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Knowledge Economy Index (KEI) 2012 Rankings for Islamic Countries and Assessment of KEI Indicators for Pakistan

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Abstract

This paper presents Knowledge Economy Index (KEI) rankings 2012 for 42 Islamic countries extracted from the World Bank's Knowledge Assessment Methodology (KAM). Knowledge Economy Index (KEI) is an aggregate index representing a country's overall preparedness to compete in the Knowledge Economy (KE). The KEI is constructed as the simple average of four sub-indexes, which represents the four pillars of the knowledge economy: economic incentive and institutional regime, education and human resources, the innovation system and ICT. Each of the pillar sub- indexes are in turn based on three indicators that proxy the performance of the pillar. 12 knowledge indicators have been used to compile the four pillars of the KEI. Pakistan's performance on the aggregate KEI (consisting of four pillars) and on individual indicators is compared with Islamic countries between 2000 and 2012. Pakistan's knowledge competitiveness has improved over the past 12 years, with the ranking rising from 122nd in 2000 to 117th in the current 2012 rankings. Pakistan has progressed in KEI pillars. In the pillar of Economic Incentive Regime (EIR) the country improved and ranked at 124. In the pillar of Information Communications and Technology (ICT) Pakistan demonstrated a significant improvement and ranked at 97th in the world in terms of the ICT pillar ranking. In Education pillar, Pakistan's performance with rank of 126 is far below and is significantly lagging the other Islamic countries. In Innovation pillar, Pakistan improved its overall performance with rank of 110, but it still remains significantly weak when compared to other Islamic economies.

Keyworlds: Knowledge Assessment Methodology, Knowledge Economy Index, Knowledge Economy Index

Introduction

Knowledge is considered the driver of productivity and economic growth and it leads to enhancing the significance of information, technologies and learning for economic performance. In connection with this we talk about knowledge economy (or knowledge-based economy). The knowledge-based economy is different from traditional economy in several aspects. The main source of growth in the knowledge economy is not mineral

resources or land but knowledge. From the various definitions of knowledge economy it is possible to formulate its general characteristic as follows: It is the economy which is directly based on the production, distribution and use of knowledge and information. Knowledge-based economy is characterized by a high and growing intensity of ICT usage by well-educated workers.

The knowledge economy is based on the generation and adoption of new knowledge created by scientific research and technological advances; investments in education and research; adoption of best practices; and openness to social, economic, and cultural innovations. For advanced industrialized countries with high labor and infrastructure costs, the knowledge economy offers competitive advantages in high-technology product manufacture and efficient service sectors. For natural- resource-based economies it offers improved technologies and higher-value added products with closer customer linkages, as well as a path for sustainable development. For developing countries, knowledge offers possibilities to short cut development phases, leapfrog technologies, and more quickly integrate into the global economy by becoming more attractive to international investors.

Knowledge has long been an important factor in economic growth. Economists are now exploring ways to incorporate more directly knowledge and technology in their theories and models. “New growth theory” reflects the attempt to understand the role of knowledge and technology in driving productivity and economic growth. In this view, investments in research and development, education and training and new managerial work structures are key. In addition to knowledge investments, knowledge distribution through formal and informal networks is essential to economic performance. Knowledge is increasingly being codified and transmitted through computer and communications networks in the emerging “information society”. Also required is tacit knowledge, including the skills to use and adapt codified knowledge, which underlines the importance of continuous learning by individuals and firms. In the knowledge-based economy, innovation is driven by the interaction of producers and users in the exchange of both codified and tacit knowledge; this interactive model has replaced the traditional linear model of innovation. The configuration of national innovation systems, which consist of the flows and relationships among industry, government and academia in the development of science and technology, is an important economic determinant. Employment in the knowledge-based economy is characterized by increasing demand for more highly-skilled workers. The science system, essentially public research laboratories and institutes of higher education, carries out key functions in the knowledge-based economy, including knowledge production, transmission and transfer.

In general, our understanding of what is happening in the knowledge-based economy is constrained by the extent and quality of the available knowledge-related indicators. Traditional national accounts frameworks are not offering convincing explanations of trends in economic growth, productivity and employment. Development of indicators of the knowledge-based economy must start with improvements to more traditional input indicators of R&D expenditures and research personnel. Better indicators are also needed of knowledge stocks and flows, particularly relating to the diffusion of information technologies, in both manufacturing and service sectors; social and private rates of return to knowledge investments to better gauge the impact of technology on productivity and growth; the functioning of knowledge networks and national innovation systems; and the development and skilling of human capital. The application of knowledge —as manifested in entrepreneurship and innovation, research and development, and software and product design—is one of the key sources of growth in the global economy. But many developing

countries fail to tap the vast stock of global knowledge and apply it to their needs. They need not deny themselves this vital tool for growth. By building on their strengths and carefully planning appropriate investments in human capital, effective institutions, relevant communications technologies, and innovative and competitive enterprises, developing countries can capitalize on the knowledge revolution. Countries such as Finland, Korea, Ireland, Malaysia, Singapore, Chile, and more recently, China and India illustrate the rapid progress that can be made. The World Bank uses the Knowledge Assessment Methodology with the object of measuring and analyzing the knowledge economy. This methodology is based on the supposition that the knowledge economy comprises four pillars: economic incentive and institutional regime, education and human resources, the innovation system, and ICT. The methodology currently comprises a total of eighty-three indicators that are constantly being updated on the World Bank's website.

Methodology

The World Bank uses the Knowledge Assessment Methodology with the object of measuring and analyzing the knowledge economy. This methodology is based on the supposition that the knowledge economy comprises four pillars: economic incentive and institutional regime, education and human resources, the innovation system, and ICT. According to this methodology, the knowledge economy is quantified by means of a numerical index known as the Knowledge Economy Index (KEI). This is calculated from the data of twelve indicators, three of which form a single pillar. To calculate the index, the values of the indicators are transformed into normalized values. The normalized value for an indicator for a specific country is arrived at by specifying the country's ranking on the index. Thus the best performing country appears in first place, the next best performing country in second place and so on. The normalized value for an indicator for a particular country is equal to the number of countries ranked lower than that country divided by the total number of countries multiplied by ten. The index for each pillar is calculated on the basis of its being the simple arithmetic mean of the normalized values of the three indicators that make up the pillar. The KEI is then calculated on the basis of its being equal to the simple arithmetic mean of the index values for the four pillars. The value of each index falls in the range 0-10 and is an expression of the relative position of a country in comparison with all the countries whose index is calculated. On this basis, the index values of the top 10 per cent of countries fall in the range 9-10, the index values of the second highest 10 per cent of countries fall in the range 8-9, and so on.

Definitions of knowledge economy and Knowledge Economy Index

Knowledge economy

In various publications we can find various definitions of the term knowledge economy. Here we present some of them: A knowledge driven economy is one in which the generation and the exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the more effective use and exploitation of all types of knowledge in all manner of economic activity. [DTI: 1998]. The OECD defines the knowledge economy by following way: "Knowledge-based economies are economies which are directly based on the production, distribution and use of knowledge and information." Knowledge-based economies are characterized by growth in high-technology investments, high-technology industries, more highly-skilled labor and associated productivity gains. [OECD: 1996, pp. 7]. "Knowledge

economy is what you get when firms bring together powerful computers and well-educated minds to create wealth".[Brinkley: 2006, pp. 3]. Knowledge-based economies are "economies in which the proportion of knowledge-intensive jobs is high, the economic weight of information sectors is a determining factor, and the share of intangible capital is greater than that of tangible capital in the overall stock f real capital".[Foray: 2004, pp. ix]. The knowledge economy consists in creation of added value on the basis of knowledge use (not only on the basis of manual work) and in this economy the importance of learning and applications of scientific findings for global competitiveness is growing. [Jahn et al].

Knowledge Economy Index

The Knowledge Economy Index assesses whether the environment is conducive for knowledge to be used effectively for economic development. It is an aggregate index that represents the overall level of development of a country or region towards the Knowledge Economy. It is the simple average of the normalized performance scores of a country or region on all four pillars related to the knowledge economy - economic incentive and institutional regime, education and human resources, the innovation system and ICT [World Bank: 2011a]. The Knowledge Economy Index (KEI) takes into account whether the environment is conducive for knowledge to be **used effectively** for economic development. It is an aggregate index that represents the overall level of development of a country or region towards the Knowledge Economy. The KEI is calculated based on the average of the normalized performance scores of a country or region on all 4 pillars related to the knowledge economy - economic incentive and institutional regime, education and human resources, the innovation system and ICT.

Knowledge Economy Pillars and Indicators

According to the World Bank (2007 and 2012), there are four fundamental pillars of a knowledge economy. For the purposes of calculating KEI, each pillar is represented by three key variables. The data set consists of 12 variables that represent the four pillars of the knowledge economy and are used to calculate countries' Knowledge Economy (KEI) indexes.

Education & Training

"An educated and skilled population is needed to create, share and use knowledge." This is achieved through the development of a robust educational infrastructure: primary and secondary education, vocational training, higher education, and lifelong learning institutions. In terms of development, knowledge economies have turned comparative advantage on its head: uneducated workers that fed low-wage economies will become more of a liability than an asset in a world where more developed human capital reaps the greatest rewards. Globalization amplifies this tendency as the market for ideas has fewer boundaries in a growing world market. The indicators of education and training are: **Average Years of Schooling (15 years old and above).** This variable is used as an aggregate measure of the educational stock in a country; Gross enrolment ratios -**Secondary Enrollment** and **Tertiary Enrollment,** are used to provide a flow rate. (Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education indicated.) Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers. Tertiary education, whether or not to an advanced research

qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.

Information Infrastructure

"A dynamic information infrastructure [television, radio, telephone, internet] is required to facilitate the effective communication, dissemination and processing of information [and knowledge]." A knowledge economy thrives on a robust network of ICT. The economic aspects of ICT are pervasive across sectors: as they represent a lucrative sector in themselves as well as an important input in the selling and marketing of other products and services. The potential for e-applications (i.e., e-business, e-government, e-learning) is great. In terms of development, ICT is the foundation for the construction of a modern industrial economy. It has the potential to produce fertile leading industries for economic take-off more easily because the requirements for acquisition and operationalization of ICT are modest compared to those of traditional brick-and mortar (i.e., high start-up cost) industrialization. Its indicators are: Telephones per 1,000 **people**. The indicator is the sum of telephone mainlines and mobile phones; **Computers per 1,000 people**. This is an indicator of personal computer penetration and use; **Internet Users per 1,000 people**. The indicator relies on nationally reported data. In some cases, it is based on national surveys (they differ across countries in the age and frequency of use they cover), in others it is derived from reported Internet Service Provider subscriber counts.

Economic Incentive & Institutional Regime

"A regulatory and economic environment that enables the free flow of knowledge, supports investment in Information and Communications Technology …, and encourages entrepreneurship is central to the knowledge economy." In this respect, governments must eliminate both political and market distortions that impede the efficient application of resources that are required for a knowledge economy to thrive. Through appropriate laws and procedures, a viable regulatory regime would encourage robust entrepreneurship and investment in ITC, as well as effective management of ITC enterprises. Fundamentally, it is overwhelmingly clear from the evidence on the correlates of development that better government produces more prosperous societies (World Bank 2007, p. 25). **Its indicators are: Tariff & Nontariff Barriers**. The index is based on the Heritage Foundation's Trade Policy index and measures the degree of economic freedom; **Regulatory Quality**. The index measures the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development; Rule of Law. The indicator measures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts.

Innovation Systems

"A network of research centers, universities, think tanks, private enterprises and community groups is necessary to tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new knowledge." A pervasive network of institutions that process and generate information, as well as institutions that produce innovations are a necessary condition for a viable knowledge economy. Three variables have been chosen to represent this pillar. As an input into the innovation system, we use **Royalty and License Fees Payments**

and Receipts, for output, we have **Patent Applications Granted by the US Patent and Trademark Office,** and **Scientific and Technical Journal Articles**. These three innovation variables are presented in two ways: all three variables are scaled by population (the "weighted" innovation variables). All three variables are presented in absolute numbers (the "unweighted" innovation variables).

Knowledge Economy Index 2012 and Ranking for Islamic Countries

Table 1 compares KEI ranking for the most recent period 2012 with 2000 levels for the Islamic countries for which this index rankings are available for the both period. The Islamic countries are ranked according to the most recent KEI rankings. It is observed that the KEI rankings have risen for seventeen of forty two countries. On the other hand, the KEI rankings of twenty five countries fell back.

Table1.
Knowledge Economy Index 2012 and Ranking for Pakistan and other Islamic Countries

Country	Rank 2012	KEI 2012	Rank 2000	KEI 2000	Change from 2000	Rank 2008	KEI 2008	Rank 1995	Change from 1995	Rank 2007	Change from 1995
U A E	42	6.94	48	6.05	6	42	6.66	46	4	49	-9
Bahrain	43	6.9	41	6.85	-2	49	6.02	35	-14	52	-18
Oman	47	6.14	65	5.28	18	62	5.37	72	10	63	9
Malaysia	48	6.1	45	6.37	-3	48	6.06	48	0	40	13
Saudi Arabia	50	5.96	76	4.60	26	65	5.15	74	9	69	-1
Qatar	54	5.84	49	6.09	-5	45	6.15	50	5	42	8
Kuwait	64	5.33	46	6.16	-18	50	6.01	52	2	46	5
Turkey	69	5.16	62	5.42	-7	53	6.61	58	5	53	7
Kazakhstan	73	5.04	78	4.58	5	68	5.01	76	8	72	3
Jordan	75	4.95	57	5.58	-18	56	5.53	63	7	62	5
Guyana	78	4.67	81	4.47	3	78	4.31	59	-19	80	-19
Azerbaijan	79	4.56	94	3.61	15	88	3.81	87	-1	89	-1
Tunisia	80	4.56	89	4.15	9	71	4.73	86	15	71	5
Lebanon	81	4.56	68	4.95	-13	70	4.86	66	-4	66	-12
Albania	82	4.53	96	3.52	14	83	4.04	93	10	94	6
Iran	94	3.91	95	3.60	1	94	3.39	104	10	98	4
Kyrgyz	95	3.82	82	4.42	-13	89	3.74	88	-1	87	-1
Algeria	96	3.79	110	2.85	14	96	3.25	108	12	99	8
Egypt	97	3.78	88	4.29	-9	84	4.03	83	-1	83	-2
Morocco	102	3.61	92	3.73	-10	92	3.45	92	0	90	4
Uzbekistan	105	3.14	101	3.25	-4	95	3.28	89	-6	92	-2
Tajikistan	106	3.13	102	3.18	-4	107	2.79	99	-8	108	-3
Indonesia	108	3.11	105	3.02	-3	98	3.23	96	-2	91	1
Syria	112	2.77	111	2.85	-1	104	2.9	106	2	104	4
Ghana	113	2.72	106	3.00	-7	110	2.5	117	7	113	1
Pakistan	117	2.45	122	2.12	5	115	2.24	119	4	114	-4
Uganda	118	2.37	120	2.16	2	111	2.46	122	11	112	12
Nigeria	119	2.2	124	2.09	5	118	2.04	124	6	115	-3

Yemen	122	1.92	128	1.98	6	119	1.8	129	10	119	1
Burkina Faso	124	1.91	133	1.82	9	124	1.64	128	4	132	0
Benin	125	1.88	115	2.39	-10	117	2.1	118	1	118	-3
Mali	126	1.86	119	2.17	-7	120	1.78	125	5	127	-9
Tanzania	128	1.79	126	2.02	-2	114	2.28	123	9	116	11
Mozambique	130	1.76	135	1.76	5	121	1.71	132	11	128	3
Cameroon	133	1.69	118	2.17	-15	123	1.69	126	3	123	-2
Mauritania	134	1.65	123	2.09	-11	113	2.35	130	17	117	9
Cote D'Ivoire	136	1.54	121	2.14	-15	n/a	n/a	116	n/a	120	-3
Bangladesh	137	1.49	134	1.77	-3	128	1.49	133	5	130	3
Sudan	138	1.48	139	1.35	1	n/a	n/a	103	n/a	124	11
Djibouti	139	1.34	136	1.59	-3	132	1.15	109	-23	135	-22
Guinea	141	1.22	132	1.83	-9	n/a	n/a	n/a	n/a	n/a	n/a
Sierra Leone	144	0.97	140	1.25	-4	134	0.91	134	0	137	-9

UAE is the Islamic world's most advanced knowledge economy in 2012, as measured by the KEI. Its top position reflects strong performance on the innovation, education and ICT pillars. Oman, Saudi Arabia and Azerbaijan showed good performance on the KEI. Oman climbed 18 positions and Saudi Arabia risen 26 positions compared to 2000. Azerbaijan jumped up 15 positions and ranked 47, 50 and 79 respectively, while Albania and Algeria moved up 14 positions to come in 82nd and 96th respectively in the list of gainers in KEI rankings since 2000. Tunisia and Burkina Faso ranked at 80th and 124th in the current rankings, up from 9 positions since 2000. Yemen climbed 6 positions and ranked 122nd. Kazakhstan, Pakistan, Nigeria, and Mozambique climbed 5 positions and ranked at 73, 117, 119 and 130 respectively in KEI ranking 2012.

Economies with Large Improvements and Reversals

Table 2 presents the 15 Islamic countries with largest increases in KEI rankings. Of the 146 economies included in the KAM, Saudi Arabia made the most progress since 2000. With a KEI of 5.96, it climbed 26 positions to rank 50th in the 2012 KEI. Significant improvements in gross secondary enrollment rates have led to Saudi Arabia's education pillar leaping an impressive 30 spots to 58th place. In addition, the rapid growth in telephone, computer, and Internet penetrations has led to a substantial strengthening of its ICT pillar. With significant improvements in the innovation, education, and ICT pillars, Oman has jumped 18 spots in the KEI rankings, to 47th place, which is the second largest improvement. Of the four pillars, the innovation pillar improved most because of a rapid increase in the number of patents registered. Significant progress in telephone, computer, and Internet penetrations has also led to a 19-spot climb in the ICT pillar to 55th position in 2012. Azerbaijan with a current KEI of 4.56, has moved up by 15 spots since 2000 to rank 79th. Its ICT pillar has raised an impressive 26 places, thanks to the strong growth of Internet users. However, the EIR is Azerbaijan's weakest pillar primarily because of its relatively weak rule of law and regulatory quality. Albania increased 14 positions mostly because of the substantial strengthening of its EIR and ICT pillars. Algeria jumped 14 positions largely attributable to significant improvements in its EIR, Education and ICT pillars. Other big gainers include Tunisia, climbing 9 positions primarily due to improvements in the innovation pillar. Burkina Faso increased also 9 positions but only because of a significant strengthening of the EIR pillar. UAE climbed 6 positions because of improvements in 3 KE pillars with the most substantial occurring for

the Innovation pillar. Yemen jumped up 6 positions largely due to improvements in its EIR, innovation and ICT pillars. Pakistan has also seen measurable improvement in its KEI since 2000. Pakistan's KEI ranking has increased by 5 positions to 117, mainly because of advances in its Innovation and ICT pillars. With the exception of ICT pillar, all other pillars currently rank above 100.

Table 3 lists Islamic countries with the largest decreases in KEI rankings between 2000 and 2012. Cameroon and Turkey lost their competitive edge mainly because of large deteriorations in their ICT pillars. Cote d' Ivoire, Mauritania, Guinea and Mali fell back mainly because of large reversals in their EIR pillars. Kuwait, Morocco and Benn fell behind in all four pillars. Jordan's ranking decreased due to setbacks in its innovation and ICT pillars. Egypt, with a weakening of performance in 3 of the 4 pillar indices has seen its KEI fall from 127th place in 2000 to the 136th position in the current 2012 rankings. Lebanon fell 13 places and ranked at 97 due to weak performance in 3 of 4 pillars. Ghana losing 7 to be ranked at 54 because of reversal in education pillar .Qatar dropping 5 positions to be ranked at 113, a worsening of the EIR pillar was a dominant factor in the weakening of the KEI.

Table 2
Improvement in KEI Ranking Top 15 Islamic Countries

Index	KEI			EIR		Education		Innovation		ICT	
Country	**Rank change**	**Index**	**KEI 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**
Saudi Arab	+26	5.96	50	+17	60	+30	58	-	84	+45	21
Oman	+18	6.14	47	-9	44	+15	74	+26	57	+19	55
Azerbaijan	+15	4.56	79	+24	103	+8	53	+14	89	+26	78
Albania	+14	4.53	82	+50	71	-16	83	+8	101	+37	72
Algeria	+14	3.79	96	+23	115	+21	71	+6	99	+21	89
Tunisia	+9	4.56	80	-13	96	+4	89	+15	70	+5	79
Burkina Faso	+9	1.91	124	+24	74	-2	144	+10	123	-4	142
UAE	+6	6.94	42	-16	50	+28	55	+35	46	+20	12
Yemen	+6	1.92	122	+17	107	-8	124	+9	127	+12	133
Kazakhstan	+5	5.04	73	+15	91	-4	40	+3	91	+23	68
Pakistan	+5	2.45	117	+4	124	-	126	+9	110	+11	97
Nigeria	+5	2.20	119	-1	137	-8	125	-7	117	+17	102
Mozambique	+5	1.76	130	+4	86	-1	145	+12	133	+5	138
Guyana	+3	4.92	78	-13	112	+12	66	-	72	+7	61
Uganda	+2	2.37	118	+28	89	-2	130	-4	118	+12	123

Table 3
Decrease in KEI Ranking Top 15 Islamic Countries

Index	KEI			EIR		Education		Innovation		ICT	
Country	**Rank change**	**Index**	**KEI 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**	**Rank change**	**Rank 2012**
Kuwait	-18	5.33	64	-11	54	-27	98	-2	64	-10	54
Jordon	-18	4.95	75	+1	62	+1	63	-39	88	-16	87
Cameroon	-15	4.56	81	+25	79	-1	64	+4	71	-45	99
Cote d'Ivoire	-15	3.82	95	-37	128	-17	69	-13	105	+27	71
Lebanon	-13	3.78	97	+19	73	-25	102	-17	85	-10	107
Kyrgyz	-13	3.61	102	-2	72	-1	115	-6	96	+3	90
Mauritania	-11	1.88	125	-31	118	+1	129	+8	112	-6	128
Morocco	-10	1.69	133	-7	138	-19	127	-5	116	-3	126
Benn	-10	1.65	134	-7	121	-10	139	-2	137	-3	118
Egypt	-9	1.54	136	+4	130	-11	133	-25	141	-8	119
Guinea	-9	1.22	141	-34	142	+19	114	-12	144	-	131
Mali	-7	1.86	126	-23	101	+6	131	+1	130	+5	137
Turkey	-7	5.16	69	-	52	-3	94	+6	58	-32	88
Ghana	-7	5.84	54	+3	45	-26	101	+11	49	-6	51
Qatar	-5	2.72	113	-15	87	-1	108	+5	120	+4	120

Assessment of KEI Pillars and Indicators for Pakistan

The Knowledge Economy Index (KEI) is an aggregate index that represents the overall level of development of a country or region in the Knowledge Economy. It summarizes performance over the four knowledge economy pillars, takes into account whether the environment is conducive for knowledge to be used effectively for economic development. Pakistan's KEI for the most recent year 2012 is 2.45 whereas the world average for KEI is 5.12 and South Asia's average is 2.84. If we compare the economy with the World Banks' income group of lower middle income economies (we fall in the same group), Pakistan is again on a lower side. The

average KEI for lower middle economies presently is 3.43. Pakistan's KEI has risen from 1.89 since 2000 to 2.45 in 2012, a positive 0.56 change rate. However, overall KEI still stands lower compared to other Islamic countries. By using the tool, we can compare the country's performance for the four individual pillars of the knowledge based economy. A comparison shows that Pakistan has progressed in all index pillars, especially the ICT. In Table 5 we show how Pakistan performed, throughout time, in each of the twelve variables that describe the four KE pillars and therefore the aggregate KEI. In the pillar of Economic Incentive Regime (EIR), Pakistan improved but is currently scoring considerably low and falls significantly behind other Islamic countries. Pakistan demonstrated improvements in the Rule of Law and Regulatory Quality indicators, while were outpaced by the current status of tariff and non-tariff barriers in the country. Despite the recent abolition of import surcharges, the average tariff rate -currently at 2.6%- and other non-trade barriers increased over time.

Table 4
KEI actual Indicators for Top 15 Islamic Countries

County	Tariff & non-Tariff barrier	Regulatory quality	Rule of law	Royalty payments and receipts	S&E journal articles/ mil pop	Patents granted by USPTO/mil pop	average of year schooling	Gross sec enrolment	Gross tertiary enrolment	Total tele per 1000 people	Computer per 1000 people	Internet per 1000 people
Saudi Arab	82.20	0.22	0.12	0.00	24.31	0.92	8.48	96.81	32.78	1930	690	390
Oman	83.60	0.66	0.68	n/a	47.47	0.51	n/a	91.32	26.44	1510	170	430
Azerbaijan	77.10	-0.28	-0.81	2.39	11.28	0.12	n/a	99.36	19.06	1040	80	420
Albania	79.80	0.28	-0.52	6.39	3.92	0.00	10.26	72.36	19.09	1440	50	410
Algeria	72.80	-0.94	-0.73	n/a	14.20	0.01	7.70	96.48	30.62	1010	100	130
Tunisia	53.50	0.10	0.22	3.72	74.14	0.10	7.32	90.21	34.44	1050	100	340
Burkina Faso	76.20	-0.13	-0.28	0.01	2.92	0.01	n/a	19.77	3.41	220	10	10
UAE	82.40	0.56	0.52	n/a	49.04	1.60	9.50	95.20	30.40	2660	330	820
Yemen	81.60	-0.60	-1.50	1.21	0.82	0.00	3.68	45.61	10.23	210	30	20

Kazakhstan	80.90	-0.37	-0.56	4.05	6.82	0.10	140.41	94.91	41.05	1180	120	330
Pakistan	32.40	-0.24	-0.56	0.22	2.56	0.01	3.36	33.06	5.18	630	110	120
Nigeria	65.00	-0.70	-1.22	1.35	2.90	0.00	n/a	30.48	10.15	480	70	280
Mozambique	81.00	-0.32	-0.58	0.16	1.09	0.00	1.75	23.37	1.46	260	10	30
Guyana	66.00	0.15	0.07	34.3	9.47	0.00	7.29	75.34	9.68	60	n/a	0
Uganda	74.80	-0.17	-0.43	0.19	5.37	0.00	5.37	27.35	4.10	300	20	100

In Education, a pillar which is instrumental for a country's transition to knowledge based environment, Pakistan's performance is far below and is significantly lagging the other Islamic countries. Nevertheless, during the past twelve years the country improved marginally, rather stagnated in its overall performance in the pillar. Gross Enrollment rates in secondary improved little between 2000 and 2012 from 26.50 to 33.06 percent, while Gross tertiary enrollment rates significantly improved over the same period, from 2.50 to 5.18 percent. In both indicators, Pakistan is not performing as competitively as other Islamic economies. In Pakistan, enrollment rates in tertiary education are around 5%, when other Islamic economies like Saudi Arabia, Algeria, Tunisia, UAE and Kazakhstan have more than 30 percent gross tertiary enrollment [Table 4]. The lack of highly qualified human capital appears to be a major factor hindering progress in Pakistan, since also very small proportion of university graduates limits the scope for technology-intensive industries, and overall competitiveness. In Innovation pillar, Pakistan improved its overall performance during the last twelve years, but it still remains significantly weak when compared to other Islamic economies [Table 4]. Pakistan is lagging behind numerous countries such as UAE, Oman, Tunisia and Guyana. Looking at three major Innovation variables which defined Pakistan's position [Table 5], data indicates that patent activity even though increased substantially during the last twelve years but still remains minimal. The availability of scientific & engineering journal articles per million population and royalty payment and receipts per million populations between 2000 and 2012 increased significantly.

Table 5
KEI Indicators for Pakistan

Indicator	2012		2000	
	actual	normalized	actual	normalized
Tariff & Nontariff Barriers	67.00	1.47	43.00	1.07
Regulatory Quality	-0.50	2.53	-0.70	1.66
Rule of Law	-0.93	1.78	-0.84	2.28
Royalty Payments and receipts (US$/pop.)	0.57	2.40	0.20	2.18
S&E Journal Articles / Mil. People	4.56	2.97	1.93	1.99
Patents Granted by USPTO / Mil. People, avg	0.03	3.15	0.01	2.74
Average Years of Schooling	5.59	1.73	3.87	1.10
Gross Secondary Enrollment rate	33.06	1.24	26.50	1.48
Gross Tertiary Enrollment rate	5.18	1.35	2.50	1.31
Total Telephones per 1000 People	630.00	2.55	20.00	2.14
Computers per 1000 People	110.00	5.07	0.00	1.94
Internet Users per 1000 People	120.00	3.17	30.00	5.59

In the pillar of Information Communications and Technology (ICT), Pakistan did demonstrate a significant improvement during the last twelve years, as shown in Table 4. The boom of mobile services along with increase in Internet penetration has assisted in mounting our position in global ICT stage. Currently accessibility, penetration and availability of ICT infrastructure shows as the strongest KE pillar for Pakistan. However, the country still lags behind other Islamic economies, such as UAE, Saudi Arabia and Oman. The ICT indicators in Pakistan; telephone penetration numbers increased more than 30 times in a period of twelve years, with total telephones per 1,000 people rising from 20 in 2000 to 630 in 2012. During the same period, computers per 1,000 people increased from 0 to 110, while Internet usage, measured by internet users per 1,000 people, grew at a spectacular rate from 30 to 112. Nonetheless, despite the impressive progress it is evident also from Table 4, that the existing gap in the availability and penetration of communication technologies is still significantly large, particularly when Pakistan is compared with other Islamic countries.

Conclusion

The World Bank uses the Knowledge Assessment Methodology with the object of measuring and analyzing the knowledge economy. This methodology is based on the supposition that the knowledge economy comprises four pillars: economic incentive and institutional regime, education and human resources, the innovation system, and ICT. Pakistan's performance is compared with other Islamic countries which are leading knowledge performers- on their most recent performance in the four KE pillars. The country's performance has been overall positive but not as competitive as that of other Islamic countries.

Examining performance in the four KE pillars, it is concluded Pakistan's economic and institutional regime has changed significantly over the last decade, tariff and non-tariff barriers have shown improved score as well as the regulatory quality has improved. There has been a downfall in overall rule of law. Education is considered as one of the primary social factor for future growth of a nation. Pakistan stagnated in Education and is a weakest area, a

traditionally strong pillar for other Islamic countries. Education is the weakest pillar for Pakistan, reflecting poor access and quality and lagging behind comparators and advanced economies. With respect to tertiary education, it is observed again that Pakistan trails below the rest of the Islamic countries in terms of tertiary education enrolment which is deemed critical for the development of the knowledge economy. Tertiary enrolment enrollment is not only abysmal but it has grown only very slowly in a decade. It is found that Pakistan demonstrated positive developments in its Innovation base but is lagging behind comparators and advanced economies. For Pakistan to remain competitive in the knowledge economy, its innovation systems should be able to convert its R&D investments and educational capacities into industrial and export strengths in the high technology sectors. This conversion could be illustrated through the number of patent applications, high technology's share in total exports and also through scientific and technical journal articles published. Unfortunately, Pakistan produces relatively lower number of scientific and technical journal articles per million population and patents granted by USPTO per million populations in relation to the other regions in the world. Pakistan improved access and penetration rates of Information and Communications Technologies, the country's strongest pillar, however, Pakistan has improved less than other countries in the world in term of total telephones per 1,000 people and computers per 1,000 people whereas Internet Users per 1,000 people has increased.

In view of the above characteristics of the knowledge economy and their impact on our economic and social space, that new thinking is required by policy makers, private sector executives and knowledge workers alike at all levels local, regional and national. Some of the major areas of improvements required such as; improve access to higher education, enhance skills and technology at all levels from the school to university, build S&T and R&D manpower by shifting the mix of social sciences and scientific / technical studies, monitoring the long term assimilation and internal sustainability of enhanced skills and provision of financial incentives for private sector to invest in R&D and innovation.

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