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A Roadmap to a Nigeria Digital Knowledge Economy: Trends and Implications

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ABSTRACT

Countries all around the world today are moving towards and actively embracing a new and evolving type of economy known as Digital Knowledge Based Economy. It is an economy where there is a high dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors. It is "an economy in which the production, exchange, distribution and use of knowledge are main drivers of economic growth, employment generation and wealth creation". However, Nigeria with her inherent multifaceted challenges has made no serious progress in embracing this new form of economy. There is need to appraise our readiness that would x-ray and give the country a direction toward surmounting some major challenges holding her down in this regard. The paper identified certain factors that are needed to ensure that Nigeria evolve into a 'knowledge driven economy' and compared Nigeria preparedness towards digital Knowledge based economy with other 'developed countries' around the world. This study seeks to provide motivation for academics, researchers, the Nigeria Government (security agencies related to cybercrime and other crime related issues) to discover mechanism, frameworks, metrics and protocols to deal with challenges to the country's readiness to embrace digital knowledge based economy. The study therefore concludes by recommending some policy guidelines such as minimizing ICT/digital literacy gap between academic and industry; 'power and energy' problems must be sorted out as quickly as possible; cybercrime and other allied act of electronic crime should be discouraged through stringent legislation; our educational system needs to be reevaluated and adequate steps taken for a working education sector; more grants should be given to research and should be adequately monitored. In addition, adequate measure should be taken for the welfare of staff both academics and other allied institutions to prevent or curb knowledge drift other countries of the world.

Keywords: - Knowledge Economy, Information and Communication, Technology, Digital Literacy, and e-Readiness.

1. INTRODUCTION

Over the centuries, particularly between the 18th and 21st centuries, nations' economies have evolved from one form of economy to another - from Agricultural Economy to Industrial Economy to Digital economy and more recently to a Knowledge Based Economy - with each form of these economies been driven by a peculiar economic impetus. If the Agricultural Economy was by human labor and Industrial Economy on machines driven by coal and iron ore and in not too distant time or years came Digital Economy with its major features was about data, information and knowledge; and which became suitable for attracting local and foreign investments into the country. This new found Digital Economy or Knowledge Based Economy popularity is traced to the advent and penetration of 'information technology' to all human endeavors where data and information are generated in seconds with digital devices to make better productive decisions. In this new economic paradigm, knowledge plays a dormant role in economic growth and it is hinged on information and communication technology that harnesses those data and information.

Today, there are renewed commitments to and a strong desire for nations to improve on their Knowledge Based Economy status in the committee of nations; and the Nigeria economy is not an exception, particularly at a time when Nigeria desires to be one of the best twenty (20) economies by the year twenty-twenty (2020) with the Vision 20:2020. In the Knowledge Economy, knowledge is recognized as the base element or engine of productivity, economic growth and developments. (Batagan, 2007). "Knowledge is the understanding or skill that one gets from facts, information which could be acquired through experience or education". It is the full utilization of data, information, skills, competencies, ideas, intuitions, commitments and motivations (Grey, 2002). In this respect, Hawkins (2002) in Kirkman *et. al.* (2002) stated that information and knowledge have become the most important currency for productivity, competitiveness, wealth and prosperity; and it is for this reason that nations place high emphasis on development of their human capital. Since knowledge resides more in human heads, knowledge is also an intellectual capital with both commercial and monetary value. Besides, Hogan (2011) stated that knowledge is not consumable; it could be collectively used; and used at different locations by different people simultaneously makes knowledge sacrosanct to the development and progress of any society especially Knowledge Economy.

Due to the enormous advantages inherent in Knowledge Based Economy, researchers and countries are motivated to evaluate and suggest mechanisms, frameworks that would ensure quick transition to this new found economy. Although several researches have been done on Knowledge Based Economy, our study is focused on evaluation of Nigeria's readiness for full implementation of Knowledge Based Economy and highlights issues relating to its realization. Therefore, the objectives of this paper are:

3 to establish the 'critical success factors' for developing a Nigeria Digital Knowledge Economy;
4 to state the challenges to a successful evolution of a Nigeria Digital Knowledge Economy,
5 to identify the prospects for a Nigeria robust Digital Knowledge Economy.

2. KNOWLEDGE ECONOMY AND ICT

Defining a "Knowledge Economy" is a challenging task precisely because "knowledge" upon which "Knowledge Economy" is based is hard to pin down with any precision (Brinkley, 2006). Hence, no single-agreed upon definition from the literature because of experts varying perspectives. However, Organization for Economic Co-operation and Development- **OECD** (2005) defined Knowledge Based Economy as an economy where there are "high dependence on information, knowledge and high skill levels; and the increasing need for ready access to all of these by the business and public sectors". It is "an economy in which the production, exchange, distribution and use of knowledge are main drivers of economic growth, employment generation and wealth creation". In this respect, knowledge is treated as a 'factor of production' like the traditional factor of production in the economy (Schumpeter, 1939); and being a predominant part of wealth creation, knowledge has a market value.

From the above, it is obvious that Knowledge, high skill level, and a high connectivity between individuals, corporate organizations, academic institutions, government parastatals etc. are features of Knowledge Base Economy. It is important to state at this juncture that there is knowledge application in all forms of economies but the form, the function and principle changes with time in line with changing culture but not all three aspects simultaneously. In the older forms of economy, knowledge was in analog format in human heads; and the communication was by verbal and print means; while the transmission of data/information was by the movement of people. This limits the knowledge connectivity and flow in these economies. But in the new economy, more appropriately referred to here as the Digital Knowledge Economy, knowledge is more in digital format stored in digital devices that allow for unrestricted movement of large amounts of information and knowledge as quickly as possible amongst people in different parts of the economy. Here, knowledge is more fluid and "knows no boundaries" since the various knowledge units (business organization, academic institutions, research centres, individuals etc.) forming the different sections of the economy are digitized and internetwork.

This is why; Tapscott (1997) observed that knowledge, digitization, globalization, virtualization, Integration /Internetworking, convergence, and innovation are key features of Digital Knowledge Economy. These aforementioned concepts presuppose the use of ICT in Digital Knowledge Economy. ICT is therefore another important driver of a Digital Knowledge Economy. It is a "diverse set of technological tools and resources used to communicate, create, store, disseminate and manage information"; and it covers a broad range of communication device or applications such as radio, cellular phones, television, computer network hardware and software, satellite systems etc., as well as various services and applications associated with them, such as videoconferencing, audio conferencing, e-learning, e-commerce, e-banking , social media platforms to mention but a few.

2.1 Knowledge Assessment Methodology (KAM) Framework.

However, the World Bank developed a Knowledge Assessment Methodology (KAM) framework which is a benchmark for assessing nations' status in Knowledge Economy comprising of four sub- indicators/indexes that should help nation's articulate strategies to transit to knowledge based economy (World Bank, 2012). These indicators/indexes that constitute the four quadrants of a Knowledge Economy are One: *Economic Incentive and Institutional Regime* (EIR) index for assessing efficient use of existing and new knowledge where entrepreneurship will flourish; Two: *Innovation* and *Technological Adoption* index for assessing innovation system of organizations to see whether they assimilated and adapted the growing stock of global knowledge to local needs and create new technological solutions ; Three: *Education* and *Training* index for assessing whether the educated and appropriately trained population are capable of creating, sharing and using existing knowledge ; and Four: *Information and Communication Technologies* (ICT) *Infrastructure* index for assessing the extent to which modern and accessible ICT infrastructure facilitate effective communication , dissemination and processing of information within the economy.

2.2 Knowledge Economic Index

In order to measure the preparedness of a country or region towards knowledge-based economy, the KAM is used. The Knowledge Economy Index (KEI) takes into cognizance whether the environment is good enough for knowledge to be effectively used for economic development. It is a sum index that represents the total level of development of a country. The KEI is calculated based on all four pillars of the knowledge economy - economic incentive and institutional regime, education, innovation and ICT. For the purposes of calculating KEI, each pillar is represented by three key variables.

2.3 Innovation and Enterprise.

Innovation is the changing or creation of a more effective processes, products and ideas which can make a firm or organization to have better productivity and performance. Innovation could be a catalyst for the growth of a Knowledge Economy. Therefore, it is key to the growth of the Nigeria's Digital Knowledge Economy. In order to evaluate the progress Nigeria has made in innovation, we need to review the trend, value of Nigeria in Global

Innovation Index for some years. The Global Innovation Index (GII) was conceived to assess or measure the extent to which nations are currently responding to the challenge of innovation as well assay the response-readiness of a country's ability to embrace and use the immeasurable benefits from, increased human capacities, technologies, enhanced institutional performance, organizational and operational developments. The GII therefore aggregates many complementary concepts that provides a total framework for assessing innovation.

According to (INSEAD/World BUSINESS, 2007) , The GII does not only determine a country's capacity to relatively response, it also gives a clearer explanation of a country's strengths and deficiencies in innovation-related policies and practices. The GII model is on a framework that relies upon eight pillars made up of five inputs (Institutions and Policies, Human Capacity, Infrastructure, Technological Sophistication, Business Markets and Capital) and three outputs (Knowledge, Competitiveness, Wealth) that underpin the factors that enhance innovative capacity and demonstrate results from successful innovation. The model uses variety of objective data from public and private and subjective data drawn from the World Economic Forum's annual Executive Opinion Survey. The Global Innovation Index for Nigeria from the period of 2007-2018 is in Table I.

Table I: Global Innovation Index for Nigeria from 2007-2018

	Nigeria GII Index	Nigeria Rank	Best Country	Best Country GII Index
2007	22.70	72	United States of America	58.0
2008	29.10	70	United States of America	52.8
2009	26.90	96	Iceland	48.6
2011	28.15	96	Switzerland	63.82
2012	24.60	123	Switzerland	68.2
2013	26.57	120	Switzerland	66.59
2014	27.79	110	Switzerland	
2015	23.72	128	Switzerland	68.30
2016			Switzerland	
2017	21.92	119	Switzerland	67.69
2018	22.37	118	Switzerland	68.40

From Table I above, it would be observed that in the 2018, Nigeria ranked 118-position with a score of 22.37%. This score is very low for a country aspiring to embrace knowledge based economy. To put the industries innovation capacity to task, Nigeria government must continue to discourage substandard products within the Nigeria economic space.

2.4 Intellectual Property Index

The CEO of GIPC, David Hirschmann (2017) opined that just as trees cannot grow without roots, innovation cannot thrive without intellectual property. There is poor performance of Nigeria as country towards intellectual property viz-a-viz Research and Development. The Research and Development sub index of the Knowledge ECONOMIC index shown in Table II, shows a retrogressive and sharp decline from 1.83 in 2013 to 2,28 in 2019. This does not speak volume of a country whose intention is to embrace the new found economy, therefore, the Government should do what is needed in this regard.

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Table 2: Knowledge Economic Index of Nigeria from 2013-2018

YEAR / INDICATOR	2013		2014		2015		2016		2017		2018	
GLOBAL INNOVATION INDEX	SWIZERLAND	66.59	SWIZERLAND	64.78	SWIZERLAND	68.30	SWIZERLAND	66.28	SWIZERLAND	67.69	SWIZERLAND	68.40
	NIGERIA	26.57	NIGERIA	27.79	NIGERIA	23.70	NIGERIA	23.15	NIGERIA	21.92	NIGERIA	22.40
	YEMEN	19.32	SUDAN	12.66	SUDAN	15.00	YEMEN	14.55	YEMEN	15.64	YEMEN	15.00
INNOVATION EFFICIENCY RATIO	MALI	1.13	MOLDOVA	1.07	ANGOLA	1.02	LUXENBOURG	1.02	LUXENBOURG	0.97	SWIZERLAND	0.96
	NIGERIA	1.03	NIGERIA	0.94	NIGERIA	0.80	NIGERIA	0.67	NIGERIA	0.52	NIGERIA	0.50
	SYRIAN ARAB	0.45	SUDAN	0.09	TOGO	0.24	BHUTAN	0.28	BUKINA FASO	0.24	BUKINA FASO	0.24
GOVERNMENT EFFECTIVENESS	FINLAND	100.00	FINLAND	100.00	FINLAND	100.00	SYNGAPORE	100	SYNGAPORE	100	SYNGAPORE	100.00
	NIGERIA	7.60	NIGERIA	14.21	NIGERIA	14.11	NIGERIA	8.03	NIGERIA	17.70	NIGERIA	18.18
	SUDAN	0.24	MYANMAR	0.00	SUDAN	-	YEMEN	0.00	YEMEN	-	YEMEN	-
RULE OF LAW	FINLAND	100.00	NORWAY	100.00	NORWAY	100.00	FINLAND	100.00	FINLAND	100.00	SWEDEN	100.00
	NIGERIA	13.56	NIGERIA	13.89	NIGERIA	16.83	NIGERIA	20.10	NIGERIA	8.89	NIGERIA	15.01
	VENEZUELA	3.49	VENEZUELA	0.00	VENEZUELA	-	VENEZUELA	0.00	ZIMBABWE	-	YEMEN	-
BUSINESS ENVIRONMENT	SINGAPORE	95.90	SINGAPORE	95.01	CANADA	93.66	FINLAND	92.10	FINLAND	92.42	FINLAND	92.99
	NIGERIA	49.00	NIGERIA	47.75	NIGERIA	NIL	NIGERIA	46.66	NIGERIA	45.77	NIGERIA	55.70
	VENEZUELA	22.43	VENEZUELA	21.90	LYBIA	-	SAINT MARTIN	0.00	BOLIVIA	42.21	SAUDI ARABIA	40.02
EDUCATION	SYRIAN ARAB	95.00	CHINA	71.30	BOSNIA	89.56	BOSNIA	89.97	BOSNIA	90.24	BOSNIA	90.51
	NIGERIA	25.60	NIGERIA	24.87	NIGERIA	24.47	NIGERIA	23.77	NIGERIA	35.74	NIGERIA	29.53
	PAKISTAN	8.11	ZAMBIA	4.59	ZAMBIA	9.94	ZAMBIA	0.00	ZAMBIA	0.00	ZAMBIA	-
RESEARCH AND DEVELOPMENT	USA	80.91	KOREA	82.62	IRAEL	85.84	KOREA	89.50	KOREA	88.16	KOREA	88.64
	NIGERIA	1.83	NIGERIA	1.92	NIGERIA	1.77	NIGERIA	1.11	NIGERIA	1.27	NIGERIA	1.28
	MALAWI	0.17	BARBADOS	0.00	GARBON	-	YEMEN	0.00	YEMEN	0.00	YEMEN	-
INFRASTRUCTURE	HONG KONG	63.43	HONG KONG	67.38	SINGAPORE	69.54	SINGAPORE	69.11	NORWAY	69.34	HONG KONG	68.91
	NIGERIA	17.59	NIGERIA	21.80	NIGERIA	22.89	NIGERIA	26.96	NIGERIA	28.17	NIGERIA	26.48
	SWAZILAND	6.20	SWAZILAND	14.83	REUNION	-	PAPUA NEW GUINEA	0.00	ZIMBABWE	15.46	ZIMBABWE	20.33
ICT	KOREA	87.30	KOREA	91.25	KOREA	92.41	KOREA	92.94	UK	93.33	UK	93.83
	NIGERIA	15.22	NIGERIA	19.43	NIGERIA	26.34	NIGERIA	27.60	NIGERIA	32.32	NIGERIA	31.07
	GUINEA	4.53	GUINEA	4.40	ANDORA	-	VIRGIN ISLAND	0.00	NIGER	9.38	NIGER	9.38
ECOLOGICAL SUSTANABILITY	ITALY	67.13	HONG KONG	73.15	HONG KONG	71.35	HONG KONG	70.49	HONG KONG	70.48	MALTA	81.56
	NIGERIA	17.71	NIGERIA	20.93	NIGERIA	26.49	NIGERIA	31.01	NIGERIA	33.64	NIGERIA	30.04
	BUKINA FASO	0.23	MALI	12.39	MALI	12.39	BERMUDA	0.00	ZIMBABWE	6.37	TOGO	18.29
INVESTMENT	HONG KONG	83.01	USA	87.27	HONG KONG	81.53	USA	80.01	SINGAPORE	74.96	CANADA	77.10
	NIGERIA	21.23	NIGERIA	25.71	NIGERIA	24.68	NIGERIA	46.20	NIGERIA	33.92	NIGERIA	34.62
	VENEZUELA	6.18	VENEZUELA	12.59	COSTA RICA	14.81	SIERRA LEONE	0.00	COSTA RICA	18.83	GUATAMELA	23.51
MARKET CAPITALIZATION	HONG KONG	100.00	SWIZERLAND	100.00	SWIZERLAND	100.00	SWIZERLAND	100.00	SINGAPORE	100.00	SINGAPORE	100.00
	NIGERIA	7.51	NIGERIA	12.40	NIGERIA	7.32	NIGERIA	46.56	NIGERIA	4.44	NIGERIA	4.21
	AMENIA	0.02	URUGUAY	0.00	URUGUAY	-	AMENIA	0.00	NAMIBIA	-	NAMIBIA	-
BUSINESS SOPHISTICATION	SYNGAPORE	69.16	SYNGAPORE	66.67	SYNGAPORE	63.13	SYNGAPORE	62.14	NETHERLAND	63.69	NETHERLAND	65.09
	NIGERIA	19.31	NIGERIA	21.26	NIGERIA	20.27	NIGERIA	20.09	NIGERIA	21.69	NIGERIA	23.53
	YEMEN	11.14	MYANMAR	8.78	MYANMAR	10.98	YEMEN	8.58	KUWAIT	15.25	YEMEN	15.72
UNIVERSITY/ INDUSTRY RESEARCH COLLABORATION	SWIZERLAND	82.23	SWIZERLAND	80.67	FINLAND	82.80	FINLAND	82.80	SWIZERLAND	80.00	SWIZERLAND	79.55
	NIGERIA	41.76	NIGERIA	38.17	NIGERIA	29.20	NIGERIA	29.20	NIGERIA	27.78	NIGERIA	25.26
	ALGERIA	14.22	MYANMAR	17.67	CHAD	16.67	VIRGIN ISLAND	16.67	YEMEN	14.76	YEMEN	22.16
KNOWLEDGE ABSORPTION	SINGAPORE	76.15	SINGAPORE	72.10	VIETNAM	72.72	SINGAPORE	70.91	NETHERLAND	78.04	NETHERLAND	77.92
	NIGERIA	14.25	NIGERIA	14.77	NIGERIA	23.41	NIGERIA	19.57	NIGERIA	24.57	NIGERIA	20.85
	YEMEN	2.94	MYANMAR	0.00	YEMEN	15.49	YEMEN	11.09	OMAN	15.61	BOTSWANA	11.96
INNOVATION INPUT	SINGAPORE	72.27	SINGAPORE	73.60	SINGAPORE	72.12	SINGAPORE	72.34	SYNGAPORE	72.25	SYNGAPORE	74.23
	NIGERIA	26.21	NIGERIA	28.63	NIGERIA	26.30	NIGERIA	30.08	NIGERIA	28.94	NIGERIA	29.85
	PAKISTAN	23.68	MYANMAR	23.03	SUDAN	21.90	YEMEN	21.67	YEMEN	22.38	YEMEN	22.18
INNOVATION OUTPUT	SWIZERLAND	66.65	SWIZERLAND	63.11	SWIZERLAND	68.63	SWIZERLAND	64.19	SWIZERLAND	65.78	SWIZERLAND	67.13
	NIGERIA	26.93	NIGERIA	26.95	NIGERIA	21.15	NIGERIA	18.50	NIGERIA	14.90	NIGERIA	14.89
	SUDAN	13.11	SUDAN	2.11	TOGO	7.20	YEMEN	7.43	TOGO	8.02	YEMEN	7.90

2.5 Human Capital Index

Another important area that is essential towards evaluating the readiness of Nigeria for a knowledge based economy is human capital development. Human capital is made of the knowledge, skills and health that people accumulate throughout their lives, enabling them to realize their potential as productive members of the society (World Bank, 2018). The human capital index (HDI) is a measure for assessing long term progress of countries (member countries) in long healthy life, access to knowledge and a decent standard of living. A 'long and healthy' is measures life expectancy metric, knowledge level is measured by using the years of education among the adult population of the country that have access to learning and knowledge supposedly received by people aged 25 years and above ; standard of living is quantified using the Gross National Income per capita expressed in constant 2011 international dollars converted using purchasing power parity conversion rates. The HDI values for Nigeria showing the trends indicating the contribution of three (Life expectancy, expected years of schooling, and mean year of schooling) indicators is shown in Table III.

Table 3: Nigeria HDI values showing the trends in three sub indicators from 1990-2019(Source: World Bank Report, 2018, Central Bank of Nigeria 2019 Statistical)

	Life Expectancy at Birth	Expected Years of Schooling	Mean Year of Schooling	GNI Per Capita (2011 PPP$)	HDI Value	% Education budget	% Health Budget
1990	45.9	6.7	NA	2,792	NA	2.83	-
1995	45.9	7.2	NA	2,569	NA	7.20	-
2000	46.3	8.0	NA	2,451	NA	8.36	-
2005	48.2	9.0	5.2	3,669	0.465	9.30	-
2010	50.8	8.4	5.2	4,862	0.484	6.40	3.58
2015	53.0	10.0	6.0	5,527	0.527	9.50	5.78
2016	53.4	10.0	6.2	5,326	0.530	4.00	4.13
2017	53.4	10.0	6.2	5,231	0.532	7.40	5.17
2018		8.2			0.340	7.04	3.90
2019						7.02	4.1

From Table III above, there was a gradual increase in the HDI values from 2005 through 2017 but abruptly nosedived in 2018, which is a clearly an indication of the country notoriously abysmal investment in Education and Health. Education and Health are major catalyst for human development that constitutes one of the chief drivers of a knowledge-based economy or society. Lucas (1998) postulated endogenous theory which showed that countries with a larger stock of human capital experience higher economic growth rates. Human capital investment through investment in quality education improves the capacity to innovate; as countries are now placing more emphasis on human capital development than infrastructural development.

According to World Bank (Word Bank report, 2018), no investment in Nigeria and Africa happens until grants come from international agencies. Despite United Nations recommendations that education be allocated 26 percent of national budget, only 7.04 percent of Nigeria's N8.6 trillion 2018 budget was apportioned, which clearly shows that Nigeria's has not embraced the importance of education as a driving force in the nation's building. It is regrettable to note that, we have not fared well as a country in 2018 and that undermines our preparedness for embracing a digital knowledge based economy.

2.6 Human Capital Flight or Brain Drain

The wellbeing of a country's human resources whose intention is to tap into the global trend of knowledge driven economy lies deeply in the health of her citizens physically, educationally and morally. However from breakdown given in Table II, it paints a negative picture of Nigeria investment towards Health and Education which has a ripple effect on the HDI Values since they are synergistically connected. The figures and trends of Nigeria budgeting for health care are orthogonal not only to the April 2001 African Union declaration on health care which states that 15% of government total allocation should be to health sector but also in stark contrast to the world Health Organization (WHO) recommendation of doctor to population ratio of 1:600. The growing population of the country amidst the minimal budgetary allocation and misplaced priority in the health sector has left the sector in a pitiable situation which has culminated in medical personnel moving out in droves from Nigeria to other countries in search of better welfare, working conditions or environments e,t,c leaving the average Nigerian to suffer the negative consequences.

There have been alarming emigrations of skilled and well trained medical doctors from the shores of the country seeking more conducive environment in terms of working condition and better pay. Though recent trend is multifactorial, NOIPOLLs and Nigerian Health Watch polls of 2019 brought to fore some of the factors for this recent alarmingly emigration to other countries; as high taxes and deductions from salary, low work satisfaction, poor salaries and emoluments, better facilities and work environment just to mention a few. It should be noted that Nigerian government invested so much in the successful training of a single doctor through subsidy in their medical education and as such there is huge divestment through this recent act of health brain drain.

There is no gainsaying that this trend is a form of modern day trans-Atlantic slave trade where able bodied men of high economic value to Africa were captured and sold into slavery to other countries and thence Slave masters indirectly harvesting from whence they did not sow and so impoverishing the African soil. Nathan Nunn (2008) explicitly asserted that slave trade had and still has adverse effect on the long term economic development of Africa by showing that there is a negative relationship between the severity of slave trades and economic performance in Africa making use of statistical analysis. Raji et al. (2018) opined that there is a negative relationship between brain drain and economic growth. It should be noted that Nigeria is pregnant with Knowledge-able citizens in all walks of human endeavours but is yet to midwife it into valuable and utility-driven knowledge that would be beneficial to the overall good of the people. It is therefore pertinent to state that for Nigeria to wholly show readiness and embrace knowledge economy, she must nurse and takes care of her knowledge induced pregnancy and put in place structures that would midwife it into a realistic and visible enterprise.

3. CRITICAL SUCCESS FACTORS FOR A NIGERIA DIGITAL KNOWLEDGE ECONOMY

In building a Nigeria Digital Knowledge Economy, certain necessary conditions or critical success factors should exist to allow the new economy to thrive. These critical success factors are as follows:

3.1 E-Readiness

A high measure of e-Readiness is one of the precursors for the Digital Knowledge Economy. According to Dada (2006) "e-Readiness" is the measure of a country readiness , preparedness or wiliness to use the benefits of Information and Communication Technology [or electronic activities]. This includes the total uptake of ICT of a country, services and applications associated with it, such as videoconferencing, audio conferencing, e-commerce, e-government, e-business, e-learning and e-health. Telecommunications infrastructure, stocks of human resources, legal and governmental supportive policies are also measures of e-Readiness of a country, nation or economy. Centre for International Development-CID (2006) observed that a clear understanding of a nation's e-readiness status is important for planning and for taking good investment decisions in a knowledge economy. Currently, Nigeria ranks 131 of 143 in e-Readiness status (Uwajie, 2014); and 112 out of 144 countries with a value of 3.31 in Network readiness (World Economic Forum, 2014).

In order to measure the e-readiness of Nigeria with comparison to global index, we need to review the ranking of Nigeria through the years using ICT Development Index (IDI). IDI is a composite index made up of 11 indicators covering ICT access, use and skill. This index is designed by International Telecommunications Union to measure the level and evolution over time of ICT developments considering the developed and developing countries.

Table 4: A table showing ICT Development index for Nigeria from 2007-2017 (Source: Measuring the Information Society Reports from 2007-2017)

	2017	2016	2015	2013	2012	2011	2010	2008	2007
IDI Score	2.6	2.72	2.48	2.35	2.18	1.96	1.85	1.54	1.09
IDI Rank	143	137	137	133	122	123	122	125	123
IDI Access Sub-index Score	3.16	2.96	2.82	2.53	1.99	1.85	1.87	0.60	0.94
IDI Access Sub-index Rank	145	147	147	144	135	136	132	134	133
IDI Use Sub-index Score	1.58	2.28	1.81	1.60	1.72	1.29	1.05	0.61	0.01
IDI Use Sub-index Rank	147	116	115	113	93	95	95	90	134
IDI Skill Sub index Score	3.53	3.13	3.13	3.51	3.51	3.51	3.39	3.8	3.55
IDI Skill Sub index Rank	140	143	143	147	137	137	135	130	124
Highest IDI Score	8.98	8.84	8.78	8.86	9.86	9.86	9.86	7.85	6.05
IDI Score for Nigeria	2.60	2.72	2.48	2.35	2.18	1.96	1.85	1.54	1.09
Percentage	28.95	30.77	28.25	26.53	22.11	19.87	18.76	19.62	18.02

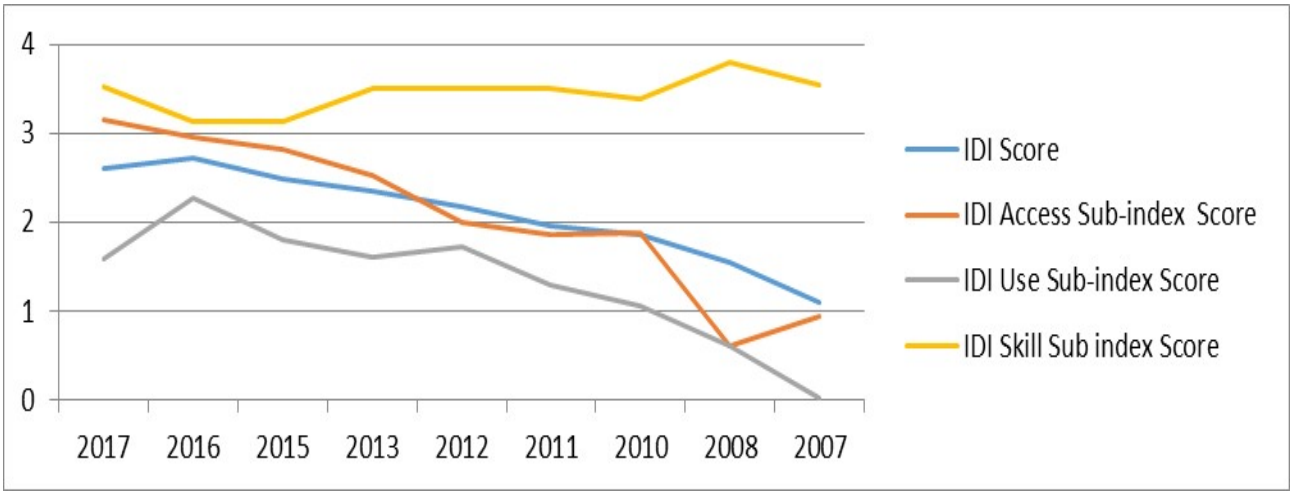

Fig. 1: Line Chart showing the component indicators (access, use and skill sub-index) of the ICT Development Index from 2007 to 2017.

From Table IV and trends depicted in Figure 2.0, though we have a considerable improvement in all indices taking into account the percentage of Nigeria's IDI score and the highest IDI score for each year as shown in Table III; yet it is expedient for Nigeria to improve her e-Readiness status by creating the necessary environment through aggressive legal and policy framework. To this extent, the National Communication Commission (NCC) and other governmental agencies must encourage the establishment of Information Technology Infrastructure that is available, accessible and affordable. Efforts should also be made to bridge the gap between our ever growing population and these infrastructures.

3.2 ICT/Digital Literacy skills

Both ICT literacy and digital literacy are related terms, ICT literacy is 'the ability to use communication tools, digital technology, and/or networks to define, create , access, evaluate, integrate, manage, , and communicate information ethically and legally to function in a knowledge society.' Digital Literacy on the other hand, is the knowledge, skills, and behaviors used in digital devices such as desktop, tablets, smart-phones, laptops and PCs, seen as network and not just computing devices. Both 'ICT literacy' and 'digital literacy' skills are survival skills in the digital era which constitutes a system of skills and strategies used by learners and users in digital environments (Okwuke, 2013). In broad terms, it entails harnessing technology in different contexts; mastery of the use of technological tools, software and platforms; creates and shares new data with others digitally; communicating in different ways in the digital world; gaining competence in digital technologies and create an environment for skills and self-learning; taking risks while developing searching skills and producing new things; develop various perspectives and take different circumstances into account and forming communities online.

Figure 1. and Table 4 clearly shows that Nigeria's level of ICT skills though encouraging in terms of our economy sub category yet it is open for more improvements and adequate measure must be taken to encourage such moves. There is need to encourage collaboration between our information industry-based relevant skills and those obtainable from University based education so as to as have an equilibrium that is necessarily important for a more productive economy. There is no gain saying that computer literacy and ability to actively use computing devices will boost the drive towards knowledge economy. There is no or little done in inculcating computer science or informatics or its variants as a course in primary and secondary schools. Though some private schools both primary and secondary schools have tried in this regards but even at that , it is not part of the core courses done either at primary and secondary final examinations and such the importance ascribed to its teaching and learning is negligible. It is our sincerest recommendation that computer science and informatics should be taught in primary and secondary schools and should be part of the examinable subjects at their final examinations e.g NECO

3.3 Information and Communication Technology Infrastructures

Information and Communication Technology infrastructures are the necessary media for knowledge flow in a Digital Knowledge Economy. Availability and accessibility of the ICT infrastructures coupled with the skills to use them is a sine qua non for a Nigeria Digital Knowledge Economy. A peek at Table IV above indicates that there is gradual improvement of IDI access Sub-index which envelops information and communication technology infrastructure from a low of 0.94 in 2007 to a high of 3.16 in 2017 which accounts for about 70.25% improvement; however the ranking seems to farther from the best country as Nigeria moving from 133rd position in 2007 to 145th position in 2017. This is a welcome development for a country whose intention is to tap and embrace a knowledge based economy yet there is still much room for improvement.

3.4 Control of Nigerian Cyberspace.

Cyberspace could be viewed as electronic and boundless space that allows electronic communication and content across multiple digital devices, platforms and across multiple digital pathways. There are more than 10 billion electronic devices connected to the Internet thereby establishing a super-cluster of Inter-cloud digital activities. In other words, Internet commands global audience with vast benefits. This makes countries in the world and specifically Nigeria's cyberspace to be vulnerable to attacks. Therefore, losing the control of our cyberspace recourses and capability means losing all the benefits of the digital revolution. It is for this reason that Aginam (2014) has asserted that there is apprehension that the cyber threat landscape in Nigeria is constantly evolving with lack of appropriate legal frame work. In other words, there are all sorts of digital crimes committed in the Nigeria Cyberspace without appropriate legislatures to deal with the situation. In the bid to measure how prepared we are as a country towards the control of Nigeria cyberspace, one needs to review the Nigeria indices of Global Cyber Security Index and see the trends. The global cyber security index is born of a cooperative partnership between private sectors and international organizations to drive the issue of cyber security to the forefront of national agendas.

The global cyber security index looks at the level of commitments in five areas: Legal measures, Technical measures, Organizational measures, Capacity Building and International cooperation with a goals to support countries to identify areas for improvement, motivate action to improve relative GCI rankings, raise the level of cyber security worldwide, help to identify and promote best practices and foster a global culture of cyber security. The result is a country level index and a global ranking readiness. A peek at the index from 2014 where Nigeria with a value of 0.441 ranks 14th position till 2018 where it has a value of 0.650 taking 57th position suggest that Nigeria comfortably occupies a medium scale in terms of index ratio being a measure for countries that have developed complex commitments and engage in cyber security programmes and initiatives.

Taking another index by National Cyber Security Index 2018 sponsored by Estonian Development cooperation as a reference, Nigeria had a score of 44.16% and a digital development level of 35.86% .Nigeria had a positive difference between the two metrics, suggesting that cyber security development is in more advanced stage than digital development in Nigeria. The information in report from National Cyber Security Index coincides with a similar index from Global Cyber security Index of 2018. Though there are some legal measures in Nigeria which include Money Laundering Act 2011, Advance Free Fraud and other Related Offences Act 2006, Evidence Act 2001 and Cybercrime Bill 2013(in view), there should be more active laws geared towards handling cybercrimes in Nigeria.

3.5 Sustainable Power and Energy

Sustainable power and energy is another key requirement for a Nigeria Digital Knowledge Economy. This is because power and energy is required to drive both the Telecommunication and Information Communication Technology infrastructures needed for knowledge flow in the economy. However, with Nigeria population at 170,123,740 (Index Mundi, 2012), less than 50 per cent currently have access to electricity (MBedi, 2015); compared to the world average required access of 80 per cent . For this reason, Nigerians resort to self-generation of electricity where about 81 per cent (at 130 million Nigerians) of the national population generate electricity through alternative sources to compensate for irregular power supply. In 2012, Nigeria's electricity consumption per capital was at 106.63 kWh - due to inadequate electricity supply from national grid (Index Mundi, 2012). In March 2014, electricity supply from the national grid was 4,306MW only, which was far below the estimated demand of 12,800MW. No wonder, Abiodu (2015) asserted that Nigeria's electricity consumption per capital has been adjudged the lowest in Africa. The low electricity consumption per capital is not unrelated to the acute power shortages. These power shortages are a major brake on growth in sub-Saharan Africa's second-biggest economy (Onuah , 2011).

Also, to drive the emerging Nigeria Digital Knowledge Economy effectively and efficiently, Nigeria requires the provision of sustainable energy such as nuclear, solar and wind energy that is replacing the fossil fuel energy in more advanced economies; more so now that Nigeria lack the capacity to refine their crude oil found abundantly in the Nigeria Niger Delta area. Though there has been efforts for the promotion and development of nuclear energy for the generation of electricity with the establishment of the Nigeria Atomic Energy Commission through the enactment of Act 46 of 1976; however, the efforts didn't yield positive results as it became moribund after a time but it was revived by the Jonathan Administration in 2011(Onuah, 2011) Therefore, building solar, wind and Nuclear power stations comparable to that of the Africa's largest wind farm, the 301 MW Tarfaya Wind Farm, situated in Moroccan Southern Atlantic Coast and the world's currently largest Kashiwazaki-Kariwa nuclear power plant in Japan , with a net capacity of 7,965MW (Chadha,2014 ; Wikipedia, 2015) is now imperative, since energy is becoming a hydra headed monster and more so now that the use of renewable energy is becoming more common in the advanced economies.

4. CHALLENGES TO A NIGERIA DIGITAL KNOWLEDGE ECONOMY.

Building a Nigeria Digital Knowledge Economy is not without its challenges. These challenges include lack of adequate data protection legislature, digital skill gap between academic institutions and the industries, digital piracy and Identity theft, insecurity, poverty and diseases.

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1. Lack of Adequate Data Protection Legislation: Data Protection is the legal control over access to and use of data stored in computer. It involves the implementation of administrative, technical or physical measures to guard against unauthorized access to data, destructive user actions, and computer failure. Since knowledge is a product of data and information, protection of the data and information protects the knowledge therein. It is for this purpose that the protection of data from threats from sources within and outside organizations and institutions is important in a Digital Knowledge Economy. Therefore, who has access to information; what information is being accessed; which information flows out of the organizations; and how this information flows out is essential for the growth of the economy. Appropriate legislature is required to protect data and information against all forms of misuse. However, Akinsuyi (2007) posited that it is evident that Nigeria does not have adequate data protection legislation and privacy laws to cater for data protection to address the emerging issue of identity theft.

2. Digital Skills gap in ICT: Since knowledge is acquired through experience and education; then the development of the requisite digital skills of the workforce is appropriate for the smooth takeoff of a Digital Knowledge Economy. Digital skills is restricted to practical abilities in using digital devices such as laptops and smartphones. Azeez, (2013) has asserted that there is currently, a digital literacy gap between Nigeria education sector and the industries; and that it is expedient to bridge this gap through education and exposure to world class digital literacy requirements by strong commitment to exposing students and workforce to the Internet and Computing Core Certification (IC^3) which is globally recognized as the standard for digital literacy. Apart from this, the ICT curriculum should be overhauled.

3. Digital Piracy and Identity Theft: Piracy is the unauthorized use, illegal reproduction, copying or copyright infringement of another's work. Recent findings by the Business Software Alliance (BSA) ranked Nigeria among countries in the world with the highest cases of software piracy, intellectual property theft and other sharp practices in the Information and Technology industry (Okwuke, 2014). Software piracy is the unauthorized copying, downloading, sharing, distribution, or installation of multiple copies onto your computers of copyrighted software. Piracy undermines the industry's ability to innovate and so reduce potential to contribute to the Digital Knowledge Economy. "Business Software Alliance's (BSA) revealed that an increase in the use of genuine software by 1% contributes $73 billion to the global economy". Hence, piracy must be curbed for the interest of the Nigeria economy as it can lead to reputational damage and loss of competitive advantage (Ajanaku, 2014). Therefore, there is need for the Nigeria government to encourage domestic software development as the benefits of doing this are enormous; and these benefits include increased job creation, improved business opportunities, better innovation, tax revenues and safety (Ihenyen, 2014). It for this reason that the Director General, Nigerian Copyright Commission has said that Commission has initiated a process of reforming the Copyright legislation to make it more effective in tackling Digital and other forms of Piracy and to provide for tougher punitive sanctions as a deterrent to piracy and all forms of infringement.

4. **Insecurity:** Nothing works in a state of insecurity. Also, no meaningful progress can be made in an economy bedeviled with a high degree of insecurity defined by Chiedu(2012) as the presence of fear and absence of economic or physical protection for persons, buildings, organizations or country against destruction or threats like crime or attacks. In other words, it is a sense of vulnerability or exposure to threats from the environment. Muhammad *et. al*. (2015) asserted that the potential security challenges for building a Digital Knowledge Economy could be at the Critical IT infrastructure or information level. The security challenges at Critical IT infrastructure may be by deliberate targeting IT infrastructures for destruction through terrorism, sabotage or natural disaster like hurricane or other

natural events; while security challenge at the information level may be by disclosure of sensitive information to others; alteration of critical information for illegal gains, unauthorized access and unavailability of critical information to stakeholder. Indeed, insecurity can keep economies stagnant or unworkable. Apart from attack on IT infrastructure and information, human ware who are the facilitators of Digital Knowledge Economy may also be object of attack. For instance, insurgency in North East part of Nigeria claimed several lives including the digital literate persons in their thousands. These individuals killed, in some way, have limited the economic growth of the Digital Knowledge Economy. It is in agreement with this, Chiedu(2012) opined that the massive loss of human resources and [other infrastructures] do not offer hopes that the nation is likely to realize its short and long term economic targets [including that of the Nigeria Digital Knowledge Economy.]

5. Poverty, Sickness and Diseases: Poverty has posed a serious challenge to the Nigerian government over the years with its attendant effects of deprivation of basic necessities of life. (Kanayo, 2014). The World Bank President restated that Nigeria ranked third position in the world poverty index; and it is a place where seven per cent of the world poor lives in, thereby being one of the top five countries with the largest number of poor people in the world (Omoh, 2014). This level of poverty could be attributed to a high level of youth unemployment in the country. Unemployed youth numbered about 11.1 million in 2012 with unemployment rate of 23.9% which is expected to hit 28.6% in September 2015 (ieconomic.com, 2015).

Additionally, there is a high prevalence of sickness and diseases coupled with a deplorable health sector in Nigeria (Oyebanji, 2015). And it is often said that the "health of the people is the health of the nation". The poor health of the people can reduce average life expectancy of the people. No wonder today, the average life expectancy of Nigeria is 52 years making Nigeria the 17th lowest in the world as at 2011 (Okpi, 2013). The deplorable health situation in the country coupled with the high level of poverty occasioned by high unemployment rate can affect the positive growth of a Nigeria Digital Knowledge Economy. Therefore, government most ensures effective healthcare delivery system capable of reducing or eliminating sickness and diseases.

5. PROSPECTS AND BENEFITS OF A NIGERIA KNOWLEDGE BASED ECONOMY.

Even though it is a herculean task to evolve and maintain a Digital Knowledge Economy, the future gains or benefits derivable from a heavy investment in it make it worthwhile. Some of the benefits in a Nigeria Digital Knowledge Economy include the emergence of a cashless society, creation of employment opportunities, and improvement of Gross Domestic Product (GDP).

1. Emergence of Cashless Society: Cashless society is a society that creates and uses electronic cash in place of physical cash in a high proportion of its transactions. Oladunjoye (2012) noted that the aim of a Cashless society is to reduce the amount of physical cash (coins and notes) circulating in the economy and encouraging more electronic–based transactions. The back bone of the cashless society policy is Electronic Banking which is the banking whereby businesses are facilitated through the use of Information Communication Technologies and electronic communication devices such as Automated Teller Machines (ATM) services, Mobile banking, Point of Sales Terminals, Internet Banking and Electronic Funds Transfer. One of the benefits of cashless society is that it engenders growth in the real sector of the economy as credit is readily available for investors and creates electronic cash which reduces cost of minting the naira as much as possible. Benefits of the cashless are enormous even though there are several complaints from different quarters that sufficient infrastructures have not been provided to make the system smooth. Dugeri (2013) asserted that there are fears of possible loss of money through fraud in the cashless system as experts have confirmed that the infrastructure supporting the cashless society in Nigeria may be 60% vulnerable to fraud. However, these fears can gradually be replaced with confidence with sufficient built-in security in the systems.

2. Creation of Employments Opportunities; wealth generation and Poverty Alleviation: A Digital Knowledge Economy is highly anchored on the use of Information and Communication infrastructure. With ICT infrastructure, the economy becomes highly networked. All of these have implications for youth employment. Incidentally, unemployment is one of the developmental challenges facing Nigeria at the moment. Therefore, evolution of a Nigeria Digital Knowledge Economy will no doubt expand job opportunities for digitally literate persons, help in wealth generation and poverty alleviation. It is in tandem with this that , Muhammad *et., al.* (2015) said that Knowledge Economy is a new source for creation of quality jobs, wealth generation, income distribution and poverty alleviation, as well as rapid economic development, prosperity and a source for facilitating global competitiveness.

3. Improvements in Gross Domestic Product (GDP): A Nigeria Digital Knowledge Economy can improve her Gross Domestic Product which a good measure of a country's economic growth. OECD (2001) defined Gross Domestic Product as an aggregate measure of production equal to the sum of the gross values added, of all resident institutional units engaged in production - plus any taxes, and minus any subsidies- on products not included in the value of their outputs. In other words, it is the market value of all the final goods and services delivered in a country in a period of one year and it is an important measure or indicator of economic progress in a country.

6. CONCLUSION AND RECOMMENDATIONS.

Though the task of creating an enabling environment for the growth and development of a Nigeria Digital Knowledge Economy is enormous, certainly, the heavy Return on Investment (RoI) on evolving a full Digital Knowledge Economy makes the effort of such investment a justifiable one, particularly at a time when the aspiration of Nigeria is to become one of the best twenty (20) economies of the world by the year twenty-twenty (2020). Since it did not take rocket science for Demark to be the world best in Knowledge Economy Index in 2008 and Sweden in 2012, it will not also take Nigeria a rocket science to rank one of the best top ten nations, if not the best, in the global Digital Knowledge Economy Index. All that Nigeria need at the moment is to strengthen her aspiration and resolve to be great; and then the aspiration to be one of the best twenty (20) nations in Digital Knowledge Economy will be a reality by the year 2020.

In the light of the above, this paper recommends as follows: One, the ICT/digital literacy gap between the academic institutions and the industries should be totally eliminated by a total overhauling of academic curricula to meet the digital needs of the industry and society. Two, the problem of power and energy must be addressed because Information and Communication infrastructure cannot run without power and energy. Therefore, Government efforts should be geared towards increasing power generation and distribution. In addition government should take a relook at the privatization of this sector, since the privatization has not yielded the desired result. Also , Nigeria must develop a sustainable energy such as solar and wind energy more so now that oil and gas reserve in Niger Delta is reducing.

Three, the fight against digital piracy should be more vigorous than before because no nation can develop through copying and imitation. Rather than using software without permission, use licensed software or at best develop use indigenous software that are tailored to our local needs. Therefore, there should be adequate legislation that provides for tougher punitive sanctions to offenders as deterrents in this regard. Four, Innovation can lead to discoveries. Therefore, to put the industries innovation capacity to task, Nigeria government must continue to discourage substandard products within the Nigeria economy space. Five, the Federal Government of Nigeria must do all within her power stop all forms insurgency as, most times, the object of attack are Information and Communication Technology infrastructure , police and police stations that secure lives and properties. Six, the must also vigorously fight unemployment, poverty, sickness and disease as these have the own fair share in limiting the growth of the Nigeria Digital Knowledge Economy. Specifically, the government most ensures effective healthcare delivery system capable of reducing or eliminating sickness and diseases

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