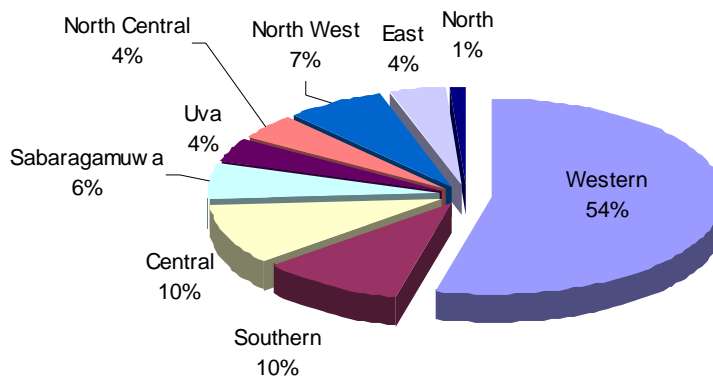


Source: ITU World Telecommunication/ICT Indicators

Poor Rural Connectivity and Penetration

Access to telecom infrastructure services is predominantly concentrated in urban areas and among the relatively wealthy centered in Colombo, Galle, and Kandy. In order to strengthen the information infrastructure and make more individuals IT literate, connectivity must reach Sri Lanka’s currently excluded groups. A total of 808,670 fixed phones were located in the Western Province in June 2006, while only 22,124 were in the Northern Province.¹⁷ With such large disparities between the levels of connectivity between provinces, the question arises of why these groups are still isolated. Many have argued that the opportunity costs associated with providing connections in rural areas is large due to the small amount of prospective subscribers, minimal usage, and the difficulties in collection. Money is available through the e-Sri Lanka initiative to support subsidized roll-out of broadband connectivity to the whole island.

Figure 14: Western Province has the lion's share of fixed line connectivity
Provincial Distribution of Fixed Phones in Sri Lanka in 2006



Source: Telecommunications Regulatory Commission of Sri Lanka, "Financial Analysis of the Telecom Sector"

¹⁷ TRC, Telecom Sector Financial Analysis

Box 3: Why does rural penetration remain low in Sri Lanka?

- Incumbents, namely SLT, do not see the economic gains from rural connections because they see only originating revenues; not the revenues generated elsewhere on the network from calls made to the rural areas. Unless the country has an appropriate interconnection regime in place, this problem will not be solved.
- More innovative new entrants will not go the rural areas because of the high costs associated with it. The highest cost item for a new entrant is backbone and it makes little sense to build backbone until a provider has developed enough traffic. In the early stages, most operators want to be able to use the incumbent's backbone on a non-discriminatory and cost-oriented basis.
- Operators have a choice on where to invest and investment is always constrained. Thus, it is reasonable that operators make assessments about where to put their investment dollars. This depends on costs (costs to use backbone; cost of getting a local authorities permission to build an antenna tower, etc.) and perceived revenues (how much the rural population is willing to spend on telecommunications).
- The hesitancy of operators to go to rural areas suggests that there is a real capital barrier in Sri Lanka's rural areas. Therefore, under e-Sri Lanka there was an attempt to implement a US \$20 million least-cost subsidy auction for the Deep South quadrant and the North East triangle. The money was obtained, the research was done, but the subsidy scheme failed to be completed as the idea of a "level playing field" does not exist within the telecommunications sector.

Source: Rohan Samarajiva, former Director-General of the Telecom Regulator Commission on the Lirneasia blog.

Policy Recommendations

Bring down costs by facilitating competition. The high costs of connectivity prevent more people from using ICTs and discourage current users from using them more widely and regularly. And future increases in the already high telecommunications rates will further inhibit public, private and civil society sectors' use of ICT. The TRC needs to promote preferential rates and other benefits for internet users, by facilitating a competitive telecommunications environment within an effective regulatory regime that ensures fair enforcement of government policy, holds operators accountable for performance, addresses consumer issues, monitors changing industry needs and provides feedback to the policy making units.¹⁸ The regulatory regime does not currently provide cost-based access to the backbone and thus, the main market operators offer their own subsidiaries preferential terms and conditions for access to the network. A competition commission would be able to address these issues and create the required level playing field. The government should consider revising the telecommunications law to address the issues of fair competition within the sector.

Increase rural sector connectivity by offering both infrastructure services and IT training. The digital divide itself can soon become a new dimension to poverty, leading to serious consequences for a country already suffering from growing inequalities. According to 2001 data, over 90 percent of internet connections and almost 54 percent of fixed line connections were in the Western Province. Particular attention must be paid to mobilizing ICT tools to solve problems of productivity, employment and income generation in rural areas where poverty is widespread. An explicit Universal Access Policy, to promote access to ICTs in rural areas and for all citizens should be established.

¹⁸ UNDP, 2004.

Create an enabling legal framework: Developing the country's ICT infrastructure cannot be implemented without improving the legal framework. The absence of laws and regulations leads to protracted legal situations. Sri Lanka desperately needs to establish a modern competition policy, and subsequently resolve ambiguities surrounding the relationship between the commission and the government. The commission should not report to a government official and it should not be staffed by ex-employees from the erstwhile incumbent. The commission should be given greater independence and authority for its regulation, as well as complete transparency and public participation in its procedures. Essentially, the transformation of the telecommunications market structure and regulator towards a more liberalized, technology-neutral model with few restrictions on cross ownership of multiple networks and services; the immediate opening up of the international services market, with no predetermined limitation on the number of licenses or the type of services to be offered; and a liberal licensing regime to permit maximum entry will be instrumental to the growth and development of Sri Lanka's information infrastructure.¹⁹

¹⁹ UNDP 2004.

IV. Cultivating a Scientific Culture

The relationship between technology and economic development is strong. Sri Lanka's ability to facilitate a scientific culture that encourages innovative thinking will determine the country's ability to effectively use knowledge for growth. The innovation system within a country consists of networks of institutions, rules and procedures, enterprises, universities, research institutes, think tanks, and consulting firms.²⁰

Adopting existing technologies and best practices is the quickest way to grow the economy. A recent report on innovation in India found that the country could achieve a five-fold increase in output simply from making better use of existing information available in the formal sector.²¹ Countries like Korea and Singapore also grew quickly by adopting existing technologies often handed down from Japan before becoming research and innovation hubs in their own right.

In Sri Lanka as in many other countries in South Asia, the primary agenda for Science and Technology (S&T) development remains the progression of institutions and universities and the institutionalization and professionalization of science in order to create a science culture.²² The general underdevelopment of these national scientific communities within Sri Lanka and most of the South Asia region is a reflection of the low priority accorded to investment in S&T over the past few years.

The most influential innovation systems are those that are able to facilitate a steady production of applied scientific knowledge. This requires a comprehensive university system, national recognition and rewards, full time specialized research institutes in critical areas of national importance, research networks and corresponding journals and professional academic bodies. It also requires a social and political legitimacy for science with steady state support, and the existence of an intellectual climate where individual scientists within national boundaries do not experience a sense of isolation.²³ In order for Sri Lanka to develop its innovation system, it will need to find efficient ways to bolster interactions between the major players: the government, research institutions, universities, and the private sector while assigning Research and Development (R&D) high priority in the near future.

Benchmarking Sri Lanka's Innovation System

Although Sri Lanka has made great advances in innovation, particularly in the agricultural sector, the country still lags far behind its more dynamic South Asia counterparts. Sri Lanka is home to several impressive research institutes with a long history such as the Industrial Technology Institute (ITI) and the National Engineering Research and Development Centre (NERDC). These bodies have played important roles in the development of national and firm level technological capabilities and produced a large number of scientific minds in the process.

The current innovation system within the country has been unable to make the great strides. In terms of absolute size, Sri Lanka performs poorly as the country lacks the critical mass of researchers and scientists that some of its regional counterparts (especially India and China) are well endowed with (Figure 15). The trend in the number of world researchers is essentially a result of the low investment assigned to the R&D sector. The developed world houses 71 percent of world researchers while the developing world maintains a mere 29 percent. This low percentage is also substantially made up of researchers from India and China. Sri Lanka currently has a total of 5,254 scientists spread among 13

²⁰ World Bank 2005a

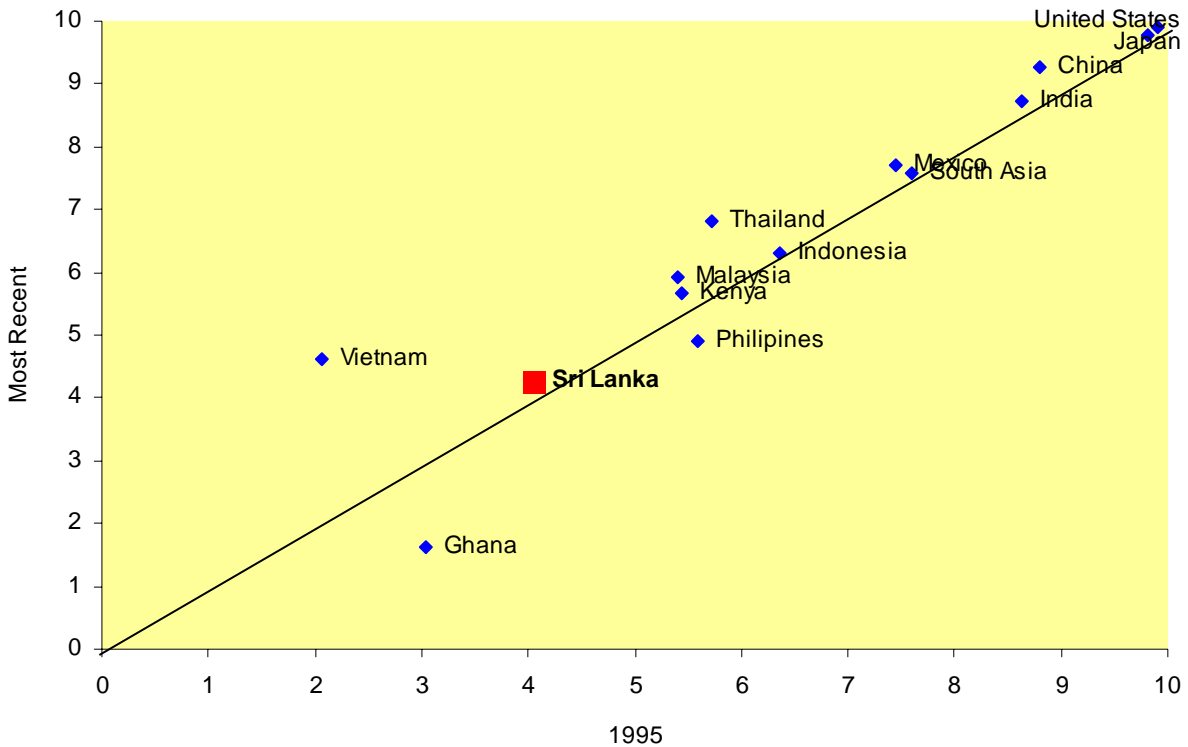
²¹ Dutz 2007

²² UNESCO, 2005

²³ Ibid.

universities and 19 R&D institutes, and more than 60 percent of these R&D institutes are agriculture based.²⁴ Although Sri Lanka has slightly improved its scientific capacity since 1995, the country still has a long way to go in creating a more research oriented society and producing a larger and more prominent population of innovators.

Figure 15: Sri Lanka's Innovation is slowly improving



Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Technology Achievement Index

Sri Lanka has neglected science and innovation in recent years. The country has some of the lowest numbers of post-graduate students in the science fields within the South Asia region. It there lacks the human resources needed for innovation. The 2001 Technology Achievement Index (TAI) attempts to capture how well a country is creating and diffusing technology while building a human skill base. It reflects a country's ability to participate in the technological innovations of the network age. The components of the TAI focus on the country's ability to adapt products and processes to local conditions, execute the diffusion of recent and older innovations, and its possession of a critical mass of individuals that are able to adapt and master the constant flow of new innovations. Countries are grouped into four categories in the index: leaders, potential leaders, dynamic adopters, and the marginalized. Sri Lanka finds it place towards the end of the dynamic adopters, ranked 62 out of 72 countries. Yet it surprisingly places just ahead of India (63). The index also shows that Sri Lanka has some of the lowest figures for gross tertiary science enrolment out of the 72 countries indexed.²⁵

A generation ago, Sri Lanka produced an influential group of science and technology graduates, but over the last few years, due to the unappealing and disadvantageous nature of the current research industry which provides individuals with low salaries and almost no professional mobility, the country

²⁴ Ibid.
²⁵ UNDP, 2001

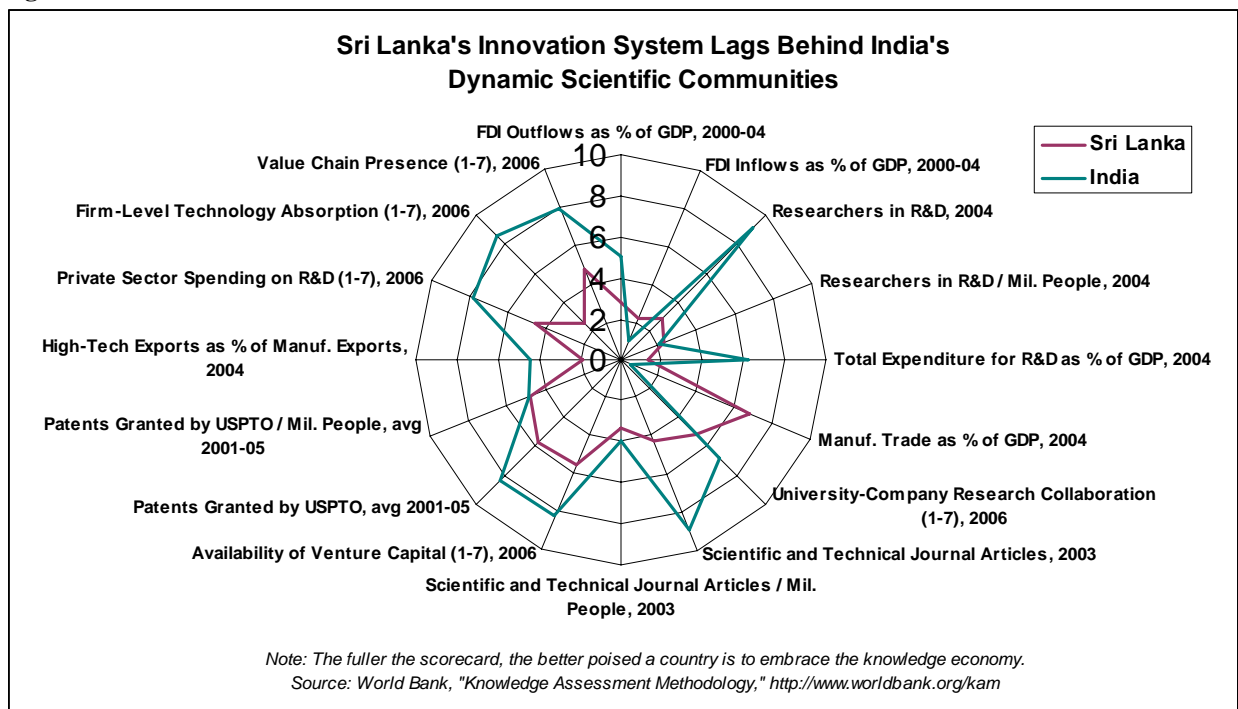
has lost a significant portion of its science-minded individuals to more “practical” professions of administration and business. A large number of the country’s academics have also left for overseas posts. The index is a testament to the popularly held belief that if Sri Lanka wants to embrace the knowledge economy, it will need to craft a scientific culture, one that encourages individuals to participate and find value in innovation and creation.

National Innovative Capacity Index

Sri Lanka has an inadequate scientific environment that is unable to respond to the demands of the industry. The National Innovative Capacity Index measures a country’s potential, as both a political and economic entity, to produce a stream of commercially relevant innovations. National Innovative Capacity depends on the technological sophistication and the size of the scientific and technical labour force, while reflecting the array of investments and policy choices of the government and private sector that affect the incentives for and the productivity of a country’s research and development activities. The index depends on three broad elements including common innovations infrastructure, cluster-specific environment for innovations, and the quality of linkages.²⁶ Sri Lanka ranks 57 out of 71 countries indexed, behind India, China, Malaysia, Mexico and the Philippines.

Within the sub-index of innovation policy and cluster innovation environment, Sri Lanka scores slightly below its overall rank at 60 and 62, respectively. However, the country ranks higher in its proportion of scientists and engineers (56) and linkages (48). The index demonstrates that Sri Lanka still struggles to establish a cluster-innovation environment that encourages efficient research and development activities fuelled by domestic buyers, and responded to by specialized research and training institutes.

Figure 16: Sri Lanka needs more focus on Innovation



Sri Lanka spends a small percentage of its GDP on R&D, amounting to only 0.14 percent in 2004. A National Science Foundation (NSF) Survey found that Gross Expenditure on Research and Development (GERD) was US\$ 18.1 million or 0.19 percent of GDP in 2001, which is not significantly different from

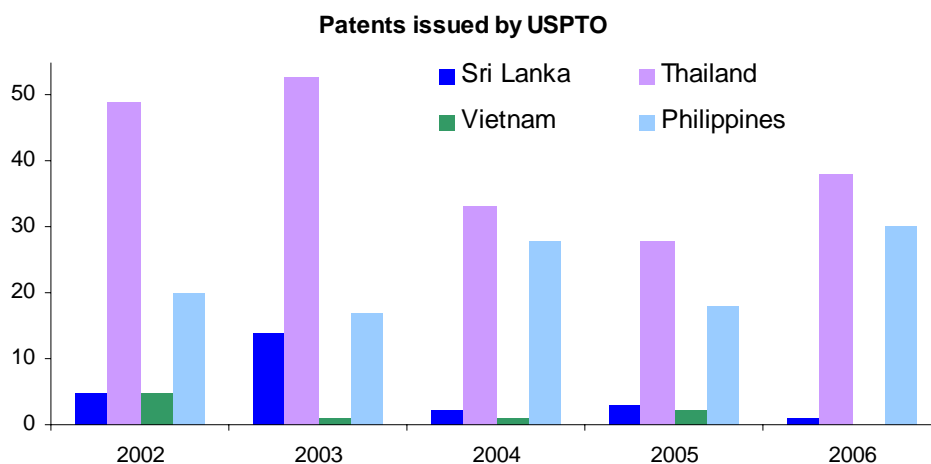
²⁶ National Innovative Capacity Index

investments in either 1996 or 2004, indicating a relative stagnation in the country's R&D efforts.²⁷ Since the 1979 Vienna Conference on S&T for Development, when many international and national agencies advocated devoting 1 percent of GDP to R&D, few countries within the South Asia region have been able to meet this goal. China, a clear outlier in this category, allocates 1.44 percent of its GDP to R&D, significantly more than any other comparator country. India has increased its spending on R&D to 0.85 percent of its GDP suggesting the high priority given to the development of the innovation system.²⁸

The Mahinda Chintana: Vision for a New Sri Lanka has a policy goal of progressively increasing both public and private investment in science and technology, up to 1.5 percent of GDP by 2016. If Sri Lanka wants to become progressively competitive in the innovation era, it will first and foremost, need to assign more value to the capabilities of innovation creation by following through with its policy goal of increasing spending on R&D from all sectors of the economy.

Sri Lanka has been granted a minimal number of patents over the last few years. The number of patents granted is one of the most efficient ways in which to measure a country's innovation system. The current intellectual property system in Sri Lanka, based on the Intellectual Property Act No. 36 of 2003, was designed to promote national creativity, to protect such creative efforts, and honor the country's international obligations under the TRIPS agreement. The National Science Foundation of Sri Lanka found that the total number of patents granted in Sri Lanka from 1995 to 2001 was less than 230, with research institutes only generating 7.7 percent of total patents.²⁹ US Patent and Trade Office (USPTO) patents, in particular, are a good measure of realized national innovative performance because the high costs involved in filing such a patent application deters all but the most determined inventors that have developed innovations with potential economic value. Additionally, the use of US patents helps ensure a standard of technological excellence that is at or near the global technology frontier. The average amount of patents granted by the USPTO to Sri Lanka from 2001-05 was 5.2, one of the lowest averages within the region China and India maintain some of the largest figures for patent grants at 448.2 and 316.4, respectively. However, Vietnam scores lower than Sri Lanka with an average of 1.8 patents between 2001 and 2005 (Figure 3-3).³⁰

Figure 17: Very few patents issued to Sri Lankans



Source: USPTO Performance and Accountability Report 2006

Publications, high-tech exports, and Sri Lanka's venture capital programs are good indicators of the country's need for modern improvements in its innovation system. Sri Lanka possesses a fair number of

²⁷ UNESCO, 2005

²⁸ Ibid.

²⁹ UNESCO, 2005

³⁰ Ibid.

researchers who are keen on publishing their findings in academic journals. However, it has been noted by The National Science and Technology Commission (NASTEC) that these valuable findings rarely succeed in being commercialized as researchers are unable to see the value in publicizing such findings, and as a result, many of these works remain gathering dust on shelves.³¹

A country's high-tech exports are another significant measure of a country's ability to innovate and commercialize their findings effectively. Sri Lanka's high-tech exports amounted to 1.5 percent of total manufactured exports in 2004, one of the lowest percentages in the region. The Philippines has some of the highest figures in the region, exporting 63.8 percent high-tech products, figures that surpass even the dynamic innovators of China and India.³²

Sri Lanka's private sector, which possesses the ability to facilitate contracted innovation, can create liaisons between researchers and the global community, thereby resulting in a greater level of efficiency in the production and distribution of useful knowledge.

Turning good ideas into promising business products and solutions requires start-up or venture capital funding. The availability of venture capital in a country is a good measure of the opportunities that researchers have in seeing profitability in their findings. In this regard, Sri Lanka also scores poorly with a score of 3.4 in 2006 behind Thailand (3.6) and India (4.6).

Issues and Recent Developments in the Innovation System

Public Sector Support for Innovation

The government has a dominant role to play in the cultivation of an influential innovation system through its financing of R&D. Governments around the world finance R&D to complement the efforts of the private sector. In Sri Lanka, public sector financing of S&T development has come in the form of funding a network of S&T institutes mandated to carry out R&D in various fields. However, gross expenditure on R&D (GERD) has been overshadowed and squeezed by military spending. Military expenditure consumed an average 2.6 percent of GDP between 2003 and 2005. The long neglect of spending on R&D has and will lead to an even greater crisis in the professionalization of national scientific communities, depriving the country of the opportunity to expand its innovation system.

Funding alone cannot improve the effectiveness of Sri Lanka's innovation system. The innovation system and its corresponding activities will need to be carefully facilitated by both government and the private sector. Sri Lanka needs to determine an entity that can identify priorities, objectives and goals, and formulate strategies to reach these goals by creating an effective management framework. However, from Sri Lanka's extensive history of creating government bodies to execute such tasks, it has been observed that these types of organizations, on their own, cannot ensure efficiency within the innovation sector. Rather, these responsibilities should be largely assigned to the private sector and the government should take it upon itself to promote the pursuit of R&D by providing the necessary benefits and support in order to assist the private sector in cultivating a more attractive innovation system, a system that is based on competition between the public and private sectors for scarce government resources.

³¹ De Costa, W.A.J.M, NASTEC

³² UNESCO, 2005

Box 4: History of Sri Lanka's Innovation System

Sri Lanka made many technological advances early on in order to meet the needs of its promising agricultural industry. Sri Lanka's modern technology era began with British colonization in the 19th century. During this pre-Independence period, the British intended to develop Sri Lanka as an agriculture base and identified tea, rubber, and coconut as the main produces to be distributed from Sri Lanka to the world market. In order to facilitate the production process, the British created major railways, road networks, engineering and medical research institutes, hospitals, clinics, and various agricultural research institutes. The major technological achievements during this time were made in hydropower electricity generation, transport, telecommunication, and broadcasting fields.

After independence in 1948, a significant amount of influential R&D institutions were established in order to develop Science and Technology in Sri Lanka. The first of this kind was the Ceylon Institute of Scientific and Industrial Research (CISIR), but the institute failed to deliver its objectives due to inadequate staff, lack of research groups, too broad an area coverage and lack of linkages with industry. The Industrial Development Board (IDB) was set up in 1966 to provide technical services to Small and Medium scale Industries (SMI). It was expected that IDB would inform other R&D organizations about the technology needs and capabilities of other industries. However, this initiative was also unsuccessful. In 1974, the National Engineering Research and Development Centre (NERDC) was set up in order to execute and promote research, innovation and commercialization. Under the recommendation of United Nations Center for Trade and Development (UNCTAD), a Centre for Transfer and Development Technology was created as a focal point to link R&D institutions with national economic planning status. The organization's inability to see these objectives through has been one of the greatest failures in the development of Sri Lanka's innovation system.

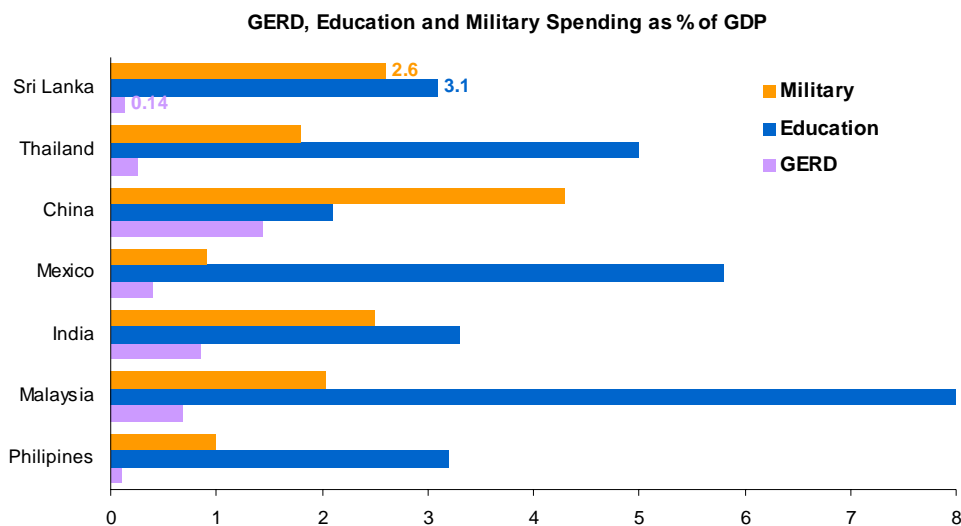
Following the 1977 policy reforms, the private sector was given a leading role in the economy and private R&D activities grew at the industry and firm levels. However, following this brief period of technological and organizational advancement, the escalation of the ethnic conflict in 1983 effectively brought the development of Sri Lanka's innovation system to a standstill, as government expenditure was diverted predominantly to war rather than industrial development. S&T development has been stagnant since 1983. Prior to independence, there were great advancements in agricultural research, but following independence, the most significant reason for failure was the lack of high level political commitment, the lack of support for R&D activities by the government and the private sector, and the poor performance of the scientific community to stimulate innovation.

Source: Dasanayaka, Sarath. 2003. "Technology, Poverty and the Role of New Technologies in Eradication of Poverty: The Case of Sri Lanka." South Asia Conference for Poverty Reduction, New Dehli, 2003.

The government should increase the level of participation in the innovation sector by offering financial incentives that would make the field more attractive. A 2001 NASTEC study on Sri Lanka's S&T institutions sought to provide insight into the achievements, activities, successes, and failures of some of the country's leading think tanks by conducting interviews with Institute Heads. A few of the institutes surveyed included the Department of Agriculture, Industrial Technology Institute, National Engineering Research & Development Centre, National Science Foundation, and 11 others. The study found that there existed significant shortages of trained and experienced personnel. The institutions attributed these flaws to strict government restrictions on staff recruitment, which led to frozen or delayed staffing of new personnel.³³ The government has the capability of removing these restrictions and implementing ones which seek to improve innovation including offering direct and indirect tax incentives for R&D or providing more funds for scientific training, which it currently does.

³³ De Costa, W.A.J.M, NASTEC.

Figure 18: Sri Lanka's spends little on R&D compared to its Education and Military spending



Source: UNESCO Science Report 2005, <http://www.photius.com/ranking> (for military expenditure as % of GDP), www.unesco.org (education expenditure), World Bank, SIMA Database (GERD)

Since 2002, the Sri Lankan government has provided an annual allocation of roughly 40 million rupees to the Council for Agricultural Research Policy for postgraduate training in other South Asian countries. As of 2005, a total of 42 Sri Lankan scientists received MSc training while 38 received training at the PhD level.³⁴ Training in countries within the region has been advantageous because it is high quality, relevant to local conditions, comparatively cheap, and provides a higher chance of trainees returning to Sri Lanka upon completion of their studies. As the Sri Lankan government's present policy has been a success thus far, seventy-five percent of the scientists are slated for training within the next ten years. Policies such as these should be extended to other research disciplines in order to increase the knowledge of scientists working in institutions and encourage students to pursue academic opportunities abroad.

Innovation and the Academic Network

As knowledge becomes an increasingly important part of innovation, the university as a knowledge producing and disseminating entity plays a larger role in industrial innovation. Over the last few years, there has been a realization that the academic sector has the capability of emerging as a major source of scientific innovation. Yet this realization has not been received much attention from policy planners in South Asia. The Vice Chancellor of the University of Ruhuna, argues that in order for the country to improve its global competitiveness and raise living standards, it must create an entrepreneurial mentality within academic institutions, producing unique and creative minds that possess the ability to produce results by commercializing their findings. Universities must see themselves as part of a larger global enterprise of creating, imparting, applying, and commercializing knowledge.³⁵

In order to increase the number of students pursuing higher degrees in the sciences, universities must introduce entrepreneurship to the curriculum in order to teach students the ways in which to make their findings profitable. In Sri Lanka, the majority of students who are taught entrepreneurship are pursuing degrees in management and business. In order to produce graduates who can transform new ideas, thoughts, and knowledge into innovative products and services, Sri Lanka will need to build up an entrepreneurial intelligence within all disciplines and train students on how to commercialize their

³⁴ Stads, Gert-Jan et. Al. 2005.

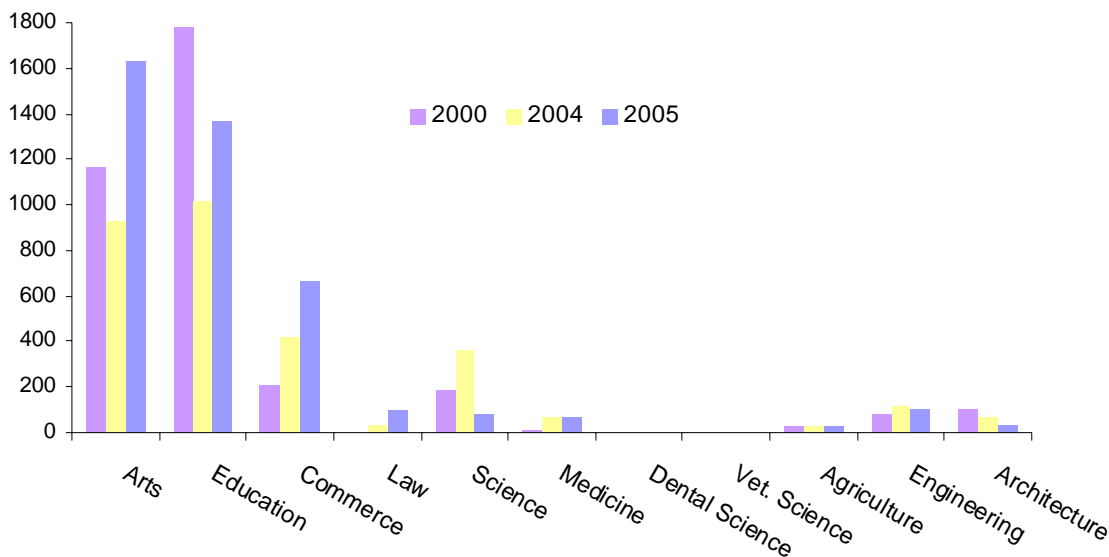
³⁵ Senaratne, Ranjith. 2006.

findings. “Multidisciplinarity will bring new and diverse perspectives and provides for cross-fertilization of ideas instead of inbreeding.”³⁶

Sri Lanka’s researchers do not have the expertise to commercialize their research findings. When Sri Lankan researchers publish their works, nothing is done to commercialize them. Some of these findings could potentially be developed into commercial products but because of a lack of entrepreneurial skills and drive, “thousands of valuable findings in many disciplines that could have given birth to new enterprises promoting industrial growth and economic development in the country, are gathering dust on the shelves of libraries”.³⁷ The national innovation capacity report states that a nation’s university system can provide a bridge between technology and companies and without such linkages, a nation’s upstream scientific and technical advances can diffuse to other countries more quickly than they can be exploited at home.³⁸

Universities can create the linkage between research and industry. Universities of the 21st century should play three roles: deliver quality undergraduate and post graduate education, conduct high impact research, and foster entrepreneurship and links to the private sector. Sri Lanka’s linkages between universities and industry are currently minimal, and in order to increase the flow of knowledge between these two pillars of the innovation system, it will be important to invite industry representatives to develop and conduct courses at the universities. These interactions will help develop the entrepreneurial skills and ignite the entrepreneurial passion of students, thereby helping them develop as researchers with an awareness of modern trends, market requirements and a commercial focus.

Figure 19: Low Science enrolment in Sri Lankan universities



Source: Sri Lanka University Grants Commission

Innovations and R&D Institutions

Sri Lanka needs to create a motivational environment within its S&T institutions to boost innovation. The country’s research institutions have made great leaps in innovation, particularly in the field of agriculture as the country is home to some of the most dynamic agricultural research institutes in South Asia. Sri Lanka also maintains an impressive number of scientists by South Asia standards (191 per

³⁶ Ibid

³⁷ Ibid.

³⁸ National Innovative Capacity Index

million inhabitants by 2004), although this number has remained stagnant since 1996. The country has also made gradual advances in the production of scientific material, publishing 120 papers in all S&T fields in 1994 and slightly increasing this figure to 141 in 2003.³⁹ However, the scientific advances within these institutions are not enough in the innovation era. Thus, institutions and other innovative clusters will need to provide incentives and create a professional climate that will encourage researchers to innovate in an entrepreneurial way. In the aforementioned NASTEC study on Sri Lanka S&T institutions, it was found that low salaries and fringe benefits and demotivating work environments created by a lack of finance, shortage of modern equipment and laboratories, and inadequate logistical support had prompted trained and skilled personnel and promising young personnel to leave the public sector S&T institutes.⁴⁰

Lack of financial resources was the most commonly cited disadvantage plaguing Sri Lanka's R&D institutions. A recent study found that many institutions had been suffering from funding shortages including funds for capital expenditure and as a result, there had been a gradual rundown of existing infrastructure facilities including equipment, laboratories, buildings, and vehicles. Even in the rare occasions where finance was present, financial regulations slowed the process with long delays in the release of approved funds from the Treasury.⁴¹

Sri Lanka's universities are bogged down in red-tape and bureaucratic procedures. An online survey was conducted through the Lanka Academic, a journal read by mostly expatriate Sri Lankans, in which 53 researchers who had experience in both foreign and Sri Lankan research environments were surveyed. The survey found that 33 percent of professionals felt that the time consumed by the procurement process in the Sri Lankan university system was more than 20 times that of foreign universities. This delay often made topical research projects irrelevant. About 68 percent of researchers had to go through this long "red-tape" at least five times a year, making the country's R&D significantly inefficient. Even with the funds secured from outside funding agencies like the NSF, the exact item desired cannot be specified when ordered through the university. This means that the supplies department will call for quotations and purchase the cheapest substitute, overlooking the type of item the researcher actually needs.⁴² This lack of funds, facilities, and administrative support for conducting meaningful research makes it difficult to maintain motivation, dedication and commitment to research and development work under such poor conditions.

R&D institutes have not been able to find an efficient way in which to conduct research, leaving researchers with ambiguous goals and objectives. Although most institutes have a well developed corporate plan, many are not feasible or practical and more importantly there are no benefits associated with attaining the plan objectives. Rather, researchers work in isolation with vague objectives which, aside from creating a demotivating environment, caused an increased duplication of projects that lacked commercial focus, forgoing most of the benefits that ought to arise from such work.⁴³

Public sector research institutes produce very little outputs. In 2001, individual inventors and private institutions claimed 72 percent and 22 percent of patents, respectively; while a mere 6 percent of patent grants went to public institutions, demonstrating the effects of the lack of direction that exists within the research institutions.⁴⁴ It is these inefficiencies that have driven many corporate partners to seek direct collaboration with more organized, foreign institutes. Researchers at the Institute of Fundamental Studies (IFS) maintained one of the few programs that were motivated to publish their research findings as their appointments and promotions were linked to publications. Unlike the IFS, most institutions claimed that

³⁹ UNESCO, 2005.

⁴⁰ De Costa, W.A.J.M, NASTEC.

⁴¹ Ibid

⁴² Nanayakkara, Thrishantha.

⁴³ De Costa, W.A.J.M, NASTEC.

⁴⁴ USPTO, 2006.

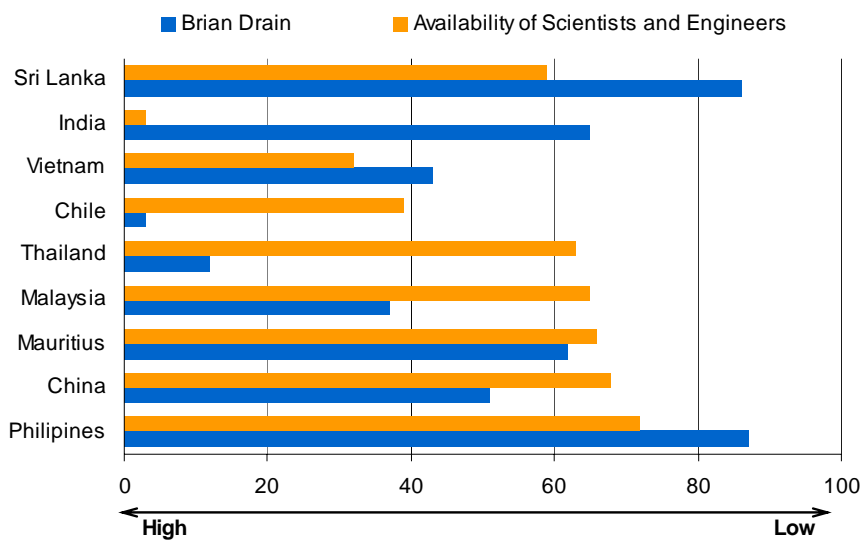
there was little incentive and pressure on researchers from respective institutes to publish their research findings in reputable journals.

Low salaries and lack of opportunities for higher education and career advancement has led to both internal and external brain drain. Scientists and researchers working at public institutions have salaries well below individuals working in the private sector, thereby making it difficult to attract a high caliber of staff. Moreover, Sri Lanka's R&D institutes offer little to no room for career advancement, further adding to the disincentives associated with being employed within the research sector. This has resulted in both an internal and external brain drain within Sri Lankan R&D institutions. Internal brain drain is loss of core competencies within R&D institutions due to a critical mass of professionals leaving the public institutions within a country for private employers. External brain drain is the emigration of professionals whose departures cause a potential loss to the economy. Providing incentives and creating a professional climate to attract and reverse brain drain will be increasingly important for the development of Sri Lanka's innovation system.

Innovation and the Private Sector

Sri Lanka's private sector has contributed a great deal to the country's innovation system. At the firm level, Sri Lanka does fairly well for South Asia, scoring 4.7 from 7. Thailand does significantly better with a score of 5.3, while India tops the region with a 5.8.⁴⁵ Establishing linkages between the institutes, universities, and other think tanks, while having the private sector set the goals and objectives for the institutions and in exchange assisting researchers market their findings, will produce an industry that encourages innovation, provides individuals with better salaries and opportunities, and makes a significant contribution to the economy.

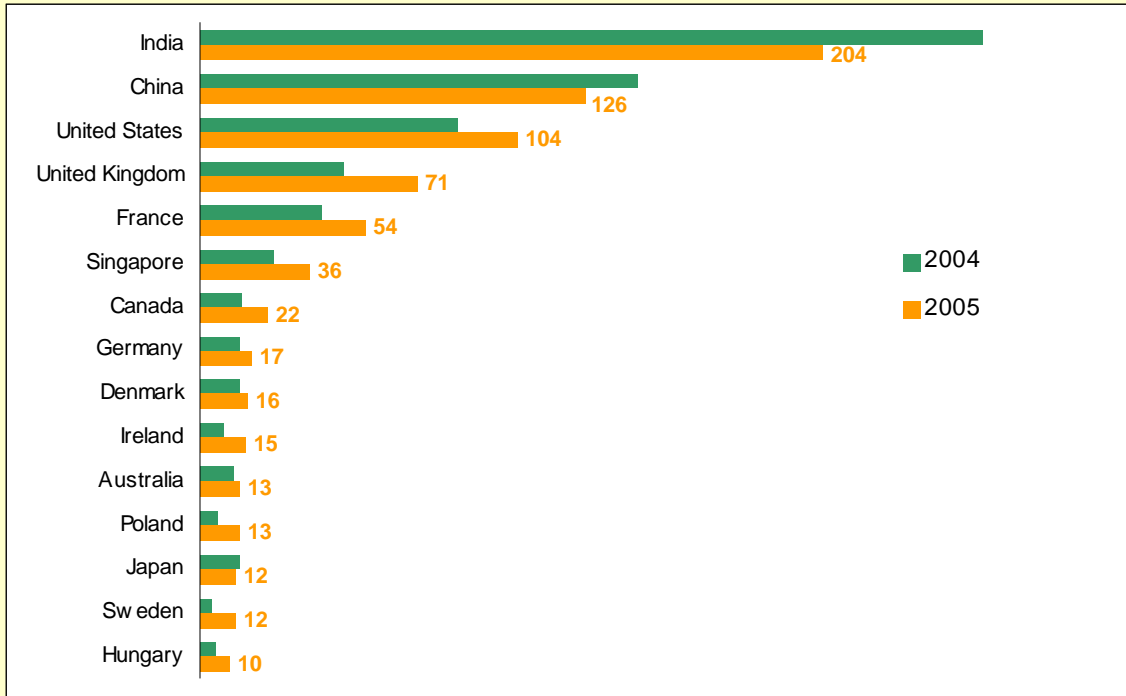
Figure 20: Sri Lanka is unable to preserve its Science and Engineering talent



⁴⁵ World Bank, KAM.

Box 5: The New Era in Networking: Global Innovation Networks

Figure 21: India and China Rank Highest for Number of R&D projects



Source: Forrester Research Inc., 2006

Even as India and China (“Chindia”) rapidly emerge as major innovation hubs, it will be just one (major) hub within the larger Global Innovation Network. The opportunity for firms and even countries around the world is to network these global hubs, and harness global talent to drive innovation. The core competency of a business becomes “knowledge networking”, no longer “knowledge generation”. The same would apply to a country looking to be a global networking hub. Global Innovation networks will emerge where inventors, transformers, financiers and brokers need to be brought together to catalyze and operationalize innovations.

Taking regional innovations for instance, a country like Sri Lanka could position itself in one of these roles within the regional innovation network. For example, Sri Lanka could be a ‘transformer’ that acts as a liaison to convert inputs from investors into market-relevant and usable products of services and provide feasibility reports and business and marketing plans for projects in the region as well as projects from other networks into the region. It could string together supply chain, sales and marketing operations and contract manufacturers, freelance experts and consultants from a database on behalf of the client firm abroad. Sri Lanka could also position itself as a broker, who finds and connects investors, transformers and financiers and facilitate their interaction. It could handle business development and IP licensing etc. as well as liaise with trade associations, community leaders, NGOs, online IP/talent marketplaces, IT solutions providers and potential customers – all this on behalf of the client company abroad, who is now relieved of having to do the ground work themselves.

For this Sri Lank will have to build up competencies and capacities in each of the areas required for such this networking advantage, everything from engineering and scientific knowledge in order to handle IP licensing or contract engineers, constructors and manufacturers to accountancy, business development and marketing skills to handle the ‘transformer’ and ‘broker’ role by preparing feasibility reports, cost and profit forecasts, industry reports etc. IT skills will be at the fore of all this, in order to effectively handle a liaison role and communicate with, as well as address the needs of, the client abroad.

Policy Recommendations

In order for Sri Lanka to create a powerful innovation system, the country will need to formulate specific policies to establish a culture that not only values innovation, but also possesses the means and skills to commercialize and promote new knowledge. NASTEC recently published a proposed National Science and Technology Policy Statement with the intention of providing a consistent long term framework for growth and development in the S&T infrastructure. However, this proposed strategy is yet to be approved and put into action. As a result, the innovation system still lacks structure and direction.

Spending on R&D needs to increase significantly. Sri Lanka needs to assign greater priority to innovation within the country in order to meet the ‘historic’ figure of devoting 1 percent of GDP to R&D, advocated by numerous international and national agencies. This spending must not come only from government, but private sector funding and involvement is essential to ensure that the budget is allocated efficiently.

Linkages between research and industry must improve. Educational institutes must get market feedback by liaising constantly with employers. Government can encourage this process by inviting the private sector to positions on the boards of academic departments to advise universities on training and research priorities. The flow of information between universities and enterprise sectors needs to be increased. In another sense, this will increase the number of students looking to take part in S&T as they will be exposed to existing opportunities within the field. In order to create a viable innovation system, Sri Lanka’s research institutes will need to pursue research that is relevant to the needs of the private sector and the economy, and this will only happen through establishing a dialogue between researchers and the private sector.

Government could introduce tax and other incentives to encourage individuals to take part in innovative activities. Although the government cannot on its own shift people’s minds about the field of research and development, it can fund the public good aspects of research. Government can also establish a financial reward system based on research performance and national prizes that recognize research excellence. Sri Lanka should also enforce and implement IPR agreements to develop the confidence of domestic and foreign innovators in the protection of their innovations. Government should also consider increasing university salaries especially in the S&T fields. Failure to compensate researchers with incentives and competitive salaries will only worsen the brain drain and the country’s innovation system.

Make entrepreneurship a priority in the sciences. Introduce entrepreneurship as a course within each discipline, both scientific and non-scientific, in order to teach students how to capitalize and promote their findings, thus making R&D a more attractive field.

Procurement should be decentralized to individual departments or research centre levels. The decentralization of responsibilities such as purchasing should be brought to department, research centre, or laboratory levels in order to provide researchers with a level of efficiency in obtaining the equipment necessary to make valuable discoveries within appropriate time frames.

V. Advancing Sri Lanka's Education System through Quality Inputs

Sri Lanka's ability to create a demand driven education system that focuses on lifelong learning will determine the country's capacity to embrace the benefits of knowledge economy. A successful education system will focus on learning rather than schooling, and creating an enabling environment that promotes creativity, improves the quality of basic and tertiary education, and provides opportunities for lifelong learning.

Developing lifelong learning systems and improving quality are the keys for Sri Lanka. A lifelong learning system involves learning from early childhood to retirement and includes formal training (schools, training institutions, and universities) and non-formal learning (on-the-job training, and skills learned from family members and people in the community).⁴⁶ It will be increasingly important to raise participation, finance, and quality at all levels. The education provided should effectively provide the labour force with the skills necessary for the emerging knowledge economy: an economy that will require hard skills including literacy, ICT competencies, and a new set of soft skills, including communication, problem-solving, creativity, and teamwork.

Sri Lanka will need to focus on improving the quality of education. Sri Lanka has been successful at producing a population of literate individuals. However, literacy alone will no longer suffice in the knowledge era. It will be increasingly important for educated individuals to supply the workforce with the market oriented skills needed to create rapid economic growth and national development. The government's new development plan, *Mahinda Chintana: Vision for a new Sri Lanka*, intends to transform the education system into one that will provide the technological skills, educational content, and methods to promote the development of inquiring and adaptable minds. This goal will only be accomplished by increasing educational funding and devoting increased resources to modernize the school curriculum, develop the teacher training system, and upgrade the examination and evaluation system. Introducing IT, English language training and greater use of technology will be important to impart the necessary skills and orient the education system to the world of work.

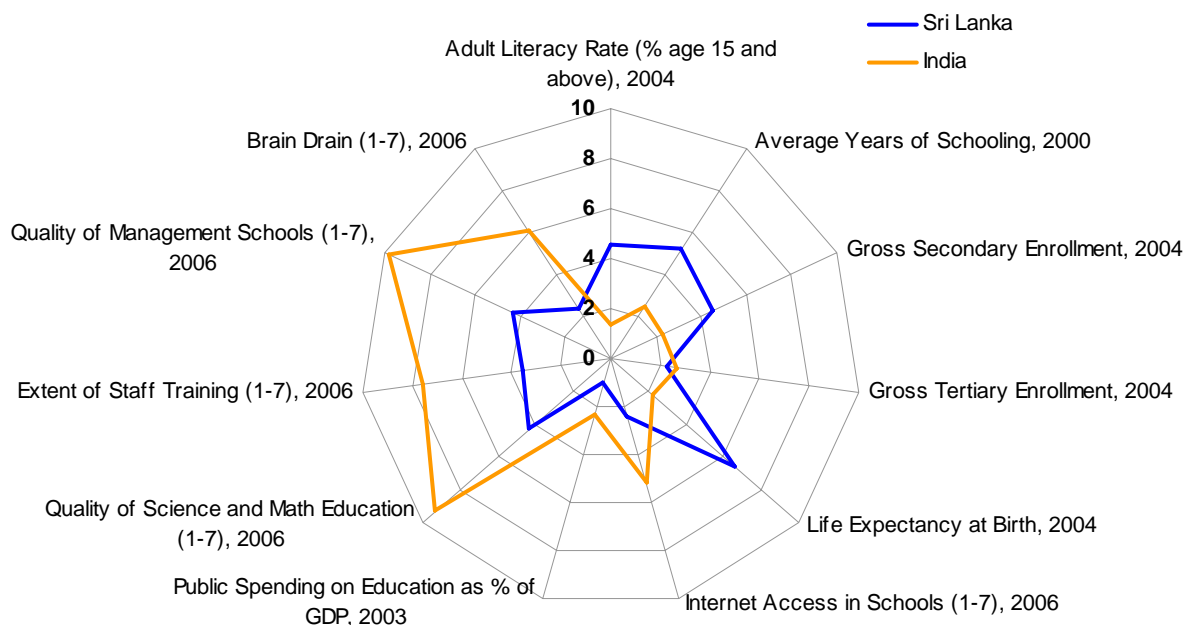
Benchmarking Sri Lanka's Education System

Although Sri Lanka has managed to achieve high levels of literacy, it has been unable to provide students with high quality educational services. Sri Lanka ranks poorly in terms of science and math education and internet access in schools. Alternatively, India has been able to provide its students with quality science and math educations, well trained staff, and well managed schools despite low levels of adult literacy.

Sri Lanka's efforts have been primarily concentrated on basic education, particularly secondary, with much less focus on higher levels of education. In order to participate successfully in the knowledge economy, the country will have to increase quality inputs such as IT access, constructive and effective teaching, better math and science education, whilst constantly consolidating existing high levels of literacy.

⁴⁶ World Bank 2005a.

Figure 22: Lack of Quality Inputs in Sri Lanka's Education system



Source: World Bank Knowledge Assessment Methodology, www.worldbank.org/kam

Issues and Recent Developments in the Education System

Governance of the Education System

To create an effective education system, Sri Lanka will need to give more autonomy to educational institutions. The general education sector in Sri Lanka has a complex governance framework. The central government is responsible for national education policy at all levels and administers around 325 national schools. It is responsible for establishing the school curriculum, setting the curricula of teacher education institutions, accrediting textbooks published by private firms, publishing and distributing textbooks, and providing school uniforms and transport subsidies. It also administers the professional development programs and courses for principals, section heads and teachers, conducts examinations, and executes a range of education development measures and initiatives. At the same time, provincial councils administer the school system by developing education plans and budgets, and deploying education administrators, principals and teachers within the province.⁴⁷ In order to increase the effectiveness and performance of schools at all levels, it will be important to further devolve education management down to the level of individual education institutions and involve local communities, to empower frontline service providers such as principals, section heads and teachers.⁴⁸

Spending on education

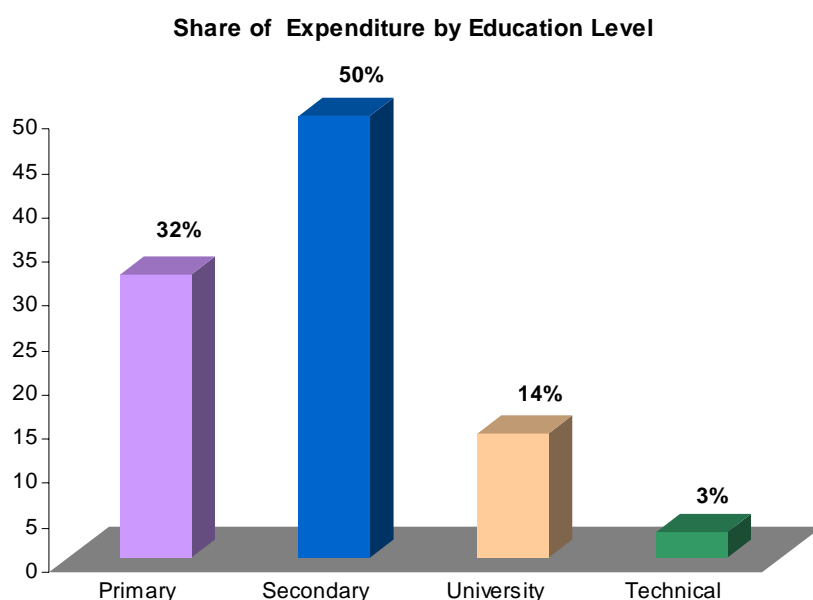
Sri Lanka currently devotes a comparatively small percentage of its government expenditure towards education and a large percentage is distributed towards secondary education. Investments in both basic and higher education are fundamental for countries to improve the productivity and quality

⁴⁷ World Bank, 2006d.

⁴⁸ World Bank, 2005b

of labour and deliver the manpower needed for development. Sri Lanka's public expenditure on education has remained at between 2-3 percent of GDP during the past decade and a half, compared to a 3.5 percent average in the rest of South Asia.⁴⁹ In 2005, the education budget increased to 2.7 percent of GDP amounting to LKR 40 million (USD 415 million), after having fallen to just 2 percent the previous year.⁵⁰ General education which includes basic and secondary levels absorbs the largest share of total expenditure followed by higher education and vocational education (Figure 23). Low investment in education means that young school leavers are not well-qualified to take up existing skilled jobs in the private sector. Sri Lanka should increase its spending on education and shift increasing amounts towards quality inputs. Areas of the education system that are potentially demand-driven, such as tertiary and technical education and vocational training (TEVT) can also be improved by increasing private sector participation.

Figure 23: Sri Lanka spends heavily on Secondary Education



Source: "Treasures of the Education System in Sri Lanka", World Bank 2005

Public versus Private Funding

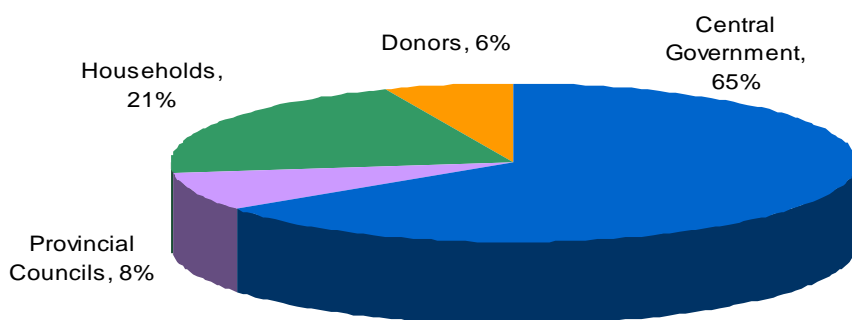
Involving the private sector in education investment, particularly at the tertiary and vocational levels will be increasingly important. Sri Lanka banned the establishment of private schools from grades 1-9 in the early 1960's and this legal prohibition still remains in force to date (Figure 24). However, a great deal of secondary and higher educational institutions are substantially financed by the private sector. Private sector investment and participation in education has many benefits. It can release more public resources for students from poorer families as the students attending private schools and educational institutions are likely to be drawn from upper income families. It can also stimulate economic activity in a sector where investment has been artificially restricted. But perhaps most significantly it would provide an alternative mode of service delivery, with considerable power and responsibility at the level of the individual educational institutions, such as private schools and institutes. These private education institutions would be compelled to offer high quality services to remain viable in an economic context where they are in competition with free public education institutions.⁵¹ This competition is particularly important in raising standards in the public sector.

⁴⁹ ADB 2006.

⁵⁰ World Bank, 2006d

⁵¹ World Bank, 2005b

Figure 24: Sri Lanka Education primarily funded by the Public Sector



Source: “*Treasures of the Education System in Sri Lanka*”, World Bank 2005

Where should funding be going?

Sri Lanka needs to devote more of its financial resources towards quality inputs such as incorporating IT into education and increasing the quality of teaching. Provincial councils play a primary role in the flow of public education finances. Education is the most decentralized sector in Sri Lanka, with education budgets, typically accounting for over half of the provincial expenditures. The main challenge faced by the recurrent education budget is and will continue to be allocating sufficient funds, once salaries and administrative costs have been distributed, to support education quality processes, such as professional development of teachers and principals, delivery of onsite academic and administrative support to schools, and meet the operating costs of capital education investment. Only 20 percent of Sri Lanka’s current resources are invested in quality inputs. It will be increasingly important to shift resource allocation in favour of equipment and technology like IT centers, science laboratories, libraries, and activity rooms.⁵²

Primary and Secondary Level Education

Low test pass rates and a lack of relevant skills are leaving students with little opportunity in the workforce. The low quality of education in terms of infrastructure, distribution of teaching resources and the learning-teaching process in the classroom is reflected in the low mastery levels of the first language, mathematics in primary grades and in low GCE pass rates.⁵³ (Figure 25). The average pass rate at the GCE O/L exam is 37 percent, implying that just one out of every three students successfully completes this basic exam. Pass rates in Sri Lanka’s underprivileged areas including the North-Eastern, North-Central, Uva, and Central Provinces are between 31 percent and 32 percent.⁵⁴

There is a desperate need for modernization and diversification of the curriculum at the primary and secondary school levels. Activity-based learning, teaching and personality development as well as technical subjects in the grades 10-11 curriculum have received low priority. Only 6 percent of schools offer science in grades 12-13. The management of the education system including the delivery of services, supervision, administration, and monitoring, is reported to be weak at local levels underscoring

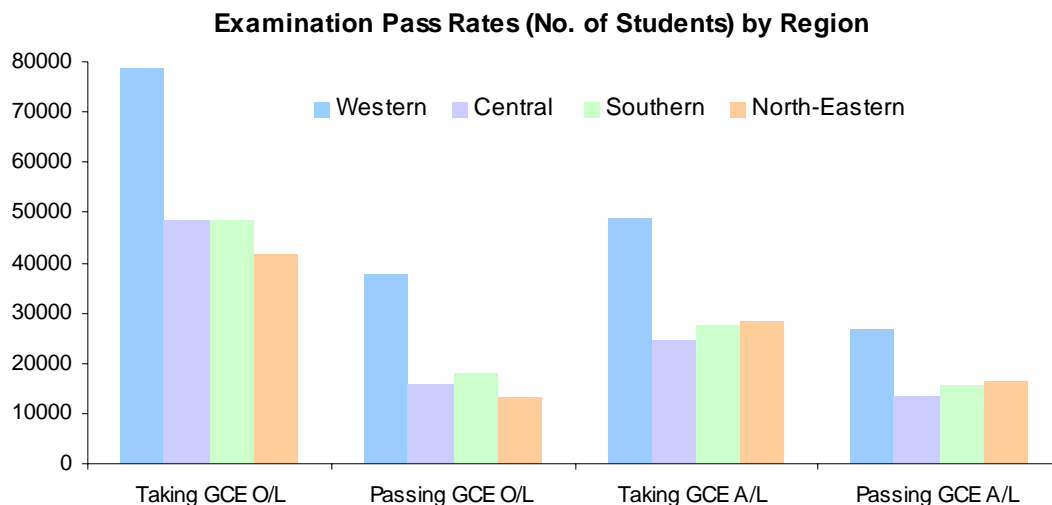
⁵² World Bank, 2005b

⁵³ World Bank, 2005b (p. 6)

⁵⁴ World Bank, 2005b (p.8)

the need for capacity building and the adoption of effective monitoring mechanisms. In order to improve the quality of learning, the school system should involve communities and parents to monitor and evaluate the school performance to a much greater degree while encouraging competition in education, giving more autonomy to schools to attract teachers and students, and using distance education technologies to improve and increase access to primary, secondary and vocational education.

Figure 25: Poor Examination pass rates at higher secondary education



Source: “Treasures of the Education System in Sri Lanka”, World Bank 2005

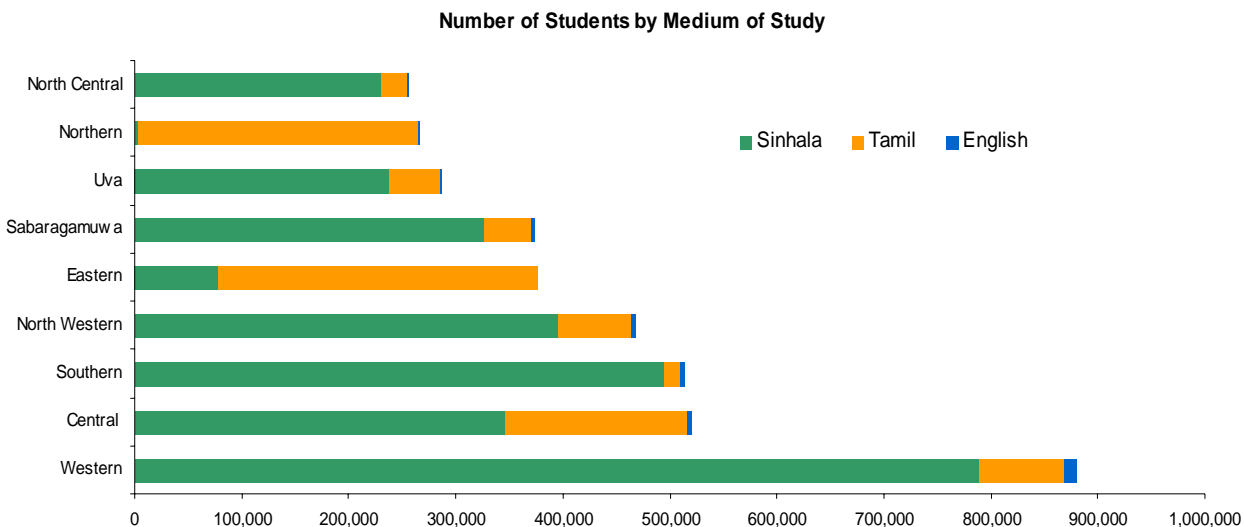
Introducing English Language Skills into the Education System

Sri Lanka’s proficiency in English remains poor, having declined significantly in the last 30 years. English is and will continue to be the global business language and, thus, in order for Sri Lanka to effectively participate in the knowledge economy, the country will need to recognize the importance of English as a determinant of future growth. English language skills not only enjoy strong demand in the national labour market, but English language competency also opens up job prospects in the global economy. In Sri Lanka’s fairly young, yet promising BPO labour market, English is considered to be the most important skill requirement, yet also one of the country’s biggest shortfalls. A recent BPO industry survey revealed that although employment prospects are opening up in the BPO sector, the supply of potential workers with good English speaking skills remains a bottleneck.⁵⁵ English is currently taught as a second language up to the GCE Advanced Level in all schools. As a result, only 10 percent of children achieve a targeted level of mastery in English language skills while English writing skills are virtually non-existent with only 1 percent of children exhibiting the required skills level. Additionally, these skills are largely restricted to urban areas where 23 percent of children master English compared to only 7 percent of rural children (Figure 26).⁵⁶

⁵⁵ Lirneasia, 2006b

⁵⁶ World Bank, 2005b. (p.59)

Figure 26: Very few students study in English outside the Western Province



Source: Sri Lanka Ministry of Education, Statistics Branch

English is gradually becoming recognized as a key factor for growth. Government is implementing new strategies in order to introduce English into the curriculum. Sri Lanka is making substantial efforts to improve the level of English proficiency among the country's youth. A pilot program has recently been launched in some schools to teach certain subjects within grades six and seven in the English medium. This program was extended to grade eight in 2004, and will be further extended to the GCE O/Level examination in 2007. Within this program, teachers will also be trained in selected Colleges of Education to teach in English. A similar project has been started in 64 schools in which science subjects at the GCE A/Level classes will be taught in English. Approximately 150 science graduates and 300 teachers have already been recruited and trained to teach in English.⁵⁷

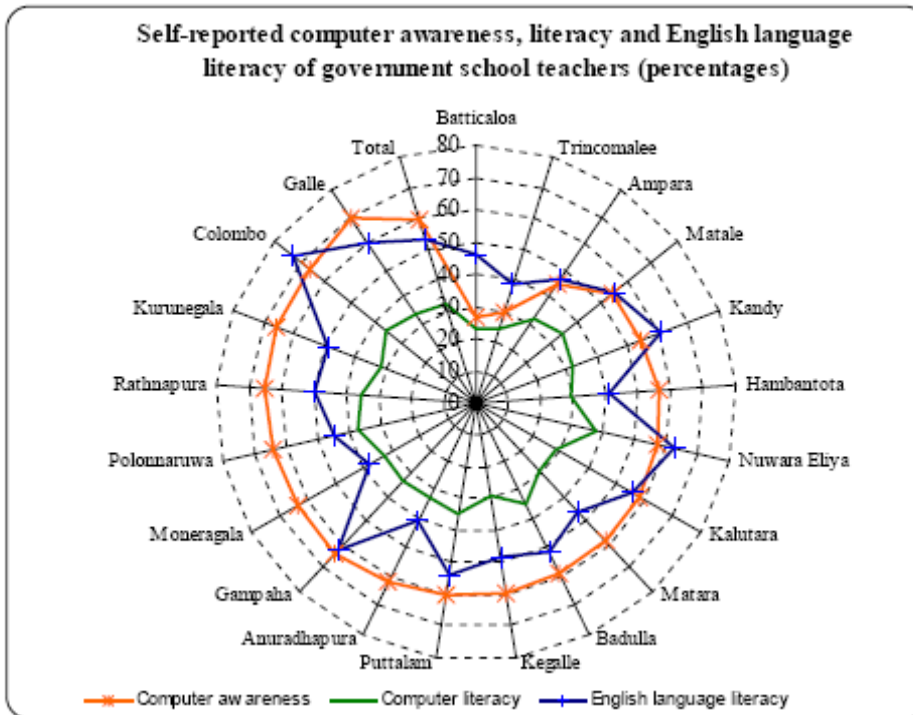
Incorporating IT into Course Curricula

Children's access to ICT is low: few students and even fewer teachers are IT literate. Even in the elite public schools, access to computer facilities, defined by the student to computer ratio is well over 1:100. Computers alone are not enough to provide students with the comprehensive skills needed to use computers. This training should be supplied by capable teachers who are skilled in not only teaching students how to use them, but also using computers, themselves, in daily lessons and incorporating them into teaching methods. A Department of Census and Statistics census found that nearly 30 percent of schools had computers in working order with National (95.2 percent) and Navodya (90.1 percent) schools considerably better equipped than other government schools (23.9 percent). The availability of land phones was low at 26 percent. Internet and e-mail facilities were only available in 6.4 and 4.1 percent of schools, respectively. The computer-student ratio is 1:137. The study found that more than 60 percent of teachers lack the computer literacy skills needed in a modern teaching environment.⁵⁸

⁵⁷ Ministry of Education, Historical Overview.

⁵⁸ Department of Census and Statistics school census conducted on November 2nd 2006.

Figure 27: Poor Computer literacy among rural Sri Lankans



Source: Sri Lanka Department of Census and Statistics

Government is expanding teacher ICT training. Teacher ICT training has started in National Colleges of Education (NCOEs) and in Computer Resource Centers. However, most of these are crash courses, which focus on computer literacy and do not enable teachers to return to their classrooms with the ability to use the computers in teaching their assigned subjects. Teachers still require intensive training not only in computer literacy, but also in how to integrate educational software into classroom activities and the school curriculum.

The Ministry of Education (MOE) has constructed a six year development plan that aims at providing IT literacy to all government teachers, to set up a computer-student ratio of 1:40, to develop the necessary text books and to obtain the required multimedia software for IT education.⁵⁹ Another project, the Secondary Education Modernization Project (SEMP) funded by Asian Development Bank (ADB) is planning to open 800 Computer Learning Centers with 16,000 computers. Projects such as these will therefore aim at helping upgrade the knowledge and skills of teachers and facilitators in integrating new educational technologies and distance education methods into their work.

Improving teaching

The incentives to teach are not currently motivational. Sri Lanka's teacher salaries have been declining in real terms by about one percent per year. In 2002, teachers earned only about 85 percent of the 1978 salary in real terms. A PhD qualified senior lecturer or professional earns in the range of about USD 200-350 per month.⁶⁰ These low wages have made it difficult to attract and retain highly qualified academic personnel at Sri Lankan universities. The low level of teacher salaries has largely contributed to poor teacher motivation and has resulted in poor education outcomes at the tertiary level. Teacher status,

⁵⁹ Department of Census and Statistics

⁶⁰ World Bank, 2006d

motivation and work attitudes have deteriorated over the past few years and the importance of re-motivating and improving the attitudes of teachers should be a national priority.

Low teacher salaries and a lack of incentives hinder deployment to difficult areas. Teachers generally avoid disadvantaged rural areas and prefer to stay in cities, towns and prosperous urban areas. This leads to overstaffing at urban schools and understaffing in rural areas with concomitant effects on learning outcomes in disadvantaged rural communities. This pattern is repeated at the tertiary level where it has also been very difficult to attract qualified individuals to reside in subsidiary towns or semi-urban locations. In Colombo, Kelaniya, Sri Jayawardenapura, and Peradeniya, the ratio of academic staff with postgraduate qualifications (such as professors and senior lecturers) to academic staff without postgraduate qualifications (such as lecturers) is 1.5:1, in the universities located in subsidiary towns or semi urban locations this ration is 0.25:1.

Absenteeism is also a significant issue affecting many schools. Sri Lanka's teachers take 7 million days of illegitimate leave per year. The incidence of teacher absenteeism as a proportion of the school year varies from 15 percent in the North-Western Province to 20 percent in the North-Central and Uva provinces.⁶¹ These are absenteeism rates based on leave days taken and evidence suggests that leave regulations are not strictly enforced, and teacher absenteeism may actually be higher. Steps are being taken to combat the low level of education service delivery in rural areas. The MOE, with the assistance of the World Bank, has begun offering various incentives to teachers serving in difficult schools through the Teacher Education and Teacher Deployment Project. This project aims to overcome some of the problems associated with teacher training and deployment.

Improvements in standardized training have led to a significant reduction in the number of untrained teachers. Over the past seven years the country has established 17 National Colleges of Education (NCOE) to ensure that all individuals joining the teachers' service successfully complete a three year pre-service teacher education program and receive due certification, or are university graduates. NCOEs require new teachers for grades 1 - 11 to undergo 2-year residential training programs combined with a 1-year internship period in schools. As a result, the number of untrained teachers in the system has been reduced from about 45,000 in 1997 to around 2,000 in 2003. In addition, 94 teachers centers have been established, one in each zone, to facilitate continuing professional development opportunities for teachers, particularly to widen and upgrade subject content knowledge, and refresh pedagogical skills through continuing teacher education. Untrained teachers are increasingly receiving standardized training in Teacher Training Colleges, at the National Institute of Education (NIE) and through the Distance Education Program. Short-term continuing education courses are conducted in Teacher Education Institutes and 100 Teacher Centers while Post Graduate courses in Education are also offered by the universities.⁶²

New government policies are currently being implemented in order to both increase the motivation of teachers and the incentives associated with teaching in underprivileged areas. In recent years, government faced substantial pressure to find jobs for the growing number of the unemployed secondary and university graduates. Last year approximately 40,000 university graduates were recruited in different ministries and 19,000 of them were assigned as teachers. This is in addition to the 3,000 teachers that are recruited from the teacher training institutions and the NCOEs. These new recruits increase the teaching force by approximately 11 percent. The MOE is preparing a policy to redeploy these teachers on the basis of incentives to work in rural areas with a view to increasing the teacher-student ratio in primary and secondary education. The MOE is also considering other policies to train teachers through distance education and retrain teachers for subject areas that are in need. MOE is also considering providing incentives, such as extra salary increments, faster promotion, allowing teachers to cash unutilized leave, and the construction of teachers' quarters for teachers appointed to disadvantaged areas.

⁶¹ Ibid.

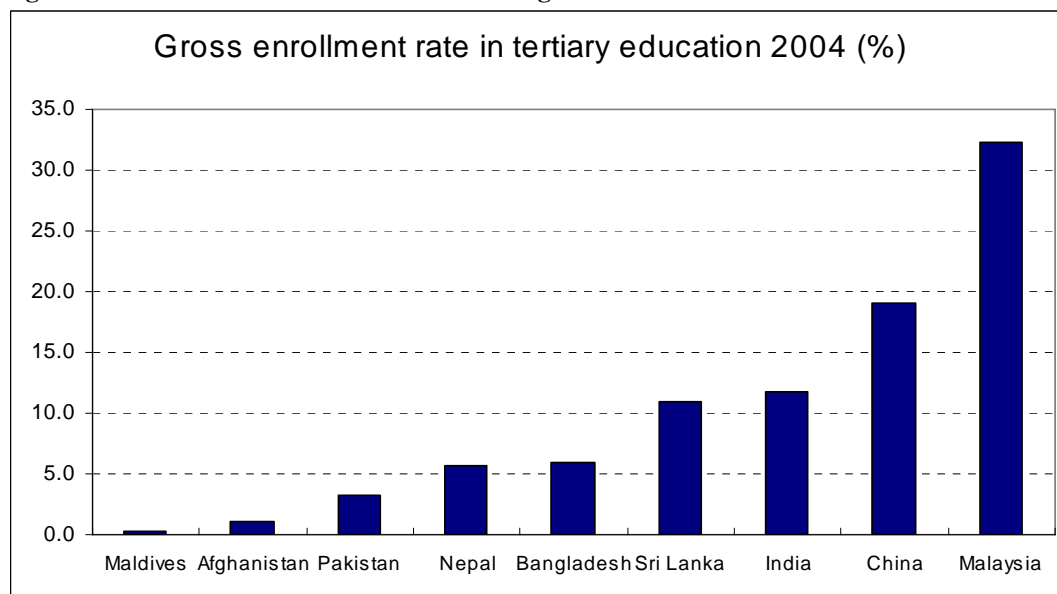
⁶² Ministry of Education, 2005.

Sri Lanka's Tertiary Education System

At 11 percent, Sri Lanka's tertiary enrolment rate is at the South Asian average. Sri Lanka's higher education system consists of 17 public universities, catering to around 100,000 students. A further 13 postgraduate and specialized institutes cater to another 6,000 students. But the bulk of tertiary education is in the private sector where students are enrolled in a variety of professional courses, such as IT, management, accounting, marketing, law, business and finance. It is estimated that if these non-university higher education entities and private institutions were included in the education statistics, the actual tertiary enrolment rate would be closer to 18 percent.⁶³ Anecdotal evidence suggests that this sector consists of a variety of institutions from the worst to the best. Without better knowledge of the situation it is difficult to discuss meaningfully the expansion of private higher education.

Sri Lanka's tertiary system has been unable to match education with market needs. The structure of the education system in Sri Lanka and the mismatch between the system outputs and the labour market needs has led to significant unemployment of secondary and university graduates. Unemployment rates of secondary and university graduates in the 19-29 age group ranges between 26 and 34 percent. Sri Lanka's recent economic growth has not been matched by growth in employment. And yet there are a large number of jobs that go unfilled as employers cannot find workers with the relevant skills. This problem is exacerbated by Sri Lanka's rigid labour laws which discourage employers from hiring young workers and investing in their training (see section II).

Figure 28: Sri Lanka needs to invest more in higher education



Source: *The Knowledge Economy and Education and Training in South Asia*, World Bank 2007

⁶³ Draft Concept Note for the National Higher Education Policy Note, World Bank May 2007

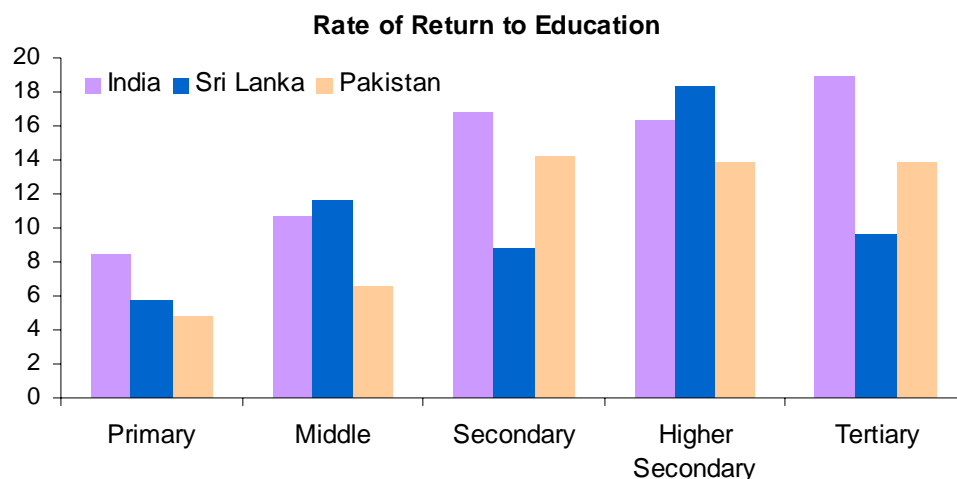
Box 6: New Developments in Sri Lanka's Higher Education

New developments in tertiary education include a government project, “Improving the Relevance and Quality of Undergraduate Education” (IRQUE) which is supported by the World Bank. While building up institutional capacity at both central and institutional levels, the project’s main thrust is to introduce a competitive mechanism to support universities engaged in programs to enhance the quality of their curricula and make them more relevant to the labor market. The project is limited to universities and undergraduate studies, and does not address the broad, long-term and systematic issues of the sector. Recognizing that higher education has a formidable potential, the government has also launched a consultative process to develop a strategy for developing this sub-sector. The public was invited to submit proposals in order to feed in ideas and suggestions for the strategy. It is planned to expand this process further, while infusing international experience and best practices. In January 2007 the Ministry of Education was split in two parts creating a fully-fledged Ministry of Higher Education, marking a renewed priority to this sub-sector by the government.

Source: Draft Concept Note for the National Higher Education Policy Note, World Bank 2007

In Sri Lanka, investing in tertiary education actually generates a lower rate of return compared to those who finish only secondary education. It would be reasonable to expect earnings to increase with the level of educational attainment and, for any given level of education, earnings to increase with years of labour market experience although at a decreasing rate. However, Sri Lanka is an exception both for the lower return on investments in higher education as well as its much flatter wage-experience profile.⁶⁴

Figure 29: Low rate of return for Sri Lanka's higher educated



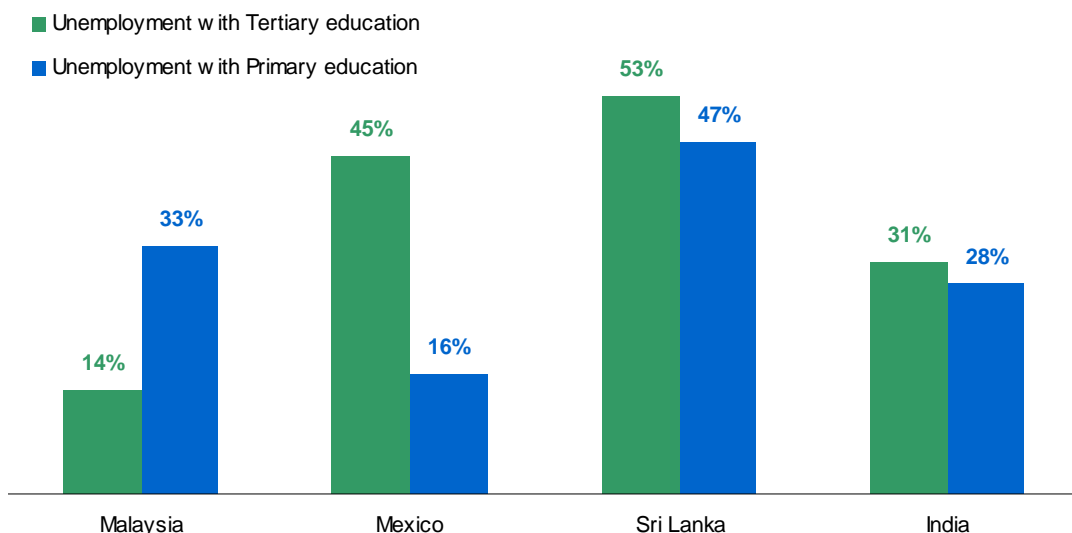
Source: The Knowledge Economy and Education and Training in South Asia, World Bank 2007

Enrolment at university is dropping rapidly as students fail to see the benefits in pursuing higher education. In order to increase the level of university enrolments, it will be increasingly important to make the Sri Lankan university system more demand driven, quality conscious, and forward looking. This will only be accomplished by empowering institutions (with full accountability), utilizing resources optimally, mobilizing additional financial resources, establishing effective quality assurance mechanisms, facilitating the networking of institutions to enhance capacity, improve quality, and promote excellence, establishing better and closer linkages with industry and community, and increasing access and reducing regional imbalances.

⁶⁴ M. Riboud et. Al

An absence of linkages to the private sector has led universities to be too academic and impractical, demonstrated by the high levels of unemployment among university graduates (Figure 30). Improving the quality and relevance to meet local needs and international standards related to issues of curricula, university-industry linkages and employability of graduates will be increasingly important for Sri Lanka to embrace the knowledge economy.

Figure 30: High unemployment levels for Sri Lanka's higher educated



Source: *The Knowledge Economy and Education and Training in South Asia*, World Bank 2007

Sri Lanka’s Technical and Vocational Training System

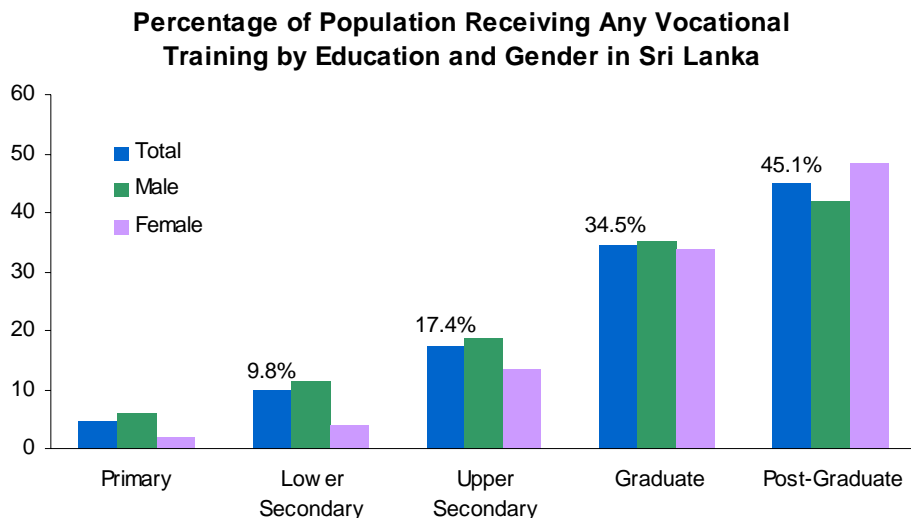
Formal vocational training is associated with returns of 17 percent; more than double that of an additional year of university education.⁶⁵ As outlined above, Sri Lanka’s formal education system has become supply driven and has a poor record of providing industry relevant skills. Sri Lanka’s TEVT institutions have become an effective option for students leaving the formal education sector.

Sri Lanka’s development of TEVT institutions has facilitated the school to work transition and has helped reduce the skill gaps and skill mismatches in the labour market. The TEVT sector is currently made up of an extensive system of public, private, and NGO sector training providers. In 2001, there were about 920 training institutes registered with the TEVC comprising of 556 institutions in the public sector, 252 in the private sector, and 112 in the NGO sector. Student intake more than doubled from 32,612 to 67,612 between 1990 and 2002 representing an annual growth of 8.9 percent, with the western province alone accounting for about 30 percent of these enrolments. A new network of Vocational Training Institutes (100) and community schools are to be set up which will facilitate an increase from 90,000 to 200,000 by 2016.⁶⁶

⁶⁵ The Knowledge Economy and Education and Training in South Asia, World Bank SASHD, 2007

⁶⁶ Hong, Tan. 2004

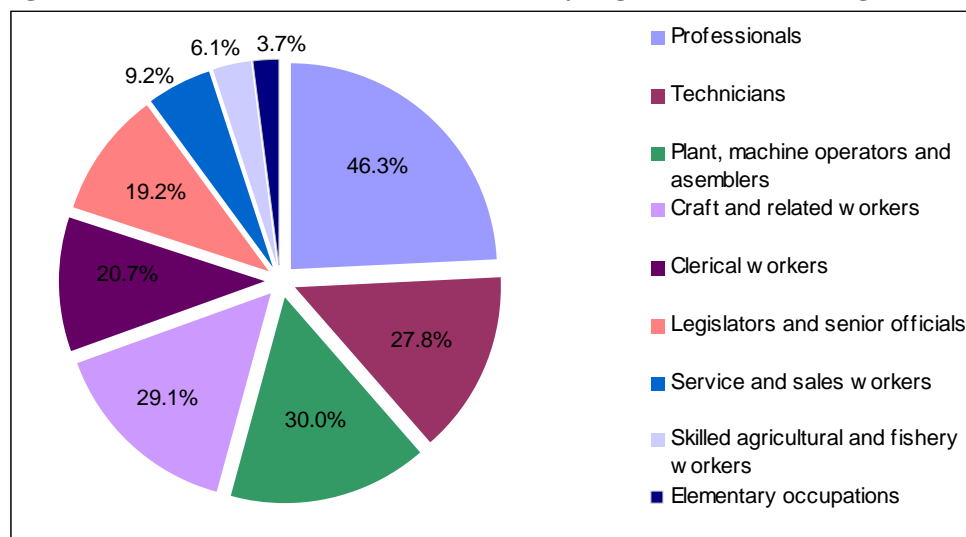
Figure 31: Training is mostly at the post-graduate level in Sri Lanka



Source: Sri Lanka Labour Force Survey 2002

There is a strong tendency for the incidence of training to rise with the level of educational attainment. It is also worth noting that the incidence of post-school vocational training peaks at or after high-school, after which it declines before peaking again after the first degree. These two points are when individuals end formal education and get post-school vocational or technical training, either to become a skilled worker after high school, or to become a professional after completing tertiary education.

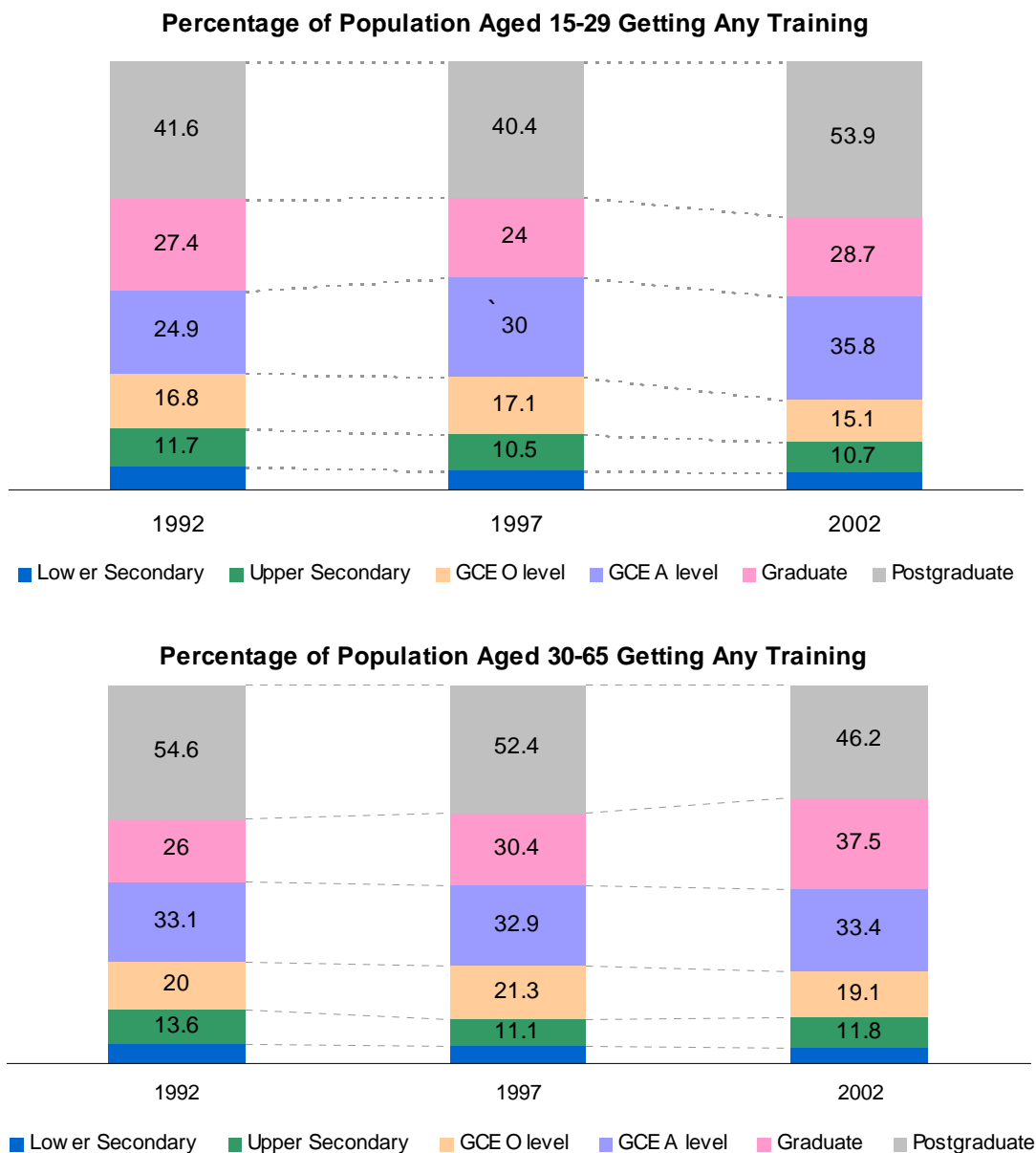
Figure 32: Professional Sector workers more likely to get vocational training than other occupations



Source: Sri Lanka Labour Force Survey 2002

Like many South Asian countries, professionals, technicians and clerical personnel are more likely than other occupational groups to get vocational training. This is likely due to the fact that these are the occupations that tend to include a high proportion of the highly educated. Sri Lanka particularly shows a relatively high share of plant & machine operators and assemblers & craft workers who received training. The occupations with the lowest share of individuals getting training are employees in sales, services and agriculture where educational requirements are low.

Figure 33: Training by Age-Group



Source: *The Knowledge Economy and Education and Training in South Asia, World Bank 2007*

Among youth, there is a dramatic increase in the incidence of training for those with GCE A levels and above, but not for those with GCE O levels and below. Among Adults 30 years and above, the only group to show a rising trend in training were university graduates. Another observation is, at each level of education, a roughly equal or higher proportion of adults report having training as compared to similarly educated youth which is consistent with a cumulative probability of training that rises as level of education and experience rises.

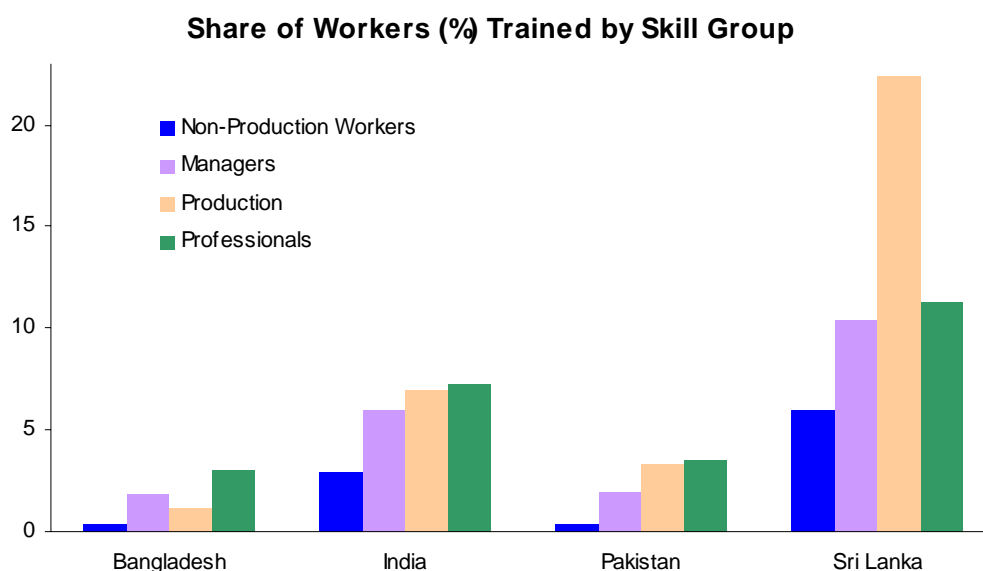
Table 3: Probability of training by Gender and Education level

	1992		1997		2002	
	M	F	M	F	M	F
Lower Secondary	11.5	3.5	10.5	2.7	9.9	2.3
Upper Secondary	15.9	8.7	14.8	6.8	15.8	6.8
Graduate	29.9	21.9	33	24.1	39.6	31.4
Postgraduate	57.5	41.8	53.3	48.9	46.9	46.7

Source: The Knowledge Economy and Education and Training in South Asia, World Bank 2007

The data also suggests that women are less likely to receive post-school vocational training as compared to their male counterparts with the same level of education. In Sri Lanka 15.1% of men get vocational training versus just 9.1% of women, although the reason for this remains unclear.

Figure 34: Production workers receive heavy training in Sri Lanka



Source: Investment Climate Survey (various years), World Bank

Although they are playing a useful role TEVT institutions can still be improved. The government's development strategy, Vision 2010, defines the three main challenges facing the TEVT sector as qualitative and quantitative mismatches in certain areas of skills demand, external and internal inefficiencies in the sector with duplication of courses, outdated curricula and equipment, shortage of good trainers, and high dropout rates. Another significant flaw in the TEVT sector is the absence of sound data on the effectiveness of these training courses. Monitoring and evaluation of TEVT institutions and their course offerings remains incomplete and based on poor data, particularly regarding training by private sector training providers and employers.⁶⁷

⁶⁷ World Bank, 2005b

Sri Lanka is taking substantial steps to improve the quality and relevance of TEVT programs. National Skills Standards based on competencies identified for specific occupations and a scheme of competency-based assessments has recently been introduced. In addition, a unified certification system has also been developed and the registration of all vocational training institutions, accreditation of their courses and quality auditing by the tertiary and vocational education commission have commenced.

Box 7: Does the Knowledge Economy shape firms in-house training decisions?

Unlike in formal education where education decisions are household and individual-based, the closer an individual gets to the world of work post-school training becomes a joint decision with employers. Information on incentives for in-house training and employer training decisions were elicited as part of the Investment Climate Surveys. In the context of this paper, it is useful to assess if these employer incentives are shaped by the needs of the Knowledge Economy. The figures below compare the incidence of training in four South Asian countries by two crude proxy variables for the export orientation and technology level of the enterprise. The firm’s export orientation is measured by an indicator variable, with a value 1 if the firm exports and 0 otherwise, and the technology level of firms is captured by an indicator variable for whether enterprises engage in R&D. As shown below, evidence suggests that firms in South Asia that export or engage in R&D activities are more likely to report in-service training, compared to those that do not. Export orientation can have a salutary effect on training to produce high quality products meeting exact standards of foreign buyers, and to increase lab productivity to meet competitive pressures. There is also support for the training-technology hypothesis. The second panel below strongly indicates that the incidence of in-service training is higher in enterprises that engage in R&D activities.

Figure 35: Sri Lanka has highest prevalence of in-house training for firms engaging in R&D

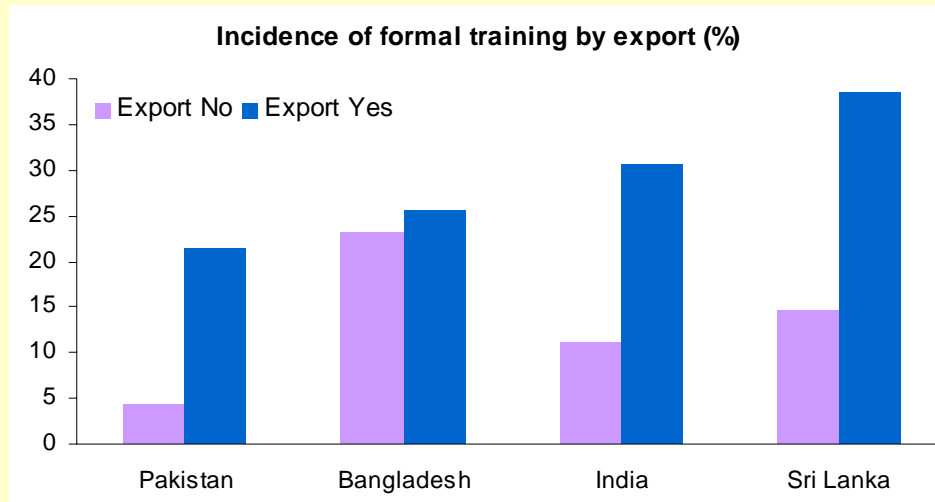
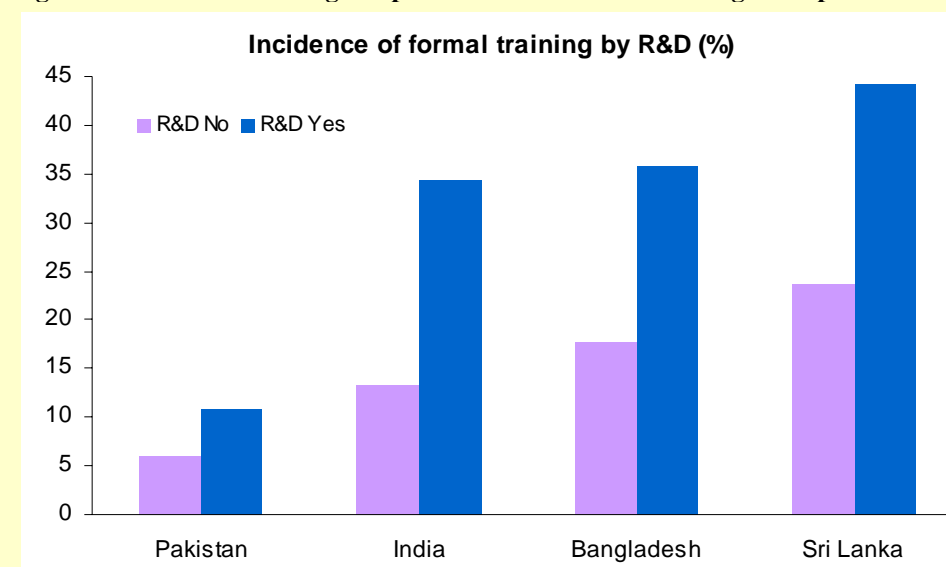


Figure 36: Sri Lanka has highest prevalence of in-house training for export-oriented firms



Source: The Knowledge Economy and Education & Training in South Asia, World Bank 2007

Policy Recommendations

Spending on education needs to increase by a substantial amount, with more of it distributed towards the TEVT sector. It will be increasingly important for Sri Lanka to focus on the vocational and training levels of education as TEVT will be needed to supply the expanding services industry workforce with individuals who possess specific demand driven skills.

Education management should be further devolved to the level of individual institutions. Giving more autonomy to the school system by involving communities and parents to monitor and evaluate the school's performance to a much greater degree while encouraging competition in education, will lead to more quality education, and thus, more knowledgeable individuals entering the workforce.

Primary and secondary education should focus on teaching students 'how to learn' rather than emphasizing occupation specific knowledge. Providing students with lifelong learning skills will make them more adaptable to the rapidly changing needs of the market.

English should be further integrated into the curriculum. Although Sri Lanka has been making attempts to introduce English into schools through math and science courses, it will be increasingly important to standardize English training in all schools. Giving students the ability to communicate in English will open up many more opportunities for them in the domestic and global community.

NCOEs should implement standardized courses in IT training for teachers. This should include not only how to use computers, but how to incorporate them into teaching in the classrooms. Many of the courses being offered through the NCOEs are still crash courses that simply instruct teachers on how to use computers, without showing them new methods of using IT in the classroom. It will be important to reform these courses in an effort to give teachers the tools they need to familiarize their students with IT. This will, in effect, produce a more IT literate population with the skills needed to progress the knowledge economy.

Teachers' salaries should be increased, and incentives for teachers instructing in difficult areas should be offered. In order to create a more motivational learning environment for teachers and students, Sri Lanka will need to offer teachers greater incentives including and particularly higher pay.

University education is too academic and needs to be made more demand driven. Sri Lanka's university system has not been successful at producing students that are prepared for the world of work. Graduates receive lower salaries than high school leavers. It will be increasingly important to reform curricula and ensure a closer link between academia and industry.

The TEVT sector can be further improved through improved monitoring and strengthening the demand-driven nature of the curriculum and courses. The TEVT sector, although successfully orienting Sri Lankan students to the workplace, has not been evaluated since its establishment. These institutions need to be assessed in order to determine if their courses and teaching practices are still relevant in the modern economy, and further upgrade them if necessary.

PART II Case Studies

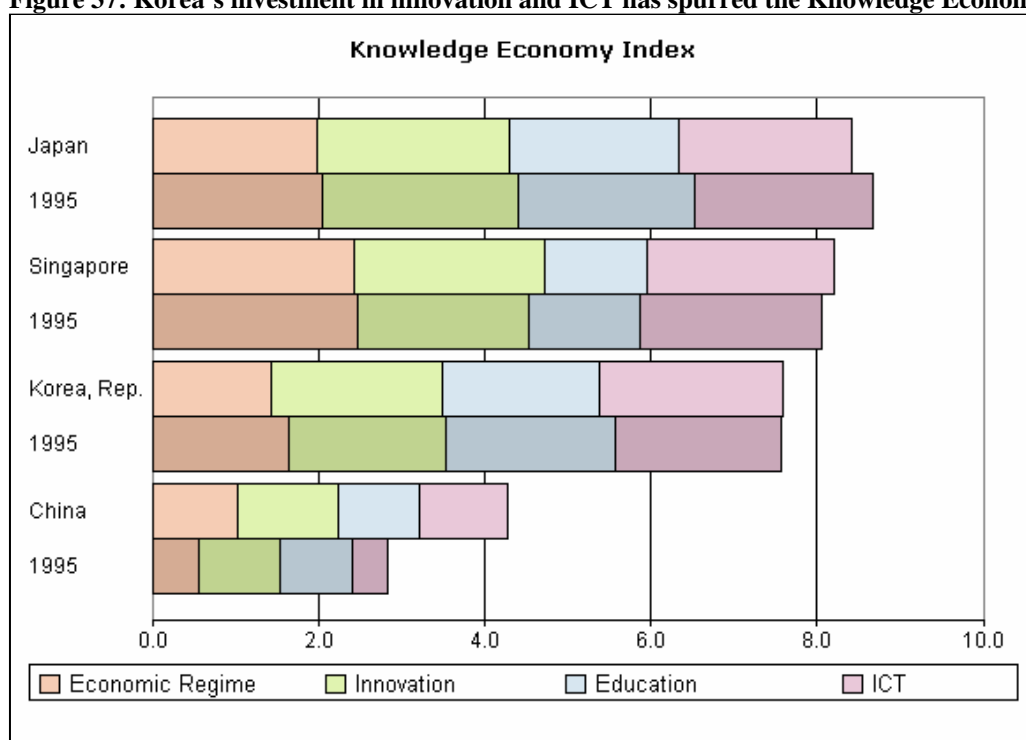
What Can Sri Lanka Learn from Other Countries?

The second part of this report evaluates the experiences of three other countries in their respective attempts to make a transition towards the knowledge economy. The case studies include Korea, Singapore, and China; three countries at very different stages in their KE transitions. Korea is currently seen as a leader in effectively using knowledge for growth while Singapore is in the process of developing its pillars in order to pursue a relatively new strategy in which innovation becomes the new focus of the economy. China is only in its initial stages of developing a new strategy for growth and beginning to invest in knowledge in order to do so. It will be beneficial for Sri Lanka to observe the methods that have and have not worked for each country. This analysis can offer many insights into how Sri Lanka can develop its own KE strategies.

I Korea: Coordination as the Key to the Knowledge Economy

Korea's sustained rapid growth rate is due to its strategic use of knowledge for development. The Republic of Korea has had consistent growth over the past four decades which has enabled it to overcome the economic and social damage caused by World War II and the Korean War. Korea's past left many with the notion that it would take decades to recover and rebuild from these events. However, after 45 years, Korea's GDP per capita has increased to over \$12,000. Korea's growth is said to be significantly accredited to its ability to use knowledge effectively in all sectors of the economy. Although Korea had not conceived an explicit knowledge economy development strategy, its commitment to strengthening each pillar through a focus on coordinating knowledge according to industry needs, led the country to immense growth in following years (Figure 37).

Figure 37: Korea's investment in innovation and ICT has spurred the Knowledge Economy



Economic, Social and Industrial Coordination

Korea's growth has been the direct result of its ability to strategically reform various sectors in accordance with industry trends. From 1950 to the present, Korea has focused efforts on all four pillars of the knowledge economy. Government has prioritized achieving sustained productivity growth by consistently increasing the domestic value addition of its goods.⁶⁸

Korea began with investments in education and the use of licensed technology. In the 1960's, Korea began investing in both export and import substituting industries, starting with subsistence agriculture and labor intensive light manufacturing sectors such as textiles and bicycles. In order to meet the industry's current needs, considerable amounts of capital were invested in primary education. And the use of

⁶⁸ World Bank, 2006c, p.4

technologies, obtained through foreign licensing, were adapted for domestic production, allowing for a gradual shift up the value-added chain toward more sophisticated products.

Moving up the value chain required investments in technical and vocational training. In the mid-1970's, Korea began the development of its heavy industries such as chemicals and shipbuilding and policies were subsequently enacted to improve the technological capabilities of the country. This transition was further facilitated and supported by Korea's incentive to improve the access to and quality of technical and vocational training.

Deregulation and further investments in higher education continued to spur growth. In the 1980's, Korea attempted to ensure a market conducive environment by deregulating various sectors and liberalizing trade. The government also expanded higher education while investing in indigenous research and development through the establishment of an R&D program. The country continued to pursue high value-added manufacturing through the 1990's by promoting indigenous high-technology innovation.

Government coordination was the key to Korea's early growth. Korea's early growth has been a direct result of the country's ability to coordinate government policies and investment in education and innovation with market needs.⁶⁹ But there came a time when the government's mechanism of resource allocation that had been effective when the economy was growing quickly was no longer effective. When the economy became larger and more complex this approach no longer produced stellar growth outcomes.

The Asian crisis of 1997 prodded government into undertaking widespread economic reforms. The old policy framework and institutions that had led Korea in the early high growth era turned out to be liabilities for sustained economic growth in the new economic environment. In response, Korea began undertaking reforms in the public and labor markets in order to overcome the crisis and ensure rapid economic recovery. Following the crisis in 1998, Korea launched a national campaign to make the transition to an advanced knowledge based economy in which domestic innovation would thrive. By using the framework developed by the Knowledge for Development program of the World Bank, Korea has since evolved into a mature knowledge based economy by assigning priority to and investing in knowledge inputs, rather than physical capital.⁷⁰

Reforming the Korea's Market Structure through Deregulation

The Korean government, in an effort to progress the institutional regime, improved the rule of law through greater transparency, disclosure of information, and increased accountability for both the public and private sectors. Since the 1997 crisis, the Korean government has relied more on market mechanisms and the private sector to take a lead in generating economic activity. Government has deregulated the economy, and promoted competition and entrepreneurship.

After the crisis, in order to rehabilitate the financial system, the government liquidated troubled institutions, wrote off nonperforming loans, and recapitalized promising financial institutions. In the corporate sector, the Korean government implemented initiatives to improve corporate governance systems, revise bankruptcy procedures, and remove anticompetitive regulations. Korea created more flexible labor markets. For example, labor laws were revised to legalize layoffs, and a legal framework for manpower-leasing services was introduced. Unemployment insurance, a well functioning pension system, and properly targeted poverty programs were all developed as part of the insurance package. In addition, the government promoted the formation of a venture capital market, which has grown rapidly

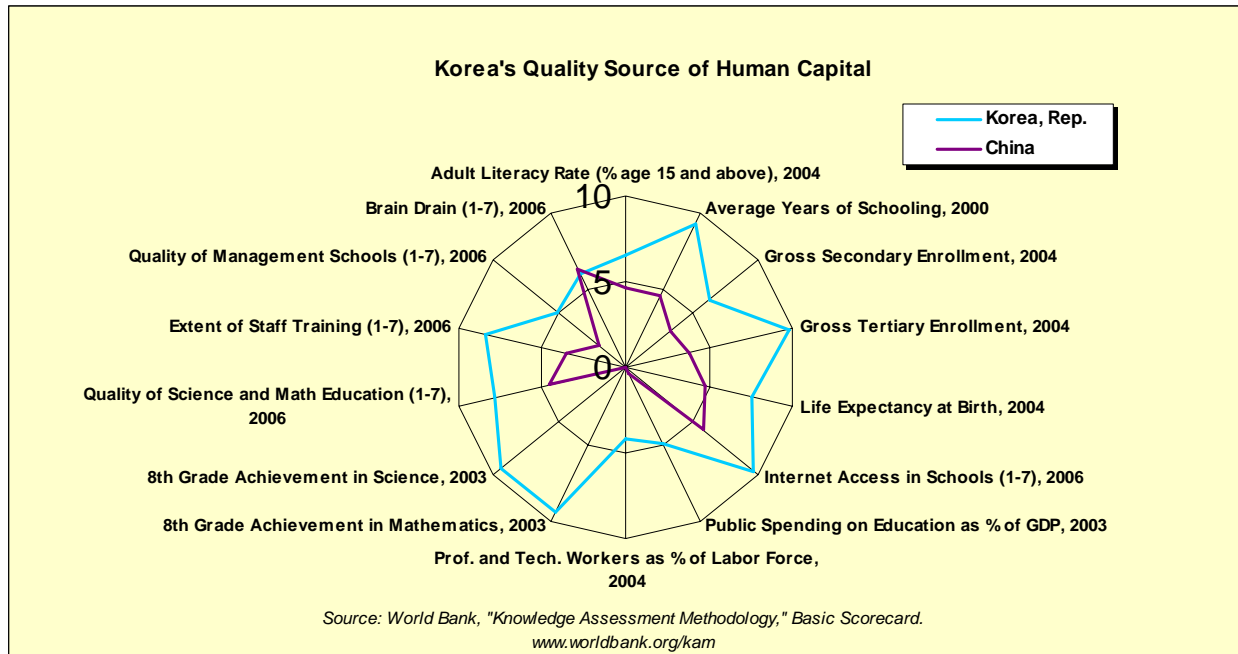
⁶⁹ World Bank, 2006c

⁷⁰ Ibid.

since the late 1990's. Korea is now one of the leading countries in terms of venture capital investment as a share of GDP.⁷¹

Developing a Demand Driven Education System

Figure 38: Korean and Chinese Education



Korea's education system was nurtured and expanded according to the manpower needs of the economy. In the 1950's and 1960's, education policies focused on the expansion of primary and secondary education, which was critical to supply at least a literate workforce to the soft manufacturing industries. Vocational high schools were also established and developed in the 1960's to provide training in craft skills for the growing labor-intensive light manufacturing industries. Junior vocational colleges were set up in the 1970's to supply technicians for the heavy and chemical industries.

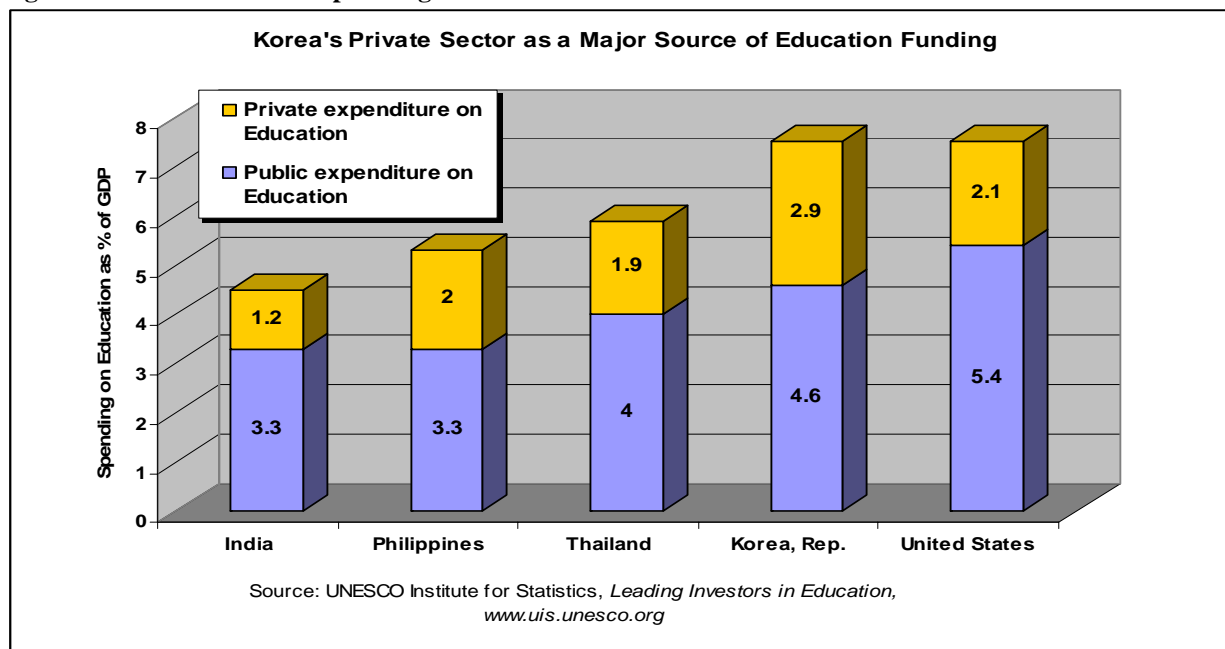
In the 1980's, the higher education expansion policies adopted by the government were instrumental in supplying high quality professional workers and R&D personnel that were required as Korea began developing its domestic innovation system.⁷² Each level and entity within Korea's education system has been strengthened, demonstrated by Korea's scorecard for education (Figure 39). It shows that enrollment is extremely high at the tertiary and secondary levels, and achievements in math and science subjects are even more remarkable. Korea has also been able to advance quality inputs with high levels of internet access in schools and high qualities of science and math education.

Korea's progress in creating an efficient education system is the result of significant investments by both the public and private sectors. In 2002, 7.1 percent of GDP was spent on education, a level much higher than the OECD average of 5.8 percent. The only OECD countries to surpass this figure are Iceland, the US, and Denmark. Public financing of the education system increased more than 27-fold in real terms between 1963 and 1995, whereas Korea's GDP increased only 14-fold during the same period.

⁷¹ Ibid.

⁷² Ibid.

Figure 39: Korea's leadership through education



Private expenditures on education are significant, accounting for 2.9 percent of GDP compared to the OECD average of 0.7 percent.⁷³ The Korean government has been tremendously successful at encouraging the private sector, either households or private foundations, to bear a significant portion of total education costs (Figure 39). The cultural factor also plays a large role in this funding as Koreans generally value education highly, and are often willing to pay more to educate their children privately. Private foundations have established a number of secondary schools and higher education institutions, in which expenses are paid for by user fees. At the secondary level, enrollment at private institutions accounts for more than 40 percent of total secondary enrolment, whereas private enrolment for tertiary education is over 70 percent. Primary education in Korea has been treated as a public good and has been mostly publicly funded, with 99 percent of primary school students in 2005 enrolled in public schools.⁷⁴ By encouraging the private sector to bear a significant portion of total education at the secondary and tertiary levels, government resources have been spent on key priority areas, such as offering universal primary education.

Developing Korea's Science and Technology Sector

Korea has developed its R&D sector by increasing the total amount of investment whilst simultaneously reducing government involvement. In the early post-war period private sector R&D spending was insignificant. But growth of the innovation system required corresponding investments in technology development. Government encouraged private investment in R&D, resulting in substantial increases in R&D spending by private firms over the past four decades (Figure 40). Consequently, the government's share of GERD has been gradually reduced and currently accounts for less than a quarter of the total. Korea's GERD has grown both in size and as a share of GDP, increasing from 0.25 percent in 1963 to 2.48 percent in 2004.⁷⁵ These increases in R&D investment have led to corresponding increases

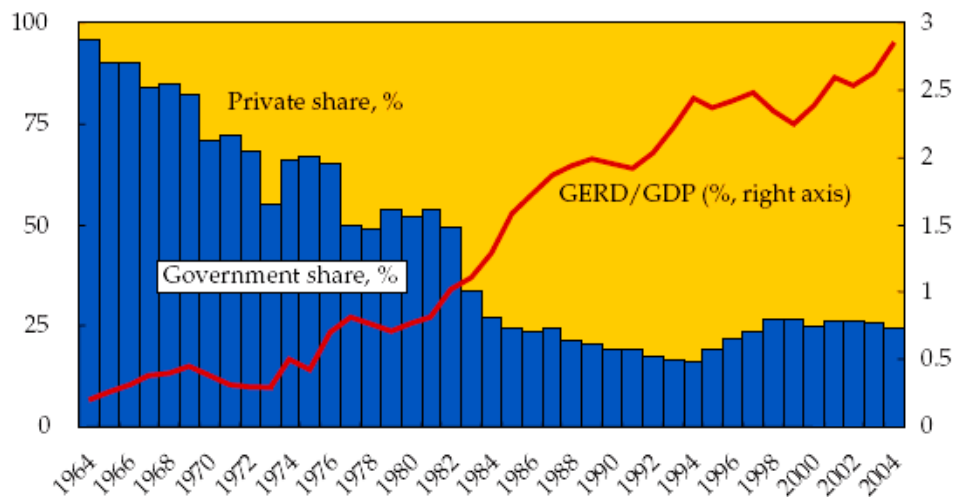
⁷³ World Bank, 2006c, p. 14

⁷⁴ World Bank, 2006c

⁷⁵ UNESCO, R&D Statistics

in indigenous innovation and adoption of foreign technologies, making the country's innovation system on par with many high income countries.

Figure 40: Significant Increases in R&D Investment by Korea's Private Sector Over Time



Source: World Bank, "Korea as a Knowledge Economy"

Korea's ability to absorb foreign technologies, improve upon, and adapt them to domestic production has allowed Korean industries to become internationally competitive. In the 1960s, when Korea launched its industrialization drive, it had to rely almost completely on imported foreign technologies. By doing so, the country promoted inward transfer of these foreign technologies and developed the domestic innovation and production capacity to digest, assimilate, and improve upon the transferred technologies and to adapt them to domestic production. This integration process allowed Korea to reduce its dependence on FDI and avoid control from multinational corporations. By the 1980's, Korean industries had increasingly become potential competitors in the international market making foreign companies significantly reluctant to transfer technologies to Korea. As a result, Korea would have to develop indigenous research and innovation and did so by investing heavily in domestic R&D. This transition required highly trained scientists and engineers as well as the financial resources necessary to support such R&D activities.

Korea's government research institutes helped meet the demand for large scale and sophisticated R&D. In the 1960's, the Korean government borrowed heavily in international capital markets. The money was allocated to selected industries to enable firms to import capital goods, build turnkey plants and obtain the latest technology and foreign experts needed for its technological assimilation strategy. In the 1970's, when the economy was moving into heavy industries, the government created Government Research Institutes (GRIs) in the fields of heavy machinery and chemicals to compensate domestic industries for their technological weakness. The GRIs worked with companies to enhance technological capabilities for further industrial development. Government's outward looking, export driven development strategy forced domestic industries into international markets, exposing them to intense global competition. To stay competitive, firms within these industries had to keep pace with technological changes by investing heavily in R&D.⁷⁶

⁷⁶ World Bank, 2006c.

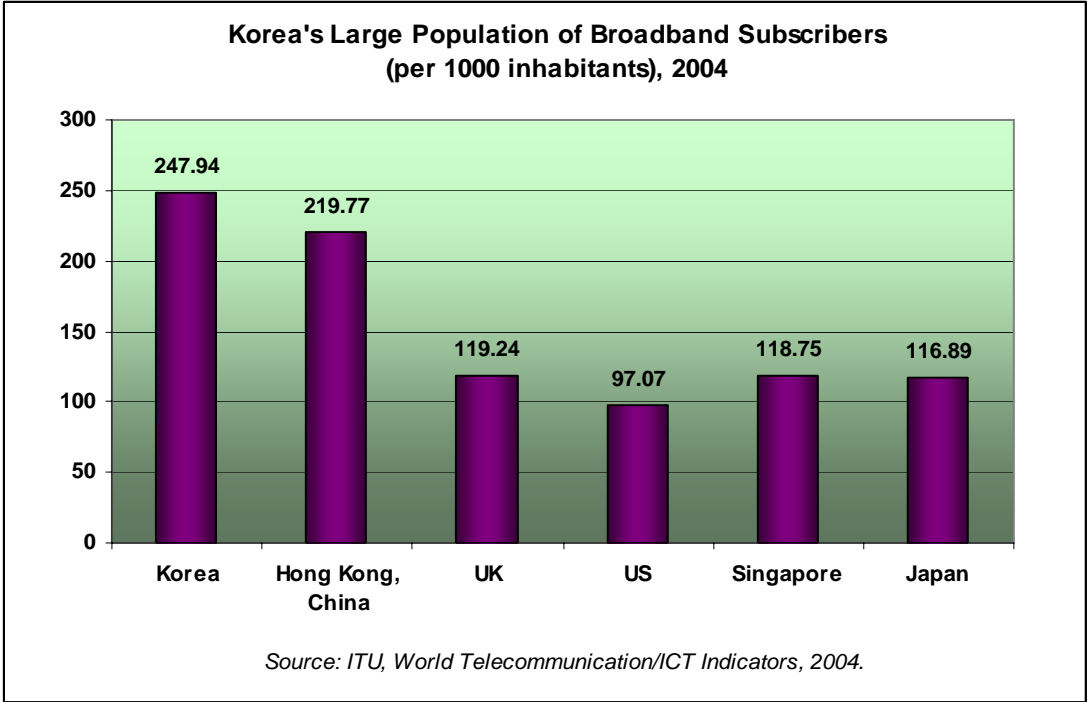
Building Information Infrastructure

Korea's excellent ICT infrastructure has been developed by a competitive private sector telecom industry. In the early 1970s, Korea's information infrastructure was inadequate. To improve its efficiency, the Korean government focused in the 1980s and 1990s on introducing competition into the ICT sector by deregulating and liberalizing the sector and privatizing the government owned telecom operators. From 1995 to 2003, the proportion of Koreans with cell phones increased to 70 percent, while the proportion of internet users increased to 60 percent. Korea is now among the leading countries in the world in terms of proportion of broadband internet subscribers, largely due to its successful construction of ICT networks connecting all areas of the country (Figure 41).

Excellent ICT infrastructure leads to increased uptake in e-commerce and e-government services. The number of subscribers to internet banking services reached 22.58 million as of March 2005 and e-commerce has increased from 50 billion won in 1998 to 314 billion won in 2004. Led by an e-government initiative, the public sector is extensively using ICT. By 2004, 97 percent of documents were dealt with through the e-approval system in the government agencies.⁷⁷

Establishing a dedicated fund on a PPP basis was key to rapid roll out of ICT infrastructure. In order to finance the investment for the rapid deployment and overcome short term budgetary constraints the Informatization Fund was established. From 1993 to 2002, the fund reached a total of \$7.78 billion, 40 percent of which was from government budgetary contributions and 46 percent of which came from private enterprises. The funds were allocated in a way that would balance ICT activities: 38 percent for technology development programs, 18 percent for human resources development, and the remaining 44 percent for building of infrastructure and diffusion, including standardization. Korea strategically used this fund to both narrow the digital divide and provide citizens with more dependable telecommunication services.⁷⁸

Figure 41: Korea wired for the future



⁷⁷ Ibid.

⁷⁸ Ibid.

Continuing Challenges

Despite its achievements, Korea's education system continues to face challenges in maintaining its competitive edge. The Korean education system has yet to evolve to meet the new skill and knowledge requirements of the knowledge economy. Teacher-centered one-way teaching, rote memorization, the lack of diversity of educational programs, and a preoccupation with preparing for entrance exams have all left little room to nurture creativity and initiative. Korea needs a more flexible education system that is less academic and that puts an end to stiff government control over the curriculum, testing, tuition fees, and the number of students in each discipline. These restrictions have eroded the links between educational output and labor market demand. There are current mismatches in supply and demand of human resources including high skilled labor shortages in strategic areas, labor shortages in small and medium enterprises, and a high degree of youth unemployment.

Critical thinking and problem solving will be the by-words of education in the future. It is increasingly important to improve students' competencies in critical thinking, problem solving, and essentially, promote lifelong learning through a broader interdisciplinary approach. These objectives will only be accomplished by granting greater autonomy to the universities and giving them discretionary powers in hiring teaching staff, management of academic affairs, and in setting student admission quotas.⁷⁹ In terms of innovation, Korea is a high spender on R&D and most of it is by the private sector, but outputs could be improved further. There will be an increasing need to update the role of GRIs, improve interaction between universities, Government Research Institutes and private firms, and improve the efficiency of private R&D output.⁸⁰

What can Sri Lanka learn from Korea's experience?

Sri Lanka should strive to formulate a strategy for development that is centered on coordination and private sector involvement. Korea's most significant development attribute was its ability to develop its skill and innovation base according to the needs of the industry. Government played a major role in effectively making a transition from a regulator to that of an architect in making strategic decisions on guiding the country towards strengthening different sectors at various times in the country's development, by taking a less direct interventionist approach.

Sri Lanka, which is beginning a transition towards becoming a major services industry, should begin investing in knowledge inputs that strengthen all relevant sectors of the economy. In terms of innovation, Korea invested heavily in R&D, but only after it had built up the knowledge capacity and technique base that it received from years of outward looking assimilation and imitation of technologies inherited from the global community.

Sri Lanka should begin investing in developing a research base geared to the process of imitation and assimilation. This will help to increase the value added of exports and begin the process of domestic innovation. Research as a discipline should be given greater funding within universities and R&D institutes, as they form the backbone of a research base. In the education system, Korea encouraged the private sector to finance a large portion of primary and secondary levels, leaving the country to focus its investment on higher education.

⁷⁹ World Bank, 2006c

⁸⁰ Aubert, Jean-Eric. 2006

Sri Lanka should begin allowing the private sector to finance education as it will encourage competition among the education sector along with providing the government with excess funding to be distributed towards higher education, which will be increasingly important in creating skilled workers for the emerging services industry.

Sri Lanka must fast track investments in ICT infrastructure. As Sri Lanka attempts to position itself as a major destination for offshoring activities, it will be even more important to have an adequate ICT infrastructure and good human resources. It is important that the country possesses the skills necessary to supply the BPO sector. Sri Lanka can also consider establishing something along the lines of Korea's Informatization Fund. Such a fund could build upon the achievements of the e-Sri Lanka initiative and help to develop IT connectivity, culture and literacy levels within Sri Lanka, and thereby, lessen the digital divide.

II Singapore's Transition to the Knowledge Economy: From Efficiency to Innovation

Singapore's commitment to efficiency has attracted FDI that has allowed it to grow rapidly. Singapore's government had always been committed to the concept of efficiency, recognizing early on that, to compensate for the country's natural "comparative disadvantage" associated with being a small economy with a limited domestic market and population size, Singapore would need to develop a highly efficient and productive infrastructure system to help reduce production costs and attract foreign investors. This commitment to efficiency, along with an honest government, which adopted proactive growth strategies and a highly educated, English-speaking workforce, has made Singapore a choice production base for multinational corporations. There are currently over 5,000 foreign companies located in Singapore and many more multinational corporations and foreign financial institutions which have established operating and manufacturing bases on the island.

Singapore has also been successful in attracting talented foreign nationals. Approximately 19 percent of the population of Singapore is made up of foreign nationals. As a result of this ability to attract foreign capital and skilled foreign workers, the Singaporean economy has grown at 8.5 percent per annum in recent years and per capita income has grown at 6.6 percent, roughly doubling every decade. Over the years, the economy has gradually moved into more technology related fields. Labor intensive industries such as textiles, once important to the island's economy are no longer part of Singapore's economic landscape.

Like other Asian countries, Singapore re-evaluated its growth strategies after the 1997 crisis. Following a period of impressive growth, the 1997 Asia economic crisis led the country to reevaluate its development strategies.⁸¹ Singapore has since recognized that efficiency alone will no longer guarantee sustained growth in the future and that it will need to formulate alternative strategies for growth.

Where does Singapore currently stand in the Knowledge Economy?

Singapore is good at incorporating existing technology, but it lags far behind other developed countries in the ability to create new technologies. In the Global Competitiveness Report, Singapore was ranked 25th in terms of firm level innovation in 2002, below most developed economies. The country ranked in the top 10 in the world in terms of technology using indicators such as quality of school science and technology education, licensing of foreign technologies etc. But it was rated much lower in technology-creating indicators like R&D spending, R&D personnel, availability of venture capital and intellectual property protection.

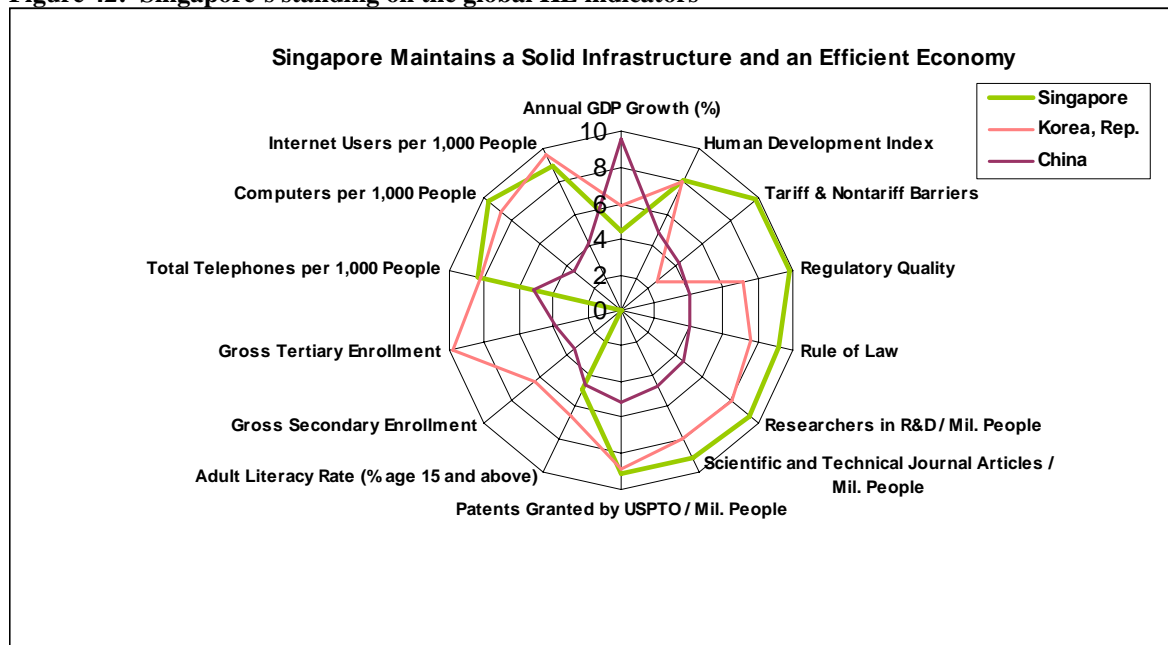
Singapore's education system is also proving a brake on improving the KE. Singapore performs poorly in terms of entrepreneurial activities, ranking 21st among the 31 countries surveyed in the 2003 Global Entrepreneurship Monitor studies.⁸² Singapore's knowledge economy scorecard further emphasizes the country's weaknesses. Adult literacy levels are much lower than Korea and equivalent to those of China (Figure 42). However, the scorecard also demonstrates the country's powerful economic and institutional regime, scoring remarkably high in rule of law, regulatory quality and tariff and non-tariff barriers.

⁸¹ Tan, Kim-Song. 2005.

⁸² Tan, Kim-Song, 2005. p. 3

Despite housing developed and active technological industries, Singapore has only recently begun to innovate domestically. Manufacturing contributes 22 percent to Singapore's GDP with electronics obtaining half the country's manufacturing output, while finance and business services maintain 26 percent. Manufacturing and services are the twin engines of the country's economic growth. Singapore has become the disk drive capital of the world and is home to a semiconductor hub, currently producing one third of the world's disk drives and housing fifteen chip fabrication plants. It has a 70 percent market share in the manufacture of offshore oilrigs. In aerospace, Singapore has the second largest cluster of aerospace maintenance, repair, and overhaul activities. In biomedical sciences, six out of 10 top pharmaceutical companies manufacture in Singapore.⁸³ The country has over time begun to recognize that in order to remain internationally competitive; it will have to focus on domestic innovation.

Figure 42: Singapore's standing on the global KE indicators



Source: World Bank. Knowledge Assessment Methodology, www.worldbank.org/kam

Embarking on a New Innovation Strategy

Key to Singapore's future growth is its investment in innovation over efficiency. In 2002, a high level Economic Review Committee (ERC) was organized by the government in order to assist the country in formulating a new development strategy. The ERC's strategy focused on enhancing the economy's innovative capacity, with the aim of making Singapore an innovation hub for Asia. The government has since devoted more resources for R&D and innovation.

Previous five year plans implemented by the National Science and Technology Board (NSTB), starting from the early 1990s, sought to target mainly short term applied technological innovations, with few attempts to deepen the culture and practice of innovation across the whole economy. Singapore's new innovation strategy, however, seeks to accomplish these goals by developing basic innovation and cultivating a scientific culture. At the 2002 Knowledge Economy conference in Sydney, Ko Kheng Hwa, MD of the Singapore Economic Development Board (EDB) discussed the country's strategy in making the transition to the knowledge economy without abandoning its powerful presence in manufacturing (Box 8). He emphasized that Singapore is looking to reform its innovation system to focus on "the broad

⁸³ Hwa, Ko Kheng, 2003.

and the basic”; from drug discovery, all the way to clinical development, clinical trials, process development and manufacturing to the provision of health care services. It aims not only to promote innovations in manufacturing, services and creative content, but also to do so at different levels of firm size, from giant MNCs to local small and medium enterprises. To pursue these strategies, the Government has allocated \$S7Billion in the next five years to support public sector R&D which will, in turn, stimulate private sector R&D.⁸⁴

Box 8 Singapore’s Strategy for Future Development

Strategy 1: Build bridges through a web of free trade agreements. These free trade area agreements, both multilateral and bilateral, will be a crucial part of Singapore’s strategy to build bridges to key economies to the world, and to increase market accessibility of companies based in Singapore.

Strategy 2: Broaden the industry base and develop new growth clusters. The country will focus on new industry clusters such as bio-medical, nanotechnology in manufacturing, as well as a portfolio of internationally salable services with high growth potential, such as educational services, professional services, and intellectual property management.

Strategy 3: Whether in services or manufacturing, the country will build new capabilities to move up the value chain in three particular areas. The first will be lifting the value added of production activities, for example, into highly automated manufacturing. The second is moving upstream into R&D, into innovation and tax baits for new ideas. The third is moving downstream into regional electronics supply chain management into market development, brand management in Asia Pacific, intellectual property management in Asia Pacific, enlarging the regional headquarter operations.

Strategy 4: Creating a vibrant enterprise ecosystem by developing the venture capital industry, increasing tax incentives for new ideas, and provisions of new users to try out the country’s new inventions.

Source: Hwa, Ko Kheng. “Knowledge Powers Singapore Economy.” Information Age. 13/02/2003

The new plan intends to shift the focus of innovation to developing technology within small firms in the services sector. More resources are being devoted towards long term, basic research. There is also an increased awareness that a significant part of innovation actually comes from small firms. The untapped innovative energy within the services sector has become a high priority. In addition to traditional service industries that thrive in Singapore such as financial, tourism, entrepot trade, healthcare, transport and logistics, the government is also actively promoting the country as a regional hub in other service industries like education, legal services and creative industries.

In order to make these transitions, the Singaporean government is investing heavily in innovation infrastructure, rather than efficiency infrastructure, deemed necessary to building up a critical mass of innovative people and innovative activities, with the immediate objective of attracting the right type of workers rather than the right type of firms (Box 9). There are also efforts to change the “mindset” of Singaporeans, to bring out the enterprising and adventurous spirit in them, by increasing the availability of innovation-enabling infrastructure such as R&D facilities, well-defined intellectual property laws, venture capital etc.⁸⁵

⁸⁴ Hwa, Ko Kheng, 2003.

⁸⁵ Tan, Kim-Song, 2005.

Box 9: Crafting an Innovation culture and the “One North” Project

In order to attract and retain creative talent, Singapore has been heavily investing in cultivating an environment that is both supportive and conducive to innovation and enterprise. Launched in December 2001, “One North” is quickly becoming a world class R&D hub for scientists and entrepreneurs working in the biomedical sciences, ICT and media. The project is expected to be completed within a 15-20 year period. Phase I of the project will construct two centers of activities; Biopolis which will serve as the focal point for biomedical sciences R&D and Fusionpolis which will house collections of firms involved in R&D and production works for ICT and media industries. The project will focus on the whole range of production activities, including a large portion of basic research while promising a “total living and working environment” with not only research institutes and business offices but also residential properties, shopping, public parks and other facilities. It will be equipped with state of the arts facilities in computing network, sewage disposal and energy generating systems and an internal shuttle train system.

The project claims to offer opportunity for “seamless interaction” among research scientists, entrepreneurs, and other business and services sector operators within an “enclave” environment. The project’s close proximity to other major tertiary institutions (e.g. National University of Singapore, INSEAD Asia campus) makes for easy collaboration with researchers from outside. The tenants of One-North comprise both public and private research institutions and business enterprises including The Genome Institute of Singapore and the Bioinformatics Institute. Private companies such as GlaxoSmithKline, Novartis Institute for Tropical Diseases are already set up and Vanda Pharmaceuticals and Paradigm Therapeutics have also signed up. Many of these firms intend to undertake a wide range of activities in Singapore, from basic research and development to product and process development, clinical research, manufacturing, business headquarters and healthcare delivery operations.

When fully occupied, the seven buildings in the Biopolis project will house about 4,000 researchers when the project is completed. Many of the researchers working in One-North will likely be foreigners. To overcome the shortage of scientists in Singapore, the government is actively recruiting from abroad. Already, some acclaimed researchers have moved into the Biopolis including Doctor Alan Colman, who cloned Dolly the sheep, has moved from Edinburgh to Singapore to continue his research. Dr Edison Liu, director of the National Cancer Institute of the US, is now in Singapore heading the country’s Genome Institute. Professor Yoshiaki Ito, one of the chief authorities on stomach cancer research in Japan, together with his team of 10 researchers, has uprooted and moved to Singapore to continue the research.

Source: Tan, Kim-Song. “From Efficiency-Driven to Innovation Driven Economic Growth: Perspectives from Singapore.” April 2005. (p. 14-16)

IPRs and Patents

The Singaporean government is committed to protecting innovators. The government has upgraded the Registry of Trade Marks and Patents to a statutory board called the Intellectual Property Office of Singapore (IPOS) in 2001 in order to formulate and regulate an entire range of IP legislations. IPOS has the mandate of building an environment that promotes greater IP creation, protection and exploitation in Singapore and has been active in developing regional and global networks, including signing various bilateral and regional treaties (including US, EU and Japan), to help extend the reach of Singapore’s IP community. In January 2003, IPOS also helped launch the Intellectual Property Academy, which has been mandated to help strengthen the IP competency in Singapore through research and education.⁸⁶

Venture capital

Government support has been a key feature of the venture capital industry development since the mid-1980s. The government was instrumental in setting up early venture capital funds such as Vertex

⁸⁶ Tan, Kim-Song, 2005. p. 17

Management and EDB Ventures. In the late 1990s, it launched a US\$1 billion “Technopreneurship” Investment Fund (TIF) to induce leading venture capitalists in the world to use Singapore as the regional hub and to spur training for a core of venture capital professionals. There are currently more than 100 venture capital firms in Singapore and they manage a total venture capital fund size of \$14Bn, investing in enterprises in Singapore and in the region.⁸⁷ However, Singapore’s major fault in venture capital is that these funds are reluctant to finance early seed stage projects. Thus, Singapore started a unique program whereby the EDB matches dollar for dollar any third-party investor who puts money into early seed stage start-ups, up to a max of \$300,000.⁸⁸ This is a good example of the enterprise ecosystem that Singapore is committed to establishing.

Recent Issues and Challenges facing Singapore’s Knowledge Economy

Innovation System

In innovation, as opposed to technology assimilation, Singapore will need to take bigger risks. The Singapore government plays a very active role in innovation, both in funding as well setting the strategic direction of which specific industries to promote. In the early years, Singapore catered to the known requirements of the multinational corporations, exploiting the shift in production bases over the course of the product cycle. It used existing technology without having to “push the frontiers”. Innovation businesses, on the other hand, require a considerable amount of frontier pushing and entail a great deal of uncertainty in terms of the ingredients needed to create the necessary and sufficient pre-conditions for success.⁸⁹

Singapore can develop itself into a regional hub for a number of service industries by maintaining a lighter regulatory approach. Like the manufacturing sector and innovation businesses, the services sector could leverage on Singapore’s strength in efficiency infrastructure. Indeed, combined with the existing hub status in certain service industries, such strength could also give Singapore a “first mover advantage” when making inroads into other service industries such as education, legal services, creative industries etc. Given the state of development in the services sector in the region, and the fast changing technology that makes services increasingly tradable, Singapore could still extract considerable value by merely moving closer to the global efficiency frontiers in the service sector without necessarily engaging in “frontier-pushing” innovations. More than the manufacturing sector, the growth of the services sector is influenced by changes in the regulatory policy. A lighter regulatory approach could make a big difference. The healthcare industry is one example. In recent years, the growth of Singapore as a regional medical hub has been hampered by a shortage in the supply of doctors and restrictions on the registration of foreign doctors. This has resulted in high private medical costs and an opportunity for some other cities in the region including Bangkok (Thailand) and Malacca (Malaysia) to vie for a slice of the pie.⁹⁰

The country’s entrepreneurial base needs to be enhanced. The number of individuals involved in R&D work has increased significantly over the past few years, in large part because of the inflows of foreign researchers. But how this will translate to greater output remains to be seen. Over the past three years, there was also a significant increase in the number of patents filed in Singapore (Figure 43). However, most of the patents were filed by non-Singapore residents (e.g. 7,340 out of 7,580 in 2002). In Taiwan, for instance, domestic residents filed 24,846 patents in 2002 compared with 20,196 patents filed by foreigners. The trend is similar for trademark registration. Singapore’s ranking in the Global Entrepreneur Monitor actually fell in 2003. It was ranked 15th in a group of 22 OECD/East Asian

⁸⁷ Tan, Kim-Song, 2005. p. 18

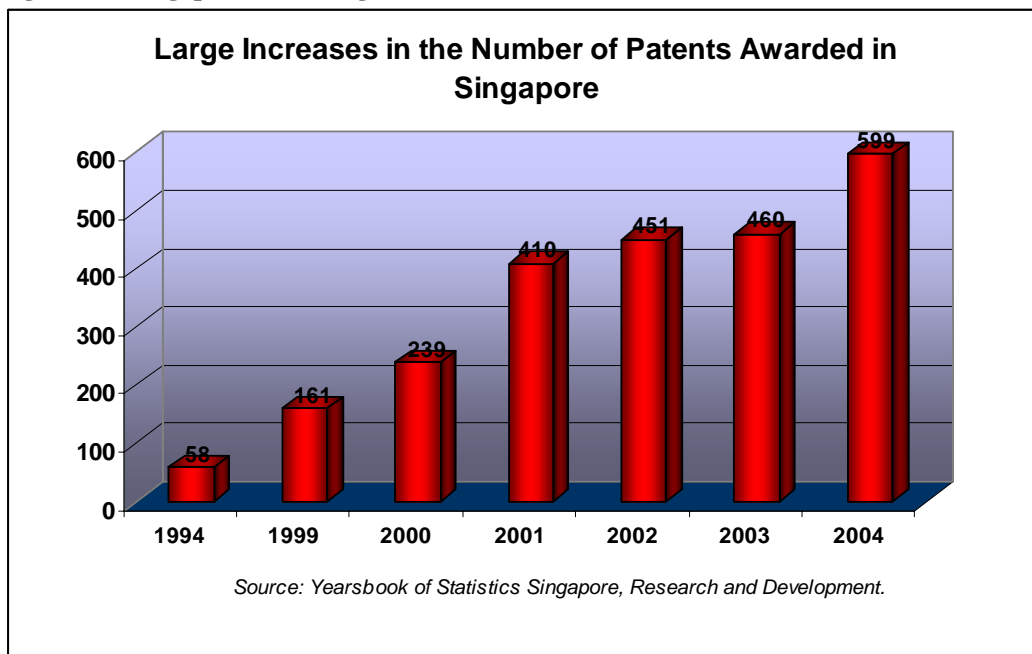
⁸⁸ Hwa, Ko Kheng, 2003.

⁸⁹ Tan, Kim Song, 2005.

⁹⁰ Ibid.

countries, compared with 11th a year earlier. In order to reverse these trends, Singapore's needs to develop entrepreneurs that are keen on commercializing their findings.⁹¹

Figure 43: Singapore increasing its innovation record



The industry focus of Singapore's innovation efforts could be difficult to define due to the country's market structure. It would be advantageous to focus on innovation in the high-tech manufacturing sector, an area in which Singapore has already built up a certain capacity for innovation. To capitalize on the increasing returns and agglomeration effects in innovation activities, deeper resource specialization is often necessary. However, investment in any particular industry must be sizeable enough for increasing returns to kick in. A diffused approach may not be effective in the end. However, concentration of resources in a few industries in accordance with the economy's perceived comparative advantage may require a lot more winner-picking and entail more risks than what the government is comfortable with. "Over-specialization" in production could result in growth patterns which may be too volatile for a small city-state. Already, "over-reliance" on the electronic industry has led to much wilder swings in GDP growth in Singapore in recent years. In this context, Singapore does face more constraints than its potential rivals in the region such as Hong Kong, Seoul and Shanghai in terms of the strategy it can pursue and the risks it can take.⁹²

The government should encourage the private sector to bear the bulk of innovation projects. The government will need to be willing to spread its resources over a wide range of industries, with the understanding that only a certain fraction of the investments will bear fruit. To compensate for its limited insight in the working of the market forces, the government often tries to bring in private sector participation, both to share the investment risk and to provide the discipline needed to guide and develop the business. The government could mitigate the risk it faces by encouraging as much private sector participation as possible and by monitoring the performance of its investments closely and frequently.

⁹¹ Ibid.

⁹² Ibid.

The Singaporean government needs to loosen its regulatory grip on the economy in order to foster a more risk taking entrepreneurial population. Too many rules and too harsh a stigma for non-conformist behaviors are said to have hindered Singaporeans' ability to innovate or to think independently. The society's intolerance for failure is also seen as a further hindrance to entrepreneurship. As part of the efforts to encourage innovation, there have been some attempts in recent years to relax the regulatory environment and government control over the social and political lives of the population. Committees were set up to identify areas where the government may be able to lighten rules and regulations so as to make it easier for individuals to start and operate businesses. Schools are revamping their curricula to inculcate a stronger entrepreneurial mindset in the students.⁹³ Changing the culture and mindset of the population to one that is more open-minded and thus, entrepreneurial will allow Singaporeans to take bigger risks in education, innovation, and business practices.

Education Issues

Tertiary education has been assigned a high priority in recent years in order to develop the human skills necessary to facilitate the country's emerging R&D efforts. Education in Singapore is highly subsidized and constitutes the second largest item of government expenditure. The country has transformed its education system into one that is industrially targeted, able to provide the higher technical skills as well as the worker training needed for high-technology production. In the process, the government has exercised control over curriculum content and quality, and ensured its relevance to the activities being produced. Manpower planning is effected through detailed quotas on the number of students to be admitted to specific programs (law, medicine, architecture, civil engineering, computer engineering, etc) at the tertiary institutions.

In July 2001, the country announced its incentive of about US\$285 million in financial support to talented undergraduate science scholars throughout their doctorates. The purpose is to ensure a steady supply of local research scientists to fuel growth in engineering and the sciences. In 2004, the government announced plans to devolve greater operational and financial autonomy to the three universities and put in place a Quality Assurance Framework for Universities to track quality enhancement in the universities. Apart from formal education, the government also directed considerable effort towards developing the industrial training system, now considered one of the best in the world for high technology production. In addition, a new agency, the Singapore Workforce Development Agency, was established in 2003 with the specific purpose of enhancing workforce skills through developing a comprehensive, market-driven and performance-based adult continuing education and training framework.⁹⁴

The government is heavily encouraging research within universities through a variety of mechanisms. Funding for research programs and graduate studies has risen substantially, especially in selected areas such as life sciences, information technology, communications and management studies etc. There is also aggressive recruitment of research faculty from abroad and greater research collaboration with reputable universities outside Singapore. The government, in an effort to transform the country into a regional education hub, is allocating a large amount of resources to the R&D efforts in the tertiary educational sector to enhance its research and innovation capacity.

Government grants have helped attract foreign universities to establish in Singapore. Government grants were given to set up joint research centers between the local and reputable foreign universities to fund collaborative projects between them. Nine world class universities offering courses in Singapore, ranging from MIT, Wharton, Johns Hopkins, Shanghai Jiaotong University, and INSEAD, and Chicago

⁹³ Ibid.

⁹⁴ Tan, Kim-Song, 2005.

Graduate School of Business, have set up their Asia campuses in Singapore.⁹⁵ More resources are also channeled to specific areas of study seen to be closely linked to the government's blueprint of an innovation-based economy: life sciences, entrepreneurial studies, communications etc.

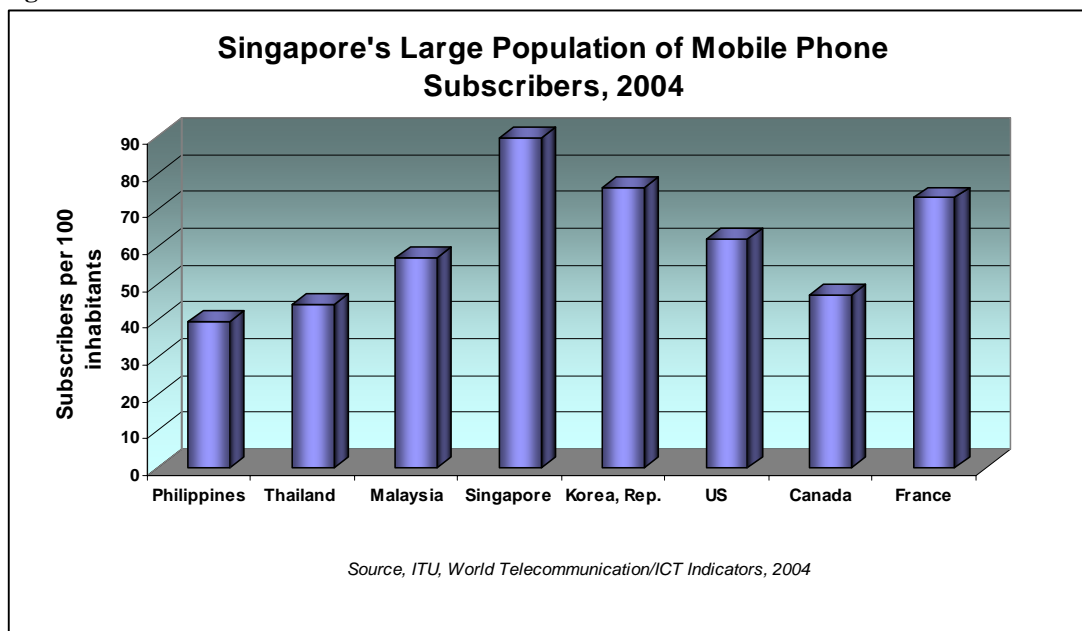
A key element of this drive for research excellence is the attraction of top researchers from abroad. Rules and regulations regarding granting of licenses for private educational institutions, programs that can be offered and intake of foreign students have been rapidly liberalized. This is aimed at building up a critical mass of educational service providers to cater to the rising demand in the region for quality education at all levels, from secondary school to tertiary and post-graduate levels.⁹⁶

Information Infrastructure

Singapore's information infrastructure has managed to connect a large percentage of the population through its commitment to liberalization and competition. The government has implemented policies to develop an information communications sector and has aspirations for Singapore to be the information hub for the region. The state owned monopoly, Singapore Telecoms, was partially privatized through listing on the stock exchange in 1993 to help realize greater efficiency. Market liberalization and a pro-competition framework were established, with regulatory functions performed by the InfoComm Development Authority (IDA).

Competition has lowered prices and spurred demand in the telecoms sector. As of September 2003, the mobile phone penetration rate in Singapore had reached 82 percent, the highest in Asia (Figure 44). The Singapore ONE project, launched by the government in 1998, provides broadband infrastructure of high capacity networks and switches, with the goal of making broadband access available to 99 percent of the population. Between 2000 and 2002, the household and corporate broadband penetration rates grew from 8 percent to 24 percent and from 15 percent to 41 percent, respectively. By June 2003, the household broadband penetration rate had increased to 31percent, in step with the IDA's target of 50 percent by 2006.⁹⁷

Figure 44: Telecom liberalization has resulted in mass access



⁹⁵ Hwa, Ko Kheng, 2003.

⁹⁶ Tan, Kim-Song, 2005.

⁹⁷ Ibid.

Singapore has been effective in incorporating IT into schools through a uniform teacher training system offered by the MOE. The National Institute of Education (NIE) is the sole teacher training institution in Singapore responsible for producing teachers effective in preparing students for knowledge for development. The programs are conducted at the diploma, degree, masters, and PhD levels. The MOE launched the IT Master plan for Education in April 1997 to effectively infuse ICT into education. This is a five year S\$2 billion plan that aimed to set out a blueprint for the use of IT in schools, and to provide access to an IT enriched school environment for every child.

At each phase of the implementation, each primary school was provided with an initial student-computer ration of 6.6:1, and spent about 10 percent of its curriculum time on IT based learning. Secondary and junior colleges started with 5:1 and 10 percent respectively for the student-computer ration and curriculum time.

The Master plan provides for the eventual targets of a student-computer ration of 2:1 and 30 percent IT based learning curriculum time. To facilitate the move towards an ICT enriched environment, NIE has adopted 'blackboard' as its entry level course delivery system, which provides the basis upon which the various e-learning models used by NIE can be built. The templates provide an easy entry to online course development for staff members using online teaching for the first time.⁹⁸ The program has been effective in preparing teachers in incorporating IT learning into their curriculums and thus, producing an IT literate population.

The Singapore government was also one of the first in the world to implement an e-government system. The Ge-BIZ portal on the e-government site was the world's first Internet-based government procurement system. At the e-Citizen centre, Singaporeans can obtain information and bid for certificates to register a vehicle, file their taxes, download forms to file for bankruptcy, register a marriage, baby, car or a pet, apply for a passport, housing or utilities, check their provident fund accounts or their child's school registration status, etc.⁹⁹

What can Sri Lanka learn from Singapore's innovation strategy?

Sri Lanka should strengthen its R&D system and cultivate innovation in its universities. Singapore recognized, early on, that it needed to develop a powerful innovation sector in order to remain competitive in the knowledge economy. The country moved quickly to address the KE pillars and brought in international experience and funding wherever possible. Sri Lanka could acquire some of these strategies in its development by encouraging a culture of innovation and more stringent protection of property rights. The country should also invest more heavily in university and private sector R&D. At the moment, the country's education system deters innovation. Students are generally not encouraged to conduct or promote research and even children in school are not encouraged to ask questions.

Singapore has been able to combat a demotivating research environment by investing more focus in creating an innovation culture through attracting the right type of people through projects like 'One North' (see Box 9) that enhance research communities. Sri Lanka could devote more effort to creating stronger research communities on a smaller scale, encouraging researchers to interact with each other and get excited about the prospects of innovation and commercialization by building links with the private sector.

⁹⁸ Cheah, H.M. and T.S. Koh. 2002.

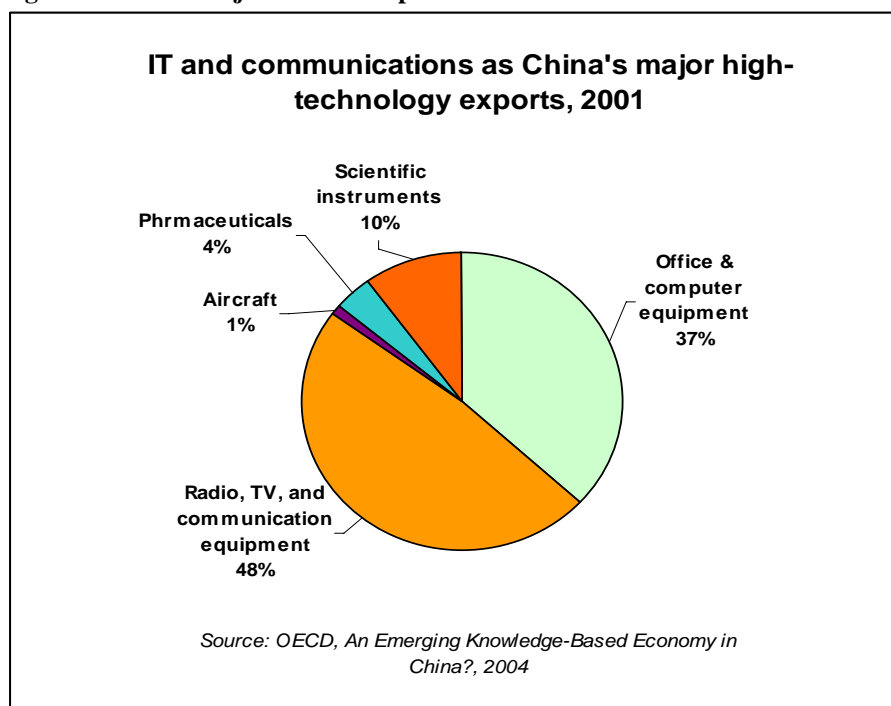
⁹⁹ Ibid.

III China: ‘Opening Up’ to the Possibilities of the Knowledge Economy

China’s ability to maintain its current rates of growth will depend on investments in the KE. At almost 1.3 billion, China’s population is estimated to be 1.6 times the size of the population of the United States, EU and Japan combined. With such a large population and despite even greater economic disparities, the country has been able to enjoy long periods of stellar growth (averaging 9 percent per annum for decades). In order for China to maintain high growth rates and raise the living standards of its population the country will need to invest in new KE techniques and sectors that will make it more competitive.

China’s astronomical growth advances have been the result of the country’s ability to provide low cost, assembly line manufacturing. By the beginning of the next decade, China could become the largest exporter in the world, accounting for an estimated 10 percent of global trade. This rapid growth in China’s trade can primarily be attributed to its ability to provide cheap goods for export. The country has been able to successfully and efficiently provide assembly line services for the production of ICT goods, in particular. They now account for the largest portion of China’s export trade, approximately 30 percent in 2005, up from just over 12 percent of total trade in 1996. In 2004, China ranked as the world’s largest exporter of IT products, outstripping the EU, Japan and US, with its major IT exports being computer and communications equipment (Figure 45).

Figure 45: ICT a major Chinese export hub



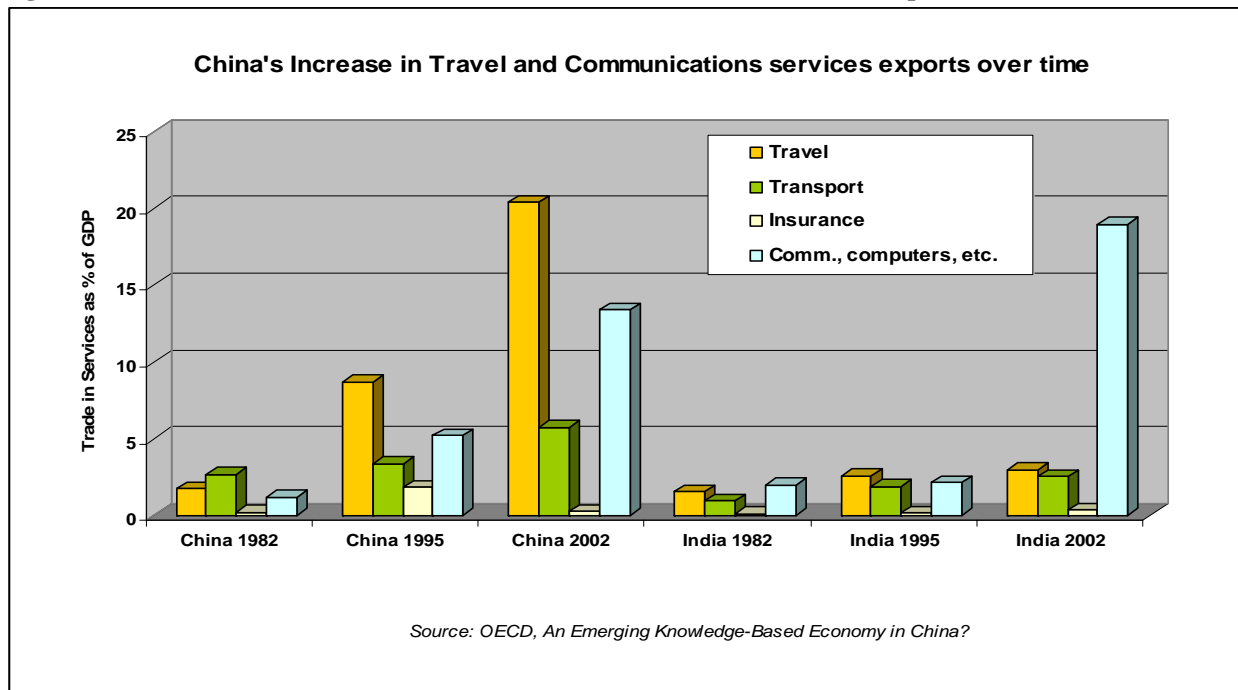
China is currently facing major challenges in its transition towards a knowledge and services based economy. In 2005, the country produced 303 million mobile phones and 81 million computers, taking second place as the world’s largest PC market, and it also became the world’s third largest producer of

semiconductors.¹⁰⁰ China's pace of IT manufacturing has drastically brought down IT costs globally. Although the country's advances in manufacturing have been impressive, China has only recently begun to confront the limitations of the sources of its growth: low cost manufacturing, imported and assimilated technology, significant flows of foreign investment, and an extremely high savings rate. China is making a rapid transition to a services based economy, with travel and communications service becoming the country's largest exports (Figure 46).

China has opened itself up to competition with its recent accession to the WTO. China's agreement with the WTO entails that it will be opening itself up to total competition, signifying that the country will need to find a comparative advantage in order to remain competitive in the global economy. The conditions of economic competition in China remain poor and strongly infused by monopolies, obscure procurement policies, protected markets, and interprovincial barriers to trade.¹⁰¹ By joining the WTO, China has agreed to undertake a series of important commitments to liberalize its regulatory framework in order to integrate in the world economy and provide a more predictable environment for trade and foreign investment in accordance with WTO rules (Box 10).

Existing tariff and non tariff barriers to internal trade diminish the potential of China's large internal market for realizing economies of scale and scope, and the removal of these barriers will allow the country to take full advantage of its large market.¹⁰² With competition coming from all sectors of the world, it will no longer be enough to import or copy high end technologies from the US and Europe. If China is to find a place in the world economy, it needs to shift to producing higher value added goods in order to support future waves of economic growth.

Figure 46: China increases travel services as India increases communications exports



¹⁰⁰ OECD Observer, 2006.

¹⁰¹ OECD, 2004

¹⁰² Ibid.

Box 10 : Accession to the WTO Entails Important Changes

The commitment of China to the World Trade Organization on a set of trade reforms that will have far-reaching impact on its economy:

- China will provide non-discriminatory treatment to all WTO Members. All foreign individuals and enterprises, including those not invested or registered in China, will be accorded treatment no less favourable than that accorded to enterprises in China with respect to the right to trade.
- China will eliminate dual pricing practices as well as differences in treatment accorded to goods produced for sale in China in comparison to those produced for export.
- Price controls will not be used for purposes of affording protection to domestic industries or services providers.
- The WTO Agreement will be implemented by China in an effective and uniform manner by revising its existing domestic laws and enacting new legislation fully in compliance with the WTO Agreement.
- Within three years of accession all enterprises will have the right to import and export all goods and trade them throughout the customs territory with limited exceptions.

Source: World Bank, China's Employment Challenges and Strategies after the WTO Accession and World Trade Organization.

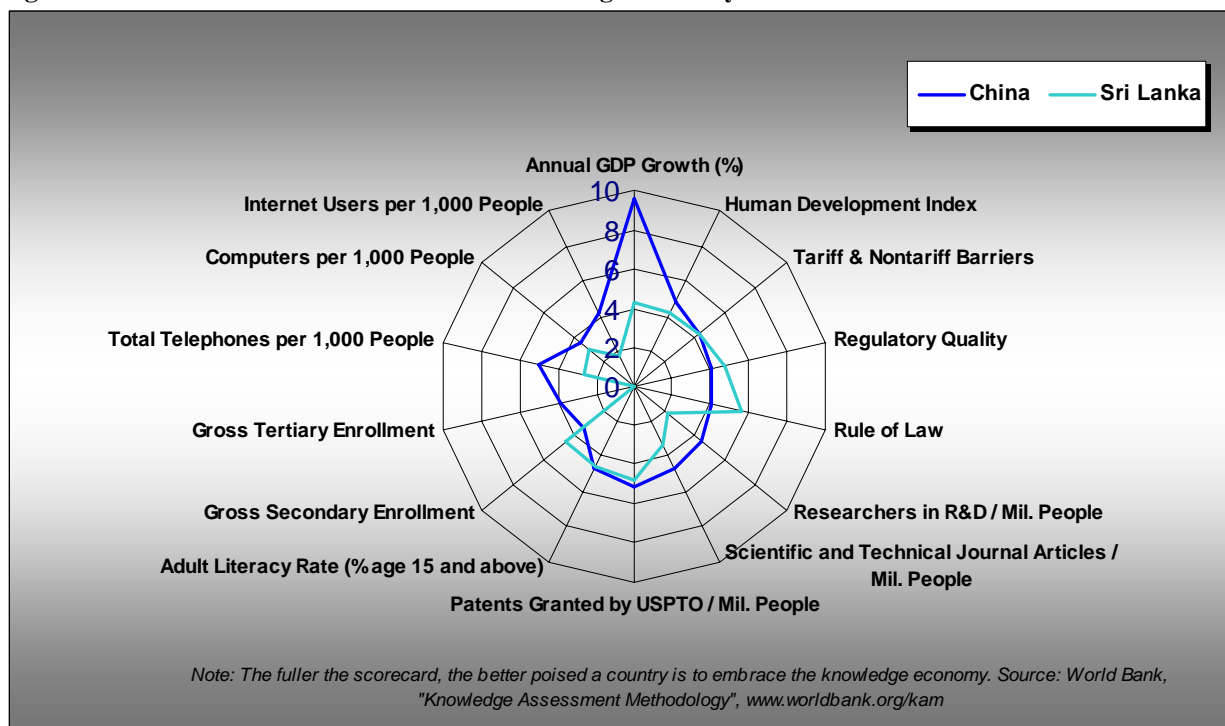
As China increasingly exposes itself to intense global competition, the country is accordingly looking to foster domestic innovation to carry it through the next stage of development. China differs from its neighbors in that China has long encouraged heavy inward investment. Of the 55 percent of China's total exports that are attributed to production and assembly-related activities, 58 percent of these are driven by foreign enterprises, of which 38 percent are entirely foreign owned. In fact, not one of the top ten high technology companies is Chinese.¹⁰³ Much of the IT assembly takes place in China, with components often imported from Japan, Taipei, the US and Europe. In response to the country's domestic innovation weaknesses, China has enacted a series of policies to transition from being a low cost manufacturer to being a global provider of high value added products, such as software, information security, and IT services. In its recent, eleventh five-year national plan for 2006-2011, the Chinese government announced its intent to foster domestic innovation in all high tech sectors through greater investment and domestically owned patents, and to reduce its dependence on foreign technology.

China's ability to embrace the knowledge economy is currently hindered by its poor rule of law, constrained markets, and low tertiary education enrolments (Figure 47). China has large and diverse provinces that differ greatly in natural and human resource endowments and in economic performance and welfare indicators. Prosperous areas include Beijing, Shanghai, and Tianjin. Parts of the poorest provinces appear to be several centuries behind in their technology and living standards. Beijing and Shanghai, the most knowledge intensive areas in China, have knowledge intensities 6.1 and 5.3 times the national average.¹⁰⁴

¹⁰³ OECD Observer, 2006.

¹⁰⁴ OECD, 2004.

Figure 47: China's Current Position in the Knowledge Economy



Overall, China has experienced impressive economic performance, reaching a high-level of human development and exceptional growth rates. The scorecard demonstrates that China's economy is still relatively protected from international competition as it scores low on tariff and non tariff barriers. Its market's lack of international exposure has resulted in a lack of competitive pressure by the global community, an environment that is not conducive to stimulating innovation and growth. China is average in its use of FDI as a way of obtaining global knowledge, but it does poorly in its domestic R&D and in the technological intensity of its exports. It also scores poorly in the indicators for the rule of law and control of corruption. The country does fairly well on adult literacy, but less well on secondary enrolment rates, and even worse on tertiary enrolment rates. The absolute number of enrolments in, and graduates from tertiary education in China match the numbers in the United States and the EU. Although large in absolute numbers, only a small portion of the population in China has a tertiary education degree. China's level of enrolments in and graduation from advanced research programmes, such as PhDs, is also significantly lower compared to other economies.

Recent Issues and Continuing Challenges facing China's Knowledge Economy

Economic and institutional Regime Issues

A considerable amount of China's economic growth has been fuelled by significant changes in government economic policy that have progressively given market forces greater autonomy. China is now in the middle of a significant transformation from a command economy to a market driven society. The momentum towards a freer economy has continued with membership of the WTO leading to the reform of a large number of China's laws and regulations and the prospect of further tariff reductions. In 2005, regulations that prevented privately owned companies from entering a number of sectors in the economy, such as infrastructure, public utilities and financial services were abolished, permitting the emergence of a powerful private sector in China's economy. The government has also introduced reforms into the state owned sector that dominated the economy in the early 1990s. State-owned enterprises have

fairly recently been transformed into corporations and, as a result, the number of state controlled industrial enterprises fell by over one half in the following five years. This transformation was supported and facilitated by the introduction of more flexible employment contracts and the creation of unemployment and welfare programs.¹⁰⁵

However, China's incentives and institutions, despite considerable progress, still constrain the economy from taking full advantage of rapid advances in global knowledge. China's institutions remain legacies of the command economy and of the Chinese traditional conceptions of the state and society, which encourage the allocation of resources based on privilege and familiarity rather than viability and productivity, causing inefficiencies in business and innovation. China's legal system, in particular, has been regarded as being extraordinarily complex and unclear, due to many uncoordinated legal initiatives of the different levels of government. Corruption, weak enforcement mechanisms, inadequately trained and underpaid judges are all staples within China's rule of law. Tax collection in China is also underdeveloped; the tax revenue of the central and provincial governments is just 14 percent of GNP, which is less than half the average for OECD countries. As a result, the government is forced to finance its spending through off budget funds, from banks.

China's financial system remains underdeveloped and is dominated by the banking sector, which is more than three times larger than the stock market. In the past, the bulk of lending went to SOEs, with the rest distributed as policy loans. But many distressed SOEs have begun to stop payment on their loans, creating a high level of non performing loans in the banking system. These forced loans constrain the emerging private sector's access to sufficient credit from the formal banking system, as banks are allocating all of their capital to projects which are less productive than some private sector projects. Thus, most of the financing for the private sector comes from re-invested earnings and informal financing, which limit the speed with which it can expand and provide productive employment.¹⁰⁶

China's government will have to reduce its direct influence on the economy and simply guide the market to promote a self-regulating, knowledge-based, socialist market system. In order to improve upon the country's political weaknesses, the government will need to create agencies for consumer protection, guard against anti-competitive practices, remove barriers to private development and foreign participation in services, where excessive regulation have constrained growth; strengthen the financial sector by increasing the autonomy of Chinese banks, permitting them to allocate capital more efficiently by instituting risk based, rather than policy based lending practices, and further develop the stock and insurance markets.

Innovation System Issues

The reform of the 1980's focused on pushing enterprises to be the driving force of S&T and R&D activities. Since the beginning of the reforms of China's national innovation system in the 1980's which sought to change the country's soviet style R&D system, the government has implemented two large scale national S&T programs that aim to foster high quality fundamental research and to facilitate the commercialization of technology. In China, the ICT industry is the most dynamic sector of the economy and there is evidence of a fast improvement of domestic firms' technological capability. The rapid evolution of the ICT infrastructure, (telephone mainlines, mobile phones, PCs, and internet) has contributed to knowledge creation, codification, and diffusion and forged a linkage between China's knowledge network and the global knowledge network.

China's new Science and Technology Program seeks to foster domestic innovation on all levels in a way that the reforms were not able to. In January 2006, China's Science and Technology Congress met

¹⁰⁵ OECD, 2004

¹⁰⁶ World Bank, 2001.

for 3 days to approve a medium and long term Science and technology program. The program identified priorities for the next 15 years and confirmed the aim of boosting investment to 2 percent of GDP by 2010 and 2.5 percent by 2020. In 2006, China for the first time spent more on research and development at just over USD 136 billion on R&D than Japan and so became the world's second highest investor in R&D after the United States. Reaching these targets will require investment in 2020 to be six times what it is today.¹⁰⁷

The Medium to Long-term plan determines 68 priority goals spread across 11 key areas of importance to China's economy and development including energy, environment, agriculture, manufacturing, transport, and public health. The plan also seeks to embark on 16 special research projects focused on core electronic devices, extremely large scale integrated circuit manufacturing technologies, wideband wireless mobile communications technology, breed new transgenic biological varieties, large scale advanced pressured water reactor, prevention of infectious diseases such as AIDS and hepatitis, R&D of giant planes, and manned space flights. Eight cutting edge technology areas and four major new research programs in protein research, nanoscience, growth and reproduction and quantum modulation research will also be implemented in upcoming years.

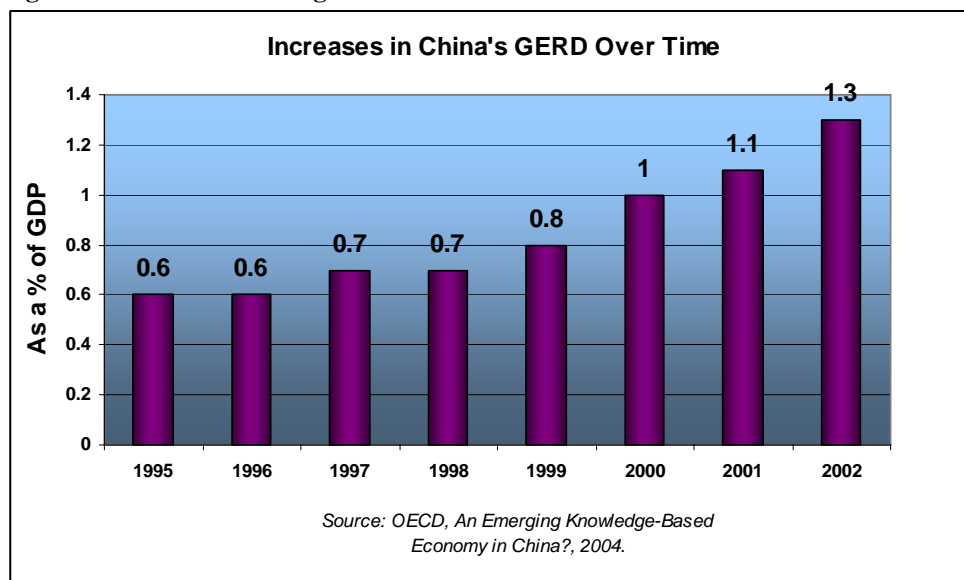
China's Innovation Strengths

Chinese policy is becoming more outward facing, as the government starts to think in terms of an integrated national system of innovation in order to meet the goals of its S&T program. China has a great chance of meeting the aforementioned goals as the government maintains the ability to mobilize resources, the world's largest scientific workforce, a high output of scientific papers and a successful strategy to attract overseas talent back to the country. Second, traditional forms of state planning and control are being replaced by lighter touch, enabling frameworks, including new funding structures and performance measures, and a far greater role of enterprise and private sector R&D. Third, there has been a marked improvement in the university sector, both in terms of the quantity of graduates, with around 350,000 IT graduates in 2004, and also in the quality of degrees and PhDs. China counts now more researchers than Japan, and is on its way to potentially overtake the EU as well. Finally, China has stepped up in the internationalization of its research system, with extensive networks of collaboration across Europe, Japan and the US, and a more visible presence in international journals and conferences. China's spending on R&D as a percentage of GDP, known as R&D intensity, has more than doubled from 0.6 percent of GDP in 1995 to just over 1.2 percent in 2004 (Figure 48). In 2004, the expenditure on research and development activities for the whole country was 184.3 billion Yuan, up 19.7percent over 2003, accounting for 1.35 percent of national GDP.¹⁰⁸

¹⁰⁷ Hepeng, Jia and Fu Jing, 2007.

¹⁰⁸ OECD Observer, 2005.

Figure 48: China increasing R&D overtime



Weaknesses in China's Innovation System

China needs to improve its dissemination of technology and facilitate a greater transfer of knowledge from the most efficient producers to the least efficient. Technology diffusion is fundamentally important for technological upgrading, but Chinese industries devoted very limited efforts and resources to technological diffusion in the past, preferring the import of technology. The absence of technology transfer channels to diffuse research results from public-funded research institutes to industry is another major impediment to the Chinese innovation system. Furthermore, as industries, universities, and R&D institutions belong to different administrative systems in China, it prevents the free flow of resources and knowledge between them.

Market institutions are still underdeveloped and ineffectively regulated. A better functioning market economy is a prerequisite for efficient knowledge and technology dissemination. Through joint funding between local and provincial governments, the central government should give higher priority and greater resources to technology dissemination schemes: engineering, research and productivity centers, renovated programs for rural industries, extension services in agriculture, and regional technical centers to support small and medium size enterprises. There is a lack of incentive for Chinese enterprises to devote their resources to R&D, since returns on investment in other activities tend to be higher and more immediate. This market environment has discouraged Chinese enterprises from undertaking R&D and other efforts to improve their product qualities and technical standing.¹⁰⁹

Private sector participation in R&D

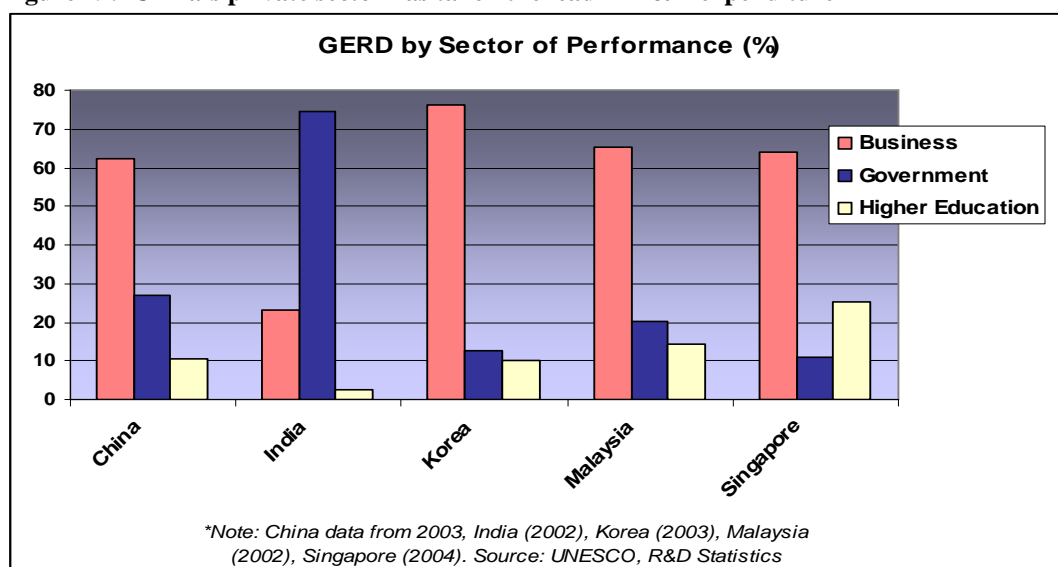
Chinese enterprises, particularly SOEs, do not invest sufficiently in R&D. A significant amount of China's growth and development has relied on imported technologies, demonstrated by the low 0.03 percent of Chinese firms that own the intellectual property rights of the core of technologies they use. This acts as a serious constraint on profitability. In terms of R&D intensity and patenting Chinese enterprises are spending on average only 0.56 percent of turnover on R&D expenditure while larger firms are spending a low 0.71 percent. China's business R&D has increased slowly from 40 percent to 45 percent of total GERD between 1991 and 1998, after which it shot up sharply to 61 percent in 2002. The

¹⁰⁹ OECD, 2004.

current level is not far behind that of the developed economies, and thus quite high for a developing economy (Figure 49).

The greatest challenge is to get Chinese companies to be more innovative, particularly in state owned enterprises, where management is still appointed by their superior administrative agencies and careers are not determined, or significantly influenced, by the performance of the enterprises that they manage. Since many of these managers' posts are of a political nature, and they are likely to be reassigned to a new post in a few years time, managers tend to be more interested in working on short-term, low-risk issues. However, since investment in R&D often carries high risk and may take a long time to deliver economic returns, R&D tends to be treated as a low priority by SOE managers. Because of this low priority, management of technological innovation is, consequently, weak in Chinese enterprises. Regardless, under a planned economy, state-owned enterprises (SOEs) are connected to state development plans, and are therefore in a favourable position to receive state allocations of various funds for innovation and technological upgrading. Therefore, they enjoy better access to the capital market for financing. China's R&D resources have therefore been channeled to SOEs, which lack the incentive to undertake R&D, while the smaller and non-state enterprises, which are more motivated to innovate, cannot get the resources they need. A greater percentage of finance needs to be distributed to the non state enterprises.¹¹⁰

Figure 49: China's private sector has taken the lead in R&D expenditure



Plagiarism and Misconduct

Protection policies must be strengthened in order to encourage people and enterprises to innovate and generate publications and patents. Since there are substantial benefits associated with scientific findings, a large number of people tend to plagiarize results, making research collaboration difficult. As a result, most researchers are said to work with the door closed. This resulting practice is inefficient and bad for innovation as it blocks technology dissemination. China's share in patent grants or applications at the US Patent and Trademark Office and the European Patent Office is still very small. However, the level of international co-operation in science and technology, measured by patent applications owned or co-owned by foreign residents and patents with foreign co-inventors, is actually higher for China than for most large economies. Chinese enterprises are adversely affected by the poor protection of intellectual property rights (IPR) in two specific way; enterprises find little incentive to invest in their own R&D and

¹¹⁰ OECD, 2004.

innovation as many enterprises simply rely on copying and imitating others' production technology and product designs and in enterprises that do put resources into R&D, their investment interest is hampered by the fact that their R&D results cannot be effectively protected in the market.¹¹¹

Inadequate R&D Personnel

China's supply of R&D personnel is currently inadequate to meet the needs of the ambitious science and technology development program. The quality of the Chinese R&D personnel is generally low and unsatisfactory and the problem starts from the Chinese education system, which emphasizes theoretical and exam oriented learning at the expense of lifelong learning and problem solving skills. This is further worsened by the lack of investment in personnel training in the enterprise sector, which limits the knowledge upgrading of technical personnel. Furthermore, China has experienced a major brain drain in the last two decades, with a large number of educated Chinese going abroad to study, and the majority having not yet returned to China.

Figure 50: More researchers needed in China



Education Issues

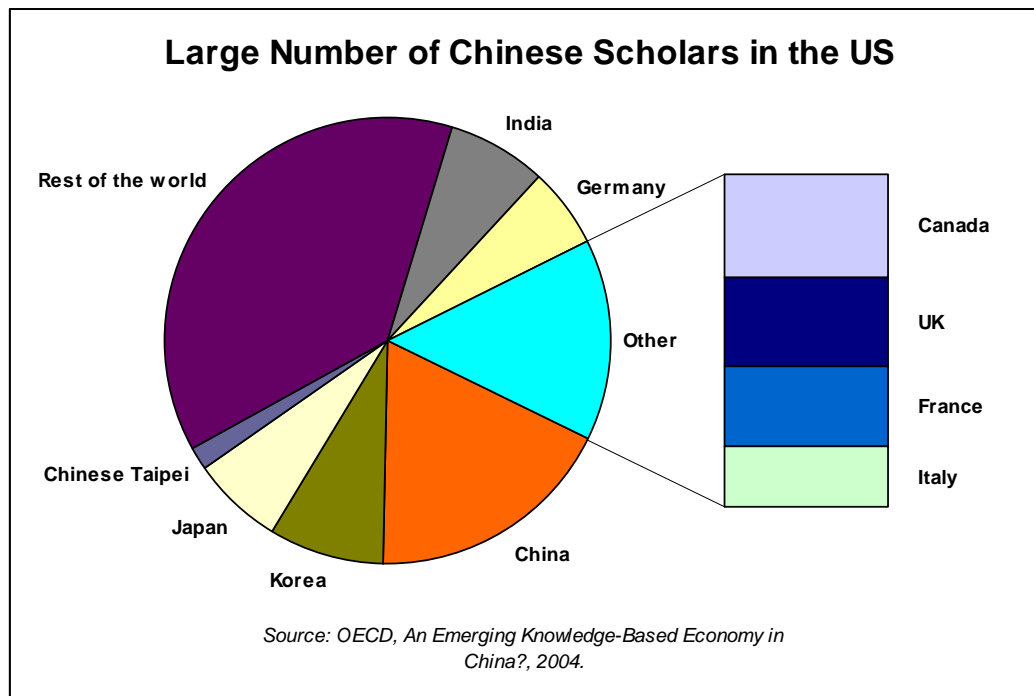
China has been able to provide students who are not able to get into universities with an effective alternative in privately funded tertiary institutions. In higher education, the government deserves credit for encouraging the mergers of small, single discipline institutions to broaden the education of students and lower the unit costs. The authorities of the public higher education system have a very selective recruitment, creating intense competition for these seats. In addition to China's public higher education system, and an independent military higher education system, there is a large informal private system of higher education which has grown rapidly since the early 1980's. Privately funded tertiary institutions are non profit entities that derive revenues from tuition and boarding fees. They offer a limited range of professional and practical courses and programs and attract second chance students unable to get into public universities. Because of the limited access to institutions of higher education, self study for the state administered higher education qualification examination has become an alternative.¹¹²

¹¹¹ World Bank, 2001.

¹¹² OECD, 2004

A large number of Chinese students go abroad in order to receive educations that are well rounded. China should develop more high quality teaching universities domestically to educate its students, reduce the need to finance education abroad, and even attract more foreign students to China. Other countries, particularly the US are benefiting from Chinese scholars that enroll in the country's universities in order to receive education that focus on soft skills as well as the hard skills (Figure 51). China's higher education institutions have limited autonomy in managerial, financial, and pedagogical matters. They lack choice in determining academic offerings, the number of students they can admit, and the tuition they charge.

Figure 51 An influx of Chinese Scholars in the US



China needs to pay more attention to soft skills to develop its private sector. The country needs to pay more attention to finance, law, accounting, design, marketing, education, technology and consulting, management, human resource development, foreign language fluency, and the ability to work in teams. These soft skills have been underdeveloped because of the traditional emphasis on mastering the hard skills. In order to attract back Chinese students from abroad and bring more foreign students to Chinese universities, the country will need to update its education system with a more modern curriculum that focuses on these soft skills that will be significant for the knowledge economy.

Vocational education

China needs to lower the enrolment in vocational schools and subsequently improve the quality. Vocational schools make up a large part (60 percent) of China's secondary education system. The qualifications from vocational schools are too narrow, due mainly to the numerous, over detailed specifications from the planned economy. The vocational and training system should put more emphasis on general competencies that promote adaptability and lifelong learning, and less on job specific skills. The economy needs skills in technology, software, management, and services. It also needs core skills that people can transfer across occupations and industry like entrepreneurship, language, social, and

teamwork.¹¹³ Most observers agree that China should encourage more students to go through a standard secondary education.

Updating Curricula

Increases in funding should be distributed towards quality inputs and modernizing the curriculum in all areas of the country. Although modern techniques are being increasingly incorporated into Chinese curricula, more emphasis needs to be placed on problem solving. Use of advanced information technologies are already leading to substantial changes in the Chinese education system. Innovative methods are being developed and used to deliver better education, in service training for primary and secondary school teachers, and training in communications and agriculture including cable television, satellite television, and online training. However, the curriculum needs to focus more on problem solving and practical skills.

More resources need to go to the rural areas. More than 60 percent of education spending goes to the primary and junior secondary segment, but poor areas lack resources for investments, a gap widened by private resources in more affluent regions. In order to combat this regional divide, China should expand compulsory education from 9 to 12 years. New methods of training, new learning materials (books) and more well trained teachers are needed. Public schools lack the resources and flexibility to adjust to the needs of the rapidly changing economy and society, while private schools, which possess greater resources and autonomy, have a competitive edge in developing new curricula and teaching methods.¹¹⁴

Information Infrastructure

Most of China still has limited and poor quality access to information infrastructure, but the digital divide is decreasing. China still lags behind most East Asian countries in telephones, computers, and internet connections per capita (Figure 52). Telephone subscriptions are increasing at a fast rate, with mobile phone subscribers overtaking fixed line subscribers in October 2003. Even though the absolute size of internet subscribers is large, the size is small in relation to the whole population. At the end of 2005, China had 111 million Internet users, amounting to just 8 percent of the population, compared with 50 percent in OECD countries. The number of broadband users stood at 64.3 million. In terms of internet users, there is a trend toward resolving the regional digital divide, with a decrease in the share of internet users in the municipalities of Beijing and Shanghai as well as the Eastern Coastal Province of Guangdong, with an increase in the share of the Western Region.

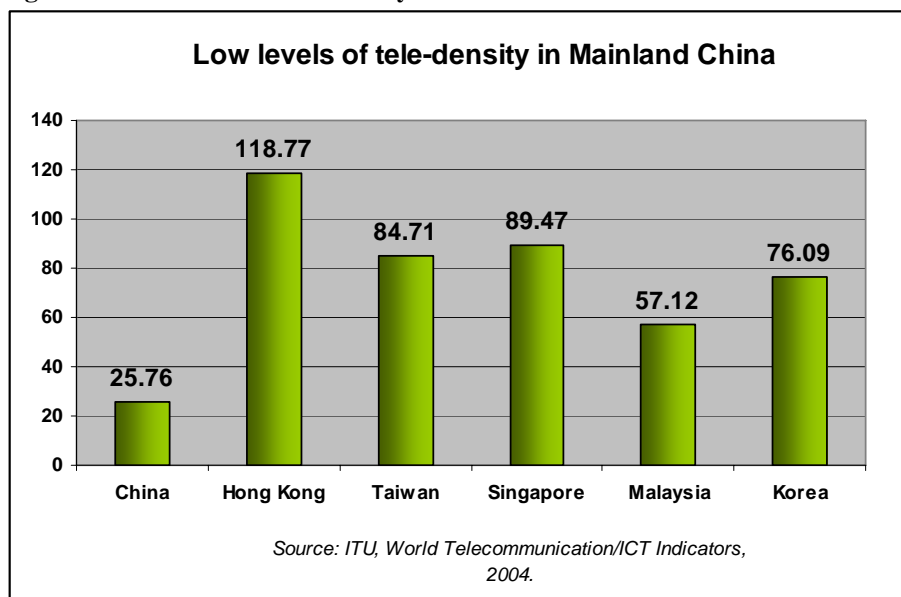
While low IT costs brought by China's competitive supply has helped OECD based firms upgrade, reorganize and boost productivity, the actual uptake of IT within Chinese firms is lagging behind. Notions like supply chain management, resource planning or knowledge management software that are standard currency in OECD firms are still undeveloped in China. Access to IT by the Chinese population is variable with a wide digital divide between urban and rural areas.¹¹⁵ China will need to decrease the digital divide within its country and find efficient way of bringing about connectivity to a larger share of its population.

¹¹³ World Bank, 2001.

¹¹⁴ OECD, 2004.

¹¹⁵ OECD Observer, 2006.

Figure 52: Low levels of tele-density in mainland China



As with most telecom industries, a greater level of competition will result in a larger share of the population having access to ICT services. China will need to promote greater competition by further opening markets dominated by China Telecom and other SOEs, create an independent regulatory body, and open more to foreign investment as a source of capital and technical expertise for information technology services. The country should promote greater use of information and communication technologies throughout the economy, such as; giving technical support to small and medium size enterprises; improving the efficiency of the banking system, including electronic banking, payment systems, and a national credit rating system; delivering internet based education and health services, promote electronic commerce-business to consumer and business to business.¹¹⁶ China has made big strides, but telephone penetration, computer use and internet access, especially in rural and urban areas are still lagging and desperately need to be improved in order to create a knowledge enabling society.

What can Sri Lanka learn from China's efforts in making a transition to the knowledge economy?

Sri Lanka needs to begin fostering domestic innovation in order to remain competitive in the knowledge economy. China is beginning to recognize the need to reform its economy and promote the development of domestic innovation. However, China is facing great challenges in moving towards a more knowledge based economy because it maintains a relatively stringent political regime. Sri Lanka, having one of the most liberal economies in South Asia, will not have so many challenges in developing a domestic innovation system. The main issue for Sri Lanka will be developing an innovative culture, which has proved to be a significant challenge in recent years. China is still in its early stages of making a transition to the knowledge economy, but what Sri Lanka can learn from China is that a history of having a closed economy is difficult to overcome, and integrating into the global community will take much more time. Since Sri Lanka is also in its beginning stages of knowledge development, the country should put great effort into strengthening innovation enabling factors such as IPRs and other protection policies. This will allow the country to innovate in an effective and efficient manner when it begins to develop a stronger and more powerful research and development base.

¹¹⁶ World Bank, 2001.

Annex 1: How ICTs and the transfer of knowledge can help achieve Sri Lanka's MDGs

MDGs	Sri Lanka's Current Position	ICT/ knowledge Inputs	Outputs	Outcome (impact)
1. Eradicate extreme poverty and hunger	National poverty headcount ration declined from 26.1% (1990/91) to 22.7% (2002), despite sustained per capital annual GDP growth of over 3% over the last 2 two decades.	Provide ICT-based agricultural pricing information	Access to price information for farmers	Increased income for farmer
2. Achieve universal primary education	The net primary enrolment rate currently stands at 96%, with the net enrolment in grade 1 at close to 100% and net primary completion at 95%. There is little regional variation in these indicators.	Networking teacher training colleges	ICT-delivered, (low cost) training for teachers	Increased the number of teachers trained
3. Promote gender equality and empower women	Gender equality has been achieved at the primary, secondary and even tertiary levels.	Set up multi-purpose community centers (run for/by women) that provide ICT training	Number of women trained in ICTs	Increased number and type of jobs obtained by women
4. Reduce child mortality	Between the late 1970s and 2000, the infant mortality rate fell from 36 to 13 infant deaths per 1000 live births and under-five mortality fell from 48 to 17. Yet, child malnutrition remains high, as one in three children aged 3-59 months is underweight and chronic/acute malnutrition affects more that one in ten children in the same age group.	Connected rural health clinics to a telemedicine network	Number of web-based consultants	Reduced child mortality.
5. Improve maternal health	Maternal mortality rate (23 per 100,000 live births in 1996) is on par with middle-income countries.	Targeted online information for rural health clinics	Improved advice and diagnosis	Reduced maternal mortality
6. Combat HIV/AIDS, malaria, and other diseases	HIV/AIDS epidemic remains at a low level with 179 AIDS and 614 HIV cases reported (end-2004). Prevalence among high risk sub-populations (0.2% for female sex workers and 0.08% for patients with sexually transmitted infections) is low. Reported cases of tuberculosis rose from about 6,500 (1997) to 8,400 (2000). Malaria-related deaths decreased from 115 (1998) to 30 (2002).	Introduce call centers for HIV/AIDS info	Advice given to potential patients	Reduction in the number of new people infected with HIV/AIDS
7. Ensure environmental sustainability	Since 1994, two successive national environmental action plans have been developed and are presently under implementation. However, the programs need to be scaled up and strengthened in earnest to reverse degradation.	E-group network on environmental issues	Exchange of info and issues	Raised awareness
8. Develop a global partnership for development	Exports (as % of GDP) rose from 13% (1972) to 36% (2004) reflecting a more liberal trade regime. Per capita official development assistance (ODA) has fallen from US\$42.9 (1990) to US\$14.3 (2000). External debt stands at 54% of GDP (2004). Over 40% of unemployed are young adults. Tele-density increased from less than 1% per 100 persons (1990) to 9.6% (2002). IT exports have grown steadily in the past decade.	Set up ICT training facilities at colleges/ universities	Increase the number of IT graduates	Reduce youth unemployment

Source: ITU, World Telecommunication/ICT Development Report 2006. World Bank, Country Assistance Strategy: Progress Report for Sri Lanka, 2006.

Annex 2: Innovation - The Key to Business Growth: The Irish Story

Collaboration and co-operation through innovation networks

Corporations today are pursuing a globally-distributed, network approach to innovation. Current university programs and company R&D activities reach across borders in search of collaborative partnerships. Companies can most easily reap the rewards of innovation through a global ecosystem in which firms, universities, and governments work together.

Ireland's innovation landscape

Ireland's innovation landscape thrives on the importance of human connections. Irish business policy brings together - in a unique, no-nonsense and highly pragmatic way - a wide range of national institutions to help create leading edge research programs. Government, funding agencies, regulatory authorities, academia and industry are constantly working as a national team, creating a fast-growing, dynamic research environment. The result of this high-level connectivity is that Ireland has become one of the new global centers for science- and innovation-based R&D. Ireland is empowering some of the world's biggest companies to research, develop and commercialize world-class products, processes and services. Long-established partnerships with global corporations have been at the core of Ireland's success in attracting leading edge R&D activities. Despite Ireland's small size geographically, its energetic, knowledge-based economy wins a disproportionate amount of Europe's R&D centers. In 2006 Ireland's inward investment agency, IDA Ireland, supported 54 R&D investment projects. The past year has seen R&D announcements by many prominent global corporations. The names speak for themselves: CISCO, GlaxoSmithKline, PepsiCo, Intel, IBM, Bristol-Myers Squibb. These corporations are actively supported by renowned global research organizations located in Ireland, such as Georgia Tech Research Institute and Bell Labs.

An integrated, collaborative strategy

The Irish Government pursues a carefully planned, integrated R&D strategy encompassing all of the key elements necessary to achieve world-class R&D. Its US\$5 billion 'Strategy for Science, Technology and Innovation' will double the number of Ph.D. graduates and attract future generations of well-educated young people into research careers in knowledge-driven companies. It will substantially extend the physical infrastructure to support them. And, for the first time ever, eight government departments will co-ordinate all activity in relation to science, technology and innovation. IDA Ireland is one of the main players behind the new wave of national, collaborative R&D activity. It works closely with Science Foundation Ireland (SFI), the agency which consolidates links between industrial and academic research and funds such research. IDA Ireland and SFI have developed a range of new initiatives to encourage pooled projects and attract world-class scientists to carry out research in Ireland. This inclusive way of bringing together industry and academia has led to a boom in research projects. More than 10,000 researchers are working on cutting edge R&D projects in Ireland. Many of them have relocated from the US, Canada, Japan, the UK, Switzerland and Belgium. Ireland's Centers for Science, Engineering & Technology ('CSETs') link scientists and engineers in partnerships across academia and industry. One such CSET is CRANN, the Centre for Research on Adaptive Nanostructures & Nanodevices. CRANN's mission is to advance the frontiers of nanoscience. It provides the physical and intellectual environment for world-class fundamental research, and has partners in Irish and overseas universities.

Tax and intellectual property

Ireland's intellectual property laws provide companies with generous incentives to innovate. The Irish tax system offers huge support to turn brilliant ideas into the finished article. A highly competitive corporate tax rate of 12.5% is a major incentive. No tax is paid on earnings from intellectual property where the underlying R&D work was carried out in Ireland. Ireland recently introduced a new R&D Tax Credit, designed to encourage companies to undertake new and/or additional R&D activity in Ireland. It covers wages, related overheads, plant/machinery, and buildings. Stamp duty on intellectual property rights has been abolished.

People skills

The IMD World Competitiveness Yearbook 2006 rates Ireland's education system as one of the world's best in meeting the needs of a competitive economy. It also ranks the Irish workforce as one of the most flexible, adaptable and motivated. Ireland's young workforce has shown a particular flair for collecting, interpreting and disseminating research information. Major investment in education has provided a skilled, well-educated workforce; Ireland has more than twice the US/European per capita average in science and engineering graduates.

A track record of success

Ireland's success in innovation spans a wide range of businesses and sectors. For example, some of the most exciting Irish-based product development has been in medical technologies. Over half of all the medical technologies companies based in Ireland have dedicated R&D centers. Boston Scientific researched and developed the world's first ever drug-coated stent using researchers in Ireland. Bristol-Myers Squibb's Swords Laboratories is the launch site for several new healthcare treatments used to treat hypertension, cancer and HIV/AIDS. GlaxoSmithKline's latest Irish R&D project involves groundbreaking research into gastrointestinal diseases, in collaboration with the Alimentary Pharmabiotic Centre in University College Cork. Recently Microsoft marked its 20th Irish anniversary by opening a new R&D center, creating 100 new jobs. The centre is working on a wide range of projects, including Digital Video Broadcasting (DVB) and SmartCard security technology. Intel, a significant supporter of education and training in Ireland, is engaged in several research collaborations with leading Irish universities, including Trinity College Dublin, University College Cork and Dublin City University. Intel's Irish operation is the global headquarters for the company's Innovation Centres. Analog Devices' long established R&D operation is heavily integrated into its Irish operation. Its 335-strong team has sole responsibility for the global design, manufacture and supply of value added high voltage, mixed signal CMOS products.

An exciting future of world-class innovation

Lucent Technologies' Bell Labs, one of the world's most eminent research institutions, has established its Center for Telecommunications Value-Chain-Driven Research in partnership with Trinity College Dublin. It will undertake research aimed at realizing the next generation of telecommunications networks. Georgia Tech Research Institute's new Irish operation will be a critical component of Ireland's innovation infrastructure. It plans to build up a portfolio of research programs and collaborations with industry which at full operation will employ 50 highly qualified researchers. Wyeth is establishing a bio-therapeutic drug discovery and development research facility at University College Dublin. It will utilize new technologies to discover the next generation of therapeutic biopharmaceuticals for the treatment of a wide variety of diseases. At an academic level, just one illustration of the integration in R&D activity in Ireland is Dublin City University's Biomedical Diagnostics Institute. It is carrying out cutting-edge research programs focused on the development of next generation biomedical diagnostic devices. Ireland's success is based on a culture of co-operation and collaboration to win complex, high value, sophisticated investments. The country's strong business philosophy of inclusiveness, informality and teamwork are the foundations on which Ireland is fast becoming an important player in the development of global innovation networks.

Source: Business Week and IDA Ireland

Annex 3: The Higher Education Policy Note

A Higher Education Policy Note, to fully understand the stumbling blocks faced by Sri Lankan higher education market and addressing issues like access, quality and relevance, is currently under preparation. Although not the strategy itself, the note will contribute to the development of the government's higher education strategy. It aims to quantify areas like access, supply of and demand for public and private higher education, data of which have hitherto been imprecise. The note will look at the size, composition and characteristics of the supply of higher education services, and explore the admissions policy in public higher education institutions compared with that of non-University and private institutions. It will also look at the financial conditions of access and the demand for various types of higher education services. The note will present insights and lessons learnt from countries where the private sector is recognized as an equal partner in tertiary education, and where higher education strategies fully include this sector in the vision of how higher education can fulfill national goals.

Faculty Staff: There will be a focus on the factors which are assumed to have the greatest impact and yet being within the direct purview of the institutions in charge of the sector. University faculty staff have been identified as ideal candidates for such focus. The Note will analyze their qualifications, conditions of training and recruitment, their teaching and research loads and their remuneration.

Quality: The Note will look into quality assurance in Sri Lanka's higher education institutions and how recent efforts to introduce accountability have already induced changes in academic culture and outcomes. There has been a recent 'mushrooming' of private higher education institutes and therefore the issue of accreditation of these institutes and colleges will be taken up. The Note will also investigate the quality of the assessment system used to gauge the skills acquired by students.

Research: As has been previously pointed out, research is still almost a marginal activity in Sri Lankan higher education institutions. Yet it is recognized that research not only contributes to growth in the long-term but can also improve teaching in the medium term. The Note will explore ways to promote the undertaking of more dynamic research by higher education institutions and make it a standard field of activity for universities with postgraduate coverage.

Efficiency: Quality is a function of a combination of inputs. Regarding staffing, probably the most vital input, at least two sources of inefficiency have been singled out in the public sector: i. the low student:teacher ratio (14:1) and ii. the high non-teaching:teaching staff ratio (4:1). The Note will attempt to disentangle the reasons behind these 'abnormal' ratios and explore the scope for efficiency gains while preserving quality.

Relevance: In the context of academic relevance of the higher education provided in Sri Lanka, the Note will explore ways to facilitate a better match between supply and demand, through, for instance, the establishment of counseling and career centers in higher education institutions, and more systematic information on the skills sought by employers. It will examine ways to improve the anticipation of labor market needs at national and international level, greater adaptability of the syllabi and upgrading the curricula. The Note hopes to discuss the role of industry-university partnerships to bring closer the academic world and the economic world and will gather relevant stories in this area together with their potential to adapt them to the Sri Lankan situation. While understanding trends in international labor migration and the fields affected by such movement, it will also look into the potential for Sri Lanka graduates in the international market for skilled labour.

Governance: With regard to governance structure of the sector and the balance between central and peripheral higher education bodies, the Note will look explore the institutional set-up of the sector and the areas where conflicts or stalemates prevent the sector from functioning optimally. It will also look into allowing greater delegation of responsibilities to the institutions with regard to critical functions such as staffing, admissions and fees.

Private Sector Role: The Note will investigate the potential of private sector contribution towards supplying quality higher education and the role of public private partnerships to enhance service delivery and contribute to financing.

Costs and Financing: In 2004, about 18 percent of public expenditure on education was in the tertiary segment. This is high, even when compared with the OECD average of 13.3 percent, and in the context of an overall relatively low level of public investment in the education sector as a whole (2.9 percent of GDP and 8 percent of government spending). In per student terms, tertiary education expenditures are also high – representing about 100 percent of GDP per capita. The corresponding figure is 80 percent for South Asia and 40 percent in OECD. Unit costs in higher education are about 10 times that of primary education. As a result, while primary education stands at one of the “cheapest” in the region, higher education stands as one of the most expensive. The proposed Note will explore the reasons for this situation, analyzing the structure of expenditures and their distribution by type of spending. The Note will also look into indications showing the inequitable, skewed nature of higher education enrollments and public resources towards children from higher income and socio-economic status. It will also analyze the direct and indirect costs of higher education to a household, and gather more information on the costs of private education. This aims to better inform the government which areas to focus public spending on, in particular with regards to various kinds of student support schemes.

The Future: The *Mahinda Chintana* policy document envisions that the currently buoyant service sector, particularly telecoms and ICT will continue to be the engine of future growth for Sri Lanka in the global context, in addition to tourism and offshoring. Enrollment and graduates targets, both broken down by fields of study will be derived from these global trends, and input requirements will be projected. This Note will project the costs of the various scenarios, simulating the contribution required from public funds given the government’s budget constraint. A comparison will be made of the trade-offs between various policies combining quantity expansion and quality enhancement. The Note will also provide projections on the contribution of the private sector as well as cost sharing schemes between tax payers and beneficiaries. It will also address the equity dimension of such cost-sharing schemes and assess the feasibility of introducing some dose of demand-side financing in an effort to give performing private institutions an opportunity to compete with their public sector counterparts on a more level higher education playing field.

Source: Draft Concept Note for the National Higher Education Policy Note, World Bank SASHD, July 2007

Annex 4: A History of Sri Lanka's Telecom Development

Thirty years ago, Sri Lanka's telecom sector was weak and unable to deliver competitive prices and quality services because of its inability to raise sufficient funds. Before Sri Lanka began liberalizing and deregulating the sector, the sector's lack of commercial orientation, inflexible pricing policies, inadequate capital investment on modern technology, lack of corporate vision, out-dated procurement systems and high levels of debt were identified as major deficiencies of the government.¹¹⁷ To remedy these challenges, Sri Lanka launched its privatization program in the 1980's. In preparation, the Department of Telecommunications (DoT) was separated from the postal service. Establishing a regulatory body was the first step in the liberalization process. Government believed that a mechanism for ensuring efficiency, setting standards of service, and exercising financial audits separate from the operational activities, was necessary in order to create an effective level playing field for private operators. It was hoped that this would deliver cheaper and better quality services to customers as a solution to poor performance.

Early commercialization initiatives proved unsuccessful. The newly established entity was unable to raise sufficient funds as it was still subject to the usual restrictions placed on all government departments. During this time, the high usage of existing facilities led to a low quality of services. In the early 1980's, more than 38 percent of telephone lines in the greater Colombo area were out of order at any given time. Applicants on the waiting list for telephones (245,000) exceeded the number of existing lines, and the waiting time was an average of 10 years.¹¹⁸

Even following industry liberalization, the new regulatory body functioned under the ministry, leaving the regulator devoid of any independent authority. The Sri Lanka Telecommunications Act of 1991 intended to separate policy-making, operation, and regulation by assigning responsibilities to the ministry, Sri Lanka Telecom and Sri Lanka Telecommunications Authority (STA) respectively. The benefits of having a regulatory body such as the STA were that it could ensure fair enforcement of government policy, hold operators accountable for performance, address consumer issues, monitor changing industry needs and provide recommendations to the policy making units. However, STA under the ministry functioned no differently from a government department, lacking both funds and telecom expertise. To assign priority to these policy changes, the national policy on the telecommunications industry was introduced in 1997 providing the necessary amendments to the existing act with the objectives of eliminating long waiting lists and allowing for private sector participation. Also during this period, in the mid 1990's, the government granted licenses to two fixed line operators (Sri Lanka Telecom and Lanka Bell) using wireless local loop (WLL) and four mobile operators (Celltell, Mobitel, Lanka cellular and MTN).¹¹⁹ The STA was converted into an independent regulatory body that would seek to establish a level playing field within the telecom sector. Under the ministry, the STA did not have the independence, power, structure, resources, or accountability necessary and in response, the Sri Lanka Telecommunications Act 27 of 1996 was enacted to convert STA into an independent regulatory body, the Telecommunications Regulatory Commission (TRC) of Sri Lanka. The responsibilities of the TRC were to set up a cost-based tariff structure, prevent anti-competitive practices, and advise government on telecommunications issues. In order to see these objectives through, the TRC was provided with the resources to build up expertise by recruiting professionals from outside, and thus, it was expected to effectively establish a favorable foundation for competition. However, the same act that created the TRC also made the secretary to the Ministry of Telecommunications the statutory chairman of the commission, leaving the commission to be indirectly controlled by the government. This situation is believed to have led to partially biased decision making by the regulator as the commission was and continues to be unable to remain uninfluenced by political pressures from interest groups.¹²⁰

¹¹⁷ World Bank, 2006e

¹¹⁸ Balasooriya et al. (p. 386)

¹¹⁹ Balasooriya et al.

¹²⁰ Balasooriya et al. (p. 389-390)

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