Volume : 2 | Issue : 8 | August 2013 • ISSN No 2277 - 8179

Research Paper

Knowledge-based Economy (KBE) Frameworks and Investigation of KBE Input-output Indicators for Pakistan

Science

KEYWORDS : Knowledge-Based Economy, Knowledge-Based Economy frameworks

Muhammad Bashir — Pakistan Council for Science and Technology, Shahrah-e-Jamhuriat , Sector G-5/2, Islamabad , Pakistan

ABSTRACT

The objective of this paper is to assess the relative efficiency of Pakistan and other Asian countries in their development of knowledge-based economies (KBEs). The KBE concept was first used by the Organization for Economic Co-operation and Development (OECD) describing it as an economy which is directly based on the production, distribution and use of knowledge and information. Subsequently, the Asia Pacific Economic Cooperation forum (APEC) and the World Bank Institute (WBI), along with the OECD, extended the concept and developed frameworks to compare the status of the knowledge base of different economies. These frameworks identify four core dimensions: knowledge acquisition, production, distribution and utilization, and use many structural and qualitative variables in their analysis. But none of the current methodologies explicitly divide the KBE indicators under these four core dimensions or measure the efficiency with which knowledge inputs are transformed to knowledge outputs. This paper attempts to describe a policy-focused KBE framework, selecting appropriate indicators from the existing OECD and WBI KBE frameworks for assessing the relative input-output efficiency of Pakistan and other Asian countries in the development of their KBEs.

Introduction

Even in the 16th century Sir Francis Bacon claimed "knowledge is power" and suggested establishment of a new system whose final aim is production of new practical knowledge for "useage and benefit of human kind". A key feature in 21st century economies is that development rests upon knowledge and its application. Indeed, today's most technologically advanced countries are knowledge-based. Creating and commercialising new knowledge has created millions of knowledge-related jobs and generated new wealth from innovation. In the past decade, a substantial body of research has been conducted on productivity-led economic growth and its determinants (Sundac & Krmpotic, 2011). A major reason for this is the widespread belief that economic growth that is due to rapid factor accumulation is subject to diminishing returns and, hence, not sustainable. Recently, there has been growing interest in the contribution of knowledge to total factor productivity growth and, consequently, to sustainable long-term economic development.

Most advanced economies have undergone significant structural changes in recent years. One of the key characteristics of the changes is the growing importance of knowledge in all sectors of economic activities. These economies have developed from an agricultural economy in which land is the key resource, then to an industrial economy in which natural resources and labour are the main resources, and now to a knowledge-based economy (KBE) in which knowledge is the key resource. Development of knowledge and knowledge management become imperative of the modern age. Knowledge has now become a factor of production and therefore investments in research, development and education are fundamentals of any successful economic policy. Future of a national economy and economic growth of a country in a knowledge based society depends on the level of new knowledge.

Effective and efficient application of knowledge as an additional factor of production is as necessary for achievement of economic development goals as traditional factors of production. Knowledge has become and will remain determining factor for individual and social welfare. The debate on knowledge economy has pointed towards the claim of a positive correlation between the country´s level of knowledge and its economic growth. Considering this role of knowledge for achieving economic growth transition countries especially are able to benefit from it. Pakistan is a country with very poor economic performance, a huge foreign trade deficit and foreign debt, increasing unemployment. The development of a knowledge economy could be the way out of the current state. But its development requires determination of the key factors which contribute to its development.

The basic difference between a traditional and knowledge-based economy is that the former depends on quantitative factors such as labour, raw materials, premises and bulk transportation, among others, whereas the latter relies more on qualitative factors, namely, qualifications, R&D and good infrastructure. Resource-driven economies sometimes depend on a protectionist environment, whereas knowledge-based economies thrive in a friendly and open policy environment, and on innovation and qualified labour.

Objective

The objective of this paper is to define the knowledge-based economy and to identify the framework for knowledge-based economies and to examine the current position of the Pakistan's economy in the process of its transformation to a knowledge-based economy and to bring the topic of "Knowledge based Economy" in the focus of the research community in Pakistan.

Structure of the paper

Paper is organized as follows: Section 2 define knowledge and basic concept of the knowledge-based economy. Section 3 of the paper considers theoretical and empirical work relating to the role of knowledge in the economy. Section 4 considers approaches to the measurement of a KBE. It discusses the need for a measurement framework, the type of frameworks. It lists examples of existing measurement frameworks and describes, in some detail, APEC and OECD and World Bank work in this field. Section 5 discusses the approach to choose indicators then lists the statistical indicators included in the framework in their dimension-characteristic context. Section 6 analyses the current position of Pakistan's economy by providing indicators measuring knowledge inputs and outputs. Finally Section 7 concludes the major findings of the study and some policy guidelines are suggested for Pakistan to compete in the New Economy.

2. Definition of Knowledge, Basic Concept of Knowledge-Based Economy

2.1 Knowledge

Knowledge, as embodied in human being (as human capital) and in technology, has always been central to economic development. Alan Burton-Jones (1999) defines knowledge as "the cumulative stock of information and skills derived from use of information by the recipient". Dahlman (1999, cited in Asia-Pacific Economic Co-operation (APEC) 2000) described four phases of knowledge flow: acquisition, creation, dissemination and use of knowledge. Others, including the Organisation for Economic Co-operation and Development (OECD) (1996) have referred to the production, distribution and use of knowledge. Howitt (1998) talked about the production and exchange of knowledge.

2.2 Basic Concept of Knowledge-Based Economy

Lately, around 1998/99, the concept of Knowledge as a source of economic development gained popularity, giving the rise

to the term "Knowledge Based Economies". The term KBE (or sometimes called the New Economy or Modern Economy) results from a fuller recognition of the role of knowledge and technology in economic growth. A knowledge-based economy is defined as "an economy that is capable of knowledge production, dissemination and use; where knowledge is a key factor in growth, wealth creation and employment, and where human capital is the driver of creativity, innovation and generation of ideas, with reliance on information and communication technology (ICT) as an enabler". The term "knowledge-based economy" was coined by the OECD and defined as an economy which is "directly based on the production, distribution and use of knowledge and information" (OECD 1996). The Asia-Pacific Economic Co-operation (APEC) Economic Committee extended this idea to state that in a KBE "the production, distribution and use of knowledge is the main driver of growth, wealth creation and employment across all industries" (APEC 2000). The UK Department of Trade and Industry defined it as a knowledge-driven economy in which the generation and exploitation of knowledge play the predominant role in the creation of wealth (Economic Research Services Department, 2000)

It is basically an economy that creates, disseminates and uses knowledge to enhance its growth and development. A country's success in the knowledge-based economy depends on the creation, acquisition, dissemination and application of knowledge.

Knowledge creation depends on the intensity of research and development (R&D) conducted in a country, and the availability of human resources needed for R&D. Knowledge acquisition is reflected in intellectual content embedded in imports from other knowledge-based economies (or through multinational corporations). Linguistic skills will help to plug into the global knowledge network. Knowledge dissemination depends on the resources allocated to develop information infrastructure, basic information technology (IT) and linguistic skills to tap into the info-communication technology (ICT) network. Finally, knowledge application is reflected in an economy's job market that demands and allows workers to apply knowledge extensively, and its ability to create new business models for generating, acquiring, diffusing and applying new ideas and processes.

3. Theoretical review, the knowledge economy framework elements and need for Framework on KBE

3.1 Theoretical review

The neoclassical school, which formulated in the world economic rapid industrialization period, by using the exogenous production functions, showed that the capital accumulation is needed for exponential and thus long run sustained economic growth and, therefore, productivity growth. N. Kaldor (1961) empirically revealed that a) the output per capita increases during the time, and its rate of growth does not decrease, b) the physical capital per worker increases during the time, c) the real income level is mainly stabile etc. Overall, they correspond to the growth theories of neoclassical school.

The long-run growth issues have again become a modern topic from the middle of 1980's. Now, empirical studies showed distinctions from the previous facts. For instance, P. Romer (1989) empirically showed that a) the average growth rate may not correlate with the income per capita, b) the growth rate of international trade positively correlates with the growth rate of the production, c) the capital growth is not a sufficient fact for explaining of production growth.

The modern growth theories tried to explain newly the rapid growth of residual part of production functions in some countries. At that period, 3those countries described with the employment rate reaching its possible maximum rate in industry, transformed from industrial economy to postindustrial, characterized with new strength and quality of productivity growth. In this context, first researches have made P. Romer (1986), R. Lucas (1988). They explained the growth of productivity or unexplained residual with the conception of human capital. The second wave of growth models got the name «Research and Development, R&D». In order to explain the residual rapid growth, Barro, Sala-I-Martin (1995), Lucas (1993) considered the development and adoption of innovations and new technologies my means of trade among countries. The postindustrial economy is characterized by the rapid advances in information and communication technologies, which enable researchers in different locations to work together, raising their productivity, resulting in rapid advances in research and development and the generation of new knowledge and technologies as well. As a result, over the past quarter century, the knowledge creation and use have increased significantly.

Its accumulation results to the improvement of the production factors labor (human capital) and physical capital (technology), thus explaining the high growth rates of residual or total factor productivity (TFP), resulting to sustained long-run economic growth. Consequently, "new growth theory" reflects an attempt to understand the role of knowledge and information in driving productivity and economic growth. The economy, where knowledge is acquired, created, disseminated and used effectively to enhance economic development, is a Knowledge Economy (KE).

3.2. The KE framework elements

Knowledge, as the main engine of economic growth and development, is developed in the endogenous R&D growth model of Chen and Kee (2005). Its interest is that it shows that simple neoclassical models with human capital as a factor of production are able to resolve the concerns of scale effects and policy invariance. Chen and Kee consider the steady-state effects of two scenarios that could result from development-oriented policies.

First scenario focuses on human capital accumulation, the increase in which will result in a larger stock of human capital in economy. The increase in human capital in the R&D sector leads to more innovations and discoveries, which results to more technological growth. The last, combined with the human capital stock in the goods-producing sector, leads to an increase in the growth rate of output. According to the model, a fixed proportion of output is invested as new capital, over again increasing the increased rate of output.

Second scenario relates to information and communications technologies (ICT). It is infrastructure in economy, which refers to the accessibility, efficiency of computers, phones, other networks. According to model, the increased flow of information and knowledge, resulting from improvement in the ICT infrastructure, leads to increased innovation, steady-state growth rate of technology, productivity and hence output.

As Chen and Kee model shows, even one time improvement of a) education system (therefore, human capital), b) information infrastructure, and hence c) innovation capability will lead to TFP growth and economic growth in long run. Consequently, we found out, that in current highly competitive and globalized world economy the development-oriented policy should emphasize the knowledge. That will tend to transition into a KE, which is the main engine for TFP growth and hence long-run economic growth. On the other hand, the review of growth models revealed, that the education, innovations, information infrastructure and economic incentive & institutional regime are the main elements or pillars for KE framework.

4. Need, Measurement and Types of Framework on KBE

4.1. The need for a framework on KBE

There has been growing demand for KBE indicators partly as a result of the increasing concern on "knowledge divide" between the advanced countries, who are generating most of this knowledge, and developing countries, which have comparatively less developed markets, institutions, telecommunications infrastructures or educated people to create, adapt, and make effective use of the rapidly growing stock of knowledge.

However, before such statistical indicators can be developed, a framework on the subject is needed. This would enable relevant statistical indicators to be grouped, organized and thus analysed in a logical manner within the framework. Moreover, any gaps in available indicators can also be easily identified by

assessing whether comprehensive and relevant statistical indicators exist for all the elements of the framework.

There is so far no internationally agreed framework for measuring a KBE. Different frameworks have been developed by individual countries and international organizations. In the course of doing so, there have been deliberations on what a KBE is.

4.2. Measurement of a KBE

The concept of the Knowledge-Based Economy (KBE) was first introduced by the OECD (Organization for Economic Development and Co-operation), which defined it as an economy which is directly based on the production, distribution and use of knowledge and information (OECD, 1996). Later APEC (Asia-Pacific Economic Co-operation Forum) (2000&2004) and the WBI (World Bank Institute) (1999) referred to a KBE as an economy in which the production, distribution and use of knowledge is the main driver of growth, wealth creation and employment across all industries. New ideas and innovation are the comparative advantage of KBEs. To produce new ideas, the KBEs need a framework where knowledge and technical progress contribute quantitatively to economic growth. Therefore, different international development organizations and statistical departments of individual countries are trying to build a comprehensive KBE framework in order to quantify the performance of KBEs among the countries to ascertain their competitiveness. In this connection, the OECD, WBI and APEC proposed a large set of variables in order to indicate the level of knowledge-based economic development (Afzal & Lawrey, 2012a). www.theinternationaljournal.org > RJSSM: Volume: 02, Number: 06, October-2012 These frameworks have one common trait in that they all give a basic analysis of the environment a KBE should possess and claim that a successful KBE should have the four core dimensions, namely, knowledge acquisition, knowledge production, knowledge distribution and knowledge utilization.

4.3. Types of Framework on KBE

Different frameworks have been developed by international organizations, including World Bank (WB), Organization for Economic Co-operation and Development (OECD), and Asia Pacific Economic Cooperation (APEC). This section reviews the frameworks or methodologies asserted by different international economic organizations.

4.3.1. OECD framework

OECD started to conduct research on the KBE and attempt to compile statistical indicators on the KBE as early as in 1996, based on their work of developing and publishing science and technology (S&T) indicators (OECD, 1996). In general, it was suggested by OECD that improved indicators for the KBE are needed for the following tasks:

(i) measuring knowledge inputs;
(ii) measuring knowledge stocks and flows;
(iii) measuring knowledge outputs;
(iv) measuring knowledge networks; and
(v) measuring knowledge and learning

The principal knowledge input indicators are expenditure on research and development (R&D); employment of engineers and technical personnel; patents; and international balance of payments. Measuring the stock of physical capital available to an economy is an awesome task, so that measuring the stock of knowledge capital would seem almost impossible. As such, only a few proxy indicators have been suggested by OECD. This also applies to the flow of knowledge. As regards knowledge outputs, again only rough indicators have been developed, including the delineation of a list of high technology industries.

Instead of approaching the KBE from measurement of knowledge direct, the above framework was later slightly modified and expanded to cover basically four main areas as follows (OECD, 1999 and 2001b):

(i) the creation and diffusion of knowledge;
(ii) information economy;
(iii) the global integration of economic activity; and
(iv) economic structure and productivity

While Indicators on creation and diffusion of knowledge build on the work of the S&T indicators, a set of indicators on information economy were also developed building on the work on indicators for the information society. Later on, the OECD Growth Project further explored the idea of a KBE and concluded that a number of factors are important for a KBE (OECD, 2001a). These conclusions suggest the following broad elements of a KBE framework:

(i) the importance of a stable and open macro-economic environment with effectively functioning markets;
(ii) the diffusion of ICT;
(iii) fostering innovation;
(iv) investing in human capital; and
(v) stimulating firm creation.

4.3.2. APEC framework

APEC approached the KBE from a perspective similar to that of the OECD Growth Project. In 2000, the APEC Economic Committee, in partnership with organizations in member economies, analysed the underpinnings of the KBE by examining the empirical evidence from the individual economies concerned. The work concluded that four dimensions characterize KBEs and are largely responsible for the strong economic performance of some economies over the last few decades (APEC, 2000). The four dimensions so deduced are that:

(i) innovation and technological change are pervasive and supported by an effective national innovation system;
(ii) human resources development is pervasive;
(iii) an efficient infrastructure operates, particularly in ICT; and
(iv) the business environment is supportive of enterprise and innovation.

4.3.3. World Bank framework

Besides OECD and APEC, the World Bank Institute (WBI) in the World Bank Group has been running a programme on Knowledge for Development (K4D). It aims at creating capability in client countries to take advantage of the new opportunities raised by the knowledge revolution and in effect building the knowledge dimension into their development strategy. The K4D programme has also developed a framework to help countries articulate strategies for their transition to a KBE. The framework consists of a set of 69 structural and qualitative variables that benchmark how an economy compares with their neighbours. The set of 69 variables serve as proxies for the five areas that are critical in the development of a KBE, namely:

(i) overall performance of the economy;
(ii) economic incentive and institutional regime;
(iii) education and human resources;
(iv) innovation system; and
(v) information infrastructure.

The above frameworks can thus be viewed as a "descriptive" or "presentation" framework using different statistical indicators rather than trying to view those indicators within context of a statistical framework. Each of them just defines a collection of statistical indicators for describing the subject under study, i.e. KBE, with the indicators grouped accordingly to particular aspects of the subject.

5. Input and Output Indicators for Knowledge Economy

To understand the degree to which an economy is a KBE, relevant statistical indicators have to be considered by different economic organization. The knowledge economy is intensively thought of and sometimes defined in terms of knowledge industries based ICT production or usage and /or high shares of highly educated labor. Each characteristic is populated by several statistical indicators. The methodologies of international organizations can be only viewed as a "descriptive" or "presentation" framework using different statistical indicators rather then trying to view those indicators within context of a statistical framework (Leung, 2004:5). In other words, to fully

understand the working of the KBE, classification of indicators such as input and output are required beyond the conventional classification of international organization presented in previous section.

Input indicators show to investment or capacity building efforts for each dimension towards knowledge economy transformation. On the other hand, output indicators determine what degree of knowledge economy a country has. Thus, output indicators illustrate the impact of input indicators or performance of a country towards knowledge economy. (Journal of Business, Economics & Finance (2012), Vol.1 (2) Karahan, 2012). Measuring knowledge economy in accordance with the input/output framework has also been need basic dimensions for consideration. Such an approach can aid analysis of basic properties of knowledge-based economy both in general and specific level. The OECD's defines knowledge-based economies as economies which are directly based on the production, distribution and use of knowledge, it is clear that basic dimensions should consist of "knowledge production", "knowledge distribution" and "knowledge utilization" (Godin, 2006: 21). "knowledge acquisition" as another dimension, is added, because in the globalization process presents a lot of opportunities to economies for getting the new knowledge from foreign resources. Thus, to get new knowledge, it is not required only to produce them. But also it is possible to acquire new knowledge from abroad in different ways in globalizing world. Finally Table-1 presents the"Input and Output Indicators" of Knowledge-based Economy concerning to four dimensions: "Knowledge Acquisition", "Knowledge Production", "Knowledge Distribution" and "Knowledge Utilization". In this framework, the accumulation of knowledge, which is the basic dynamic for development in new economy, can be provided by both "Acquisition" and "Production". Acquisition of Knowledge can be perfectly provided by the way of making an economy fully openness to world in trade and Foreign Direct Investment (FDI). Thus openness degree of an economy, as input indicators, depends on the ratios of a country's trade (exports plus imports) and FDI inflows to its GDP. On the other hand, real GDP growth is accepted as an output indicator concerning to knowledge acquisition. Production of Knowledge, which is the other part of accumulation of knowledge, is required to invest on Scientific R&D. The share of expenditure on Scientific R&D in GDP and number of scientists are input indicators of the dimension of knowledge production. In this dimension, "scientific publications" is selected as output indicators. The accumulation of knowledge leads to the creation of wealth only if the knowledge is effectively distributed and utilized. For this reason, distribution and utilization of knowledge are selected as other two basic dimensions. Distribution of Knowledge includes all form of disseminating or diffusion of knowledge by the way of Information and Communication Technologies (ICT) and transmission of knowledge by the way of education. Expenditures on education and net enrolment at secondary are output indicators of knowledge distribution dimension while Personnel Computer (PC) penetration per 1000 population indicates the output. Utilization of Knowledge covers absorbing and transferring of knowledge from scientific form to technological form by the way of Technological R&D. "R&D towards increasing the stock of knowledge" means Scientific R&D and this indicator is located in dimension of knowledge production as an input indicator. On the other hand, "R&D towards using of knowledge stock to devise new application" connotes "Technological R&D" and put in the dimension of knowledge utilization as an input indicator with knowledge transfer rate from university to industry and export of high-tech sector are output indicators.

We build a policy focused KBE framework based on WBI (1999, 2002) KBE definition considering four knowledge dimensions under which there are four output variables and some selected input variables. The KBE input-output variables are selected from WBI KBE frameworks by observing timely data availability and preferably be available for all the study countries for the purposes of comparison.

Table 1: Input and Output Indicators for Knowledge Economy

Dimensions	Knowledge acquisition	Knowledge production	Knowledge distribution	Knowledge utilization
Input	1.Trade Openness= (Exports + imports)/GDP 2. FDI inward flows as % GDP	1. R & D expenditure as % GDP 2.Intelectual Property Rights (IPR)	1. Education expenditure as % GDP 2. Net enrolment ratio at secondary school	1. Knowledge Transfer rate (university to industry) 2.FDI inflows % of GDP
Output	Real GDP growth	Scientific & Technical publications per 1000 population	Computer users per 1000 population	High-tech export % of Total export

Table 1 is an example of variable segregation out of many KBE indicators depending on data availability. Many of the factors listed above define the knowledge economy and its effect on entrepreneurial activities and economic development (Kassicieh, 2010). For instance, Derek, Chen and Dahlman (2004) emphasized that education and skilled workers are key to efficient knowledge www.theinternationaljournal.org > RJSSM: Volume: 02, Number: 06, October-2012 dissemination which tends to increase productivity when shared by information and communication technology (ICT) infrastructure. ICT infrastructure refers to the accessibility of computers, internet users, mobile phone users etc. Accordingly, we consider education expenditure and the school enrolment ratio as an input variable and computer users per thousand populations as the output variable for the knowledge distribution dimension.

The World Bank Institute (1999) has stated that an effective innovation system depends on research and development (R&D) expenditure, foreign direct investment (FDI) inflows, and knowledge sharing between universities and industry. These variables are often considered as knowledge utilization inputs in order to produce domestic knowledge intensive products in a national innovation system (Poorfaraj, Samimi and Keshavarz, 2011). Hence, we consider FDI inflows and the knowledge transfer rate as input variables and high-tech exports as a percentage of total exports as the output variable in the knowledge utilization dimension. In many developing countries, knowledge and technology is nurtured from foreign sources and enters the country through FDI, imports of equipment and other goods which are promoted by trade openness and licensing agreements (Poorfaraj, Samimi and Keshavarz, 2011).

These variables can make an enormous contribution to economic growth provided the existence of a sound, transparent legal and regulatory system in the individual countries. Therefore we consider FDI, trade openness, transparency and legal and regulatory quality as inputs while real GDP growth is the output variable in the knowledge acquisition dimension.

Dahlman and Andersson (2000) have stated that East Asian economies are weak in innovation activities compared to other, advanced economies, which account for nearly 90 per cent of global R&D expenditures and about the same proportion of patents granted and scientific and technical papers produced. They also argue that stronger protection of intellectual property rights enhances the efficiency of innovation systems in a KBE. Hence in our policy focused framework, we include these variables under the knowledge production dimension.

6. Analysis of Knowledge-based economy input and output indicators of Pakistan

In this section, our aim is to find out Pakistan's placement in Knowledge-based Economy using knowledge measurement system developed in previous section. We also analyze the rel-

evant variables in Pakistan comparing with the values in other Asian Countries. Table-2 and Table-3 present formulations of input and output indicators separately.

Table-2 Input Indicators of Knowledge Economy for Pakistan and Asian Countries

Dimension	Knowledge Acquisition		Knowledge Production		Knowledge Distribution		Knowledge Utilization	
Country	Exports + Imports/ GDP	FDI inward flow as % GDP	R&D expenditure %GDP	Intellectual Property Rights	Education expenditure % GDP	Net enrolment ratio at secondary school	Knowledge transfer rate	FDI inflow % of GDP
China	49.00	2.73	1.70	4.00	-		4.60	2.73
Hong Kong	380.00	23.78	0.79	5.40	1.00	73	4.60	23.78
India	44.00	1.84	0.76	3.60	-	60	3.70	-
Indonesia	45.00	1.64	0.08	3.80	3.00	67	4.20	45.00
Japan	25.00	0.22	3.36	5.20	3.00	100	4.90	25.00
Korea	96.00	0.73	3.74	4.10	4.00	96	4.70	96.00
Malaysia	171.00	3.77	0.63	4.70	4.00	69	4.70	3.77
Pakistan	33.00	2.81	0.46	3.10	3.00	35	3.40	2.81
Philippine	62.00	1.62	0.11	2.80	3.00	62	3.30	1.62
Singapore	123.00	15.75	2.43	6.10	3.00	-	5.40	15.75
Taiwan	144.00	1.29	-	4.90	-	-	5.20	1.29
Thailand	126.00	4.17	0.21	3.10	4.00	74	4.10	4.17

Table-3 Output Indicators of Knowledge Economy for Pakistan and Asian Countries

Dimension	Knowledge Acquisition	Knowledge Production	Knowledge Distribution	Knowledge Utilization
Country	Real GDP Growth	Scientific & Technical Publication Per 1000 Population	Computer Users Per 1000 Population	High-Tech Export %of Total Export
China	9.3	1483.67	60.0	31.00
Hong Kong	4.9	-	699.00	31.00
India	6.3	16.18	30.00	9.00
Indonesia	6.5	-	20.00	13.00
Japan	-0.7	6912.38	690.00	20.00
Korea	3.6	6057.06	580.00	151.00
Malaysia	5.1	514.12	230.00	47.00
Pakistan	3.0	440.14	110.00	2.00
Philippine	3.9	105.47	70.00	66.00
Singapore	4.9	6853.13	740.00	49.00
Taiwan	3.75	-	840.00	46.00
Thailand	0.1	636.38	210.00	26.00

The first column of table 3 shows the results of knowledge acquisition dimension where China gets the highest efficiency. It refers that China is using its knowledge acquiring inputs- trade openness and FDI most efficiently than other countries of Asia. Second column shows the efficiency value of knowledge production dimension where Japan, South Korea and Singapore are the best performer and also benchmark countries for other. According to the third column, Taiwan is the best performer in knowledge distribution dimension. Taiwan put an example for other Asian as well as many developing countries by making the country as a manufacturing base, producing increasingly technology and knowledge-intensive goods and increase the use of ICT users in recent times Their computer users are 840.00 per thousand populations which give them an upper hand over other Asian economies in ICT use and that eventually disseminate knowledge faster and contribute to build stronger knowledge base economy in the World. Therefore it exhibits Taiwan as the most efficient and benchmark country in this dimension among the Asian countries. Finally, the last column shows that the South Korea and Philippine have the greatest efficiency in knowledge utilization dimension. FDI inflows as % GDP and knowledge transfer rate from university to industry as input variables and high-tech export as a % total manufacturing export as output variable has been used for this dimension. If we explain in terms of recent experience, we find that, the Korea is the largest manufacturer of high-tech products as % total export and its percentage of high-tech products as % of total manufacturing export was 151, followed by Philippine 66 and Singapore 49. This implies that the Korea is making optimum use of its FDI in flows in order to create new knowledge and ideas in the universities that eventually shift this knowledge to high-tech industrial growth.

Pakistan has the worst indicators in the dimensions of knowledge production sand knowledge utilization against other countries both in input-based and especially output-based. Indeed, Scientific & Technical Publication per million populations and Export of High-tech Products as a % of total are 440.14 and 2 and quite lower than the relevant values of other countries. The number of Scientific & Technical Publication per million populations and export of high-tech products as a % of total export are more than 6000 and 50-150 in Japan, Singapore and Korea. In addition, difference of the values in Pakistan and other countries in output indicators is the much bigger than input indicators. This also shows the low output/input ratio in the dimension of knowledge production and utilization and indicates that Pakistan has a low level of productivity or efficiency in using the inputs of knowledge production and utilization. Other trouble value concerning with output-based indicators for Pakistan relates to Computer Users per 1000 Population under the dimension of knowledge distribution. The value of this ratio is only 110 in Pakistan while in Korea, Japan, Hong Kong, Singapore and Taiwan this value is between 580 and 840.

7. Conclusion and policy recommendations

The world economy is being transformed from a traditional resource-based economy to a new knowledge-based economy. Knowledge is increasingly recognised as the key to determining competitiveness in the 21st century, emphasising the role of information, technology and learning in economic performance. We drew up a indicators set for KBE by reviewing the existing frameworks on KBE issued by different international economic organization. We set out a range of inputs and outputs measures grouped under four dimensions. Each dimension is basically derived from based on the acquisition, production, and distribution and utilization of knowledge which is basic engine of development in new economy. These dimensions include relevant statistical indicators in the form of input-based and output-based. Thus eight knowledge leading input indicators and four knowledge driven outcomes are determined to comprehensively define and characterize the knowledge-based economy and to describe the current position of Pakistan in the process of transformation from a traditional resource-based economy to a knowledge-based economy. Indicators of a knowledge-based economy, in terms of inputs and outputs, were examined. After

an analytical framework was presented, Pakistan's economy has been analyzed in order to find out its placement in new economy. Findings show that the most efficient countries are China in the knowledge acquisition dimension, Japan, South Korea and Singapore, in the knowledge production dimension, Taiwan in the knowledge distribution dimension and the South Korea and Philippines in the knowledge utilization dimension. This paper provides empirical evidence to measure the comprehensive efficiency of KBEs that would allow government to determine areas for greater investment in order to develop the KBE dimensions of their economies. According to results, Pakistan's figures are unfavorable in terms of knowledge inputs and knowledge outputs and shows weak performance in almost all the KBE dimensions. The lessons from the success of Japan, South Korea, Singapore and the Philippines for weak performance countries like Pakistan in KBE are to improve the efficiency of FDI inflows, to optimise the use of research and development expenditure, to increase the secondary school enrolment ratio and finally to increase the interaction between academia and industry, which facilitates the creation and commercial use of knowledge. It is concluded that Pakistan's economy runs inefficiently, especially in the knowledge intensive industry. Therefore, policy makers should basically focus on the activities increasing the efficiency of knowledge production and utilizing inputs for successful transformation of Pakistan towards knowledge-based economy and a successful strategy will allow Pakistan enter into a knowledge-based economy with competence and confidence: by investing in knowledge embodied in physical capital, and by investing in people and institutions to enhance the capability to create and use knowledge.

REFERENCE

Adil Kurtic, Sabina Donlagic, Determining Key Factors for Knowledge Economy Development un Bosnia and Hercegovina, Management, Knowledge and Learning, International Conference 2012 | Rukhsana Kalim and Suleman Aziz Lodhi The Knowledge-based Economy: Trends and Imlications for Pakistan, The Pakistan Development Review,41:4 Part ll (Winter 2002) | Lee Kyu Sang, David V. Gibson (2002), "Towards Knowledge-based Economy in Korea: Metrics and Policy", International Journal of Technology, Policy and Management, Vol:2, No:3, 2002. Journal of Business, Economics & Finance (2012), Vol.1 (2) Karahan, 2012 | Leung K. C. Stephen, (2004), "Statistics to Measure the Knowledge-based Economy: The Case of Hong Kong", Asia Pacific Technical Meeting on Information and Communication Technology Statistics, 30 November 2004, Wellington. | Derek H. C. Chen and Carl J. Dahlman ,The Knowledge Economy, the KAM Methodology and World Bank Operations ,The World Bank Washington DC 20433 October 19, 2005 | Munshi Naser Ibne Afzal,Dr. Roger Lawrey, Investigating World Bank Knowledge Assessment Methodology (KAM) using Data Envelopment Analysis (DEA): A study in ASEAN region, The International Journal's Research Journal of Science & IT Management | World Bank Institute. (2002). Programme on knowledge for development. Knowledge Assessment Methodology and Scorecards. | World Development Indicators (WDI online), Washington: World Bank | The Knowledge-based Economy, OECD , Paris 1996 | Stephen K.C. Leung Census and Statistic Department Hong Kong, China, 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, 30 November - 2 December 2004 | UNESCO Institute for Statistics, countries profiles | Sang Kyu Lee, Towards knowledge-based economy in Korea, Int. J. Technology and Management, Vol.2,3,2002 | Ozcan Karahan, Input-output Indicators of Knowledge-Based Economy and Turkey, Journal of Business, Economics & Finance, Year: 2012, Volume: Issue: 2