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Examining Sudanese Economy's Readiness to be a Knowledge-Based Economy

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المستخلص:

تهدف هذه الدراسة الى تحليل جاهزية الاقتصاد السوداني للتحوّل الى اقتصاد معرفة ، كما تهدف الى تحديد مؤشرات اقتصاد المعرفة التي تؤدي الى تحقيق تنمية مستدامة في السودان.

أجريت هذه الدراسة باستخدام اسلوب المعايرة باعتماد مؤشر اقتصاد المعرفة (المعتمد من البنك الدولي) والذي يستند على حزمة من الركائز، والتي تضم: مؤشر الابتكار والبحث والتطوير، مؤشر التعليم ، مؤشر البنية التحتية المبنية على تكنولوجيا المعلومات والاتصالات ، ومؤشر الحوافز الاقتصادية والحاكمة الرشيدة. تمت معايرة اقتصاد السودان باقتصاديات الدول العربية والتي يقع ضمن منظومتها (الاقتصادات ذات الدخل المنخفض والمتوسط) وهي مصر، الجزائر ، سوريا ، المغرب، اليمن وموريتانيا (باستخدام احدث البيانات). وقد أظهرت نتائج المعايرة استعداد منخفض وضعيف لاقتصاد السودان في كل مؤشرات اقتصاد المعرفة مقارنة بهذه الدول.

ABSTRACT:

The aim of this study is to explore the readiness of Sudanese economy to be a knowledge-based economy, and to determine the basic knowledge economic factors for achieving sustainable development in Sudan. The study has been carried out using the benchmarking process depending on the Knowledge Assessment Methodology(KAM) indicators adopted by the World Bank, which used the following indicators: innovation, research and development; education; infrastructure based on Information and communication technology (ICT); economic incentives; and regime (governance). Sudan has been compared with the Arab Countries from the Lower Middle Economies which include (Algeria, Egypt, Syria, Morocco, Yemen and Mauritania) using recent data. The study revealed a very low level of readiness in Sudan economy compared to those countries as far as the key knowledge economy indicators are concerned.

Keywords: Knowledge economy; Benchmarking; Knowledge economy index; Knowledge economy indicators (pillars), ICT.

INTRODUCTION:

The world economies are experiencing a great transformation from traditional economies (where factors of production include land, capital, and labor) to knowledge based economies (where knowledge is the key factor of production). Knowledge becomes the main tool of economic development in all over the world economies. Factors of knowledge includes items as how people use their education and skills; innovation; entrepreneurship; training support; communication and information technologies; and research and development.

THE STATEMENT OF THE PROBLEM:

In Sudan, we can easily witness the wide development of the main indicators of knowledge based economy, but many problems still surround its diffusion and adoption. Since Knowledge economy is more than an economic terminology, it is a long term transformation process from traditional economy to knowledge-based economy; this massive transformation requires social, political and cultural factors since it affects humans, organizations, business and politics. These factors received less attention when setting the strategic agenda in Sudan.

It becomes very vital to identify to what extent Sudan is able to acquire and build a knowledge economy? Is it possible that Sudan will adopt a knowledge-based economy? What are the actual potentials needed to build a knowledge economy in Sudan? What are the main challenges facing Sudanese government and what are the urgent needs required for exploring potential alternatives that assist in facing these challenges?

These factors have a significant role in shaping the way of life and even the decision making process in Sudan. Therefore, better adoption can be achieved by directing the efforts and decisions to make the right choices and actions.

OBJECTIVES:

The objectives of this study can be stated as:

- 1.To analyze the potential factors of the Knowledge economy in Sudan; and to examine Sudan's readiness in undertaking the development of a knowledge economy.
- 2.To determine the current readiness of Sudan's knowledge economy indicators in terms of innovation (research and development); education; ICT infrastructure and economic incentives and regime (governance)?

QUESTIONS:

In this study, the main question is:

Q1. What is the current readiness of Sudan's knowledge economy indicators in terms of innovation (research and development); education; ICT infrastructure and economic incentives and regime (governance)?

HYPOTHESIS:

H₀: There is a low level of readiness for Sudan Economy to be a knowledge-based economy as compared to lower middle income Arab countries.

IMPORTANCE OF THE STUDY:

The studies and the publications concerning the analysis of knowledge-based economy especially in the Arab countries in general and in Sudan in specific are either very rare or concentrated in analyzing knowledge-based for developing economies. This study can be considered as an addition so far that will be conducted on Sudan. It reflects the importance of analyzing the indicators of knowledge economy in Sudan. This study offers policy makers the opportunity to understand, and be better able to analyze Sudan economic situations on the macro level particularly those related to sustainable economic development.

The findings of the study can be applied in Sudan and other countries that share similar cultural, religious, and economic backgrounds.

METHODOLOGY:

Research is a systematic process of inquiry to explore and discover knowledge about something happening or existing in society, science or nature. The main methodology used here is the KAM (the benchmarking methodology). The benchmarking methodology provides an analytical tool for policy-makers to identify strong or weak areas in their country's performance on the four drivers of knowledge Economy.

The KAM is a user-friendly interactive Internet-based tool that provides a basic assessment of countries' and regions' readiness for the knowledge economy.

KAM utilizes indicators, scorecards and indexes that represent the knowledge economy readiness and compares a given country with its neighbors, regions, and competitors or even with selected leading countries.

The benchmarking process for this study uses the knowledge assessment methodology (KAM). This has been developed by the World Bank Institute to test a country's readiness for a knowledge economy compared with other regions and countries. The world's overall knowledge economy average provides a good indicator of a country's specific status and could be utilized to generate a reasonable understanding of Sudan's current knowledge economy readiness.

DATA COLLECTION SOURCES:

We would use two sources of secondary data:

1. References, Books, journal articles, previous studies, publications, annual reports etc.
2. Secondary sources of the World Bank Knowledge Economy Index. The benchmarking process from the World Bank knowledge economy index will be applied in analyzing the secondary data.

THE LIMITATIONS

- a. This study use only one methodology which is the knowledge assessment methodology (using benchmarking methodology). Benchmarking is important in measuring outcomes (but not causation) of policies. It allows comparisons between countries and indicates how well countries are doing compared with others in terms of their adaptation, mastery and development of different indicators.
- b. This study was conducted in one country with less socio-economic development levels. The findings based on this research may be possible to generalize only to other similar countries with the same socioeconomic situations.
- c. The research paper covers the most recent periods in Sudan. The period is not determined by an exact date; rather it depends on the availability of data.

KNOWLEDGE:

Knowledge has many definitions: knowledge is defined as: "Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject". (Knowledge is also defined as: Knowledge in an economic context can be thought of as a type of instruction or recipe that sets out how a good or service can be produced. Innovation, on the other hand, is "the successful development and application of new knowledge".

Adam Smith the father of Economics had discovered the importance of knowledge when he applied the division of labor to the growth of knowledge, he mentioned the role of men of speculation, whose trade is not to do anything, but to observe everything; and who upon that account are often capable of combining together the powers of the most distant and dissimilar objects".

The economic exchange of knowledge was first developed and stabilized as distinct from the exchange of commodities within the context of the market economy. For example, the patent system can be considered as a typical product of industrial competition in the late nineteenth century.

Knowledge as a good has many non ordinary features: *non rivalry*: knowledge is not diminished by consumption; *fixed or zero marginal cost*: the subsequent uses of the idea are possible at zero marginal cost; *Non-excludability*: knowledge is a continuum, once knowledge is produced people has a continuous access to it; and *a cumulative and progressive good*: existing knowledge is the only factor to produce new knowledge.

KNOWLEDGE ECONOMY:

Knowledge economy has also many definitions:

The KAM Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge. This is an indication of overall **potential** of knowledge development in a given country. Methodologically, the KI is the simple average of the normalized performance scores of a country or region on the key variables in three Knowledge Economy indicators – education and human resources, the innovation system and information and communication technology (ICT) .

SUDAN: ECONOMY:

The Gross Domestic Product (GDP) in Sudan was worth 64.05 billion US dollars in 2011, expanded by 2.80 percent in 2011 from the previous year.

Table 1 Macroeconomic Indicators (Figures for 2010 are estimates; for 2011 and later are projections)

	2010	2011	2012	2013
Real GDP growth	5	2.8	2	2.8
Real GDP per capita growth	2.5	0.4	-0.4	0.4
CPI inflation	13	15.3	19.8	17
Budget balance % GDP	-3.1	-4.3	-3.4	-4.3
Current account % GDP	-6.4	-7.5	-12.3	-8.0

Source: African economic outlook

Real gross domestic product (GDP) is expected to grow modestly in 2012 and 2013 owing mainly to the loss of oil revenue and population following the secession of South Sudan in July 2011.

The net primary school enrolment rate for the population 6-13 years old in Sudan was 69% for males and 64% females. For secondary education it was 21% males and 23% females. In terms of labor force participation, males constitute 38.3% while the share of females stood at 14.1%. According to the available recent data, unemployment among men stood at 13 % compared to 20% for women. Women occupy 28% of the seats in the newly elected parliament in 2010.

According to the Global Innovation Index 2013: Sudan has a very low ranks according to score (19.81) with a rank of 141; compared to its comparators in middle income group, with a rank of 35; compared to sub-Saharan countries with a rank of 32 and an *efficiency* rate of 0.49 with a rank of 138.

Sudan's ICT development Index has changed from the rank of 131 in 2007 to the rank of 120 in 2012 which means that there is a remarkable development in ICT field in Sudan.

SUDAN KNOWLEDGE ECONOMY INDEX:

This section presents Knowledge Economy Index (KEI) rankings 2012 for Sudan 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 indicators of the knowledge economy: economic performance; economic incentive and institutional regime, education, the innovation system and ICT.

Each of the pillar sub-indexes are in turn based on four indicators that proxy the performance of indicator. 18 knowledge indicators have been used to compile the four pillars of the KEI

Table 1.1 presents Sudan's performance on the aggregate KEI and KI performance and rank during 1995-2012:

Table 2 Sudan KEI and KE rank (1995-2012)

Sudan	1995			2000			2012		
	Rank	KEI	KI	Rank	KEI	KI	Rank	KEI	KI
	138	2.08	2.54	1.35	1.35	1.62	137	1.48	1.82

Source: KAM World Bank 2012

Table 1 provides Sudan's knowledge competitiveness as *slightly improved* over the past 17 years, with the ranking rising from 138 in 1995 to 137 in the current 2012 rankings. The KEI and KI have declined from 2.08 and 2.54 in 1995 to 1.48 and 1.82 in 2000 respectively. Knowledge index consists of knowledge economy index (KEI) {is also called economics and institutions regime and knowledge index) and (KI) (consists of education index, innovation index and ICT index).

SUDAN KNOWLEDGE ECONOMY INDICATORS:

Table 3, Figure 1 presents Sudan knowledge economy indicators for the period (1995-2012) extracted from the World Bank's Knowledge Assessment Methodology (KAM). They reflect Sudan's performance on the aggregate KEI (consisting of four pillars) and on individual indicators is compared with rest of the world (for the periods 1995-2000 and 2012. Sudan's knowledge competitiveness has improved over the 1995-2000 and 2012 years, with the ranking rising from 131th, 132th in 1995 and 2000 respectively to 122nd in the current 2012 rankings.

During the same period Sudan has shown different degrees of progress in KEI pillars: In the pillar of Economic Incentive Regime (EIR) the country shows a negative progress and ranked 138th, 142nd and 142nd as compared with rest of the world.

In the pillar of Information Communications and Technology (ICT) Sudan demonstrated a significant improvement and ranked at 104th in the world in terms of the ICT pillar ranking. In Education pillar, Sudan's performance is deteriorated with ranks of 127th (1995), 124th (2000) and 131 (2012) is far below and is significantly lagging the other world countries.

In Innovation pillar, Sudan has a weak performance with ranks of 134th, (1995) and 141th (2000 and 2012) remains significantly weak when compared to other world economies.

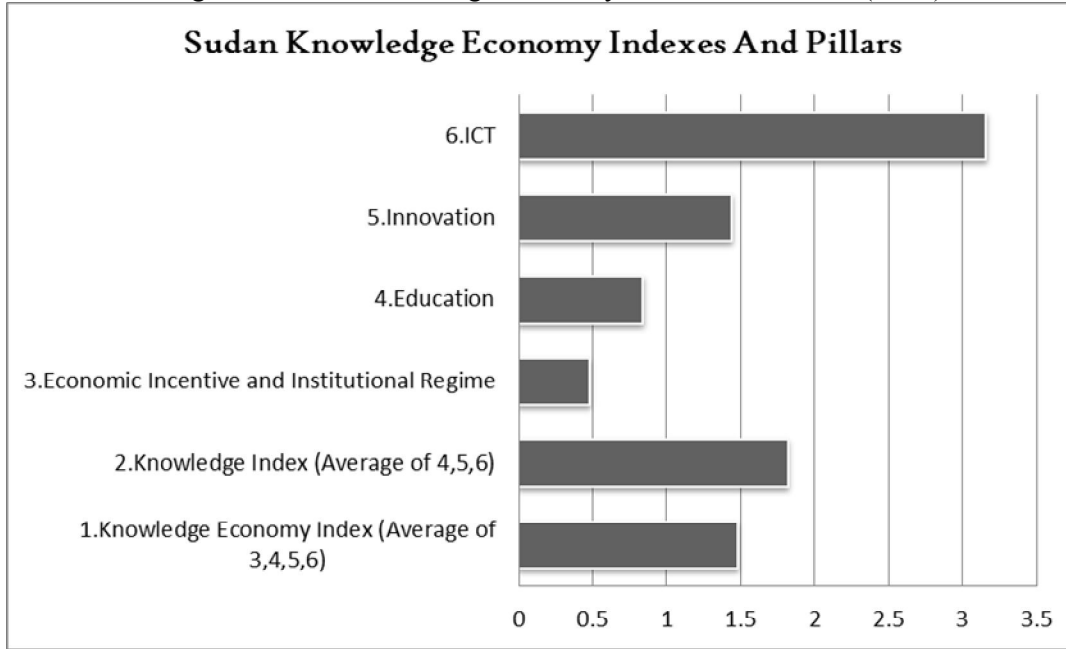
Sudan's overall development pattern in all four of the knowledge economy pillars therefore does not appear to have changed significantly in terms of the knowledge economy readiness during the past two decades.

Table 3 Sudan Knowledge Economy Indexes and Pillars (*weighted by population*)

Index	Sudan					
	Group: All					
	1995		2000		2012	
	Index	Rank	Index	Rank	Index	Rank
1.Knowledge Economy Index (Average of 3,4,5,6)	2.08	138	1.53	138	1.48	137
2.Knowledge Index (Average of 4,5,6)	2.54	131	1.86	132	1.82	122
3.Economic Incentive and Institutional Regime	0.71	138	0.54	142	0.48	142
4.Education	1.27	127	1.38	124	0.84	133
5.Innovation	2.17	134	2.09	141	1.44	141
6.ICT	4.18	142	2.10	132	3.16	104

Source: KAM 2012

Figure 1 Sudan Knowledge Economy Indexes and Pillars (2012)



Source: KAM 2012

BENCHMARKING SUDAN KNOWLEDGE ECONOMY INDEX AND KNOWLEDGE ECONOMY (KEI –KE) INDICATORS WITH ARAB COUNTRIES FROM LOWER MIDDLE INCOME GROUP:

Sudan is classified as a lower middle income, (\$1006-\$3975), based on its GNI (GDP previously) per capita. The World Bank economies divided economies (according to Gross National Income (GNI) per capita) to the following three groups:

1. low income, \$1,005 or less;
2. lower middle income, \$1,006 - \$3,975;
3. upper middle income, \$3,976 - \$12,275; and
4. High income, \$12,276 or more.

In this section we benchmark Sudan with its comparators from Arab countries which belong to lower middle income economies: (Algeria; Egypt, Arab republic; Morocco; Syrian Arab Republic; Yemen, Republic and Mauritania).

Benchmarking Sudan KEI and KE Pillars with Arab countries from Lower Middle Income Economies:

In this section we benchmark Sudan KEI and KE pillars with six Arab countries from lower middle income economies (Algeria; Egypt, Arab Republic; Morocco; Syrian Arab Republic; Yemen, Republic And Mauritania).

Table 4 compares Sudan Knowledge economy index and pillars with its comparators from Arab countries belong to lower middle income group:

Table 4 Benchmarking Sudan KEI and KE pillars with Arab countries from Lower Middle Income Economies:

Country	KEI		Economic Incentive and Institutional Regime		Innovation		Education		ICT	
	recent	1995	recent	1995	recent	1995	recent	1995	recent	1995
Egypt	6.06	7.15	7.02	5.89	6.79	8.22	5.3	6.95	5.11	7.55
Algeria	5.84	5.66	3.21	3.1	5.71	5.95	7.64	6.05	6.81	7.55
Morocco	5.55	6.34	7.1	6.89	5.91	7.63	2.57	3.28	6.63	7.55
Syrian	4.17	5.47	2.63	2.74	4.55	5.24	3.9	4.64	5.58	9.26
Yemen	2.41	3.71	3.79	3.13	2.71	3.33	1.95	1.78	1.19	6.59
Mauritania	2.33	3.3	2.64	1.9	2.74	3.02	0.87	1.26	3.05	7.04
Sudan	2.14	3.08	0.36	1.32	2.58	3.5	0.86	1.56	4.77	5.96

Source: World Bank 2012

Table 3 benchmarks Sudan KEI and KE pillars with Arab countries from lower middle income economies (Algeria; Egypt, Arab republic; Morocco; Syrian Arab Republic; Yemen, Republic and Mauritania) belongs to lower middle income economies. The eight countries are ranked according to their KEI. Egypt has the highest KEI with 7.15 and 6.06 while Sudan has the lowest KEI with 3.08, 2.14 during the periods 1995, and 2012 consecutively. All countries have shown a declining in their KEI except of Algeria (KEI (1995) of 5.66 to KEI (2012) of 5.84.

There is a significant improvements in ICT pillar in Sudan has jumped from ICT index of 4.77 (1995) to 5.96 (2012). In Education, a pillar which is instrumental for a country's transition to knowledge based environment, Sudan's performance is far below and is significantly lagging the other Arab countries of Lower Middle economies. During the past twenty years the country has negatively improved. In Innovation pillar, Sudan has not improved its overall performance during the twenty years; it still remains significantly weak lagging behind other Arab countries of Lower Middle economies. As for Economic Incentive and Institutional Regime Sudan has the weakest index among its comparators of Arab countries of Lower Middle economies with indexes of 1.32, 0.36 during the period from 1995 up to 2012.

KNOWLEDGE ECONOMY INDICATORS:

We examined fourteen knowledge economy indicators of the knowledge economy pillars to study Sudan's performance of those indicators. As compared to lower middle income countries Sudan has a low performance in the indicators of governance especially Regulatory Quality, Rule of law, government effectiveness and press freedom its normalization fell below the 50th percentile in the governance indicators of the knowledge economy. Sudan has a good position compared to its group in the indicators of economic performance, education, ICT.

PILLAR 1: ECONOMIC PERFORMANCE:

Sudan has been consistently ranked among the bottom performers in international competitiveness rankings. Measured by many indicators related to the knowledge economy, it has been ranked among the least performing countries. In 2012 Sudan has no record in world economic forum's (WEF) global competitiveness report.

In the following section we compare Sudan economics' performance with its comparators from Arab countries of the lower middle economies.

Three economic performance indicators have been used: annual GDP growth (%), GDP per capita and human development index (The Human Development Index (HDI) is a comparative measure of life expectancy, literacy, education, standards of living, and quality of life for countries worldwide), countries are ranked as : very high Human Development ; high Human Development; medium human development, low human development.

Table 5 Benchmarks Sudan's Knowledge Economy scorecard on Economic Performance with its comparators of Arab countries of Lower Middle economies:

Table 5 Benchmarking Sudan's Knowledge Economy scorecard on Economic Performance with its comparators of Arab countries of Lower Middle economies:

Country	Annual GDP Growth (%)		GDP per Capita (in/nal current \$ PPP)		Human Development Index	
	Actual	normalized	Actual	normalized	Actual	normalized
Egypt	6	7.5	5.673.00	3.97	0.62	3.54
Algeria	2.8	1.9	8.172.00	8.81	0.68	6.9
Morocco	5	6.6	4.494.00	3.26	0.57	2.78
Syrian	4.6	5.97	4.730.00	3.55	0.59	2.99
Yemen	4	5.14	2.470.00	2.27	0.44	1.74
Mauritania	4.2	5.56	1.929.00	1.7	0.43	1.53
Sudan	7.8	9.1	2.210.00	1.99	0.38	0.56

Source: World Bank 2012

Sudan ranks the first among its comparators of Arab countries from the lower middle income groups with 7.8 Annual GDP Growth (%); Sudan ranks the fifth among its comparators of Arab countries from the lower middle income group (Mauritania is the last) as for GDP per Capita (1.99); while Sudan ranks the last among its comparators of Arab countries from the lower middle income group as for Human Development Index (0.56).

INDICATOR 2: EDUCATION:

Education is considered as a fuel of well-being and is used to measure the economic development and quality of life, Education is the key element of a knowledge-based, innovation-driven economy. It affects both the supply of innovation and the demand for it.

In the following section we compare Sudan's Education with its comparators from Arab countries of the lower middle economies. Four variables are used: adult literacy rate (% age 15 and above), Gross Secondary Enrollment rate, Gross Tertiary Enrollment rate and Public Spending on Education as % of GDP.

Table 6 Benchmarking Sudan's Knowledge Economy scorecard on Education with its comparators of Arab countries of Lower Middle economies:

Country	Adult Literacy Rate (% age 15 and above)		Gross Secondary Enrollment rate		Gross Tertiary Enrollment rate		Public Spending on Education as % of GDP	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Egypt	66.37	1.43	67.2	4.76	28.45	6.58	4	4.83
Algeria	72.65	3.1	96.48	9.52	30.62	7.11	4	4.83
Morocco	56.08	0.48	55.85	2.86	12.88	3.42	6	8.62
Syrian	84.19	4.52	74.74	5.24	n/a	n/a	5	6.55
Yemen	62.39	0.95	45.61	2.38	10.23	2.89	5	6.55
Mauritania	57.45	0.71	24.46	0.71	3.81	1.05	3.81	1.05
Sudan	70.21	2.14	37.97	1.43	n/a	n/a	n/a	n/a

Source: World Bank 2012

The benchmarking process of Sudan's Knowledge Economy scorecard on education with its comparators of Arab countries (Lower Middle Income Economies) has revealed the weakness status of Sudan in this variable. Sudan Knowledge Economy scorecards on Education Sudan ranks the third as for Adult Literacy Rate (% age 15 and above) compared to Arab countries of lower middle income group; and has a better position than Mauritania, the sixth as for Gross Secondary Enrollment rate, we were unable to normalize the Gross Tertiary Enrollment rate and Public Spending on Education as % of GDP, because of the lack of information.

Furthermore, we tried to compare Sudan's Education index, published by The United Nations with its Human Development Index every year, The **Education Index** is calculated from the *Mean years of schooling index* and the *Expected years of schooling index*. Table 6 compares Sudan with its Arab comparators of lower middle income economies as for the education index;

Table 7 UN Education index for Arab countries (Lower Middle Income Economies)

The country	UN Education index	International rank
Syria	0.76	124
Algeria	0.71	129
Egypt	0.62	136
Yemen	0.597	153
Morocco	0.590	155
Mauritania	0.55	160
Sudan	0.52	161

Source: BTI 2012

From the above table we can observe that Sudan has the lowest rank in the list (161 from 183 in the world). This backward status in Sudan can be due to the inefficiency in the educational system. Efficiency enhancers, such as higher education, like its primary-level one, appear to be misaligned with the requirements of a competitive economy. There is a pressing need to revisit the mathematics and science curricula, improve the quality of management and internet access in schools and invest in high quality, specialized training of staff at the business levels.

INDICATOR 3: RESEARCH AND DEVELOPMENT:

For a country to compete globally, the role of R&D for long term economic and social well-being should be deeply deep understood. The aim of Scientific Research is the generation of new scientific knowledge as well as the correction and integration of previous knowledge, either immediately applicable or not.

In the following section we compare Sudan's research and development with its comparators from Arab countries of the lower middle economies. Sudan rank 141 (from 142) in its innovation index globally, it has the lowest innovation index compared to Arab countries of the lower middle income economies.

Table 8 Benchmarking Sudan's Knowledge Economy scorecard on research and development with its comparators of Arab countries of Lower Middle economies:

country	FDI Outflows as % of GDP		S&E Journal Articles / Mil. People		Researchers in R&D / Mil. People,		S&E Journal Articles / Mil. People,	
	Actual	normalized	Actual	normalized	Actual		normalized	
Egypt	0.45	8.38	24.16	8.81	3	8.33	1.15	4.05
Algeria	0.17	5.95	14.2	7.86	0.99	2.86	0.99	2.86
Morocco	0.43	8.11	25.253	9.23	12.13	7.62	799	8.46
Syrian	0.16	5.68	n/a	n/a	n/a	n/a	3.96	4.76
Yemen	n/a	n/a	0.82	1.19	n/a	n/a	n/a	n/a
Mauritania	0.19	6.76	1.06	2.14	2.6	4.72	0.64	0.48
Sudan	0.07	4.05	0.89	1.9	n/a	n/a	1.02	3.1

Source: World Bank 2012

According to table 7: The benchmarking process of Sudan's Knowledge Economy scorecard on research and development, with its comparators of Arab countries (Lower Middle Income Economies); has revealed the weakness status of Sudan in this variable. This can be due to the fact that Sudan lacks the potential to achieve a step change in the performance of R&D over the period to 2012 and beyond. It has a weak enterprise base which lacks the potential to increase its R&D capability and absorptive capacity. It also has lacks a growing public research base. The determinant of Sudan's future economic well-being will be its success in stimulating business to do more R&D, promoting innovation and a culture of entrepreneurship amongst researchers and fostering effective linkages between enterprise and academia.

INDICATOR 4: INFORMATION AND COMMUNICATION TECHNOLOGY (ICT):

All the indicators are telling that Sudan has made impressive advances in ICTs due to considerable improvements in telephones (fixed plus mobile, in which Sudan has experienced a boom in mobile telephony), computer penetration, and, most laudably, Internet users. But in fact Sudan has a weak expenditure on ICT, and weak availability of e-government services. The only strong normalized factor is the availability of computer per 1000 people.

This means that Sudan's progress in ICT development has, to say the least, been disappointing despite some positive developments in recent years. Sudan has managed to export on a comparable basis between US \$ 150 to \$200 million. While it produces around 5500 IT graduates per year, except for a few leading institutions, they are of poor quality. A large number of the few high quality graduates find it much more attractive to seek employment overseas rather than within Sudan despite the relatively high salaries offered to such graduates by domestic companies.

In the following section we compare Sudan's ICT with its comparators from Arab countries of the lower middle economies. Three variables are used: Total Telephones per 1000 People, Computers per 1000 People, and Internet Users per 1000 People,

Table 9 Benchmarking Sudan's Knowledge Economy scorecard on ICT with its comparators of Arab countries of Lower Middle economies:

Country	Total Telephones per 1000 People,		Computers per 1000 People		Internet Users per 1000 People	
	Actual	normalized	Actual	normalized	Actual	normalized
Egypt	790	4.39	40	3.81	200	7.14
Algeria	1,010	7.56	100	7.14	130	5.71
Morocco	900	5.85	60	5.24	320	8.81
Syrian	640	3.66	90	6.19	190	6.9
Yemen	210	0.49	30	2.62	20	0.48
Mauritania	680	4.2	50	4.5	20	0.5
Sudan	370	1.22	110	8.33	100	4.76

Source: World Bank 2012

From the above table we can observe that Sudan current level of internet users per 1000 people is ranked the fourth as compared to its comparators, the fifth as for the availability of telephones per 1000 people. Sudan level of availability of computers per 1000 people is the first among the group.

The benchmarking process of Sudan's Knowledge Economy scorecard on ICT with its comparators of Arab countries (Lower Middle Income Economies) has revealed a relatively better status of Sudan in this variable.

As for economic performance; Sudan ranks the first among its comparators of Arab countries from the lower middle income groups with 7.8 Annual GDP Growth (%), but ranks the fifth among its comparators of Arab countries from the lower middle income group (Mauritania is the last) as for GDP per Capita (1.99). Sudan ranks the last among its comparators of Arab countries from the lower middle income group as for Human Development Index (0.56).

As far as governance Sudan ranks the last, among its comparators of Arab countries from the lower middle income groups as for regulatory quality; rule of law and government effectiveness.

This supports our hypothesis Sudan has a low level of knowledge economy readiness compared to its comparators of lower middle income countries in KEI, KI, indicators (Research and development; economic incentives and regime; innovation and education), ICT relative to other indicators is a strong factor in creating the knowledge based economy in Sudan.

CONCLUSION:

The four main knowledge economy pillars with a total fourteen knowledge economy indicators (knowledge economy inputs) influencing the turning process of economies into knowledge-based economies were tested in accordance to Sudan case study. These indicators: highlight the significance of ICT, education, economic performance, and research and development.

Sudan is performing relatively very poor in the economic incentives and institutional pillar, the information infrastructure pillar and in the education pillar (especially tertiary education) and in particularly the innovation pillar.

The key concluding message coming out of this research paper is that; Sudan is not using its economic resources and opportunities in a way that develop a more diversified knowledge-based economy.

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