Journal of Economic, Administrative and Legal Sciences
Volume (3), Issue (11) : 30 Nov 2019
P: 203 - 221
ISSN: 2522-3372
مجلة العلوم الاقتصادية والإدارية والقانونية
المجلد (3)، العدد (11) : 30 نوفمبر 2019 م
ص: 203 - 221

Benchmarking process of the knowledge economy pillars for sustainable development in Saudi Arabia

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Abstract: The fluctuations in oil price limit the ability to maintain growth in the long-run for oil-producing countries with heavy economic dependence on oil revenues. The Saudi government has initiated economic strategies with the aim of diversifying the economic base. Thus, the knowledge economy is important for Saudi Arabia in terms of offering other economic drivers to achieve sustainable economic development. So, the aim of this study is to assess Saudi's readiness for the knowledge economy through presenting the current situation of knowledge economy pillars in the country and then offer recommendations that could lead the Saudi Arabia to sustainable development. The analytical framework in this study is a comparative and benchmarking approach using AKI 2016, along with other indicators to assess Saudi readiness in respect of the key knowledge economy pillars. The study findings show that Saudi Arabia has achieved positive progress in knowledge economy pillars but the overall performance in knowledge drivers is not as competitive compared with the other members of the benchmarking group. A knowledge economy strategy that is comprehensive and integrated is required, in which all knowledge economy indicators are equally supported; setting specific time targets to implement the national strategy for the transition towards the knowledge economy will also be beneficial.

Keywords: AKI, Benchmark, Knowledge economy, KAM, KEI.

مقارنة مرجعية لركائز الاقتصاد المعرفي للتنمية المستدامة في المملكة العربية السعودية

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الملخص: تقلبات أسعار النفط تحد من القدرة على الحفاظ على النمو على المدى الطويل بالنسبة للبلدان المنتجة للنفط والتي تعتمد اعتمادا اقتصاديا كبيرا على عائدات النفط. فقد أطلقت الحكومة السعودية استراتيجيات اقتصادية بهدف تنويع القاعدة الاقتصادية. بالتالي اقتصاد المعرفة مهم للمملكة العربية السعودية من حيث تقديم دوافع اقتصادية أخرى لتحقيق التنمية الاقتصادية المستدامة. لذلك فإن الهدف من هذه الدراسة هو تقييم استعداد السعودية لاقتصاد المعرفة من خلال تقديم الوضع الحالي لركائز اقتصاد المعرفة في البلد، ثم تقديم التوصيات التي يمكن أن تقود السعودية إلى التنمية المستدامة. الإطار التحليلي المستخدم في هذه الدراسة هو منهج المقارنة المرجعية باستخدام AKI 2016، بالإضافة إلى مؤشرات أخرى لتقييم استعداد السعودية فيما يتعلق بأركان الاقتصاد المعرفي الرئيسية. أظهرت نتائج الدراسة أن المملكة العربية السعودية حققت تقدماً إيجابياً في ركائز اقتصاد المعرفة، لكن الأداء العام في الدوافع المعرفية لم يكن بالمنافسة مقارنة بالأعضاء الآخرين في المجموعة المرجعية. كما استخدمت الدارسة مؤشر التنافسية العالمية (GCI) الذي أظهر أن المملكة العربية السعودية شهدت عددًا من التحسينات على ركائزها التنافسية. لذلك فإن المطلوب تبني استراتيجية تكون شاملة ومتكاملة، حيث يتم دعم جميع مؤشرات اقتصاد المعرفة على قدم المساواة؛ بالإضافة إلى إن تحديد أهداف زمنية محددة لتنفيذ الاستراتيجية الوطنية للانتقال نحو اقتصاد المعرفة سيكون مفيدًا أيضًا.

الكلمات المفتاحية: AKI، المعيار، اقتصاد المعرفة ، KAM، KEI.

1. Introduction

In the past, exploitation of natural resources and the labor force was the engine of growth. But since the 1950s, the term knowledge economy has appeared to describe the shift from traditional economies to technological economies based on information and knowledge. Knowledge relies on value added to human capital to obtain highly skilled labor. This concept came from the economist Frizt Machlup in 1962, in a study published in the United States that measured the production and distribution of knowledge. Machlup wrote that knowledge as a communication process involves production and distribution. Knowledge is the formation of four components; R&D, education, information and communication (Godin, 2008). All economies have been based on knowledge since the time of the Industrial Revolution but its role has become greater now (Houghton & Sheehan, 2000). Knowledge application is now considered one of the key sources of growth in the universal economy and for greater social development and economics. The knowledge economy is important for economic growth which is why economists now include technology and knowledge in their models and theories (OECD, 1996). Additionally, knowledge-based capital is gradually becoming more driven towards growth and investment in OECD economies (OECD, 2012). Most countries that have applied a knowledge-based economy have achieved great economic benefits; therefore, this study will present some of the experiences surrounding the knowledge these countries have had.

1.1 The problem of the study

The problem of the study is that Saudi Arabia's economy currently being driven by non-renewable resources limits its ability to maintain growth in the long-run because of the fluctuation in oil prices. For an economy that depends on oil revenue, which fluctuates based on external factors, it is important to look for other sustainable economic ventures.

1.2 The importance of the study

This paper tries to build a significant contribution to the existing literature in the knowledge economy area through creating awareness among decision makers on the potential of continuing knowledge economy initiatives as a sustainable development option, and offering recommendations to Saudi's current economic challenges and future uncertainties.

1.3 Objective of the study

The objectives of this research are: to present the relationship between economic growth and sustainable development; and then to examine Saudi's readiness in undertaking the development of a knowledge economy through the examination of its current knowledge economy pillars. Finally, to offer recommendations that could assist the government in pursuing a practical strategy for developing a knowledge economy that would lead to sustainable development in Saudi Arabia.

The rest of this study is organized as follows: Section (2) provides the literature review. The status of the knowledge economy of Saudi Arabia and methodology comprise Section (3) and Section (4) respectively. Section (5) presents the benchmarking process. Finally, findings and recommendations are presented in Section (6).

2. Literature review

The literature review will comprise three aspects: (1) the first provides an overview of the knowledge economy. (2) The second section includes some studies that have discussed the relationship between a knowledge economy and economic growth. (3) The third section will display briefly the experiences of some countries that have applied a knowledge economy.

2.1 An overview of the knowledge economy

A knowledge-based economy is important due to it having features such as Information and Communications Technology (ICT), which is high and growing in intensity; thus, it can be used by well-educated knowledgeable employees. Knowledge intangibles have a growing share of GDP compared with physical capital (Brinkley, 2006). Moreover, the important features of a knowledge economy are networks and geographical clusters which allow organizations to arise, co-locate in different countries and to share the understanding of tacit knowledge. The economics of knowledge has new rules and characteristics different from ordinary goods, so economic activity is changing and the meaning of scarce resources is also changing (Houghton & Sheehan, 2000). According to ADB (2014), a knowledge economy can benefit all countries and sectors. For low-income economies there can be higher productivity and efficiency through the application of ICT, education, high skills and innovation. Also, low-income economies can benefit from e-learning, which can be used as an inclusive education and can reduce the cost of government services and delivery by the exploitation of technological options. Moreover, the principles of the knowledge-based economy can also apply to agriculture and service sectors, not only the industrial sector.

Related to the knowledge economy basic pillars, K4D (2012) has developed four pillars related to the knowledge economy index aimed at helping countries transfer to the knowledge economy; these pillars are education & skills, innovation systems, institutional & economic regime, and infrastructure of information & communication.

For Education & Human capital, information technologies (IT) have tacit importance and codified knowledge required for increasing various types of skills and knowledge. Computer literacy and access to networks is becoming more important than traditional literacy but the knowledge economy needs continuous learning of codified information and the competencies to use it. Tacit knowledge of skills is important in the labor markets as well as a necessity in the use of tools to handle that knowledge (OECD, 1996). Education is considered one of the most important factors in the forming of intellectual capital.

Therefore, investment in continuing education means a country can transfer to an innovational economy (Alkhimenko, Asaliev & Kuksova, 2014).

The second pillar is innovation; according to OECD (2004), multiple factors drive innovation, which involves the development of both explicit and tacit knowledge. In electronic networks there is dissemination of knowledge as well as established elements, such as R&D. Also, the innovation system indexes include articles in scientific and technical journals as well as patents (Tichá, 2007).

The economic and institutional regime is the third pillar; Debanth (2011) stated that the entire process of knowledge creation and dissemination in a knowledge economy is dependent on suitable government policies that come from economic incentives and institutional regimes. An economic incentive and institutional regime index are the systems that allow for the allocation of resources and stimulate creativity with efficiency, diffusion and use of present knowledge, through the provision of suitable economic policies and institutions (Tacon, 2012). An institutional regime has features that enforce and support the basic rules of commerce and protect property rights if the regime includes an accountable, effective and corrupt-free government and a legal system. Intellectual property rights are important as the absence of protection will obstruct new knowledge diffusion greatly and scientists and/or researchers' incentives to create new technological knowledge will be reduced (Chen & Dahlman, 2006).

The last pillar of the knowledge economy is ICT and includes a discussion by Chen and Dahlman (2006) that indicated active communication, diffusion, and the processing of knowledge and information results in an adequate and modern information and communication technology infrastructure. The ICT infrastructure refers to television, radio, computers, phones and the internet. ICT also consists of hardware, software, networks, and media for the collection, storage, processing transmission, and presentation of information in the form of voice, images, text, and data. In addition, innovation and productivity can constantly rise with increased flow of information and technologies. However, ICT is reliant upon three indicators: Computers, telephones and internet users and these indicators are used in calculating knowledge economy performance (World Bank, 2012).

2.2 Knowledge economy studies that discuss the relationship between knowledge economy pillars and growth

A study by Barro (2001) emphasized the role of education as a determinant of long-term economic growth through the analysis of a panel of 100 countries from the period 1965 to 1995. The results indicated that: growth is positively related to years of school attainment and the workers with an educational background would be complementary to new technologies. Moreover, in the future it is expected that half of the total GDP and total employment will come from knowledge-based organizations and knowledge-based industries (Brinkley, 2006). Also, Hanushek and WÖßman (2007) stated that

human capital in the labour force can be increased through education as that can raise labour productivity, which leads to a higher level of output. In addition, education can promote growth through raising the capacity for innovation and the knowledge economy for products, new technologies and processes. They found that there was a relationship between school attainment and growth rates and schooling increases growth in the long run by 0.58 % points (p. 4).

Aghion et al. (2009) indicated that the European Union's slow growth in recent years may be due to the low rate of investment in higher education, being 1.1% of its GDP compared with 3% in the US. Enterprises spend more money on R&D and have a high level of technical education that directs them towards innovation. It was also found that Europe, in the thirty years after World War II, showed growth had increased by investment in education (p. 3). Krueger and Lindahl (2001) found that the countries with the lowest levels of education had consistent results, indicating that education was statistically, significantly and positively associated with their growth. Sundać and Krmpotić (2011), in their study of 118 countries, examined the effect of various knowledge economy factors on GDP per capita and found that ICT and education are important factors that play a role in economic growth. Moreover, much of the research focus was on the relationship between technology and labour productivity and they reported evidence of positive strong links between labour productivity growth and investment in technology (Powell & Snellman, 2004). For the role of information & communication technology in economic growth, Chen and Dahlman (2006) claimed that ICTs are vital to the knowledge economy and have, in recent years, been seen as effective in the promotion of economic growth, as well as sustainable development. Also recognized in recent years are the features of ICT's that enhance productivity and show a variety of uses, which are included in all economic activity sectors (Warr & Ayres, 2012). A large knowledge economy leads countries to become wealthier and the key driver of productivity and longer term economic growth is R&D activity; thus, the UK government in 2014 said its ambition was to increase spending on R&D to 2.5% of GDP (Johnston et al., 2014).

In this context, ACT (2015) has used the knowledge economy with an innovation ecosystem to build a development strategy based on renewable energy, which has increased over the past five years to over 400% and with a growth rate that has increased four-fold.

2.3 Some countries' experiences with the knowledge economy to give a realistic example and lessons for developing countries

The OECD started a two year project for increasing the knowledge-based capital (KBC) entitled New Source of Growth. Research shows that there is a positive relationship between macro-economic growth, business investment in KBC and the change in productivity. Between 1995 and 2007, the 20 to 25% growth of labour productivity in Europe was explained by investment in KBC. Also, in the United States, 27% of labour productivity growth was the result of investment in KBC (OECD, 2012, PP. 3-7).

Finland is an example of a country which has shifted from an economy based on forestry and paper production into becoming a global mobile leader (Powell & Snellman, 2004). According to BlomstrÖm, Kokko and SjÖholm (2002), Finland's GDP growth rate increased to 4.7% between 1994 and 2000, compared with -3.5% in 1991-1993. This growth resulted from increased investment in R&D (p. 8).

Between 1991-1993 Swedish development was hit by the financial crisis but it regained its competitiveness, production, incomes and exports. Thus, Sweden is another example of a country with experience of the knowledge-based economy through investment in R&D (BlomstrÖm, Kokko & SjÖholm, 2002). Singapore's real GDP per capita matched most European countries; it was fast transforming into a base for labour intensive manufacturing. Then, it became a location for foreign multinational companies for regional head office services and as a financial centre, getting an advantage from an inflow of technology from abroad (BlomstrÖm, Kokko & SjÖholm, 2002). Korea is an example of developing each of the pillars of the knowledge economy, which has resulted in rapid economic growth over the past four decades. Particularly, the Korean government's role was important and effective, and technology was also mastered gradually and raised throughout the stages of industrialization (Suh & Chen, 2007). Another example is China; Dahlman and Aubert (2001) stated that "For a long part of history, China was the largest and most advanced economy in the world" (p. 1). In brief, the reasons for economic progress in China were the trend towards industrialization and the orientation to build a knowledge-based economy. Also, China was open to the world and strategically planned to develop industries, as well as encouraged innovation and scientific research (Riyadh Economic Forum, 2009). The final example in this study is Malaysia, which leapfrogged from an industrial society to post-industrial through ICT, and employed economic targets called the national vision 2020 projection. It included efficacy of the strategic intervention approach which included political visionary leadership, creative planning processes and institutional reform. Also, partnerships between public, private and civil society sectors have to be made (Shariffadeen, 2008). There are other countries that have a plan for the application of knowledge in the future, such as the UK, which has built its vision for the future. The UK output was lost during the 2008 to 2009 recession but it will have successfully recovered by 2020 and unemployment will have returned to levels before the recession. This succeeding and flourishing will result in sustained growth in the UK's knowledge economy (Levy, Sissons & Holloway, 2011). Looking at the experiences of countries using the knowledge economy, they are achieving tangible progress in all pillars of the knowledge economy simultaneously with a focus on education and training. Also included are the government initiatives in the development and support knowledge pillars, with the gradual participation of the private sector (Riyadh Economy Forum, 2009). In general, these experiences can give policy lessons and conclusions to today's developing countries, such as recognizing there are opportunities where they have to catch up.

In the Arab region, a knowledge economy exists; however, its variation depends on the structure of the economy and the progress of knowledge is poor and still slow due to the environment not being

convenient for the knowledge to be used effectively (Nour, 2013). A precise knowledge-based economy is important for developing countries and a study about the Arab world by Alroubaie (2013) has highlighted the importance of knowledge for sustainable development. Since knowledge has become a global good and is considered a determining input for the new economy, the Arab world can exploit this to gain knowledge through building knowledge capacity.

Two studies by Alrahbi (2008) used Knowledge Assessment Index (KAM) to evaluate the knowledge economy pillars in Oman. Also, Bashir (2013) employed benchmarking using a KAM approach to assess the knowledge economy indicators for Pakistan.

3. The status of knowledge economy in Saudi Arabia

Education pillar: Saudi Arabia's education pillar has leaped an impressive 30 spots to 58th place due to significant improvements in gross secondary enrollment rates (World Bank, 2012). Saudi Arabia has been taking steps towards a knowledge age through: (1) establishment of the Afaq programme by the Ministry of Higher Education to develop a future plan for the university educational system in the long-run from 2005-2030. The project supports scientific research needs within the knowledge society. (2) King Abdullah scholarship programme established in 2005 that gave opportunities for 5000 young Saudis to study abroad from 2007-2008. Also, the King Abdullah University of Science and Technology (KAUST) opened in 2009 to focus on research. The King Abdullah Project in 2009 for General Education Development was established for lower education levels to transfer to an excellence model with $2.4 billion in funding. The population in Saudi Arabia is young but that serves the knowledge economy due to their ability to adapt to higher education (Gallarotti & Alfilali, 2013).

ICT pillar: Saudi Arabia has had a substantial strengthening of its ICT pillar because of the rapid growth in telephone, computer and internet users (World Bank, 2012). The Saudi Arabian ICT score is 8.33 occupying 21st place, which means the country, in terms of information and telecommunications, is one of the hardest-wired nations in the world. Infrastructure, at the beginning of the decade 2002-2010, had shown advances in many aspects, such as an increased demand for electricity, a rise in commercial and industrial sea port activity, an increase in paved roads, telecommunications and in internet users (Gallarotti & Alfilali, 2013). Also, a National e-Government Program was launched by the Saudi Arabian government to build on the foundation of the knowledge economy and improve the public sector (Bashehab & Buddhapriya, 2013).

Innovation and R&D pillar: the Saudi Arabian R&D and innovation score is 84. The Saudi government in 2000 created the Saudi Arabian General Investment Authority (SAGIA) to formalize economic liberalization in the country. The SAGIA plan to launch six economic cities was completed in 2020 and these industrialization cities aim to diversify the economy and contribute $150 billion to GDP. The government allocated over $60 billion for the construction of four of the cities: King Abdullah

Economic City, Prince Abdul Aziz bin Musaid Economic City, Knowledge Economic City and Jazan Economic City, all with advanced IT, media, research centers and free-trade zones (Gallarotti & Alfilali, 2013). Higher education has done much to support growth in technology. Research centers at the universities are guided by R&D for the building of knowledge centers, such as the Riyadh Techno Valley of King Saud University, and the Dhahran Techno Valley of King Fahd University of Petroleum & Minerals (Gallarotti & Alfilali, 2013). Moreover, Alsodais (2013) stated that Saudi Arabia, in order to build a knowledge economy, developed a strategy called the National Science, Technology and innovation Plan (NSTIP) to support innovation. Meanwhile intellectual property laws (IP) were revised to be more effective during the enhancement of creativity and innovation thus demonstrating the Government's commitment by launching a number of initiatives to encourage Saudi inventors and to promote IP awareness. However, the total expenditure on scientific research to the GDP was 0.9% in 2012, considered small compared to the total of GDP (General department of planning , 2014). But over time Saudi Arabia has been on its way to shifting from an oil economy to knowledge economy with reform of research institutes, creating top-tier universities and investing in one of the largest overseas education scholarships, which has led the country to become one of the most important players in scientific research in the Middle East (Nature Index, 2018).

The economic and institutional regime (EIR) pillar: the EIR indicator is 60. In the Eighth Development Plan, the government of Saudi Arabia has adopted an ICT national plan to establish a knowledge economy in cities across the country and to support its production and competitiveness. It is continuous in its efforts in the Ninth Development Plan toward a knowledge economy by focusing on human resources development (Bashehab & Buddhapriya, 2013). For the regime, Gallarotti and Alfilali (2013) indicated that King Abdullah has a combined political agency and economic development for historic reforms in Saudi Arabia through the creation of a National Dialogue, commissions on human rights, the struggle against corruption, social reforms, education and political systems, all of which establish more commitment to liberal tendencies.

4. Methodology

The study will apply a benchmarking process in analysing the secondary data, through tools known as Arab Knowledge Index 2016, as well as using other indicators, such as the Global Competitiveness Index (GCI) 2017-1018. These tools help countries to know their economic performance relative to their competitors and neighbors, which could help them to improve their growth in the global environment.

The benchmarking process is a reliable technique and useful for developing countries to know their current position in terms of knowledge economy through comparing with other countries. Saudi

Arabia has been benchmarked against its neighbors (the Gulf Cooperation Council (GCC) countries) who have similar socio-economic characteristics to Saudi Arabia.

5. Benchmarking process

5.1 Main economic performance indicators

GDP growth is used to explore the overall performance of a country's development. Figure 1 presents the overall economic performance of the benchmarking group from 2006-2016. It shows that Saudi's overall economic performance seems strong in terms of growth rates, which in turn is affected by an increase in oil prices during this period. However, Figure 2 shows GDP and GDP per capita growth in Saudi Arabia from the period 2006-2016, and reveals the absence of stability of GDP growth rates, which reflects the dependence of Saudi's economic performance on oil revenues.

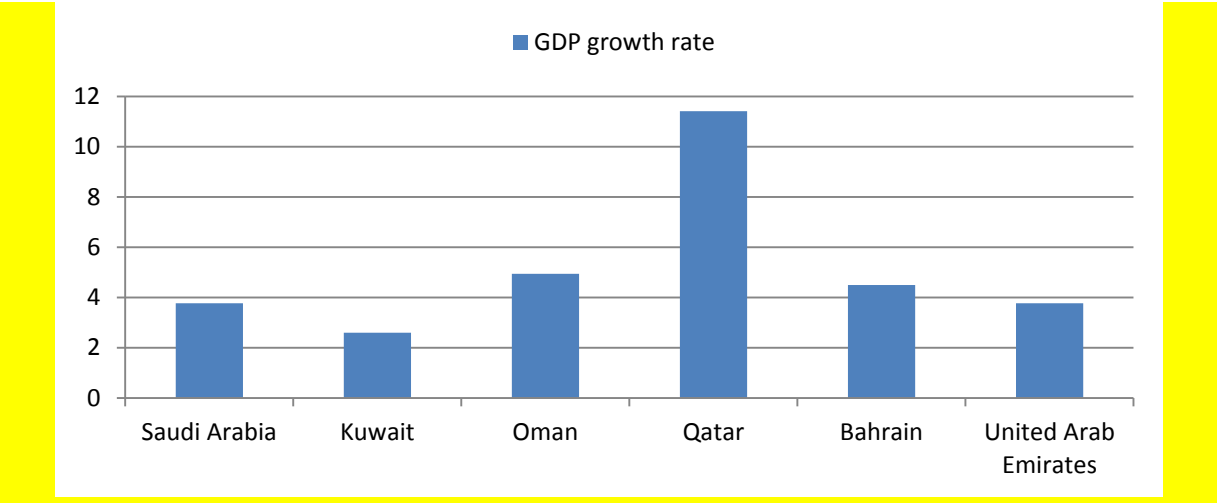

Figure (1) Overall economic performance of the benchmarking group, 2006-2016

Source: World Bank database.

It is worth mentioning that the contribution of the oil sector to GDP has declined gradually, reaching 24.8% in 2016 compared to the contribution of the non-oil sector, which reached 74.8% in the same year (SAMA, 2017, p. 124).

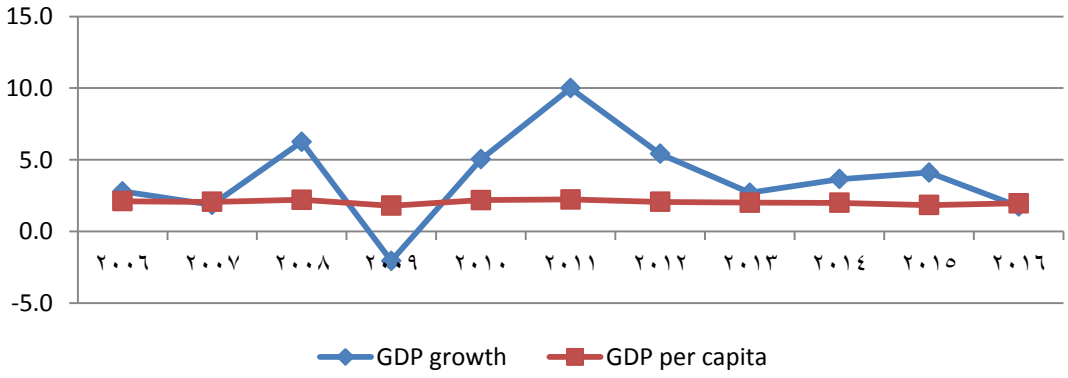

Figure (2) GDP and GDP per capita growth in Saudi Arabia, 2006-2016

Source: World Bank database.

5.2 Arab Knowledge Index 2016

In general, there are many indicators related to various developmental areas that help to improve knowledge in the Arab region in terms of opportunities and obstacles, such as The Knowledge Economy Index (KEI). The KEI, an interactive online benchmarking tool developed by Knowledge for Development (K4D) at the World Bank Institute, consists of a set of 83 structural and qualitative variables as proxies for knowledge economy pillars for helping countries to identify the problems and opportunities they face in transferring to a knowledge economy. It summarizes each country's performance on 12 indicators corresponding to the four knowledge economy pillars (World Bank Institute, 2008).

Based on KEI 2012, Saudi Arabia was ranked 50th in 2012 compared with 76th in 2000, but knowledge economy pillars performance is uneven (Gallarotti & Alfilali, 2013).

These indicators remain unable to access the specificities of the Arab situation. Most of the current indicators do not take into account the multiplicity of human societies, diversity, different cultures and economic levels. Thus, the concept of the Arab Knowledge Index (AKI) was born. The AKI was developed based on six essential components: (1) pre-university education; (2) higher education; (3) technical vocational education and training (TVET); (4) R&D and innovation; (5) information and communications technology (ICT); (6) the economy. Figure 5 shows these six components, which are referred to as sub-indices (Griss et al., 2015).

This section will illustrate the current readiness of Saudi's knowledge economy drivers or pillars using these six indicators through the tool known as AKI to evaluate Saudi's knowledge economy preparation. Therefore, the comparison in this section will be done with only the GCC countries using the same method as the AKI 2016.

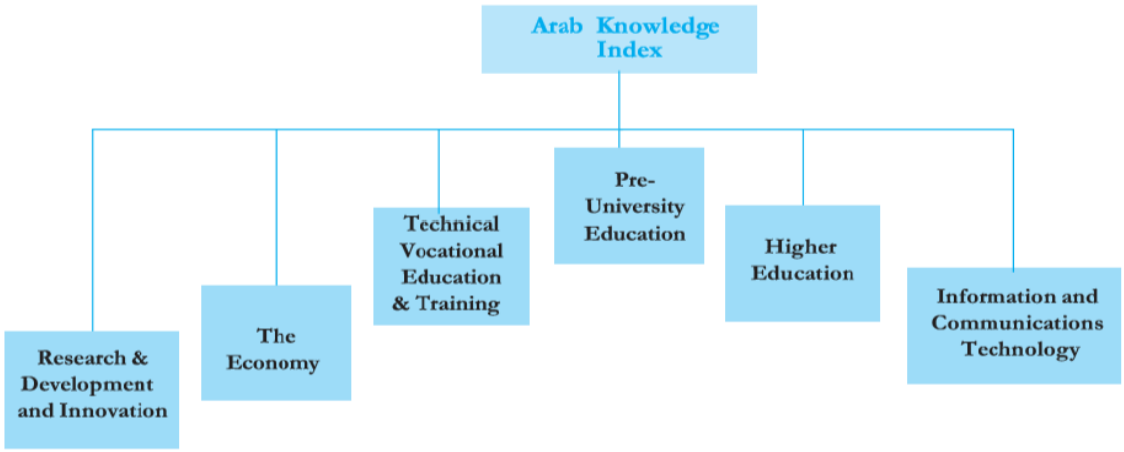

Figure (3) AKI components

Source: AKI (2016), p.7.

Each AKI indicator in Figure 5 has pillars: (1) the pre-university education is a composite index based on the four key foundations (general developmental context; enabling environments; knowledge capital; and management and governance of the educational system). (2) Technical Vocational Education and Training has three pillars: development context education, training and organizational framework. (3) The economy indicator has three pillars: organisational performance & human resources, competitiveness & creative development, and economy-related ICTs. (4) Higher education has three pillars: higher education inputs, outputs and processes. (5) Information and communications technology has two pillars, which are enabling environment and technological capabilities. (6) Finally, the research, development and innovation indicator has three pillars: R&D, innovation and enabling environment and infrastructure (Griss et al., 2016). Based on AKI 2016, the six indicators were calculated on a scale from 1- 100.

5.2.1 Assessment of AKI for Saudi Arabia

This study used AKI 2016 as a tool to assess Saudi Arabian readiness for a knowledge economy and to compare the Saudi performance for the knowledge pillars with other countries. Thus, Figure 4 summarizes how Saudi Arabia performed in each of the six pillars and their indices, and Figure 5 shows the GCC countries' performance in all knowledge economy pillars.

As Figure 4 reveals, there are high scores and low scores for knowledge drivers. In the pillar of economy, the indicator is 62.45, Saudi Arabia demonstrated improvements in economy-related ICTs but organisational performance and human resources indicator, as well as competitiveness and creative development indicator, need to improve. In pre-university education, the pillar performance score is 69.31, which is positive and the highest score compared with the other six indicators of the knowledge economy. For indices of this pillar, the country score in the enabling environment index is low compared with other indices (knowledge capital and development context scores are 82.5 and 73.4, respectively). In the pillar of higher education, the Saudi score is 56.54, lower than the performance of other pillars. As shown in Figure 4, the higher education outputs index is lower than other indices for this pillar. For the technical vocational education and training pillar, the Saudi score is 54.33, which is positive but it is the lowest score compared with the other pillars. In terms of indices, the education and training score is low compared with other indices for this pillar. In information and communications technology (ICT), the Saudi score is 69.22, which is positive and the highest of the pillars. Both indices of this pillar are positive. In the R&D and innovation pillar, the Saudi score is 61.12, which is also positive but research and development indices need to improve (see Appendix 1).

From Figure 5, the pillar of economy indicator is 62.45, which falls behind other GCC countries, such as Qatar and United Arab Emirates (UAE). In pre-university education, the pillar performance score is 69.31, which is positive but lower than other GCC countries. For the Higher education pillar the Saudi

score is 56.54, which is better than other GCC countries except UAE. For the technical vocational education and training pillar, the Saudi score is 54.33, which is positive but lower than most GCC countries. In information and communications technology (ICT), the Saudi score is 69.22, which is positive but lower than UAE, Qatar and Bahrain. For the R&D and innovation pillar, the Saudi score is 61.12, which is also positive and on average close to the UAE and Qatar score.

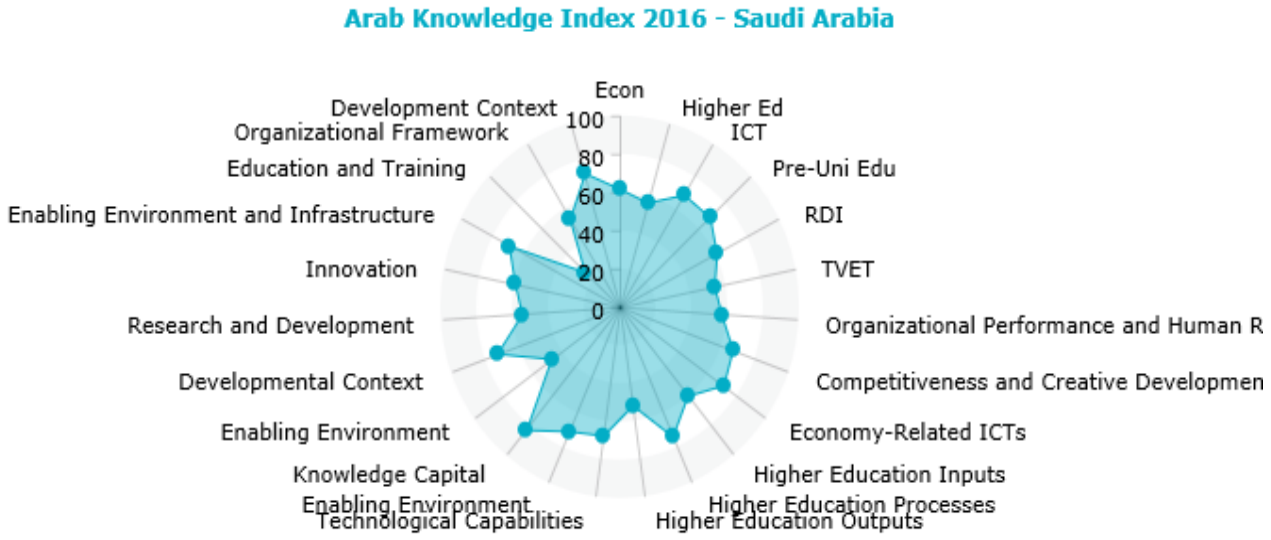

Figure (4) AKI for Saudi Arabia 2016

Source: AKI database, (2016)

Generally, comparing Saudi Arabia with other GCC countries, the results show that United Arab Emirates is the strongest in all pillars then Qatar. But Saudi Arabia is stronger than Qatar for one pillar, which is higher education, while there is almost one point difference in the R&D indicator in favor of Qatar. In sum, the findings suggest that Saudi Arabia achieved a positive position in knowledge economy pillars but is still not competitive compared with the benchmarking countries group.

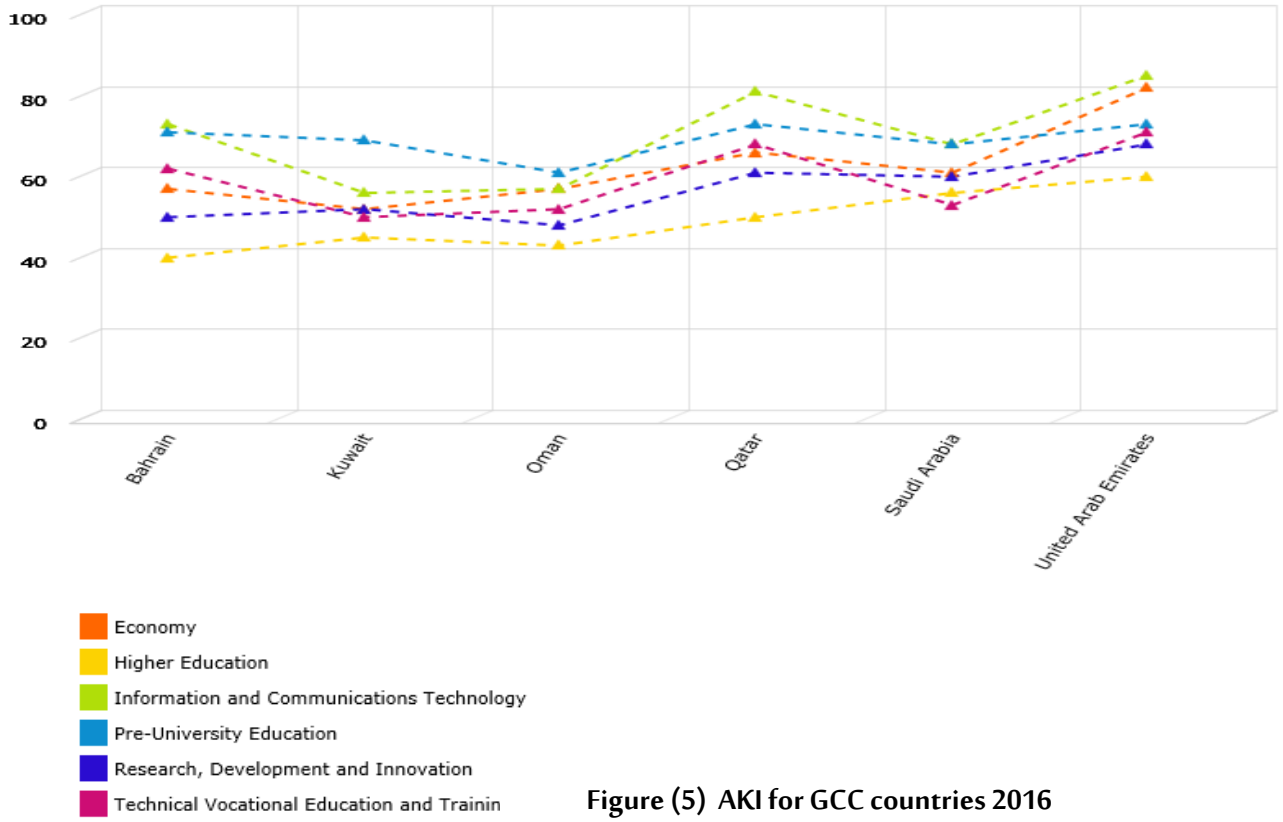

Figure (5) AKI for GCC countries 2016

Source: AKI database (2016)

5.3 The Global Competitive Index (GCI)

In 2004, the World Economic Forum established the GCI, which is an annual report to assess the ability of countries to provide affluence to their citizens by using available resources. This report employed the global competitiveness standard to ranks countries. The GCI measures the range of institutions, policies and factors that determine the prosperity of the economy at the present time and for the future. This index has twelve pillars related to knowledge economy pillars (see Figure 8).

Assessing the GCI for Saudi Arabia, based on the GCI 2017-2018 report, Saudi Arabia is ranked 30th out of 137 in global completion, which means Saudi Arabia slips one position from 29th (compared with the previous report), with a relatively stable overall performance. Financial market efficiency (down 10 places to 56) has declined as credit growth slowed and interest rates increased in 2016 but the macroeconomic environment after the 2015 oil price shock has improved slightly. Saudi Arabia has a stable good-quality infrastructure, the largest market in the Arab world and stable institutions. For the labour market, the most challenging aspect for doing business is restrictive labour regulations: the labour market is divided between different population groups and women remain largely excluded. The lack of

adequately educated workers needs changing to advance the quality of education to align with economic needs (GCI report, 2017-2018).

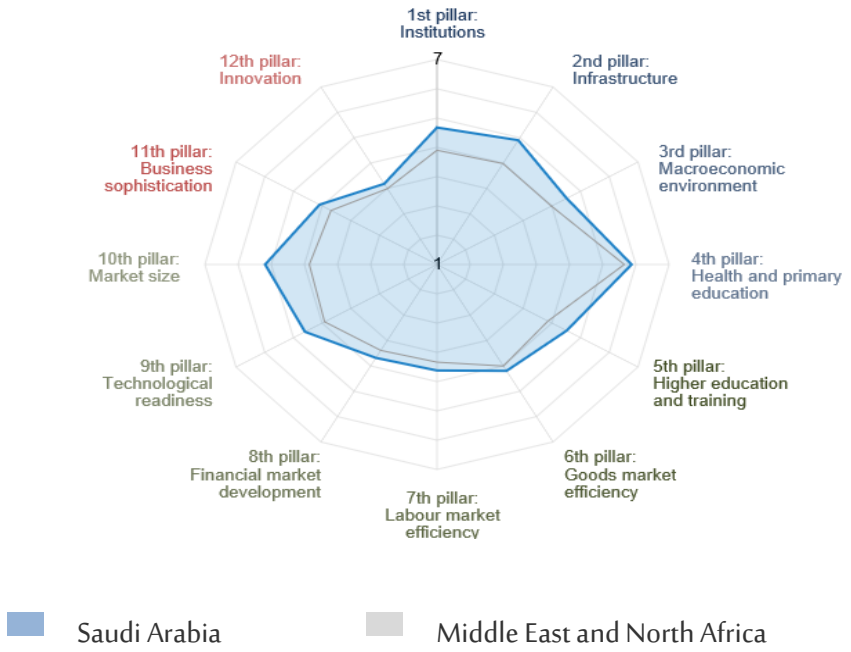

Figure (6) Global Competitiveness Index 2017-2018 score (1-7)

Source: Global Competitiveness Index 2017-2018, database.

Comparing Saudi Arabia with the GCC countries, Saudi Arabia is ranked 30th in the global competition, which is higher that Bahrain's, Kuwait's and Oman's ranking (see Table 1).

Table (1) The Global Competitiveness Index of the GCC countries 2017-2018

Country	GCI rank/137 country/economy
United Arab Emirates	17
Qatar	25
Saudi Arabia	30
Bahrain	44
Kuwait	52
Oman	62

Source: GCI, 2017-2018.

6. Findings and Recommendations

The objective of this study was to understand Saudi Arabia's strengths and weaknesses in terms of knowledge economy readiness. A benchmark technique was employed in this study to explore Saudi's position in terms of knowledge economy indicators. The benchmarking process of AKI 2016 reveals that Saudi's economy indicator was 62.46, which indicates that:

1- The Saudi economic climate is appropriate to apply knowledge for sustainable economic development.
2- The benchmarking approach showed that pre-university and ICT seem to be the strongest pillars in Saudi Arabia followed by economy and R&D indicators.
3- The government spending on human resource development is continuing to increase from 148307 million in 2011 to 191572 million in 2016 (SAMA, 2017, p. 118).
4- Saudi Arabian spending on ICT was 111.98 billion Riyals in 2014. The spending was for telecommunication services, hardware, IT services and software which accounted for 65%, 23%, 8%, and 4%, respectively. The ICT investment in the country in 2014 was 17.83 billion Riyals. Also, the gross value added to the Saudi Arabian ICT sector was estimated to be 26.57 billion Riyals. The national policy that included diversification of the economic income base drove the ICT investment in Saudi Arabia (CITC, 2015, p. 7).
5- For scientific research, Saudi Arabia over the past four years in the Nature index rating increased to be the second highest country in the Western Asia region (Nature, 2018).
6- Saudi Arabia has adopted a strategy to transform into a knowledge economy, vision 2030, which includes three themes: (1) vibrant society. (2) Thriving economy, which includes four goals; open business, investment for long-run, rewarding opportunities and leveraging its unique position. (3) An ambitious nation that focuses on many aspects, such as a raised ranking in the Government Effectiveness Index, from 80 to 20 and raised ranking from 36th to be among the top five nations on the E-Government Survey Index (The 2030 Vision, 2018).
7- The GCI report shows that Saudi Arabia has seen a number of improvements to its competitiveness pillars.

Based on these findings, the country will be transformed to a knowledge economy, which means that Saudi Arabia is on its way to a knowledge economy.

There are, though, some key lessons from this study for Saudi Arabia:

1- Try to benefit from other countries' experiences of a gradual, coordinated and complementary development of all knowledge economy pillars.
2- Government, the private sector and civil society are necessary to building national strategies which could help to achieve high rates in knowledge economy drivers.

3- Increase investment in scientific research and improve indicators of the economy and ICT, as well as human capital.
4- A knowledge economy strategy is required to be comprehensive and integrated in which all knowledge economy indicators are equally supported.
5- The transfer from an oil economy to knowledge economy needs time, so specific time targets to implement the national strategy for the transition towards the knowledge economy will be beneficial.

In view of the above, success along these indicators of the knowledge economy would lead Saudi Arabia to more sustainable development. For further research, Saudi studies could use the European countries as a benchmark instead of the GCC countries because the Saudi Crown Prince stated that "the Arab countries have witnessed a major development in their economies in recent years, and the Middle East will be the new Europe in the next five years" (Future Investment Initiative, 2018).

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Appendix (1)

Saudi Arabia's AKI 2016 for all indicator of knowledge economy

Country	Saudi Arabia
Economy	62.4569
Organizational Performance and Human Resources	56.607
Competitiveness and Creative Development	66.6944
Economy-Related ICTs	70.7253
Higher Education	56.5354
Higher Education Inputs	60.4722
Higher Education Outputs	51.5849
Higher Education Processes	74.4281
Information and Communications Technology	69.223
Enabling Environment	70.7764
Technological Capabilities	67.6696
Pre-University Education	69.3058
Knowledge Capital	82.5867
Enabling Environment	47.4051
Development Context	73.4985
Research, Development and Innovation	61.1207
Research and Development	55.209
Innovation	60.4178
Enabling Environment and Infrastructure	69.7058
Technical Vocational Education and Training	54.3336
Development Context	73.4985
Education and Training	27.4548
Organizational Framework	54.1415

Source: AKI database, 2018.