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Transition to knowledge-based economy in Saudi Arabia

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Transition to knowledge-based economy in Saudi Arabia

Samia Satti Osman Mohamed Nour

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: http://mgsog.merit.unu.edu

Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499

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Transition to Knowledge-Based Economy in Saudi Arabia

By Dr. Samia Satti Osman Mohamed Nour

(April 2014)

Transition to Knowledge-Based Economy in Saudi Arabia

By Dr. Samia Satti Osman Mohamed Nour [1]

(April 2014)

Abstract

This paper discusses the progress in transition to knowledge-based economy in Saudi Arabia. As for the methodology, this paper uses updated secondary data obtained from different sources. It uses both descriptive and comparative approaches and uses the OECD definition of knowledge-based economy and the World Bank Knowledge Index (KI) and Knowledge Economy Index (KEI) and other indicators often used in the international literature to examine progress in transition to a knowledge-based economy in Saudi Arabia. This paper is valuable because it adds to the existing studies in the regional and international literature and it fills the gap in Saudi Arabia literature by presenting a more comprehensive analysis and investigating recent progress in transition to knowledge-based economy in Saudi Arabia. Moreover, the results confirm the importance of supporting the efforts aimed at enhancing knowledge- based economy in Saudi Arabia. Our findings imply that over the period (2000-2012) Saudi Arabia has achieved significant improvement, rapid and fastest progress not only by regional standard but also by international standard, in the international rank Saudi Arabia has climbed 26 places compared to 2000, obtaining 50th place in 2012 ranking, compared to 76th place in 2000 ranking. Our findings support the hypothesis concerning some progress in transition towards knowledge-based economy in Saudi Arabia. The progress appears from improvement in terms of KI, KEI, ICT pillar, education pillar, economic incentive and institutional regime pillar, innovation efficiency index, knowledge creation index, knowledge impact index, knowledge diffusion index and technological infrastructure, despite deterioration in both innovation pillar and knowledge absorption index. Based on the findings the paper recommends that to improve transition to knowledge economy and achieve sustainable economic development, it is essential for Saudi Arabia to strengthen and improve knowledge by investing heavily in education, training, boosting knowledge absorption index and innovation through intensive spending on R&D.

Keywords: Knowledge, Knowledge-based economy, Knowledge Index, Saudi Arabia.

JEL classification: O10, O11, O30

[1] Corresponding Author: Dr. Samia Satti Osman Mohamed Nour, Affiliated Researcher – UNU-MERIT, School of Business and Economics, University of Maastricht, Maastricht, the Netherlands; and Associate Professor of Economics, Economics Department, Faculty of Economics and Administration, King Abdulaziz University, Jeddah, Saudi Arabia.; and Associate Professor of Economics, Economics Department, Faculty of Economic and Social Studies, Khartoum University, Khartoum, Sudan (on leave)**.** E-mail: samiasatti@yahoo.com; samia_satti@hotmail.com. The research work presented in this paper was originally prepared for and presented in the King Abdulaziz University - Faculty of Economics and Administration Second Annual Conference 2014: "National Economy: Challenges and Ambitions" **2**2-24 April 2014, Jeddah, Kingdom of Saudi Arabia. .The author would like to thank the participants for their useful comments on this paper. All the usual disclaimers apply.

Transition to Knowledge-Based Economy in Saudi Arabia

1. Introduction

This paper aims to assess the progress in the transition to knowledge-based economy in Saudi Arabia. This paper addresses the following question: how important is the progress in the transition to knowledge-based economy in Saudi Arabia? We examine the hypothesis concerning some progress in the transition to knowledge– based economy in Saudi Arabia.

We fill the gap in Saudi Arabia literature by presenting a more comprehensive analysis to improve understanding of the progress in the transition to the knowledge-based economy in Saudi Arabia using recent and update data. We provide a more updated study and a new case study compared to few earlier studies on the knowledge economy in the Arab region (Nour, 2010; 2011; 2012; 2013). Different from earlier studies in the Arab literature (Nour, 2010; 2011; 2012; 2013) that examine the incidence, existence and transfer of knowledge, an interesting element in our analysis is that we investigate the recent progress in transition to knowledge-based economy in Saudi Arabia and we support the recent efforts aim to enhance knowledge-based economy in Saudi Arabia.

Regarding research method, we use the descriptive and comparative methods of analysis. We use the OECD (1996) framework and definition of a knowledge-based economy"- economies which are directly based on production, distribution and use of knowledge and information. Also we use definition of tacit and codified sources of knowledge and the World Bank framework and definition of Knowledge Index (KI), Knowledge Economy Index (KEI) and KEI four pillars-economic incentive and institutional regime, education and human resources, innovation system and Information and Communication Technology (ICT) pillars.

The rest of this paper is organized as follows: Section 2 presents the conceptual framework and literature review. Section 3 shows the general socio-economic characteristics of Saudi Arabia. Section 4 explains the development and progress in transition to knowledge-based economy in Saudi Arabia. Section 5 provides the conclusions and policy recommendations.

2. Conceptual Framework and Literature Review

In the recent years the world economy is witnessing a fundamental structural change driven by globalization and ICT leading to a new economic system characterizing by increasing importance of knowledge. Hence, knowledge creation, accumulation and acceleration is intensified the pace of scientific and technological progress and has been at the heart of economic growth literature. The definition of knowledge in the literature is based on the distinction between codified and tacit knowledge (Dasgupta and David, 1994), and embodied flows (knowledge incorporated in to machinery and equipment) and disembodied flows of knowledge (the use of knowledge transmitted via education systems, scientific and technical literature, consultancy, movement of

personnel). Often investment in knowledge refers to public spending on education, training, R&D and ICT.

Drucker (1998) argues that *"knowledge has become the key economic resource and the dominant—and perhaps the only—source of competitive advantage"*. Powell and Snellman (2004) define the knowledge economy as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. The key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources.[2] David and Foray (2001) discuss knowledge-based communities as agents of economic change, they find that knowledge-based activities emerge when people, supported by information and communication technologies, interact in concreted efforts to co-produce (i.e. create and exchange) new knowledge, new information and communication technologies are intensively used to codify and transmit the new knowledge. Therefore, a knowledge intensive community is one wherein a large proportion of members are involved in the production [and] reproduction of knowledge. According to OECD (1996) the term "*knowledge-based economy*" results from a fuller recognition of the role of knowledge and technology in economic growth. Knowledge, as embodied in human beings (as *"human capital"*) and in technology, has always been central to economic development. OECD (1996) discusses "knowledge-based economies" – economies which are directly based on the production, distribution and use of knowledge and information. The OECD economies are increasingly based on knowledge and information and are more strongly dependent on the production, distribution and use of knowledge than ever before. Indeed, it is estimated that more than 50 per cent of Gross Domestic Product (GDP) in the major OECD economies is now knowledge-based. This is reflected in the trend in OECD economies towards growth in high-technology investments, high-technology industries, more highly-skilled labour and associated productivity gains.[3]

The conceptual framework discussed in the international literature, implies the distinction between knowledge-based economies and resource-based economies. According to OECD (1996) knowledge-based economies- are economies which are directly based on production, distribution and use of knowledge and information, with important role of information, technology and learning in economic performance (cf. OECD, 1996). While a resource-based economy is the economy of a country whose gross national product or gross domestic product to a large extent comes from natural resources (e.g. oil and gas). Gorzelak (2001) defines a framework of knowledge-based economy based on the distinction between the old paradigm (resource driven economies) and the new paradigm (knowledge driven economies). Gorzelak (2001) argues that applying the concepts of the knowledge economy to urban management suggests the need for a

[2] See Powell and Snellman (2004), p. 199.
[3] See OECD (1996), pp. 3, 7, 9, 18-19.

paradigm shift from resource driven urban economies to knowledge driven urban economies (see Figure 1).

Figure 1- Knowledge Economy as an Agent of Change in Cities

Old Paradigm Resource driven economies	New Paradigm Knowledge driven economies
Quantitative factors Labor Raw materials Premises Bulk transportation Energy	Qualitative factors Qualifications Research and development Local suppliers Reliable infrastructure Good living conditions
Subsidization Tax allowances Grants and direct subsidies Low user charges and rents	Entrepreneurial Friendly and stable policy environment Effective and honest promotion Competitive attraction of capital, innovation and qualified labour

Source: Adapted from Gorzelak (2001).

The World Bank uses Knowledge Index (KI) and Knowledge Economy Index (KEI) to compare knowledge across the world countries. According to the World Bank, KI measures a country's ability to generate, adopt and diffuse knowledge. KI indicates overall potential of knowledge development in a given country. 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.[4] According to the World Bank (2011) the term Knowledge Economy has been coined to reflect this increased importance of knowledge. Framework for a Knowledge-based Economy consisting of four pillars help countries articulate strategies for their transition to a knowledge economy: economic incentives regime, education and human resources, the innovation system and information and communication technology (ICT). Making effective use of knowledge in any country requires developing appropriate policies, institutions, investments and coordination across the four functional areas.[5] According to OECD (1996) government policies, particularly those relating to science and technology, industry and education, will need a new emphasis in knowledge-based economies. Need for recognition of the central role of the firm, the importance of national systems and the requirements for infrastructures and incentives which encourage investments in research and training. Among the priorities, special emphasis should be given to enhancing knowledge diffusion, upgrading human capital and promoting organizational change. Governments can provide the conditions and enabling infrastructures for these changes through appropriate financial, competition, information and other policies.[6]

[4] The KEI is calculated based on the 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. The Economic incentive and institutional regime pillar includes tariff and nontariff barriers, regulatory quality and rule of law. The education and human resources pillar includes average years of schooling, secondary enrollment and tertiary enrollment. The innovation system pillar includes royalty and license fees payments and receipts, patent applications granted by the US Patent and Trademark Office and scientific and technical journal articles. Information and Communication Technology (ICT) pillar includes fixed telephones, mobile and internet users. Methodologically, the KI is the simple average of the normalized the key variables in three Knowledge Economy pillars – education and human resources, the innovation system and information and communication technology (ICT). For the purposes of calculating KI and KEI, each pillar is represented by three key variables, see (www.worlbank.org): See the World Bank- KEI, 2012: http://siteresources.worldbank.org/INTUNIKAM/Images/KEIindex.jpg.

[5] See the World bank (2011) "Knowledge for Development" accessed January 23, 2013.

[6] See OECD (1996), pp. 3, 7, 9, 18-19.

3. General Socio-Economic Characteristics of Saudi Arabia[7]

Based on the above framework and before examining progress in transition to knowledge based economy in Saudi Arabia, in this section it is useful to begin with the general socio-economic characteristics of Saudi Arabia. Table 1 shows the general socio-economic and development characteristics of Saudi Arabia as measured by (economic growth (GNI per capita), life expectancy, mean years of schooling, literacy rate and gross enrolment ratios. Table 1 illustrates that Saudi Arabia exhibit high standard of economic development as measured by GNI per capita and human development index. The World Bank classifications of economies put Saudi Arabia among high-income economies.

Saudi Arabia plays an important role in the global economy, mainly because of its position as one of the most influential members of the Organization of Petroleum Exporting Countries. Saudi Arabia has the biggest oil reserves in the world, it accounts for 25 per cent of the total world oil reserves.[8] Saudi Arabia has an oil-based economy; the petroleum sector accounts for roughly 80 per cent of government budget revenues, 45 per cent of GDP, and 90 per cent of export earnings.[9] Oil revenues facilitate progress in gross domestic product and human development Index (see Figures 2-3). By regional standard, Saudi Arabia has maintained its position as the strongest Arab economy and strongest Gulf economy. Saudi Arabia is holding 25 per cent of the total Arab GDP.[10] Saudi Arabia contributes with 45.75 per cent of the total Gulf GDP and 62.53 per cent of the total Gulf population (see Figure 4-5).

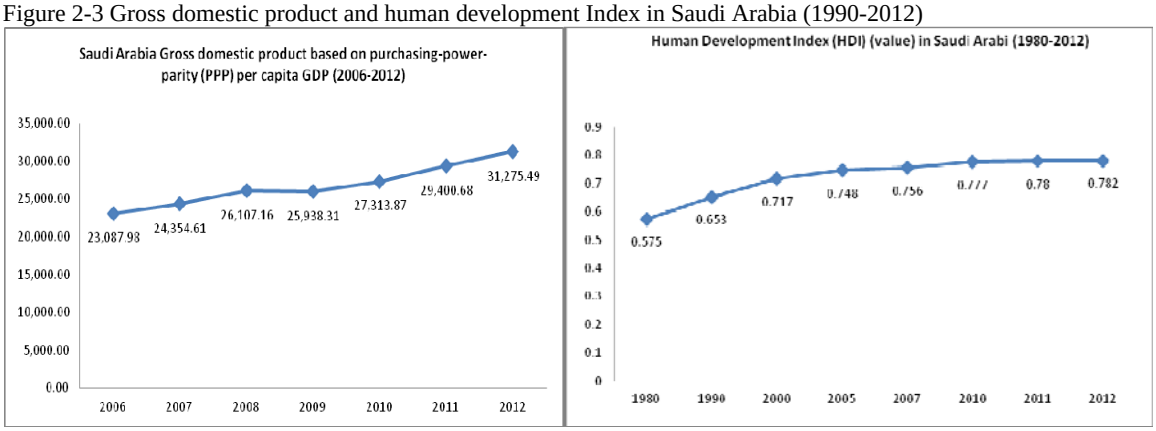
Table 1- General socio-economic characteristics of Saudi Arabia compared to world regions (2002-2012)

									Gross enrolment ratio		
	Population Total (millions)	GNI per capita (PPP[2] US$)	Human Development Index (HDI) Value	Life expectancy at birth (years)	Mean years of schooling (years)	Expected years of schooling (years)	Adult literacy rate (% ages 15 and older)	Population with at with at least secondary education	Primary (%)	Secondary (%)	Tertiary (%)
	2012	2012	2012	2012	2010	2011	2005–2010	2010	2002–2011	2002–2011	2002–2011
Gulf countries											
Saudi Arabia	28.7	11,474	0.782	73.6	10.6	14	86.6	54.6	106	101	36.8
United Arab Emirates	8.1	42,716	0.818	76.7	8.9	12	90	64.3	104	92	22.5
Bahrain	1.4	19,154	0.796	75.2	9.4	13.4	91.9	78	107	103	..
Oman	2.9	24,092	0.731	73.2	5.5	13.5	86.6	53.9	105	100	24.5
Qatar	1.9	87,478	0.834	78.5	7.3	12.2	96.3	63.4	103	94	10
Kuwait	2.9	52,793	0.79	74.7	6.1	14.2	93.9	48.9	106	101	21.9
Average Gulf countries	(45.9)[1]	39618	0.792	75.3	8.0	13.2	90.9	60.5	105.2	98.5	23.1
Human Development Index groups											
Very high human development	1,134.30	33,391	0.905	80.1	11.5	16.3	..	85.9	104.2	100.4	75.8
High human development	1,039.20	11,501	0.758	73.4	8.8	13.9	92.7	64.2	110.5	91	48.7
Medium human development	3,520.50	5,428	0.64	69.9	6.3	11.4	82.3	50.5	113.4	70.7	22.1
Low human development	1,280.70	1,633	0.466	59.1	4.2	8.5	60.8	25.2	98.2	37.4	6.8
Regions											
Arab States	357.3	8,317	0.652	71	6	10.6	74.5	38.4	97.7	71.1	24.1
East Asia and the Pacific	1,991.40	6,874	0.683	72.7	7.2	11.8	93.8	..	111	78.8	26.1
Europe and Central Asia	481.6	12,243	0.771	71.5	10.4	13.7	98.1	83.5	99.9	91.2	57.5
Latin America and the Caribbean	597.7	10,300	0.741	74.7	7.8	13.7	91.3	50.4	115.9	90.9	42.5
South Asia	1,753.00	3,343	0.558	66.2	4.7	10.2	62.8	39.2	113.6	57.6	15.7
Sub-Saharan	852.5	2,010	0.475	54.9	4.7	9.3	63	29.7	100.3	40.3	6.2
Least developed countries	870.4	1,385	0.449	59.5	3.7	8.5	60.7	..	101.8	36	6.6
World	7,052.10	10,184	0.694	70.1	7.5	11.6	81.3	57.7	107.9	71.2	28.7

Source: UNDP Human Development Report (2013), pp. 146-147, 173, 196-197.
Note: (1) amount refers to total Gulf countries, (2) PPP refers to purchasing power parity.

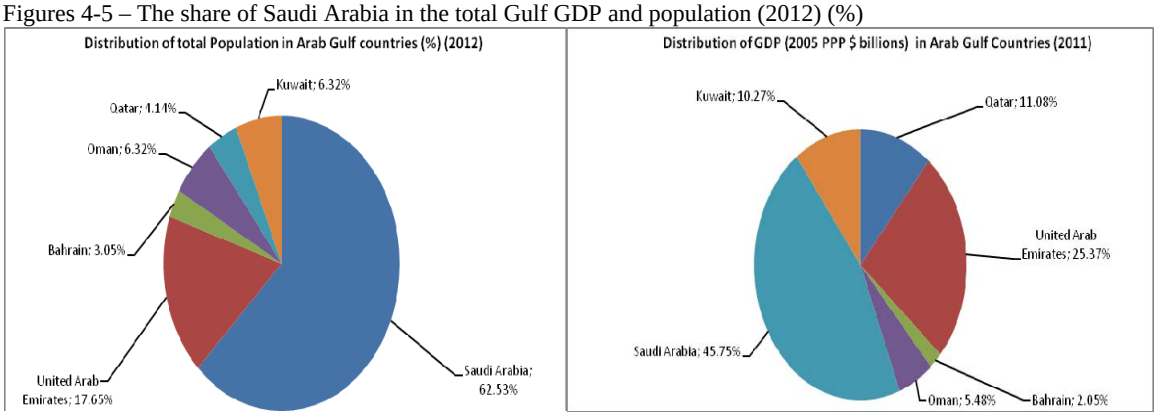
[7] The Arab Gulf countries region is composed of six countries, including Bahrain, Kuwait, Oman Qatar, Saudi Arabia, and United Arab Emirates.
[8] See Saudi Arabia Ministry of Economy and Planning: Economy and resources: http://www.mep.gov.sa/themes/GoldenCarpet/index.jsp#1393653270516, accessed on February 28, 2014.
[9] See Saudi Arabia Economy Profile 2013: http://www.indexmundi.com/saudi_arabia/economy_profile.html., accessed on February 22, 2014.
[10] See Saudi Arabia Ministry of Economy and Planning: Economy and resources: http://www.mep.gov.sa/themes/GoldenCarpet/index.jsp#1393653270516, accessed on February 28, 2014.

Figure 2-3 Gross domestic product and human development Index in Saudi Arabia (1990-2012)



Sources: Adapted from (1) IMF (2013) and (2) UNDP-HDR (2013)

Figures 4-5 – The share of Saudi Arabia in the total Gulf GDP and population (2012) (%)



Source: Adapted from UNDP-HDR (2013)

4. The development of knowledge based economy in Saudi Arabia

Based on the above background, and in view of recent interest in Saudi Arabia to develop a comprehensive, pragmatic national strategy for transformation into knowledge society that appears from the National strategy for the transition to a knowledge society, it is interesting and relevant to examine development of knowledge based economy in Saudi Arabia.[11] This section discusses the research question and hypothesis concerning progress in transition to knowledge-based economy in Saudi Arabia using the World Bank knowledge index and knowledge economy index and the OECD (1996) definition of a knowledge-based economy.

Generally, the performance and progress of Saudi Arabia in transition to knowledge-based economy appears from the World Bank Knowledge Index (KI) and Knowledge economy index (KEI) over the period (1995-2012). Knowledge economy index reflects the change in performance of Saudi Arabia on all four pillars related to knowledge economy - economic incentive and institutional regime, education and human resources, innovation system and ICT.[12]

By international standard, the place of Saudi Arabia in the global KI is perceived from the rank of world countries in terms of KI. For instance, the rank of world countries in terms of KI

[11] See Saudi Arabia Ministry of Economy and Planning: National strategy for the transition to a knowledge society: Ramadan 1434 AH / July 2013: http://www.mep.gov.sa/themes/GoldenCarpet/index.jsp#1393653539210, accessed on February 28, 2014.

[12] For the purposes of calculating KI and KEI, each pillar is represented by three key variables see the World Bank website: www.worldbank.org.

implies that Saudi Arabia shows only minor change and slow progress over the period 1995-2000, in the international rank Saudi Arabia has climbed two places compared to 1995, obtaining 76th place in 2000 ranking, compared to 78th place in 1995 ranking. Then over the period (2000-2012), Saudi Arabia shows major change and the fastest progress not only relative to Gulf and Arab countries but also world countries, in the international rank Saudi Arabia has climbed 26 places compared to 2000, obtaining 50th place in 2012 ranking, compared to 76th place in 2000 ranking. This implies significant improvement in the rank of Saudi Arabia not only by regional standard but also by international standard (see Table 2 and Figures 6-23). The World Bank (2012) puts Saudi Arabia at the top of the economies with large improvements and reversals. It confirms that "*of the 146 economies included in the KAM, Saudi Arabia made the most progress since 2000. With a KEI of 5.95, it climbed 26 positions to rank 50th in the 2012 KEI. Significant improvements in gross secondary enrolment 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 ([Table 3])*".[13]

By regional standard, the regional performance in terms of KI and KEI implies that the United Arab Emirates (UAE) is ranked at the top in the Arab region and at 42nd globally, followed by Bahrain, which is ranked at the second place in the Arab region and at 43 globally, followed by Oman, which is ranked at the third place in the Arab region and is ranked 47th globally, while, Saudi Arabia is ranked (50th) globally and at the fourth place after UAE, Bahrain, and Oman the top countries in the Arab region respectively (see Table 2 and Figures 6-23).

The performance of Saudi Arabia in terms of KI shows slight deterioration over the period (1995-2000) decreased from 5.21 in 1995 to 4.67 in 2000, and then shows slight improvement over the period (2000-2012) increased from 4.67 in 2000 to 6.05 in 2012. The performance of Saudi Arabia in terms of KEI shows slight deterioration over the period (1995-2000) decreased from 5.02 in 1995 to 4.6 in 2000, and then shows slight improvement over the period (2000-2012) increased from 4.6 in 2000 to 5.96 in 2012. The performance of Saudi Arabia in terms of economic incentive and institutional regime pillar shows slight deterioration over the period (1995-2000) decreased from 4.45 in 1995 to 4.4 in 2000, and then shows slight improvement over the period (2000-2012) increased from 4.4 in 2000 to 5.68 in 2012. The performance of Saudi Arabia in terms of education pillar shows slight improvement over the period (1995-2012) increased from 4.11 to 4.28 and to 5.65 in 1995, 2000, and 2012 respectively. The performance of Saudi Arabia in terms of innovation pillar shows slight deterioration over the period (1995-2012) decreased from 5 to 4.24 and to 4.14 in 1995, 2000, and 2012 respectively. The performance of

[13] See Knowledge Economy Index (KEI) 2012 Rankings: The World Bank's Knowledge Assessment Methodology (KAM: www.worldbank.org/kam): http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf, accessed February 2014.

Saudi Arabia in terms of ICT pillar shows slight deterioration over the period (1995-2000) decreased from 6.51 in 1995 to 5.49 in 2000, and then shows slight improvement over the period (2000-2012) increased from 5.49 in 2000 to 8.37 in 2012 (see Table 2 and Figures 6-23). In 1995 the performance of Saudi Arabia in terms of KI (5.21), and KEI (5.02), implies that the best performance was related to ICT pillar (6.51), followed by innovation pillar (5), followed by economic incentive and institutional regime pillar (4.45), and finally education pillar (4.11) respectively. In 2000 the performance of Saudi Arabia in terms of KI (4.67), and KEI (4.6), implies that the best performance was related to ICT pillar (5.49), followed by economic incentive and institutional regime pillar (4.4), followed by education pillar (4.28), and finally innovation pillar (4.24) respectively. In 2012 the performance of Saudi Arabia in terms of KI (6.05), and KEI (5.96), implies that the best performance was related to ICT pillar (8.37), followed by economic Incentive and institutional regime pillar (5.68), followed by education pillar (5.65), and finally innovation pillar (4.14) respectively (see Table 2 and Figures 6-23).

The progress of Saudi Arabia in terms of the value of KEI (1.36) and KI (1.38), largely attributed to progress in ICT pillar (2.88), followed by education pillar (1.37) and economic incentive regime pillar (1.28) respectively, while innovation pillar decreased by (-0.1). The progress in Saudi Arabia rank over the period (2000-2012) appears in terms of progress in KEI (26), which is largely attributed to progress in ICT pillar (45), followed by education pillar (30) and economic incentive regime pillar (17) respectively, without progress in innovation pillar (0). The progress in Saudi Arabia rank (2012) in terms of KEI (50) is largely attributed to the rank in terms of ICT pillar (21), followed by education pillar (58), economic incentive regime pillar (60) and innovation pillar (84) respectively. These results implies that the improvement in KI and KEI are related to improvement in terms of ICT pillar, followed by economic incentive and institutional regime pillar and education pillar respectively, by contrast, the innovation pillar shows slight deterioration and weak performance (see Table 2 and Figures 6-23).

These results imply some progress to knowledge-based economy in Saudi Arabia that appears from slight improvement in KI, KEI, ICT pillar, education pillar, economic incentive and institutional regime pillar, this slight improvement was reduced by the observed deterioration in terms of innovation pillar. This implies that to improve the performance in KI, KEI and hence, transition to knowledge economy, it is essential for Saudi Arabia to strengthen and improve the performance of innovation pillar (see Table 2 and Figures 6-23).

Table – 2- Knowledge index and Knowledge Economy index in Saudi Arabia and world regions (2000-2012)

Country	Change in rank from 1995 and from 2000		Rank		The Knowledge index (KI)		The Knowledge Economy index (KEI)		Economic Incentive Regime		Innovation		Education		ICT	
	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012
Arab countries																
Saudi Arabia	2	26	76	50	4.67	6.05	4.6	5.96	4.4	5.68	4.24	4.14	4.28	5.65	5.49	8.37
United Arab Emirates	-2	6	48	42	5.56	7.09	6.05	6.94	7.51	6.5	4.32	6.6	4.44	5.8	7.92	8.88
Bahrain	-5	-2	41	43	6.66	6.98	6.85	6.9	7.45	6.69	6.37	4.61	6.34	6.78	7.26	9.54
Oman	0	18	65	47	4.53	5.87	5.28	6.14	7.51	6.96	4.25	5.88	4.22	5.23	5.12	6.49
Qatar	5	-5	49	54	5.81	5.5	6.01	5.84	6.64	6.87	5.51	6.42	4.85	3.41	7.05	6.65
Kuwait	11	-18	46	64	5.88	5.15	6.16	5.33	7	5.86	5.38	5.22	5.17	3.7	7.09	6.53
Average Gulf countries	1.83	4.17	54.17	50	5.52	6.11	5.83	6.19	6.75	6.43	5.01	5.48	4.88	5.10	6.66	7.74
Regions																
Arab region					4.14	4.21	4.12	4.17	4.21	4.30	3.93	3.98	3.69	3.72	4.73	4.83
North America	1	0	1	1	9.2	8.7	9.18	8.8	9.1	9.11	9.54	9.45	8.67	8.13	9.39	8.51
Europe and Central Asia	3	0	2	2	7.84	7.64	7.56	7.47	6.72	6.95	8.38	8.28	7.38	7.13	7.78	7.5
East Asia and the Pacific	-1	1	4	3	5.69	5.17	5.79	5.32	6.07	5.75	7.43	7.43	3.68	3.94	5.98	4.14
Latin America	1	1	5	4	5.67	5.31	5.54	5.15	5.14	4.66	6.14	5.8	5.07	5.11	5.8	5.02
World	-2	-2	3	5	6.06	5.01	5.95	5.12	5.61	5.45	7.75	7.72	3.89	3.72	6.53	3.58
Middle East and N. Africa	1	0	6	6	5.07	4.51	5.16	4.74	5.41	5.41	6.44	6.14	3.8	3.48	4.97	3.92
South Asia	-4	1	8	7	2.7	2.77	2.98	2.84	3.79	3.05	3.56	4.23	2.22	2.17	2.33	1.9
Africa	1	-1	7	8	3	2.43	3.04	2.55	3.13	2.91	3.95	3.95	1.7	1.44	3.36	1.9

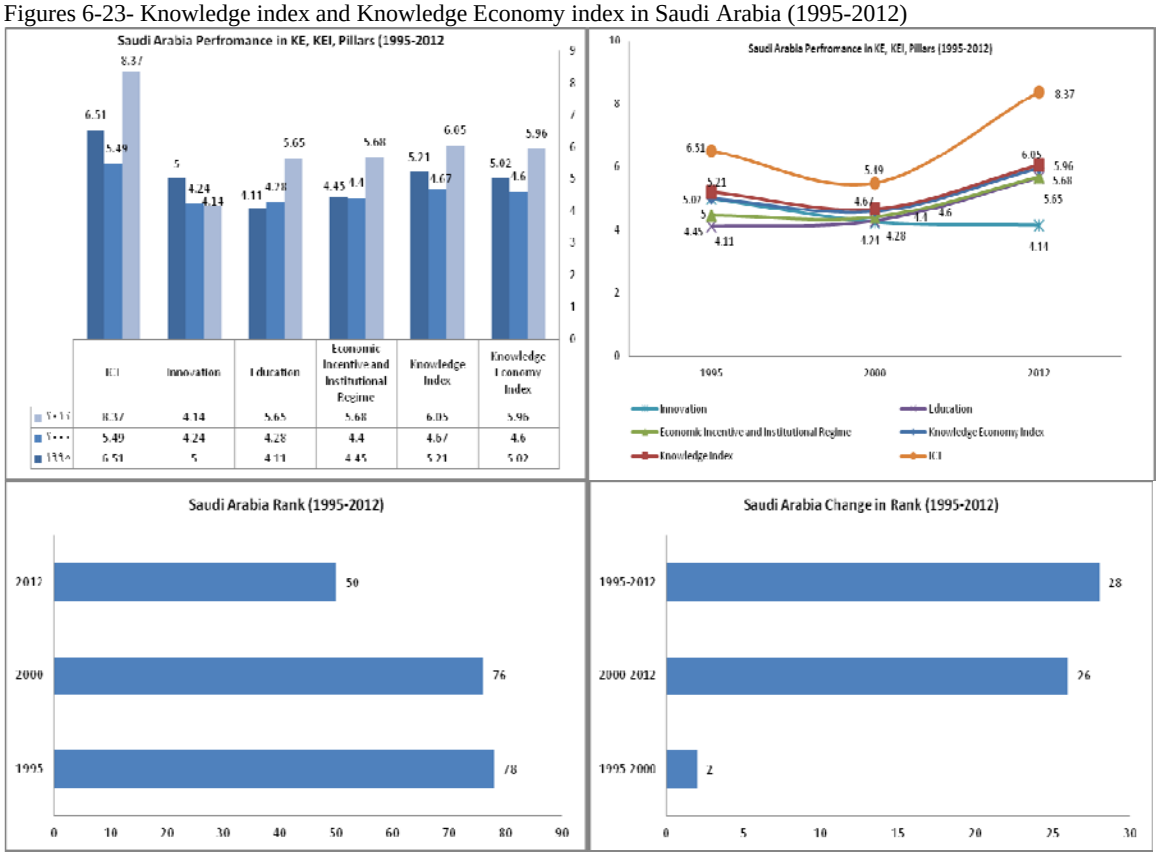
Source: The World Bank (2012).

Table 3 - Improvements in KEI Rankings – Top 10 Countries

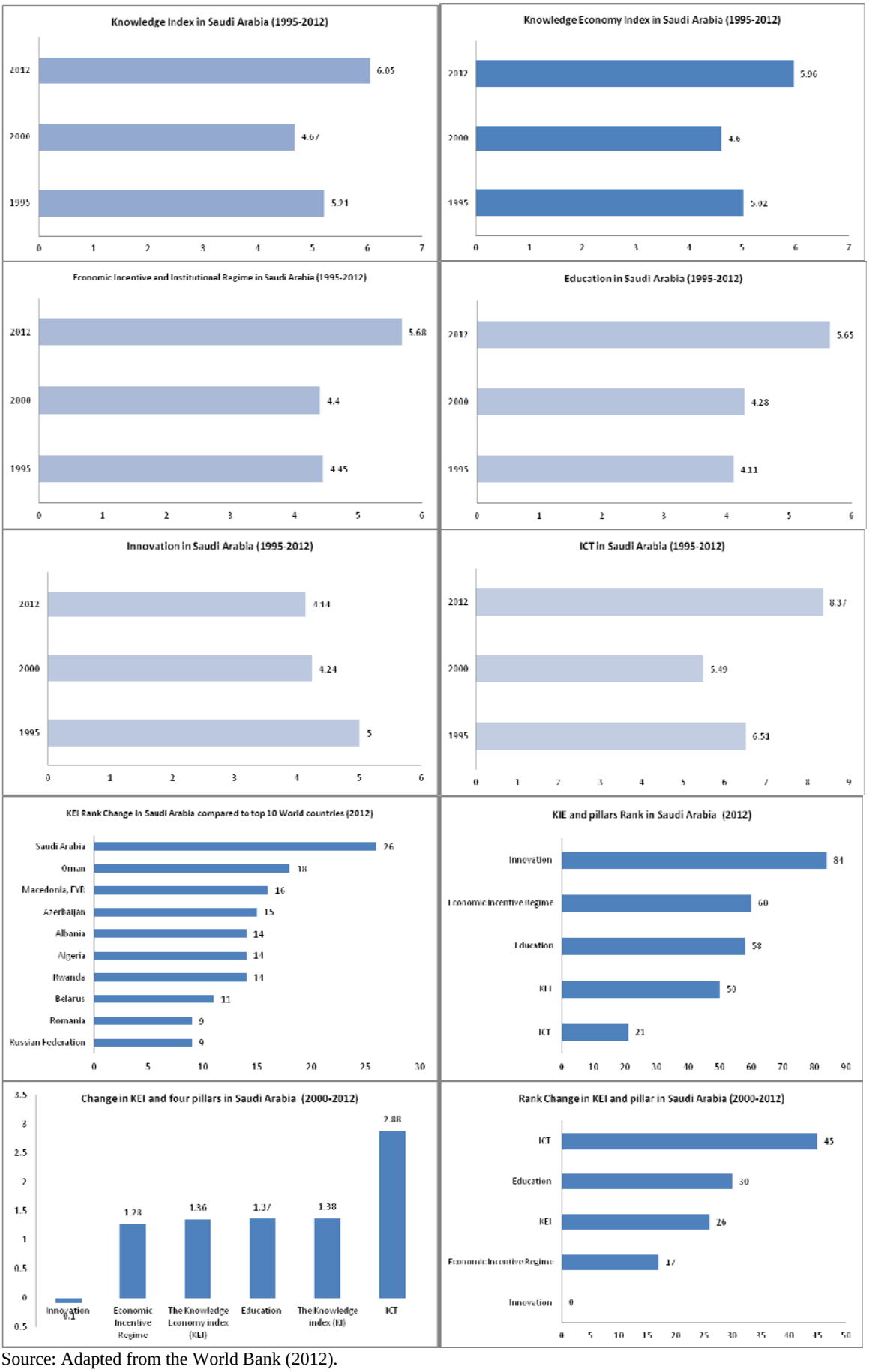
Country/Economy	KEI Rank Change	KEI 2012 Rank	KEI 2012	EIR Rank Change	EIR 2012 Rank	Innovation Rank Change	Innovation 2012 Rank	Education Rank Change	Education 2012 Rank	ICT Rank Change	ICT 2012 Rank
Saudi Arabia	26	50	5.96	17	60	0	84	30	58	45	21
Oman	18	47	6.14	-9	44	26	57	15	74	19	55
Macedonia, FYR	16	57	5.65	34	59	10	69	-12	78	17	48
Azerbaijan	15	79	4.56	24	103	14	89	8	53	26	78
Albania	14	82	4.53	50	71	8	101	-16	83	37	72
Algeria	14	96	3.79	23	115	6	99	21	71	21	89
Rwanda	14	127	1.83	45	95	10	134	2	137	3	143
Belarus	11	59	5.59	21	114	5	60	-1	33	20	47
Romania	9	44	6.82	20	40	10	53	19	29	5	59
Russian Federation	9	55	5.78	15	117	11	40	-17	44	19	44

Source: KAM 2012. Reconstructed from the KAM's "KEI and KI indexes" mode (www.worldbank.org/kam) [14]

Figures 6-23- Knowledge index and Knowledge Economy index in Saudi Arabia (1995-2012)



[14] See Knowledge Economy Index (KEI) 2012 Rankings: The World Bank's Knowledge Assessment Methodology (KAM: www.worldbank.org/kam): http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf, p.7.

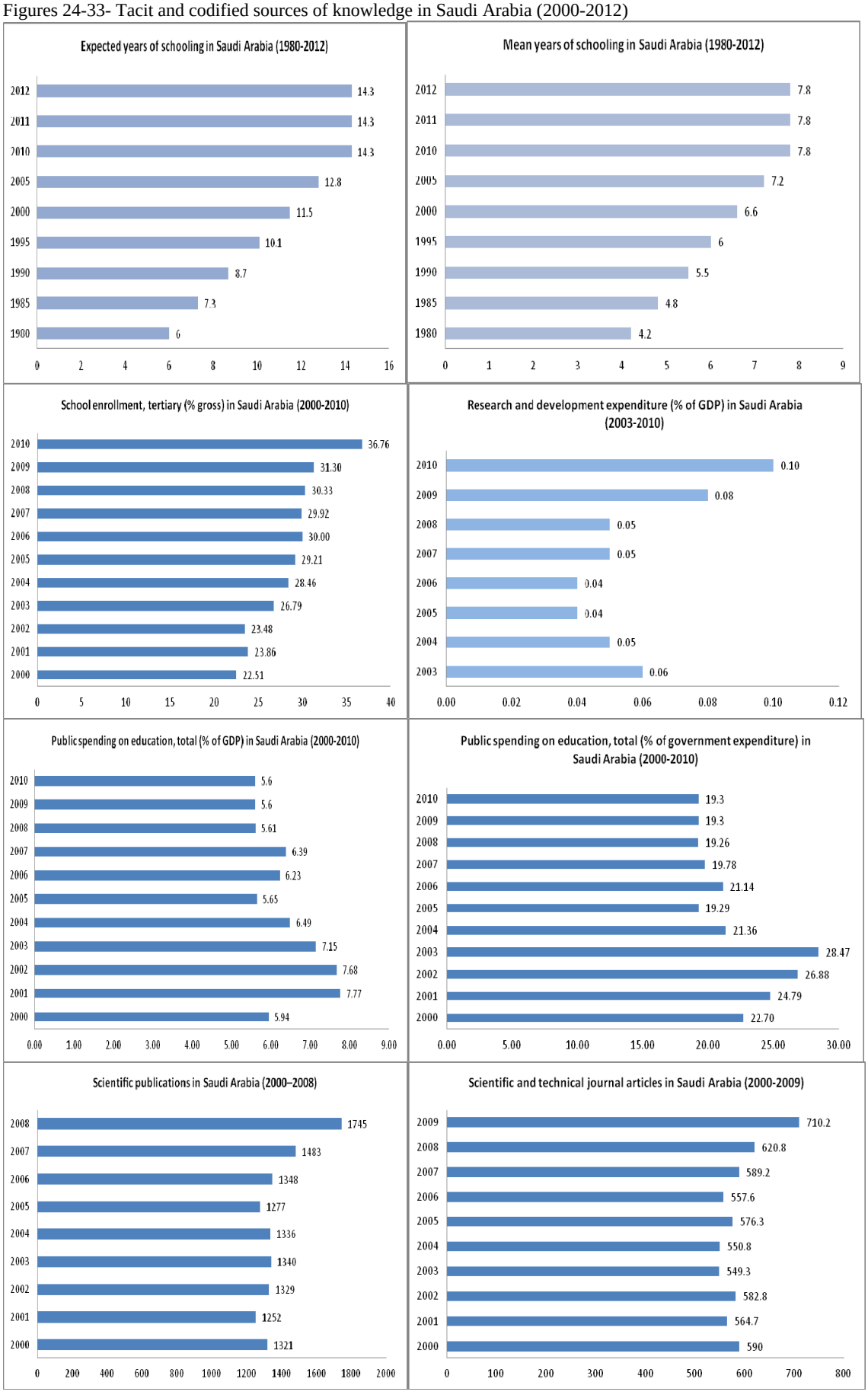


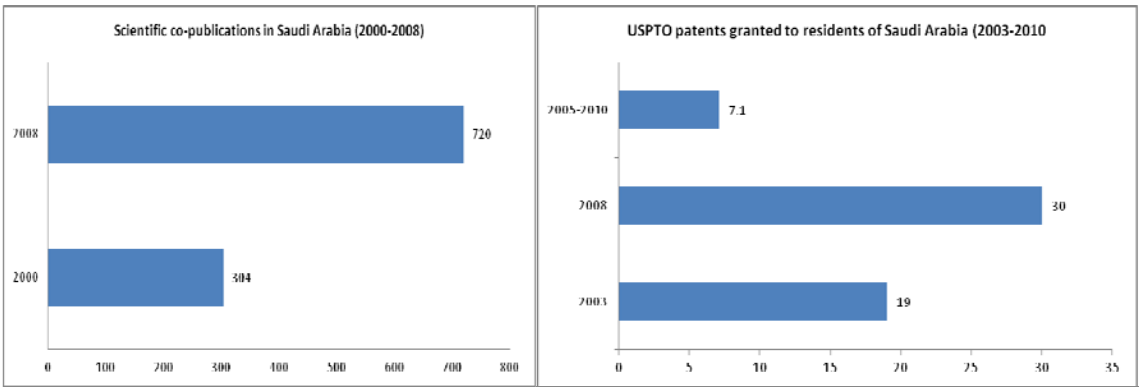
Source: Adapted from the World Bank (2012).

In addition to KI and KEI we examine the progress in tacit and codified sources of knowledge in Saudi Arabia using the broad definition of knowledge found in the new growth literature that highlights both the tacit and codified components of knowledge. Mainly, we define tacit knowledge by the share of high skilled defined by the share of enrolment in tertiary education. We define codified knowledge by the embodied knowledge distributed in many indicators, including the share of spending on education and R&D as percentage of GDP. In addition, we use several variables related to knowledge such as patents, publications, cooperation – measured by joint publications, and schooling years – defined by mean years of schooling and expected years of schooling in Saudi Arabia. Figures 20-29 below show the progress in tacit and codified sources of knowledge in Saudi Arabia. The performance of Saudi Arabia shows improvement in terms of tacit knowledge as measured by the share of enrolment in tertiary education from 22.51 in 2000 to 36.76 in 2010, and improvement in both mean years of schooling (7.8) and expected years of schooling (13.7) over the period (1980-2012). Figure 24-25 show Saudi Arabia's progress in both mean years of schooling and expected years of schooling indicators, between 1980 and 2012, Saudi Arabia's mean years of schooling increased by 3.6 years and expected years of schooling increased by 8.3 years.[15] The performance of Saudi Arabia shows improvement in terms of codified knowledge as measured by the share of spending on R&D as percentage of GDP from 0.04 in 2005 to 0.08 in 2009 and to 0.10 in 2010, while the share of spending on education as percentage of GDP show slight deterioration decreased from 5.94 in 2000 to 5.6 in 2010 and the share of spending on education as percentage of government spending show slight deterioration decreased from 22.7 in 2000 to 19.3 in 2010, this implies that despite deterioration in government spending on education, Saudi Arabia government still allocating near to one fifth of government spending to education. The performance of Saudi Arabia shows improvement in terms of scientific publications and cooperation– measured by joint publications, but shows slight deterioration in terms of patent decreased from 30 in 2008 to 7.1 in 2010 (see Figures 24-33).

[15] See UNDP- Human Development Report (2013) "The Rise of the South: Human Progress in a Diverse World: Explanatory note on 2013 HDR composite indices: Saudi Arabia,," p. 2.

Figures 24-33- Tacit and codified sources of knowledge in Saudi Arabia (2000-2012)





Sources: Adapted from (1) the World Bank – World Development indicators (2012), (2) UNDP-HDR Report (2013, 2011, 2009), (3) UNESCO-UIS Global Education Digest, (2011, 2012) (4) UNESCO-UIS Science Report (2010a, b), (5) UNDP- Human Development Report (2013) "The Rise of the South: Human Progress in a Diverse World: Explanatory note on 2013 HDR composite indices*:* Saudi Arabia,," p. 2.

The weak performance and deterioration in terms of innovation in Saudi Arabia that appears from the performance in the World Bank KI and KEI, as explained above, also appears from the performance in terms of Global Innovation Index (GII) issued by INSEAD (2012-2013). Mainly, that appears in score value of global indicators of innovation related to knowledge in Saudi Arabia compared to other world countries. For instance, the performance in terms of GII over the period (2009-2013) implies that Saudi Arabia score value in terms of GII shows improvement from 32 in 2009 to 54 in 2010 and 2011, and then shows slight deterioration to 48 in 2012 and to 41.2 in 2013 (see Table 4 and Figures 34-41).

The performance and place of Saudi Arabia in GII is perceived from the rank of Saudi Arabia among the world countries in terms of GII over the period (2012-2013).The international rank in GII, implies that the rank of Saudi Arabia improved by both international and regional standards over the period (2012-2013). For instance, by international standard, the rank of Saudi Arabia shows improvement in GII, Saudi Arabia has climbed 12 places compared to 2012, obtaining 42nd place in 2013 ranking, compared to 54th place in 2012 ranking. By regional standard, Saudi Arabia rank in the Arab region shows improvement from the seventh place regionally after Qatar (26), United Arab Emirates (34), Jordan (41), Bahrain (46), Lebanon (49), Kuwait (52), and then Saudi Arabia (54) in 2012, to the second place regionally after the United Arab Emirates (38), then Saudi Arabia in the second position in the Arab region and ranked (42) globally in the International Classification (see Table 4 and Figures 34-41).

The GII reports (2009-2013) show the performance of Saudi Arabia concerning some indicators associated with knowledge absorption, creation, impact and diffusion. The use of GII reports (2009-2013) and application of the OECD (1996) definition of knowledge-based economies- economies which are directly based on production, distribution and use of knowledge and information, also imply slight improvement in the performance concerning progress in the transition to knowledge-based economy in Saudi Arabia that appears from slight improvement in knowledge creation, knowledge diffusion and knowledge impact (see Table 4). Mainly, the trend

over the period (2011-2013) implies that the performance of Saudi Arabia has improved in some indicators, but has deteriorated in other indicators. For instance, the performance of Saudi Arabia in terms of Global Innovation Index implies that the score value shows slight improvement increased from 32 in 2009, to 54 in 2010 and 2011, and then shows slight deterioration decreased from 54 in 2011 to 48 in 2012, and to 41.2 in 2013. The performance of Saudi Arabia in terms of innovation efficiency index shows slight improvement increased from 0.6 in 2011 and 2012 to 0.8 in 2013. The performance of Saudi Arabia in terms of knowledge absorption index shows slight improvement increased from 35 in 2011, to 41 in 2012, and then shows deterioration decreased from 41 in 2012 to 26.8 in 2013. The performance of Saudi Arabia in terms of knowledge creation index shows slight improvement increased from 2.1 in 2011, to 2.7 in 2012, and to 10.2 in 2013 respectively. The performance of Saudi Arabia in terms of knowledge impact index shows slight deterioration decreased from 35.2 in 2011, to 25.4 in 2012, then increased from 25.4 in 2012 to 38.6 in 2013. The performance of Saudi Arabia in terms of knowledge diffusion index shows slight improvement increased from 17.5 in 2011 to 17.9 in 2012 and to 18.3 in 2013 respectively (see Table 4 and Figures 34-41). This implies some progress to knowledge-based economy in Saudi Arabia that appears from slight improvement in innovation efficiency index, knowledge creation index, knowledge impact index, knowledge diffusion index, this slight improvement was reduced by the observed deterioration in terms of both GII and knowledge absorption index. This implies that to improve the performance and transition to knowledge economy, it is essential for Saudi Arabia to strengthen and improve the performance of GII and knowledge absorption index.

Finally, the performance in terms of capacity for innovation and localization of technology, technological infrastructure and human capital also reflect the progress to knowledge-based economy in Saudi Arabia (see Table 4). For instance, the performance in terms of capacity for innovation and localization of technology index implies slight deterioration in Saudi Arabia (from 0.27 in 2009 to 0.24 in 2012), Arab countries (from 0.25 in 2009 to 0.19 in 2012) and Gulf countries (from 0.23 in 2009 to 0.20 in 2012). The performance in terms of technological infrastructure indicators implies slight improvement in Saudi Arabia (from 0.41 in 2009 to 0.49 in 2012), Arab countries (from 0.36 in 2009 to 0.37 in 2012) and Gulf countries (from 0.47 in 2009 to 0.49 in 2012). The performance in terms of human capital indicators implies slight deterioration in Saudi Arabia (from 0.60 in 2009 to 0.57 in 2012), and Gulf countries (from 0.59 in 2009 to 0.57 in 2012) compared to stagnation for Arab countries (0.48 in 2009 and 2012). (see Table 4 and Figures 34-41). This implies slight progress to knowledge-based economy in Saudi Arabia that appears from slight improvement in technological infrastructure, this slight improvement was reduced by the observed deterioration in terms of both capacity for innovation, localization of technology and human capital. This implies that to

improve the performance and transition to knowledge economy, it is essential for Saudi Arabia to strengthen and improve capacity for innovation, localization of technology and human capital.

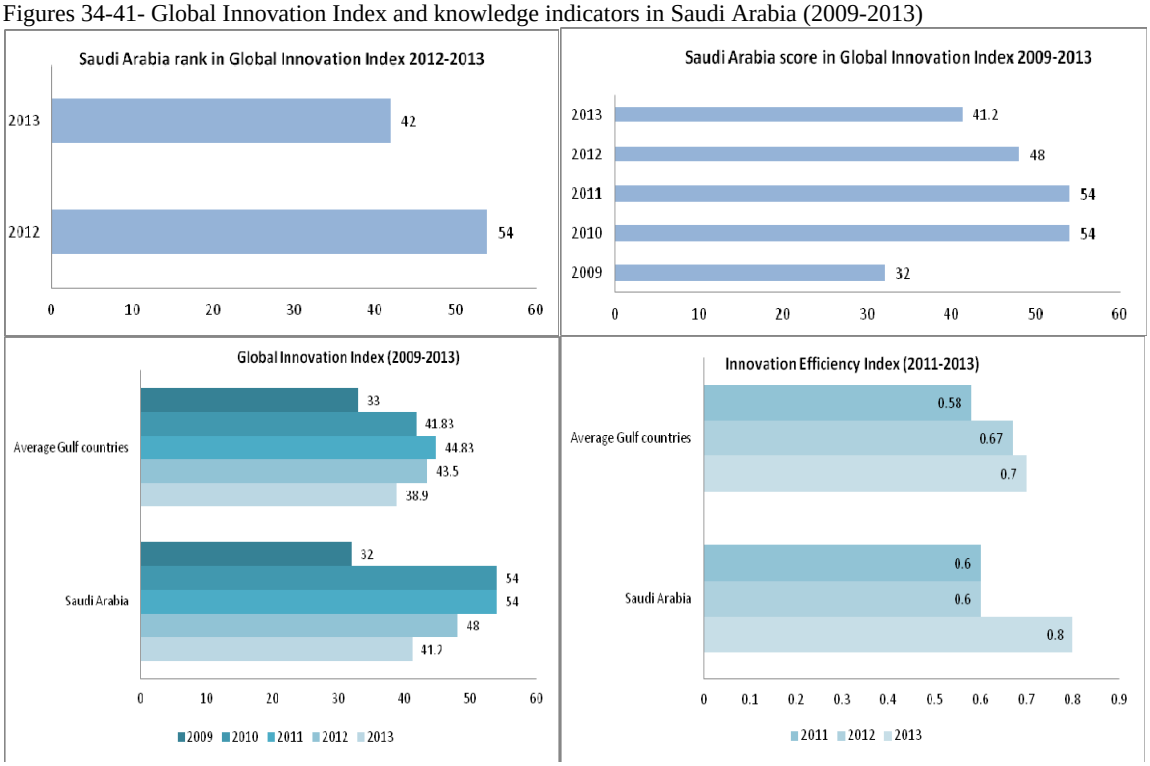
Table - 4- Global Innovation Index, knowledge indicators, capacity for innovation and localization of technology index and technological infrastructure rankings in Saudi Arabia and Gulf countries (2009-2013)

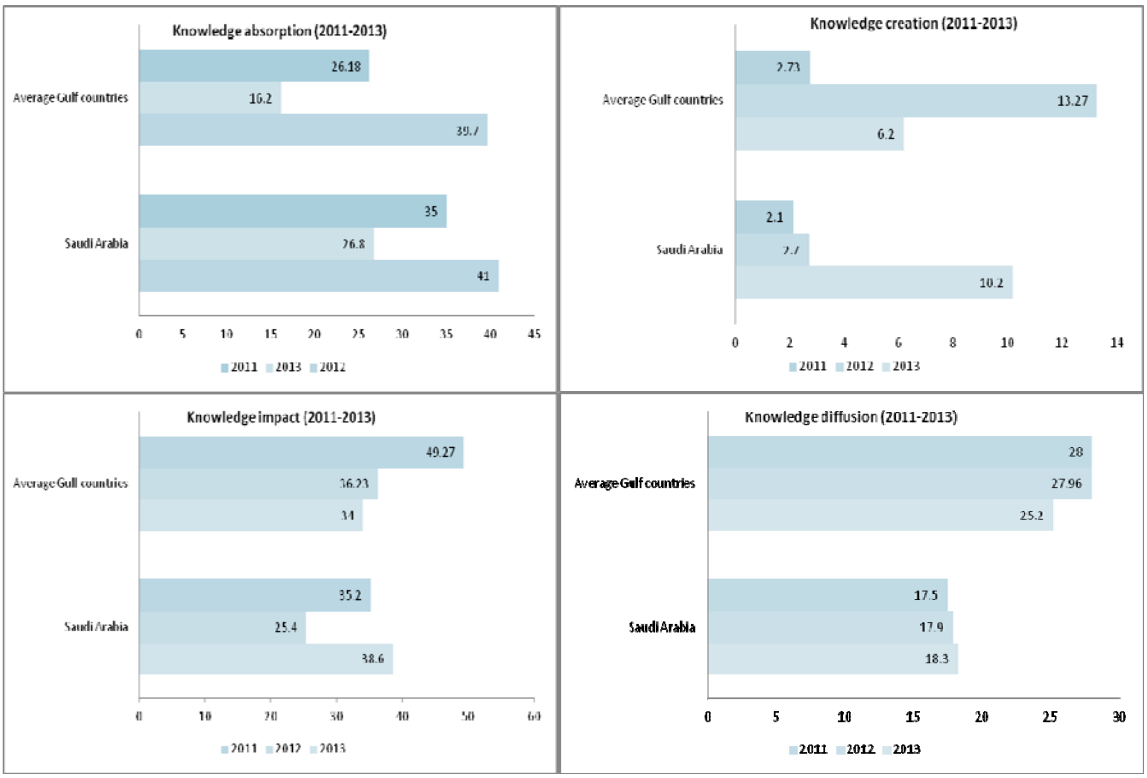
	Global Innovation Index [1]					Innovation Efficiency Index [1]			Knowledge absorption[1]			Knowledge creation [1]			Knowledge impact [1]			Knowledge diffusion [1]		
	2009	2010	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013
Gulf countries																				
Qatar	24	35	26	33	41	0.8	0.7	0.7		65	10	1.2	1.5	5.4	100.0	74.2	45.4			
United Arab Emirates	26	24	34	37	41.9	0.5	0.6	0.6	15.6	34.8	20.7	1.8	28.2	7.2	35.7	27.7	25.9	0.3	0.3	1.5
Bahrain	34	40	46	41	36.1	0.4	0.6	0.6	24.2	28.1	18	2.9	19.3	2.6	55.3	39.7	27.7	18.5	23.3	0.4
Oman	52	65	57	47	33.3	0.5	0.7	0.5	37.6	36.2	11.7	3.3	22.8	4.6	35.1	32.0	.29.0	28.7	25.8	36.2
Saudi Arabia	32	54	54	48	41.2	0.6	0.6	0.8	35.0	41.0	26.8	2.1	2.7	10.2	35.2	25.4	38.6	17.5	17.9	19
Kuwait	30	33	52	55	40	0.7	0.8	1	18.5	33.1	9.9	5.1	5.1	7.1	34.3	18.4	32.6	75.0	72.5	18.3
Average Gulf countries	33	41.8	44.8	43.5	38.9	0.58	0.67	0.7	26.1	39.7	16.2	2.73	13.2	6.2	49.27	36.23	34.0	28.0	27.96	75.6
		3	3						8				7							25.2

	Capacity for innovation and localization of technology Index [2]		Technological infrastructure Index [2]		Human capital Index [2]	
	2009	2012	2009	2012	2009	2012
Gulf countries						
Qatar	0.42	0.24	0.56	0.34	0.60	0.65
United Arab Emirates	0.16	0.21	0.59	0.66	0.58	0.53
Bahrain	0.23	0.16	0.50	0.68	0.63	0.59
Oman	0.31	0.25	0.24	0.29	0.52	0.51
Saudi Arabia	0.27	0.24	0.41	0.49	0.60	0.57
Kuwait	0.01	0.12	0.51	0.49	0.60	0.56
Average Gulf countries	0.23	0.20	0.47	0.49	0.59	0.57
Average Arab countries	0.25	0.19	0.36	0.37	0.48	0.48
Average comparable countries	0.41	0.38	0.52	0.47	0.70	0.66

Sources: (1) The Global Innovation Index (GII) Reports (2009, 2010, 2011, 2012, 2013), (2) Arab Planning Institute (2009, 2012)

Figures 34-41- Global Innovation Index and knowledge indicators in Saudi Arabia (2009-2013)





Sources: Adapted from GIR Reports (2009-2013)

The GII Report (2013) indicates strength of Saudi Arabia in terms of some indicators and also indicates weakness of Saudi Arabia in terms of other indicators related to innovation index and other knowledge related indicators. For instance, The GII Report (2013) indicates strength of Saudi Arabia in terms of infrastructure, mainly, information and communication technologies (ICTs) (ranked 25 globally), mainly government's online service (ranked 19 globally), ICT and organizational model creation (ranked 15 globally), tertiary education (ranked 31 globally), mainly share of graduates in science and engineering (ranked 7 globally), Innovation linkages (ranked 21 globally), mainly, state of cluster development (ranked 20 globally) and joint venture and strategic alliance (ranked 13 globally). The GII Report (2013) indicates weakness of Saudi Arabia in terms of knowledge creation, mainly, domestic resident patent application (ranked 79 globally), knowledge diffusion, mainly the share of high-tech exports (ranked 115 globally), the share of communication, computer and information services exports (ranked 114 globally), and Research and development (R&D), mainly gross expenditure on R&D as a percentage of GDP (ranked 97 globally), and number of researchers per million population (ranked 107 globally).[16]

Apart from the above assessment, the transition to knowledge based economy is probably affected by the prevailing economic structure. From economic perspective, the stylized facts in the literature confirm that oil provides a significant contribution for developing the economies and social welfare in Saudi Arabia and Arab Gulf countries; in particular, it leads to higher per capita income. Oil provides opportunity and challenge for transition to knowledge based economy

[16] See the GII Report (2013): the global innovation index Profiles: Country/Economy 2013: Saudi Arabia, p. 238.

in Saudi Arabia and Arab Gulf countries. On the one hand, oil provides opportunity for transition to knowledge based economy, because the revenues from oil can be utilized to facilitate the transition to knowledge based economy in Saudi Arabia and Gulf countries. On the other hand, the heavy reliance on oil in Saudi Arabia and Gulf countries implies challenge for transition to knowledge based economy. Similar to typically oil-based (natural resources) based economies, the transition to knowledge-based economy in Saudi Arabia and Arab Gulf countries is impeded by the prevalence of the oil based economic structure. Notably, the oil-based economy implies heavy reliance of the economy on natural resources (oil and natural gas), rather than knowledge based economy. This challenge of weak knowledge based economies in the Arab region is well documented in the Arab literature (cf. UNDP-AHDR, 2002; 2003; 2009; UNDP-MBRF-Arab Knowledge Report, 2009; 2010; Nour, 2010; 2013). The dominance of oil-based economies in the Arab region implies great risk and uncertainty because the heavy reliance on production and export of oil implies dependence on a single, decreasing, exhaustible and non-renewable economic resource. This impedes the creation of enabling economic environment for the transition to the knowledge-based economy that depends on knowledge, which is an abundant and renewable economic resource that can be easily diffuse and accumulate to prevent the diminishing returns to scale and ensure the increasing returns and dynamic growth in the economy. So Saudi Arabia face the challenge to utilize current oil revenues to build the economy on new and renewable sources of income, to facilitate transition and shift from the oil-based economy to knowledge-based economy and sustainable development in Saudi Arabia.

From economic perspective, the transition to knowledge-based economy in Saudi Arabia is also impeded by weak capacity for innovation required for the transition to knowledge-based economy in Saudi Arabia. Mainly, due to insufficient spending on R&D and scientific research, as Saudi Arabia is similar to other Arab countries do not spend more than 0.2 per cent of the annual GDP on research areas (see Figure 27). Moreover, Saudi Arabia faces economic challenge for allocation of the economic resources to different priorities, including, commit to the priority of the transition to a knowledge-based economy. The incidence of unemployment, mainly, youth unemployment in Saudi Arabia will intensify the competition for public financial resources to be allocated amongst economic growth, human and social development issues (education, training, and youth employment), creating jobs, and supporting of knowledge institutions. Creating jobs for the growing Saudi population of working age is a top priority for the government. Saudi Arabia government faces the challenge to allocate government funds to different priorities: employment and knowledge.

Therefore, our results in this section support the hypothesis concerning some progress in transition to knowledge–based economy in Saudi Arabia.

5. Conclusions

This paper discusses the progress in transition to a knowledge-based economy in Saudi Arabia. As for the methodology, this paper uses updated secondary data obtained from different sources. It uses both descriptive and comparative approaches and uses the OECD definition of knowledge-based economy and the World Bank Knowledge Index (KI) and Knowledge Economy Index (KEI) and other indicators often used in the international literature to examine progress in transition to a knowledge-based economy in Saudi Arabia. This paper is valuable because it adds to the existing studies in the regional and international literature and it fills the gap in Saudi Arabia literature by presenting a more comprehensive analysis and investigating recent progress in transition to knowledge-based economy in Saudi Arab. This paper is also consistent with the recent interest in Saudi Arabia to develop a comprehensive, pragmatic national strategy for transformation into knowledge society that appears from the National strategy for the transition to a knowledge society. Moreover, the results confirm the importance of supporting the efforts aimed at enhancing knowledge- based economy in Saudi Arabia.

Our findings imply significant improvement in the rank of Saudi Arabia over the period (2000-2012), mainly, Saudi Arabia has achieved rapid and fastest progress not only by regional standard (relative to Gulf and Arab countries) but also by international standard (relative to the world countries), in the international rank Saudi Arabia has climbed 26 places compared to 2000, obtaining 50th place in 2012 ranking, compared to 76th place in 2000 ranking.

Our findings support the hypothesis concerning some progress in transition towards knowledge-based economy in Saudi Arabia. Our results imply that the progress to knowledge-based economy in Saudi Arabia appears from slight improvement in terms of KI, KEI, ICT pillar, education pillar, economic incentive and institutional regime pillar, innovation efficiency index, knowledge creation index, knowledge impact index, knowledge diffusion index and technological infrastructure. This slight improvement was reduced by the observed deterioration in terms of innovation pillar, GII, knowledge absorption index, capacity for innovation, localization of technology and human capital. Finally, our results imply that from economic perspective, oil provides opportunity and challenge for transition to knowledge based economy in Saudi Arabia.

Based on the findings the paper recommends that to improve transition to knowledge economy, it is essential for Saudi Arabia to strengthen and improve KI and KEI by investing heavily in human capital, mainly, education and training, boosting innovation through intensive spending on research and development, improve innovation pillar, capacity for innovation, localization of technology, Global Innovation Index and knowledge absorption index.

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