

An analysis of knowledge economy in Sri Lanka: a regional perspective

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Abstract—The purpose of this study is to examine and evaluate Sri Lankan knowledge economy and its transformation process to assess Sri Lankan readiness to embrace a knowledge economy and further to seek the challenges that Sri Lanka confronts in becoming a strong knowledge economy. This study adopts benchmarking process which benchmarks Sri Lanka's readiness for knowledge economy with its competitive, neighbouring countries and with several strong knowledge economies under four drivers of knowledge economy: Human Resource, Information and Communication Technology Infrastructure, Innovation System and Business Environment. The study is based on published information of various sources. The study analyses the indices data by comparing year 2000 and year 2012 with all necessary variables proposed by the Knowledge Assessment Methodology. The findings of the study indicate that the level of Sri Lanka's readiness to embrace a strong knowledge economy is quite strong compared to other South Asian countries. However when compared with the selected strong knowledge economies of the Asia Pacific region, the readiness should be further improved to gain the vast majority of its benefits to the economy.

Keywords—Drivers of Knowledge Economy, Knowledge Economy, Sri Lanka and Transformation Process of Knowledge Economy

I. INTRODUCTION

Ultimate objective of any economy is sustainable economic growth and social development. The rate of growth of an economy is determined by the rate of investment and the level of efficiency of capital which is fairly stable over the short term and can be altered only over the medium and long run. Therefore investment is the key determinant to achieve economic growth. Investments are mainly of two types, domestic investment and foreign investment. Domestic investment is insufficient to achieve economic growth target because of the mismatch between their capital requirement and saving capacity especially for developing countries like Sri Lanka. Therefore major strategies and policies focus on attracting foreign private investment to fulfil the gap between their capital requirements and saving capacity in developing countries

(Osinubi, 2010). Sri Lankan government make efforts to attract foreign investors since 1977.

The situation has eased with the introduction of Knowledge Economy Index (hereafter KEI) by the World Bank that takes the most important indicators of economy in to consideration and gives an average mark for each and every country. According to KEI, the countries which are ranked higher indicate that they are more competitive than the other countries which are ranked lower. As a result, now investors are in a position to identify the country which is most suitable for their investment just by looking at KEI. Therefore the orientation towards knowledge economies is becoming a key strategy in attracting foreign investments.

Hence this study involves evaluating Sri Lankan knowledge economy orientation and its transformation process and further seeks to address the challenges that Sri Lanka confronts in becoming a strong knowledge economy.

A. Problem Statement and Objective of the Study

Taken the fact above mentioned in to consideration, the problem statement for this study has been developed as "What are the challenges that Sri Lanka confronts in becoming a strong knowledge economy?"

Specific Objective

To identify challenges in building a strong knowledge economy in Sri Lanka.

General Objective

To assess current position of Sri Lankan knowledge economy orientation, benchmarking with SAARC and selected Asian Pacific countries.

1) *Sri Lanka in 2016*: The strategic socio-economic vision for Sri Lanka in 2016 was initiated in 2005 with the implementation of the Mihinda Chintana Vision for Future-Towards New Sri Lanka which is redeveloped in the year 2010 as Mihinda Chintana Vision-Emerging Wonder of Asia. The main objective of this policy document is the doubling of the economic growth of the country by the year 2016 that will need structural changes in the economy. Apart from that other targets are shown by table 1 (Mihinda Chintana Vision for future, 2010).

Item	Unit	2016 Projected
Population	mn	21.9
GDP	USD bn	98
Per Capita Income	US\$	4,470
Inflation - GDP Deflator	%	4
Exports	US\$ bn	18
International Trade Turnover	US\$ bn	44.1
International Services Income (Net)	US\$ bn	2.6
Earnings from Tourism	US\$ bn	2.5
Remittances	US\$ bn	7
Access to Electricity	%	100
Access to Telecommunications	%	100
Women in Labour Force	%	40
Unemployment	%	3.2
Infant Mortality	per 1000	4
Maternal Mortality	per 1000	0.2
Poverty	%	4.2
Primary School Enrolment	%	100
Literacy Rate - (15 - 24 years)	%	98
Literacy Rate - Computer	%	75
Investment in Research and Development	%	1.5

Table 1. Targets of Mahinda Chinthana

II. LITERATURE REVIEW

A. Knowledge Economy

The knowledge economy is an economy which creates, disseminates and uses knowledge and information to gain competitive advantage to the nation and enhances its economic and social development. The knowledge economy is seen as the latest stage of development in global economic restructuring. Thus far, the global economy has transformed from an agricultural economy to an industrial economy and to a knowledge economy. Roberts cited in 2009, the concept of knowledge economy started to appear in the 1960s with the work of Machlup, 1962; Bell, 1974 and Porat and Rubin, 1977. In these five decades, the interest pertaining to knowledge economy has gradually increased with the invention of computer and the use of internet. Hence knowledge economy is not a new concept and has been at the core of any country's development process. Excellent human resources, an effective innovation system, adequate information infrastructures and an effective business environment are the prerequisites for the development of knowledge economy. World Bank has identified these as four drivers of knowledge economy, which are used to measure performance of knowledge economy. Currently, most developed and developing countries including Sri Lanka adopt knowledge economy as

a development strategy since knowledge economy is vital and helps to achieve competitive advantage. Finally it leads to economic and social development of a nation.

Definitions for the Knowledge Economy: According to literature, even though there are many academic studies on knowledge economy, there is no universally accepted definition for it. Many international organizations and individuals such as Organization for Economic Co-operation and Development (hereafter OECD), World Bank, Asia Pacific Economic Cooperation (hereafter APEC) have provided different definitions and directions to build knowledge economy in both developed and developing countries. OECD definition is the base definition for this study.

"Knowledge economy is directly based on the production, distribution and use of knowledge and information" (OECD, 2006, p.7).

B. Knowledge

Knowledge is always a broader concept than information. Roberts (2009) said that if there is a great deal of knowledge stock in economy, its economic position and competitive advantages to the nation will be higher in comparison with other economies. Hence today, knowledge is the primary input and major output in the economic activities of an economy. No longer is knowledge considered as a product. It is a strategic asset. Roberts (2009 cited in Drucker, 1993; Lundvall, 1992 and Reich, 1992) has recognized knowledge as the only resource which can create competitive advantage for a country and achieve sustainable economic growth in the long run. The OECD (1996) divided the knowledge into four categories. They are, Know-What, Know-Why, Know-How and Know-Who.

The first two types of knowledge can be obtained through reading books, attending lecturers and accessing databases. Other two type of knowledge (Know-How and Know-Who) can be obtained through practical experience. Hence many researchers commonly believe that Knowledge can be broadly divided into two types as explicit knowledge and tactic knowledge.

1) *Unique Characteristic of Knowledge*: Today knowledge has become the vital economic resource. It can be differentiated from other resources because of its unique characteristics.

The first one is marginal cost of acquiring the knowledge is nearly zero (Roberts, 2009). As knowledge is freely available and there is no need to reproduce for every new consumer, knowledge is considered as public good.

The second one is law of increasing returns (Passerini, 2007). Law of diminishing marginal returns is not applicable for the knowledge. That is, unlike labour and capital, with increasing use of knowledge, the returns will also increase.

Due to above characteristics, knowledge flow to where demand is the highest and the barriers are the lowest and has become the main production factor. As a result, knowledge based economies are not suffering from scarcity. Chen and Dahlman (2006) developed a theoretical model to identify a strong link between knowledge and economic growth. They pointed out that lower level of development means lower level of innovation capability whereas higher level of development means higher level of innovation capability.

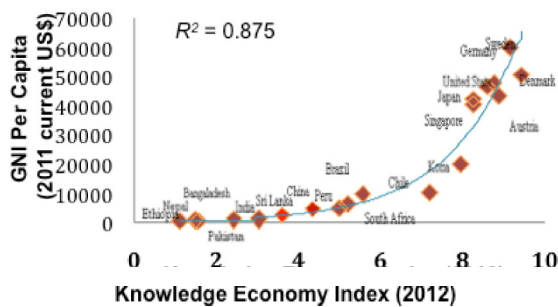


Fig 1. Strong link between knowledge and economic growth

These findings emphasise that with the purpose of obtaining competitive advantages and achieving sustainable economic growth, in twenty first century it is more beneficial to invest in knowledge inputs rather than in capital inputs.

C. Drivers of Knowledge Economy

Economic variables play a key role in measuring economic performances. After the Second World War, national accounts and Gross Domestic Product (here after GDP) have been the standard economic variables that are called traditional economic variables which guide the policy decision of the government and behaviour of business organizations, workforce and customers. However with the emerging knowledge economy, traditional economic variables fail to capture fundamental feature of economic performance and lead to misinterpret economic policies. Therefore measuring the performance of the knowledge economy became a greater challenge. It becomes further serious as the relationship between knowledge inputs and output are difficult to summarize by using production function (OECD, 1996). As a result, many international organizations such as OECD, APEC, World Bank and individuals attempt to develop conceptual frameworks in order to assess performance of knowledge economy and to identify main knowledge economy drivers. However there is no universally accepted framework to measure knowledge economy.

The knowledge economy frameworks highlight the building blocks of the knowledge creation, acquisition, dissemination and utilization. According to Al-Rahibi (2008), each and every feature of knowledge economy

should be included in the knowledge economy framework if it is possible. Furthermore he said that there are more than seventeen knowledge economy frameworks which are developed by different international organizations and individual countries. Among these frameworks OECD, APEC and World Bank frameworks have been developed from the experiences of many countries. Therefore these frameworks have greater relevance to assess development of knowledge economy in developing countries.

1) *World Bank's Framework*: the World Bank has developed a framework in order to help countries to measure their knowledge economy development. According to World Bank successful transition to knowledge economy requires adequate ICT infrastructures, modern and effective innovation system, excellent human resource, and effective business environment. These four dimensions are known as the four drivers of knowledge economy and they together build the knowledge economy framework.

2) *ICT Infrastructures*: ICT infrastructure creates easy access to global knowledge. Therefore it is the most important tool to acquire and update knowledge. As cited in Hussain (2012) the Economists see it as a production tool and non economists see it as a consumption tool that helps to recreate and gather knowledge (Kenan, 2001). Moreover Fors (2002) and Moreno (2002) stated that improvement of ICT has greatly contributed to the flow and storing of knowledge at higher speed and at lower cost. As a result, ICT facilitates to bring down knowledge gap, improve education and health care, increase efficiency of public administration, encourage democracy and develop commerce. According to Rao (2004), ICT offers more opportunities for alleviation of poverty, employment generation, promoting greater transparency of government and quick decision making process and finally empowering rural communities by providing easy access to government services. Apart from that Jain (2006) said that ICT facilitates in capturing, creating, organizing and transforming knowledge from the right people at the right time for the right job. Therefore new technology development ensures the accurate and timely delivery of knowledge in more efficient and effective ways than that can be done by individuals. Finally Jain concluded that in twenty first century delivery and utilization of knowledge is impossible without using ICT. Chen (2008) stated that ICT is important to build a strong knowledge economy because the application and development of ICT assist in gathering and innovating new knowledge. According to Al-Rahbi (2008), the use of ICT reduces geographical distance and facilitates to share knowledge, reduces uncertainty and transaction cost and increases competitiveness across boundaries.

There are many empirical studies that indicate strong relationship between ICT infrastructures and productivity. For an example Oliner and Sichel (2000) examined the

impact of use of information technology on the growth of productivity of the United States (hereafter US) economy using time series data which covers the private nonfarm business sector in US. This study has used a quantitative method and has adapted the model developed by Robert (1957) with a slight modification. Selected variables were, growth in output (Y) as the dependant variable and computer hardwares (Kc), computer softwares (Ksw), communication equipment (Km), other capital (Ko), labour hours (L), labour quality (Q) and multifactor productivity (MFP) as the independent variables. Their finding was that the technological development in computer sector has significantly contributed in achieving accelerated productivity growth in US.

3) Innovation System: Innovation is the most vital factor that helps to create knowledge, develop industries and to achieve economic competitiveness in the knowledge economy. Schumpeter is the first person who proposed the innovation theory. Chen (2008) said that an effective innovation system is always in a position to improve, create and gather knowledge. It contributes to economic competition in knowledge economy. According to him, National Innovation System (hereafter NIS) determines the knowledge economy development in a country. Also Lu and Etzkowitz (2008) explained that, innovation capabilities of a country and the ability to suck up new knowledge are the most important factors for knowledge economy development. According to them, in order to build a strong knowledge economy it requires taking into account overall knowledge infrastructures plus supporting facilities including research institutes, government organizations and universities apart from building industrial capabilities. Further Zeng (2009) said that in this knowledge era, innovation is vital to create both trade competitiveness and national competitiveness of a country, where a country is not in a position to effectively learn and absorb foreign technology merely on international trade and on foreign direct investment. Hence the country should provide sufficient opportunities and favourable environment to create competitive capabilities at international level and should invest in human resource in order to improve learning and innovation abilities of domestic businesses organizations. Goh (2005) mentioned that the government has the main role in developing NIS. In this process, the government should give priority to the development of private sector in a country, because the government is not in a position to create innovations directly but can facilitate and encourage private sector to do so. Hence the government has the major role in developing strategic research and development programmes for the purpose of promoting effective innovations essential for long term development. Further the governments should create an active business environment suitable for a transformation to strong knowledge economy. There are several studies that indicate that innovation has significant positive effect on productivity and economic growth. (Chen and Dahlman

cited in 2005, Lederman and Maloney, 2003 and Guellec and Pottelsberghe, 2001)

4) Human Resource: Well educated employees are essential to efficient creation, acquisition, dissemination and utilization of relevant knowledge which increase productivity and economic growth (Chen and Dahlman, 2005). Saginove and Belyansky (2008) stated that well educated work force always gives competitive advantage to the nation in the knowledge economy. Matlay (2001) said that the labour market has different requirements at each stage of economic development. In order to construct a knowledge economy, it requires new skills, ideas and creativity from workers. It further emphasizes that the competitiveness of knowledge economy depends on the continuous innovation and for that well educated workforce is an essential requirement. Ribound et al. (2007) provides significant evidence that well educated workforce is critical for technology development as well as to create knowledge economy. According to them, the demand for educated and skilled workers is increasing faster than the supply in South Asian region. But still unemployment rate among the educated workers remains very high due to mismatch between labour market requirements and education and training policy. Further Jennifer and Chopra (2008) stated that one of the main problems associated with human capital is, it takes longer time to develop well educated workers even though a physical infrastructure can be built within a few years. According to them, the average time for creating a well educated worker is twenty (20) years. However this estimated time can be altered owing to various reasons therefore it cannot be standardized for all parts of the world.

There are many empirical studies on human resources that indicate importance of human resource for economic growth and development. As an example, Barro (1991) has done an empirical study using data from 98 countries including Sri Lanka in the period of 1960 to 1985 and found that the growth rate of real per capita GDP is positively related to the initial human capital and negatively related to the initial level of real per capita GDP. Then Hanushek and Kimko (2000) found that the quality of labour force has a steady and strong relationship with economic growth and the quality of labour force is dependent on maths and science education of the workers more than on the number of year of schooling. Cohen and Soto (2006) also provide empirical evidence to prove that education is positively associated with economic growth.

5) Business Environment: The policy implementation and economic incentives given by the government have a positive effect on the development of a strong knowledge economy (OECD; 1996 and World Bank; 2004). Hearn and Rooney (2002) have done a study for the purpose of identifying the role of government in building knowledge economy. They found that societies and cultures have

greater impact on knowledge economy and the role of government is to help building knowledge society. For that purpose, the government should perform the role of a coordinator in order to provide leadership and other facilities to the community. Finally they concluded that government has much broader task to perform in order to drive the country in the path towards strong knowledge economy. According to Dahlman and Utz (2005), the main characteristic of effective business environment is the degree to which the legal system of the country supports its basic rules and property rights. In most of the developing countries, an inadequate legal environment is one of the main barriers to build strong knowledge economy because investors are very interested in the regulatory framework in the country and they prefer to invest in countries where there is a strong political regime. Apart from that micro economic stability, competition, good regulatory policies, legal rules and procedures and risk taking of entrepreneurs are the other important elements. Furthermore economic incentives and intellectual property rights help to create a more effective business environment which is vital to create new knowledge and facilitate other drivers of knowledge economy (Kurtic and Donlagic, 2012). There are several studies which indicate that business environment has significant positive effect on efficient use and creation of knowledge (Chen and Dahlman cited in 2005 Schan and Warnar, 1995; Bosworth and Collins, 2003 and Levine et al., 2000).

D. Applications of Knowledge Economy Frameworks

According to Literature, the human resources help to innovate and circulate knowledge, effective ICT helps to decrease transaction cost and distribute knowledge, effective business environment helps to improve performance of innovation and effective national innovation system helps to create national competitiveness. Finally all these pillars together create strong knowledge economy.

1) *Empirical Investigation:* Chen (2008) has done a study in order to identify causality between innovation system, human resources, business environment, information technology and national competitiveness. This work used the knowledge assessment methodology of World Bank. The linear structural relation model was applied to test the causality. The findings were that the overall economic competitiveness depends on the excellent human resources, effective ICT, effective business environment and the effective innovation system and these four drivers of knowledge economy indirectly affect to each other. According to this study, effective innovation system was the key to develop strong knowledge economy in a country.

Then Sundac and Krmpotic (2011) have done a study in order to identify the relationship between human resources, business environment, ICT and Innovation system and GDP per capita. It utilized knowledge assessment scorecards of World Bank and 114 countries were taken as the sample.

The countries are divided into three income groups according to GDP per capita and Purchasing Power Parity (hereafter PPP). They are namely Low Income Country (LIC), Middle Income Country (MIC) and High Income Country (HIC). Multivariate regression was used to identify the relationship between all established variables and GDP per capita PPP.

Their finding was that only two knowledge economy drivers, education and ICT play an important role in low income countries. In middle income countries, education, ICT and law and institution have greater impact on knowledge economy development. This study further says that in developed countries four drivers of knowledge economy had statistically significant contribution to development of knowledge economy. Their main conclusion was that there is no single scenario for building a strong knowledge economy. Further they divided the process of building a strong knowledge economy into three stages. Here LICs belong to the first stage, MICs belong to the second stage and HICs belong to third stage in the process of building a strong knowledge economy (Sundac and Krmpotic, 2011).

Jolio (2006) has done a study in order to assess Peru's condition to integrate itself into knowledge economy as a benchmarking study. Knowledge assessment methodology of World Bank was used to assess Peru's readiness for knowledge economy and was benchmarked with other Latin American countries and China, Japan, USA, Korea, Spain, OECD and Finland in terms of business environment, human resource, ICT and Innovation System.

Kurtic and Donlagic (2012) have done another study in order to determine key knowledge economy factors which have an impact on development of knowledge economy in Bosnia and Herzegovina. Benchmark process and factor analysis were used to determine key factors among the key knowledge economy pillars (business environment, human resource, ICI and Innovation System).

Furthermore World Bank has done several studies in order to assess the level of readiness for knowledge economy in each country. For example; Building the Sri Lankan Knowledge Economy (2008), India and the Knowledge Economy Leveraging Strengths and Opportunities (2005), etc. All these studies also employed Knowledge assessment methodology to benchmark the country with its neighbours and competitors.

E. The Knowledge Assessment Methodology

The Knowledge Assessment Methodology (hereafter KAM) is developed by World Bank institute's Knowledge for Development Programme. The purpose of KAM is to provide a guiding tool for benchmarking and help the countries to measure their readiness for building a strong knowledge economy. KAM consists of 84 structural and qualitative variables. KAM helps to benchmark

countries with its neighbours, competitors and countries it wishes to imitate. A country can identify the problem and opportunities that it confronts in becoming a strong knowledge economy with the help of KAM (World Bank; 2004 and Knowledge Economy Index 2012 Rating).

F. Knowledge Economy Index

Chen and Delman (2005) has defined knowledge economy index (KEI) as

an aggregate index that represents the overall level of development of a country or a region in Knowledge Economy that summarizes over the four drivers and constructed as the simple average of the normalized values of the 12 knowledge indicators of the basic scorecard. (p. 12)

The values of each driver are constructed by using the simple average value of the normalized values of the particular variable in the basic scorecard (World Bank, 2004). The Diagram 1 shows the knowledge economy index.

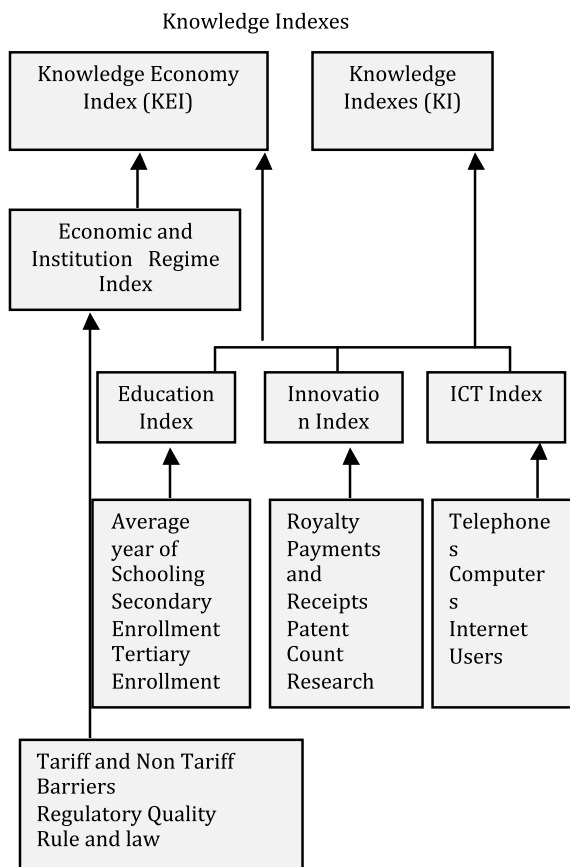


Diagram 1. Formulation of knowledge economy index

G. The Basic Scorecard

The basic scorecard is a tool introduced by World Bank’s KAM. It consists of 12 variables that are based on the four drivers of knowledge economy (World Bank, 2004).

According to Chen and Delman (2005), it is very useful in identifying problems and opportunities that a country confronts in becoming a strong knowledge economy. Further it helps to recognize where to focus policy attention in order to make the transformation into a strong knowledge economy. There are several ways to show the basic scorecard of KAM such as the spider, diamond and bar charts. Among them, the spider chart is the most popular and widely used analytical aid therefore this study uses the spider chart to show the normalized values for each drivers of knowledge economy. In the spider chart the centre indicates the minimum normalized value of 0 while the outer perimeter of the spider chart indicates the maximum normalized value of 10. Therefore a bigger spider chart indicates that the country or the region is in a better position on the particular variable.

H. Normalization Procedure of the KAM

Each and every variable used in the KAM are normalized on a scale from zero to ten. However it does not say that an economy should necessarily target for a perfect score of 10 on each and every variable. Among these variables some variables reflect performance and the rest of variables reflect trade-offs which characterize different development strategies and others reflect the exact structural characteristics of an economy.

1) *The steps of Normalization Procedure:* The raw data (*u*) is collected from World Bank databases and other international organizations for 84 variables and 146 countries. Ranks are allocated to each country based on the absolute values (row data) which describe all 84 variables (rank *u*). Countries with the same performance are qualified to receive the same rank. Rank number 1 is given to the country which performs the best and rank number 2 is given to the countries which perform second best and so on. For each specific country, the number of countries that ranks lower or below it is (*N_w*).

The formula for normalizing the scores for every country on every variable is as follows (Equation 1).

$$\text{Normalized } (u) = 10 * (N_w / N_c)$$

Equation 1. Formula for normalized scores

Where,

u = Normalized Score

N_w = Worst Rank

N_c = Total Number of Countries in the Sample

The above formula allocates a normalized score from 0 to 10 for each of the 146 countries with existing data on the 84 variables. The normalized score between zero to ten scale describe the performance of each country on each variable. The normalized scores between 9-10 are given to

the first top 10% of countries and the normalized scores between 8–9 are given to the second best of 10% in the group and so on.

III. METHODOLOGY

A. Benchmarking Process

In this research, Sri Lanka's readiness for knowledge economy is benchmarked with its competitive and neighbouring countries and with some strong knowledge economies in order to achieve the objectives of this study. The selected countries are India, Pakistan, Bangladesh, Bhutan, Maldives, Nepal and Afghanistan which are South Asian countries and China, Singapore, Korea and Malaysia were selected based on the geographical proximity for the purpose of comparing Sri Lanka with some strong knowledge economies.

B. Development of Conceptual Framework

This study uses World Bank framework with modifications to group, organize and analyse data. Diagram 2 shows conceptual framework developed for this study.

1) *Dimensions of Knowledge Economy:* According to literature, there are four dimensions in the concept of strong knowledge economy that are called as drivers of knowledge economy. They are: Business Environment, Human Resource, ICT Infrastructures and Effective Innovation system. According to Chen (2007) all these above drivers of knowledge economy are positively related to each other and to strong knowledge economy development.

2) *Selected Variables and Measurements:* The KAM propose more than 80 variables under four drivers of knowledge economy that are used to measure development of knowledge economy. Among these variables, 12 variables are selected based on criteria: International comparability, Availability in Sri Lanka and Relevance for our policy requirements. Stephen (2004) is the first person who used these criteria to select most appropriate variables to measure transformation process of knowledge economy in Honkong, China.

3) *Selected Variables:* Human Resource - Adult literacy rate (% age 15 and above), secondary and tertiary enrolment (% gross) and public spending on education as a % of GDP.

ICT Infrastructures –Telephones per 100 people (telephone mainlines + mobile phones), computers per 100 persons and internet users per 1000 people.

Innovation System – Researches in R&D per million people, patent applications granted by the USPTO per million people and total expenditure for R&D as a % of GDP.

Business Environment – Government effectiveness, rule of law and regulatory quality are the selected variables in each dimension.

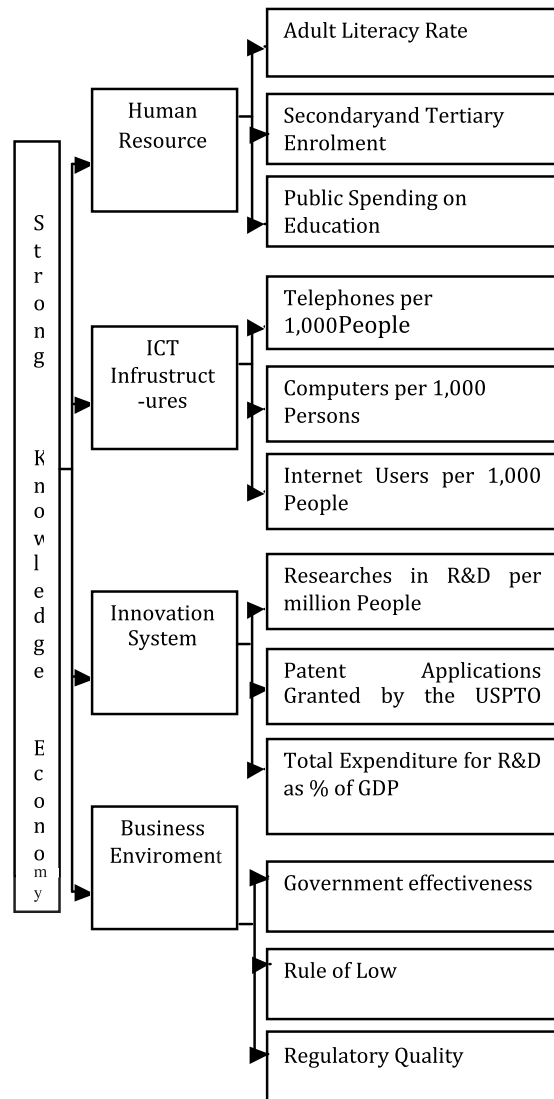


Diagram 2. Conceptual framework

Sources of Data Collection: Due to the nature of data requirement the possibility of collecting primary data is restricted. Therefore this study relies completely on secondary data. The data published for the period from 2000 to 2012 were sourced from: Department of Census and Statistics-Sri Lanka, Central Bank of Sri Lanka publications and web site World Bank website, publications and Databases, United State Patent and Trademark Office, Ministry of Education-Sri Lanka, Telecommunication Regulatory Commission of Sri Lanka, Knowledge Assessment Methodology of World Bank, UNESCO Statistics and International Telecommunication Unit (ITU).

IV. DATA PRESENTATION AND ANALYSIS

A. Knowledge Economy Index

KEI can be used to assess overall Knowledge Economy readiness of a country. According to latest ratings, Sri Lanka's Knowledge Economy position has suffered a

weakening in relative sense. Its KEI has fallen from 87th place in 2000 to 101st position in the current 2012 ranking. The Figure 2 benchmarks Sri Lanka's relative position of Knowledge Economy with other countries, among which China and Pakistan have successfully improved their KEI by 14.1% and 15.57% respectively while other countries in the group including Sri Lanka have weakened in development of knowledge economy in the year 2012 compared to year 2000 in a relative sense. The relative position of Sri Lanka, Singapore, Korea, Malaysia, India, Nepal and Bangladesh have dropped by 15.58%, 3.75%, 5.34%, 3.17%, 2.55%, 23.30% and 15.81% respectively. It means that the countries in the group excluding China and Pakistan have not made progress on the Knowledge Economy comparatively. However in accordance with KE Index 2012, Sri Lanka still appears as the best country in the South Asian region and just behind Singapore, Korea, Malaysia and China. But Singapore, Korea, Malaysia and China are Asian Pacific countries. It means that Sri Lanka is the most suitable market place for foreign investors to invest in south Asian region.

B. Human Resource

Well educated labour force is essential for creating, sharing, disseminating and using knowledge effectively and efficiently because Knowledge Economy demands a set of new skills such as: ICT skill, problem solving ability, group learning, analytical skill, working in a team based environment and effective communication. As a result, the people who have these competencies are considered as the driving force of the KE (Dahlman and Utz, 2005). The Figure 3 benchmarks Sri Lanka's relative position in education performance using education index which revealed that Sri Lanka, Korea, China, Nepal, and Pakistan have increased their education indices by 3.48%, 0.33%, 16.96%, 20.98%

and 10.77% respectively in the year 2012 compared to 2000 in relative sense. At the same time, education index of Singapore, Malaysia, India and Bangladesh have fallen by 19.72%, 3.51%, 1.74% and 28.91% respectively. Accordingly, Sri Lanka has improved its relative position in the last decade and Sri Lanka is standing as the best performing country among the SAARC countries with a skilled and educated workforce. But Sri Lanka is still far behind the other selected Asian Pacific countries in the group excluding China that illustrates the necessity of continuous development of the education system of Sri Lanka in order to create excellent labour force.

Hence this section involves assessment of effectiveness of educational system and quality of human resources in terms of literacy rate, secondary and tertiary enrolment and expenditure on education in order to identify challenges to build a strong knowledge economy in Sri Lanka.

1) *Adult Literacy Rate*: Sri Lanka has achieved gradual development of adult literacy rate during the period from 2001 to 2010 and was able to maintain adult literacy rate above 80% throughout this period.

Also Sri Lankan literacy rate is 10% well above the world average literacy rate. The high standards of primary and junior secondary education has contributed greatly to achieve higher adult literacy rate which is a result of effective policy implementation of the government such as tuition free schooling, free text books and uniforms and special education programs for differently able students (Ministry of Education, 2006). When Sri Lanka is benchmarked with SAARC countries, it is behind only to Maldives in terms of adult literacy rate. Further this process points out that Sri Lanka is still behind compared with other strong economies in Asia such as Malaysia, China and Singapore.

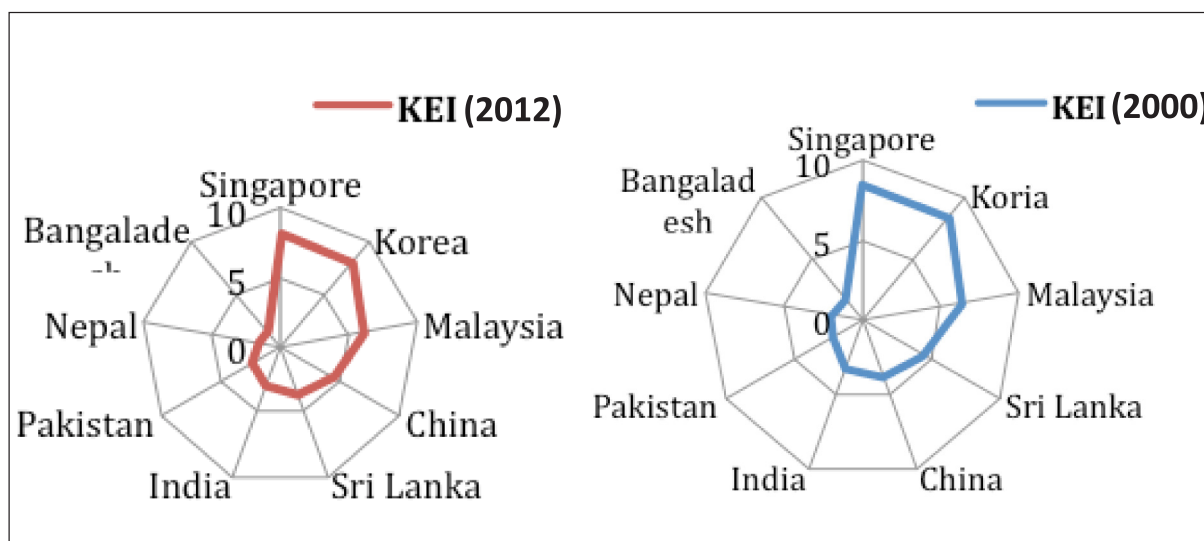


Fig 2. Knowledge economy index

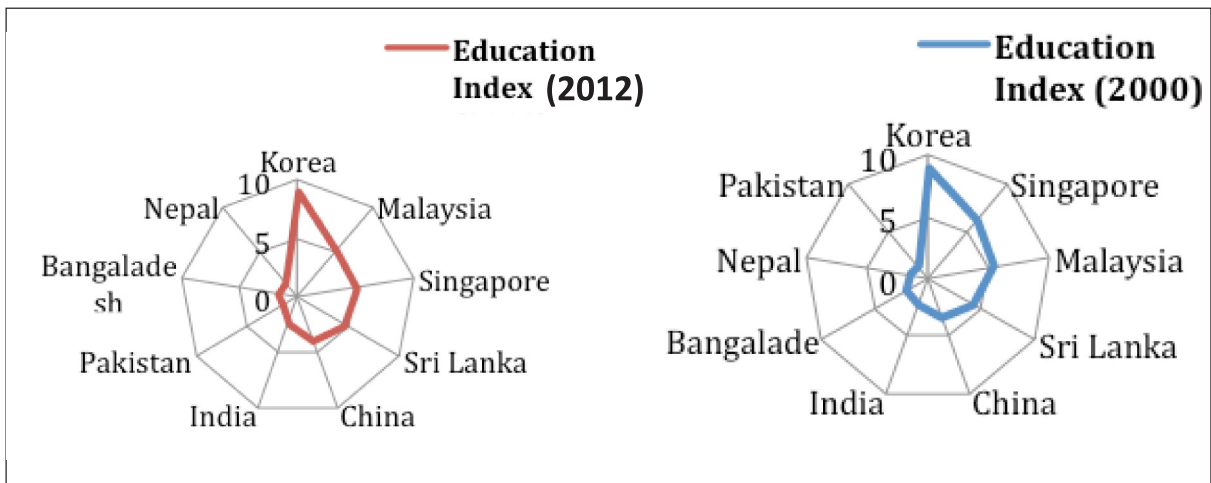


Fig 3. Education index

Hence Sri Lanka should improve adult literacy rate in order to be a strong KE. However Sri Lanka expected to achieve 98% adult literacy rate by the year 2016 under the Mahinda Chintana.

2) *Secondary and Tertiary Enrolment*: Well educated workers are highly demanded in KE. To produce such workers primary education is not sufficient and it requires strong senior secondary and tertiary education. Among them tertiary level education is more significant and play a key role in the production of skilled labour force with analytical and creative thinking that provide foundation for innovation. According to Global Competitive Report (2010 – 2011), “Quality higher education and training is crucial for economies that want to move up the value chain beyond simple production processes and products” (K Schwab, World Economic Forum). However in the case of Sri Lanka, tertiary enrolment is considerably lower than secondary enrolment even though both secondary and tertiary enrolments show a gradual development over the last decade. But there is a substantial gap between

secondary and tertiary enrolment that indicates most of Sri Lankan students leave their formal education after the completion of secondary education and a very few students go for tertiary level education. This highlights the requirement of effective education policy to develop higher education in Sri Lanka.

That is, there is a mismatch between higher education system output and the requirements of the labour market because unemployment among educated population is very high than that of less educated population. Therefore the higher education system of Sri Lanka needs to be developed in a way which can produce educated and skilled workers to meet labour market requirements. Sri Lanka stands behind India, Bhutan and even Bangladesh in terms of secondary enrolment while Sri Lanka is the second best in tertiary enrolment among South Asian countries. However when Sri Lanka is compared with other selected Asian Pacific countries, Sri Lanka is placed last in terms of both indicators.

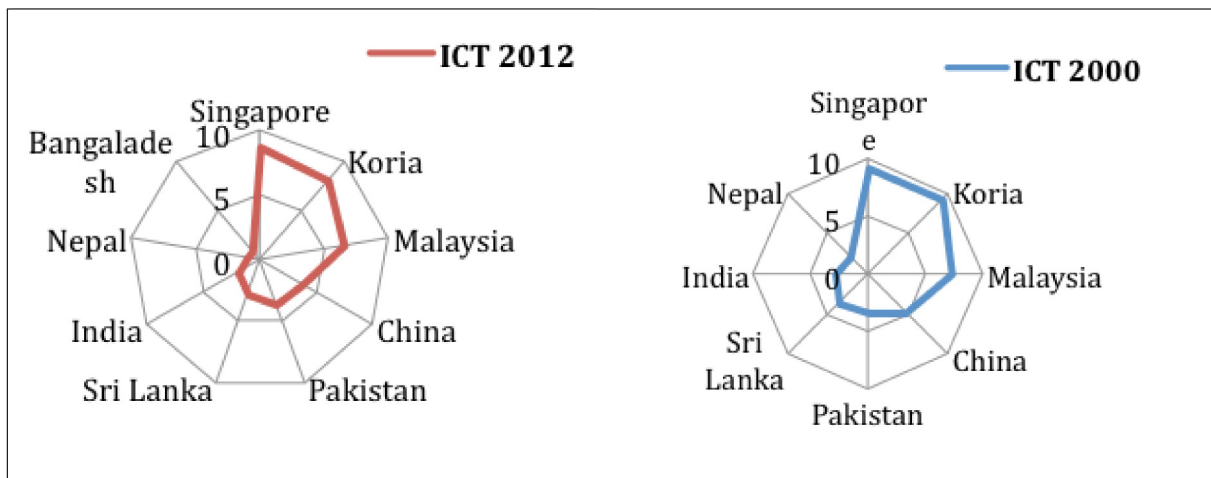


Fig 4. ICT index

3) *Education Expenditure as a % of GDP*: Investment in education is fundamental for countries to improve the productivity and the quality of the labour and deliver the manpower needed for their economic development. In general the investment in education produces a wide array of economic and social benefits to the country. Therefore the amount of money allocated for education is also important for the development of education in a country that will directly affect the creation of skilled and educated labour force. In accordance with World Bank, the developing countries should allocate at least 3% of GDP as education expenditure (Treasures of the education system in Sri Lanka, 2005).

C. ICT Infrastructure

The ICT has an immense impact on building a strong knowledge economy and facilitates to acquire, create, disseminate and use knowledge. The use of ICT reduces transaction costs. Therefore it has become the backbone of KE. The educated workers are needed to develop and use ICT. The adequate access level and connectivity ensure all parts of the country to participate in KE (Dahlman and Utz, 2005). According to World Bank ICT promotes economic growth, improve delivery of government service and expand the delivery of education. Furthermore it is one of the most important tools to balance urban and regional development across the country. In terms of accessibility to IT infrastructure, Sri Lanka performed much better than other countries in the South Asian region.

The figure 4 benchmarks Sri Lanka's relative position in ICT performance using ICT index. It shows that Pakistan has increased its ICT index by 11.8%, while ICT indices of other countries: Nepal, Bangladesh, India, Sri Lanka, China, Korea, Malaysia and Singapore have decreased by 51.90%, 45.12%, 33.33%, 22.87%, 21.04%, 12.6%, 9.99% and 5.18% in the year 2012 compare to 2000 in relative sense. With the ICT improvement of Pakistan, Sri Lanka has drop down to the second place among the SAARC countries on ICT performance even though Sri Lanka is the best performing country in terms of KEI in South Asian region.

Further this graph indicates that Sri Lanka and Pakistan are still far behind the other selected Asian countries in the group in terms of ICT performance. It means that Sri Lanka should further develop its ICT performance in order to build a strong KE.

Hence this section involves assessment of accessibility and connectivity to ICT in terms of the number of computer users, internet users and telephone users in order to identify challenges to build a strong knowledge economy in Sri Lanka.

1) *Computers per 1,000 People*: The number of computer users is also important to build a knowledge economy. Among SAARC countries, Maldives has the highest number of computer user and Sri Lanka stands in the second place.

Other SAARC countries Bhutan, India, Bangladesh, Nepal, Pakistan and Afghanistan stand behind Sri Lanka, which indicates that Sri Lanka is in a strong position in terms of computer use within the SAARC region. However that does not reflect the fact that computer use and computer literacy of Sri Lanka is at a favourable position because when it is compared with other selected Asian countries: Singapore, Korea, Malaysia and China, Sri Lanka still stands at a very lower level in terms of computer use and IT literacy. This reflects poor computer use and computer literacy are the most common issues faced by the SAARC region. It is essential to take immediate and strong action to eliminate this burden from the SAARC region. But Sri Lanka shows faster growth in computer use over the last decade. Western Province has reported the highest rate of computer use. It is higher than the average level of the island. The lowest rate was reported from Uva province. Other provinces are also depicting a very poor position in terms of computer use. This huge deviation between Western Province and other provinces is not a favourable condition to build a strong knowledge economy in Sri Lanka. So that it is vital to promote computer use in these areas as much as possible for the purpose of achieving ICT development in the country. For this purpose, the ICT national policy of the country requires to be further developed or to be introduced new policies and programs to increase computer use in the areas which reported lower use of computers. Western Province focused ICT Infrastructure Development leads high inequality of computer use.

2) *Internet Users per 100 People*: Internet is other most important tool to acquire, share and disseminate information. In SAARC region, Maldives and Bhutan are the best countries in internet use while Sri Lanka stands in the third place in the South Asian region. Other SAARC countries, India, Bangladesh, Nepal, Pakistan and Afghanistan stand behind Sri Lanka. However Sri Lanka is not in a satisfactory position in terms of internet use when it is compared with other selected Asian countries such as Singapore, Korea, Malaysia and China. However Sri Lanka has achieved gradual development of internet use from the year 2000 to 2007. After 2007, there was an accelerated growth in internet use and that can be expected to grow further. The expansion of broadband connection is one of the main causes that lead to increase in accessibility to the internet because most of Sri Lankan people access internet via broadband connection using fixed line connections.

According to ITU World Communication/ICT indicator, the cost of internet connectivity in Sri Lanka has dropped steeply. In the year 2004 it was \$25.28/20hrs and it has been decreased to \$7.3/20hrs in 2008 and further has fallen to \$2.4/20hrs in the year 2010. This steep price decline is a reflection of the high competition in the market. However, Sri Lanka is ranked in the 60th place in terms of cost of internet connectivity in accordance with ICT Price Basket 2010 ranking. All the economies which are

at the top of the ICT Price Basket pay less than \$1/20hrs including China, Singapore and Malaysia which makes it alarming that Sri Lanka still pays a high cost for internet connectivity. Other issue associated with internet use is that the unawareness of internet and its usefulness among the people living in Sri Lanka. Department of Census and Statistics is conducted a survey in order to assess the computer literacy of household population in the age group of 5 – 69, according to its finding, the majority (90%) is not aware about this facility, another 7% is aware of internet but they can use it with the help of others and only 3% is in a position to use internet on their own.

3) *Telephones per 100 People*: Number of telephone users in Sri Lanka has increased over 2000 to 2010 due to rapid advancement of mobile phone use among Sri Lankan people that is common to entire SAARC region. In Sri Lanka, Western Province has reported the highest rate of telephone use. The lowest rate was reported from Uva province. Other provinces are also in a very poor position when compared with the Western Province. It is important to promote telephone use and provide necessary infrastructure to these areas.

However the Sri Lankan government seems to be aware of these ICT development barriers. The Information communication Technology Agency (hereafter ICTA) was setup in 2003 to function as an agency for ICT policy and program implementation in Sri Lanka. Currently ICTA has prepared a national ICT policy and an ICT policy for the government. One of its most notable achievements is the establishment of “Nanasala” throughout the country. Further Mahinda Chintana has recognized the importance of empowering the young generation with modern ICT and has proposed several development programs to increase IT utilization in Sri Lanka.

D. Innovation System

Innovation system has greater impact on building a strong knowledge economy and facilitates to acquire, create, use and disseminate knowledge. Innovations contribute to the

development and use of new and existing knowledge in the local level for most developing countries. The government should provide a favourable climate for the business organizations in order to develop an innovation system of the country (Dahlman and Utz, 2005).

Figure 5 benchmarks Sri Lanka’s relative position in innovative performance using innovation index. According to this graph Sri Lanka’s Innovation index has fallen by 5.56% in the year 2012 compared to year 2000. But China, Pakistan, India, Nepal, Bangladesh, Malaysia, Korea and Singapore have increased their innovation index by 37.7%, 23.48%, 17.49%, 10.40%, 9.74%, 4.39%, 2.56% and 2.15% respectively. Further it shows that India is the best performing country and still Sri Lanka appears as the second best performing country among the SAARC countries in terms of innovation. Other SAARC countries stand behind Sri Lanka, even though they have shown relative improvements, therefore all the countries in the South Asian region are very weak in innovation when it is compared with the selected AP countries in the group that is also indicated by the above figure.

This section involves assessment of effectiveness of innovation system in terms of research and development expenditure, number of researchers and number of patent granted by USPTO in order to identify challenges to build a strong knowledge economy in Sri Lanka.

1) *Research and Development Expenditure as a % of GDP*: Innovations funding can be measured by the expenditures on research and development as a percentage of GDP. In Sri Lanka, it has been around 0.15% in the 2000 - 2008 period and later 2001, it shows gradual decline of the amount allocated for research and development. Vienna Conference on Science and Technology for Development and many international organizations pointed out the importance of allocating more than 1% of GDP to research and development in order to build effective innovation system in a country (Rodwan et al., 2008).



Fig 5. Innovation index

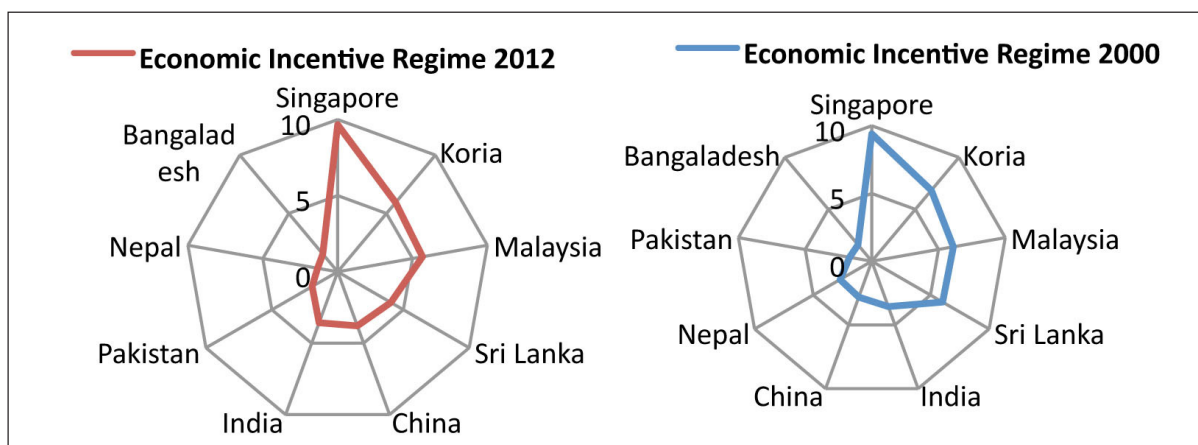


Fig 6. Economic incentive regime index

When comparing Sri Lanka with other SAARC countries and selected Asian Pacific countries, on research and development expenditure as a % of their GDP, Sri Lanka is the country which has been allocating less for research and development in the group. Among SAARC countries, India is the country which allocates the highest portion of expenditure as a % of GDP to research and development among SAARC countries and even Bangladesh and Nepal allocate on research and development more than Sri Lanka. Generally Korea and Singapore are considered as the countries with the most innovations. They allocate more than 2.2% of their GDP to research and development. It is even above the world average (World average – 2.14% of GDP). The South Asian average for research and development expenditure is 0.75% as a percentage of GDP (2007). These facts are signalling a red light about NIS of Sri Lanka and reflect the requirement of increasing investment in research and development to become competitive in South Asian region as a country with innovations.

Other most important factor associated with innovation system of Sri Lanka is that a large portion of expenditure in research and development is financed by the government which is about three fourth of the total research and development expenditure of the country. Private sector and foreign investments in research and development are less which is only about 20% and 4%-5% of total research and development expenditure respectively. In the case of most innovator countries, the private sector investment in research and development is about 70% of its total research and development expenditure. For an example in Korea private companies are the leaders in innovation (Jolio, 2006). But in Sri Lanka the government plays the major role in promoting innovation. Therefore the government's approach towards innovation has greater impact on NIS.

2) *Number of Researchers in Research and Development:* Number of researchers in research and development is another important indicator to measure NIS of the country and this is an indicator that represents the input of the

innovation system. But in the SAARC region country's number of researchers is very few compared to Asian Pacific countries. Number of researchers in the country and their contribution to NIS is the most significant to be an innovator country, but unfortunately the number of researchers in SAARC countries is not sufficient at all.

In 2000 number of researcher in Sri Lanka was 135 which have been dropped to 96 within eight years. A Few numbers of researchers in research and development is one of the problems that Sri Lanka and most SAARC countries confront in building an effective innovation system.

Therefore Sri Lanka should take necessary actions in order to increase the number of researchers in research and development. In the case of Sri Lanka, majority of researchers work in government and higher education sector while a few work in private sector. Number of researchers in business enterprises is not enough to be an innovative country because the researchers who work in business enterprises greatly contribute to invent new things most of the time which have higher commercial value. But unfortunately private sector contribution to national innovation system is not satisfactory.

3) *Number of patent Granted by USPTO:* This indicator shows that the number of patent documents granted by USPTO to each country in the group which is one of good indicator to measure a country's innovation system. Sri Lanka has been granted the smallest amount of patents over the period from 2002 to 2010. It is an evidence of the poor performance of invention system of Sri Lanka. Among SAARC countries, India is the best performer and Sri Lanka and Pakistan stand in second and third place respectively. Other SAARC countries Bhutan, Bangladesh, Nepal, Maldives and Afghanistan have not been granted of any patent over the last few years. This reflects poor performance of innovation within the SAARC region. However India is in a much stronger position when compared with other SAARC countries including Sri Lanka. Korea, Singapore and China have excellent performance

on innovation. Sri Lanka has a very long journey ahead to reach an effective innovation system. As this indicator always represents the level of national performance on innovation, very low rating means the country does not have an effective innovation system. That reflects not only Sri Lanka but also for the entire SAARC Region requires national policies to enhance the national inventions system.

E. Business Environment

The fundamental driver of knowledge economy is effective business environment that facilitates the redeployment of resources from less efficient to more efficient uses. The most important elements of this driver are macroeconomic stability, competition, good regulatory policies and legal rules and procedures leading to entrepreneurship and risk taking (Dahlman and Utz, 2005). The Figure 6 shows the relative position of Sri Lankan business environment, using economic incentive regime index. According to this graph Sri Lanka is the best performing country among the SAARC countries. Other SAARC countries stand behind Sri Lanka. However all South Asian countries are very weak in maintaining effective business environment when it is compared with selected Asian Pacific countries in the group which is also indicated in the above figure 6.

1) Government Effectiveness: The selected Asia Pacific countries maintain quality public and civil service. Among SAARC countries India is the best country and Sri Lanka stands in the second place in terms of government effectiveness. However when it is compared with selected Asian Pacific countries, both countries have to further work harder on government effectiveness, though other SAARC countries stand far behind India and Sri Lanka. This indicates that entire South Asian region is very less effective in providing public services and civil services.

Sri Lanka has maintained much better position over last four to five years when compared with the years such as 2004,2000. But this is not a favourable condition for effective business environment; therefore it requires further improvement of government effectiveness for which commitment is essential and should have foresight in relation to policy formulation and implementation in order to achieve quality of public service.

2) Regulatory Quality: Sri Lankan government is capable of formulating and implementing sound policies and regulations which promote private sector development than other SAARC countries and even China. When compared with other selected Asia Pacific countries such as Singapore, Korea and Malaysia. Compared to them Sri Lanka also have relatively weak though positive climate for the private sector development.

3) Rules and Law: Bhutan is the best country on rules and law while Sri Lanka stands in second place among

the SAARC countries which indicates that Bhutan and Sri Lanka perform much better in terms of property rights and prevention of crime and violence than other South Asian countries. But when it is compared with other selected Asian Pacific countries within the group such as Singapore, Korea and Malaysia the condition is much different.

Sri Lanka has performed much better in terms of rules and law from 2002 to 2004. Then it has shown an accelerated drop down. However in the year 2007, it has been recovered up to a certain level. However the confidence of agents was dropped down again as we can see in the year 2008 as well in 2009. Later 2009 there was no fluctuation. But the confidence of agent in relation to property rights and prevention of crime and violence still remain at a very lower level. In order to build a more elite business environment it is important to enhance the confidence of agents regarding the rules and law (Governance Indicator, 2012)

V. CONCLUSION AND RECOMMENDATIONS

A. Introduction

This study has focused on the development of knowledge economy in Sri Lanka as benchmarking effort. This benchmarking process revealed the Sri Lanka's challenges in building a strong knowledge economy in respect of human resource, ICT, innovation and business environment and its relative position when benchmarked with selected Asian Pacific countries and South Asian countries.

Sri Lanka has to go a long journey towards building a strong knowledge economy when it is benchmarked with selected Asia Pacific countries. However its relative position is somewhat stronger than other South Asian countries in terms of four pillars of knowledge economy. In addition, the following challenges were found in relation to building a strong knowledge economy in Sri Lanka.

B. Challenges Identified

Human Resource Related: The challenge ahead is to improve the quality and equality of education. Further it is important to make the education system more responsive to market needs as well as to promote and facilitate the tertiary level education.

1) ICT Related: The challenge ahead is to enhance ICT awareness and accessibility in all parts of Sri Lanka because lower level access and use of ICT and high cost of connectivity emphasise that distribution and exchange of knowledge is less efficient within the country as well as at international level.

2) Innovation Related: The challenge ahead is to improve the innovation inputs and outputs and increase private sector investment in research and development. Because poor performance on innovation emphasise that innovation system of Sri Lanka is weak.

3) *Business Environment Related*: The challenge ahead is the improvement and maintenance of good governance because poor performance on business environment reflects that such nations are economies without solid institutional regime.

The situation in Sri Lanka has become appealing with the decades of war coming to an end since 2009. The Government of Sri Lanka is making all efforts to attract foreign investments by improving the business environment via incremental advancements.

C. Feasible Solutions / Proposals

Sri Lanka should formulate and implement different policies and programmes in a more effective and efficient way in order to drive the country in a path towards a strong knowledge economy.

1) *Feasible solutions for the development of human resource*: In order to achieve the quality and equality of education, effective spending on education should be increased and the quality of tertiary education needs to be improved. Further it requires development of sound university-industry partnership and introduction of lifelong learning system.

2) *Feasible solutions for the development of ICT*: In order to enhance ICT awareness and accessibility in all parts of Sri Lanka, boosting the rural sector connectivity and encouragement of private investments in ICT infrastructure is essential. Further it requires enhancing ICT literacy and skills among the population and bringing down the cost of connectivity by facilitating competition within the ICT industry.

3) *Feasible solutions for the development of Innovation System*: In order to improve the innovation inputs and outputs and increase private sector investment in research and development, government spending on research and development needs to be increased significantly and alternative sources of funding for research and development should be established. Further it requires facilitating and developing infrastructure required for research and development and creating an attractive environment to encourage the private sector to invest in research and development.

4) *Feasible solutions for the development of Business Environment*: In order to improve and maintain good governance, Sri Lanka should formulate and implement sound policies and regulations which promote private sector development, increase use of ICTs in providing government services and strengthen intellectual property rights and their enforcement in Sri Lanka.

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REFERENCES

- Al-Rahibi IA (2008). "An empirical study of the key knowledge Economy factors for sustainable economic development in Oman", Doctoral thesis, Faculty of Business and Law, Victoria University, Melbourne, Australia, Aug.
- APEC (2002). "The new economy in APEC: Innovations, digital divide and policy", APEC Economic Committee.
- Barro RJ (1991). "Economic growth in a cross section of countries", The Quarterly section of Economics, Vol. 106, p.407-443.
- Chen C (2008). "Causal modeling of knowledge-based economy", Journal of Management Decision, Vol. 46, p.501-514.
- Chen DHC and Dahlman CJ (2005). The knowledge economy, the KAM methodology and World Bank operations, The World Bank, Washington.
- Cohen D and Soto M (2006). "Growth and Human Capital: Good data, Good result", Technical paper no 179, September, OECD Development Center, Paris.
- Dahlman C and Utz A (2005). "India and the knowledge economy leveraging strengths and opportunities, World Bank, Woshington.
- Fors M and Moreno A (2002). "The benefits and obstacles of implementing ICTs strategies for development from a bottom-up approach", Journal of Aslib Proceeding, Vol.54, p.198-206.
- Gunawardana KD (2005). "An empirical study of potential challengers and benefits of implementing e-learning Sri Lanka" Proceedings of the second international Conference on eLearning for Knowledge-Based Society, Aug, 2005, Bangkok, Thailand.
- Ghosh M and Ghosh I (2009). "ICT and information strategies for a knowledge economy the Indian experience", Journal of electronic library and information society, Vol.43, p.187-201.
- Goh A LS (2005). "Promoting innovation in aid of industrial development: The Singapore an Experience", International Journal of Public Sector Management, Vol. 18, p.216-240.
- Hanushek EA and Kimko DD (2000). "Schooling, labour-force quality and the growth of nations", The American Economic review, Vol. 90, p1184-1208.
- Hearn G and Rooney D (2002). "The future role of government in knowledge-based economies", Journal of foresight, Vol. 4, p.23-33.
- Hossain A (2012). "K-economy in the SAARC integration: A comparative study among the member countries", Journal of International Business, Vol. 22, p.28-47.

- Jain P (2006). "Empowering African's development using ICT in a knowledge management approach", *Journal of the Electronic Library*, Vol.6, p.261-269.
- Jolio CA (2006). "Peru and the knowledge economy: A general assessment", this paper was prepared during the author's participation in the Voice Second Programme at the World Bank, Washington.
- Kurtic A and Donlagic S (2012). "Determining Key Factors for Knowledge Economy Development in Bosnia and Herzegovina", *Management, Knowledge and Learning International Conference*.
- Lu L and Etzkowitz H (2008). "Strategic challenges for creating knowledge-based innovation in China: Transforming triple helix university-government-industry relations", *Journal of Technology Management in China*, Vol. 3, p.5-11.
- Matlay H (2001). Entrepreneurial and vocational education and training in central and Eastern Europe, *Education + Training*, Vol. 43, p.395-404.
- Mihinda Chintana Vision for the Future (2010). National Economic Policy, Sri Lanka.
- Ministry of Education, (2006). "Education sector development framework and programm", Sri Lanka.
- OECD (1996). "The knowledge based economy", Paris.
- Oliner SD and Sichel ED (2000). "The resurgence of growth in the late 1990s: Is information technology the society?", *Division of Research and Statistics, Federal Reserve Board*.
- Osinubi TS and Amaghionyeodiwe LA (2010). "Foreign Direct Investment and Economic Growth in Nigeria", *Review of Economic and Business Studies*, Vol.3, p.105-127.
- Passerini K (2007). "Knowledge-driven development indicators: still an eclectic panorama", *Journal of Knowledge Management*, Vol.11, p.115-128.
- Powell WW and Snellman K (2004). "The knowledge economy", *Annual Review Sociology*, Vol. 30, p.199 -220.
- Psarras J (2006). "Education and training in the knowledge-based economy", *Journal of Information and Knowledge Management System*, Vol.36, p.85-96.
- Rao SS (2004). "Role of ICTs in India's rural community information system", *Journal of Info*, Vol.6, p.261-269.
- Ribound M, Savchenko Y and Tan H (2007). "The knowledge economy and education and training in South Asia: A mapping exercise of available survey data".
- Roberts J (2009). "The global knowledge economy in question, critical perspectives on international business", *Journals of Critical Perspection on International Business*, Vol. 5, p.285-303.
- Robertson PL (2003). "The role of training and skilled labour in the success of SMEs in developing countries", *Journal of education + Training*, Vol. 45, pp461-473.
- Rodwan I, Kuruppu N, Bandara S and Wijesinghe A. (2008), "Building the Sri Lankan Knowledge Economy", World Bank, Washington.
- Romer PM (1989). "Human capital and growth: theory and evidence", working paper No 3173, National Bureau of Economic Research, Cambridge.
- Saginove O and Belyansky V (2008). "Facilitating innovations in higher education in transitive economy", *Journal of Education Management*, Vol.22, p.341-351.
- Stephen KCL (2004). "Statistics to measure the knowledge-based economy: The case of Hong Kong, China", 2004 Asia Pacific Technical Meeting on Information and Communication Technology (ICT) Statistics, Wellington.
- Sundac D and Krmpotic IF (2011). "Knowledge economy factors and development on knowledge based economy", *Journal of CroEcoSur*, Vol.13, p.105 -141.
- The Global Competitiveness Report (2010-2011)
- The World Bank (2007). "The knowledge economy and education and training in South Asia'.
- Treasures of the education system in Sri Lanka (2005). Human Development Unit, South Asian Region, World Bank USPTO (2006), "Performance and Accountability Report", United State.
- United State Patent and Trade Mark Office (2010). "Performance and Accountability Report", United State.
- Whelan K (2000). "Computers, obstescence and production, Division of Research and Statistics", Federal Reserve Board.
- World Bank (2004). "Benchmarking countries in the knowledge economy: Presentation of the knowledge assessment methodology (KAM) knowledge for development program", World Bank Institute.
- Zeng Z (2009). "The comparison of innovation activities and international trade effect in China and Japan in the era of knowledge economy: Empirical research on patents as an example", *Journal of Chinese Economic and Foreign Trade Studies*, Vol. 2, pp211-228.
- World Bank (2012). <<http://data.worldbank.org/>>indicator accessed 05/Aug/2012
- World Bank (2012). <[http:// web.worldbank. org/ wbsite/ external/wbi/wbiprograms/kfdlp/extunikam/0,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.htm](http://web.worldbank.org/wbsite/external/wbi/wbiprograms/kfdlp/extunikam/0,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.htm)>l accessed 05/ Aug /2012
- Central Bank - Sri Lanka (2012). <http://www.cbsl.gov.lk/html/english/08_stat/stat.html> accessed 05/Aug/2012
- Information and Communication Technology Agency (ICTA) (2012). <<http://www.icta.lk/>> accessed 05/Aug/2012

International Telecommunication Unit (ITU) (2012).<<http://www.itu.int/D/ICTEYE/indicators/asp>>accessed 07/Aug /2012

International Telecommunication Unit (ITU) (2012).<<http://www.itu.int/en/ITU-D/Statistics/Pages/default.aspx>> accessed 07/Aug /2012

Ministry of Education - Sri Lanka (MOE) (2012).<<http://www.moe.gov.lk/web/index/.php?lang=en>>accessed 12/Aug /2012

Nanasala (2012).<<http://www.nanasala.lk/>> accessed 05/Aug /2012

Department of Census and Statistics-Sri Lanka (2012).<<http://www.statistics.gov.lk/>>accessed 05/Sep /2012

Telecommunication Regulatory Commission-Sri Lanka (2012).<<http://www.trc.gov.lk/information/statistics.html>>accessed 05/Sep /2012

United Nations Educational Scientific and Cultural Organization (UNESCO) (2012). <<http://www.uis.unesco.org/Pages/default.aspx>> accessed 05/ Aug/2012

United State Patent and Trade Mark Office (USPTO) (2012).<<http://www.uspto.gov/>> accessed 05/ Aug/2012

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