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INTRODUCING A MODELTO IMPROVE RECENT SUB-SAHARAN AFRICA NETWORKED READINESS INDEX

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ABSTRACT

In this paper we specifically address a number of recent recommendations suggested by The Global Information Technology Reports 2013 - 2015 with respect to Sub-Saharan Africa countries slow progress in developing its ICT infrastructure within the current world of Big Data and ICT for inclusive growth; warning that if care is not taking in terms of improving the framework condition for innovation and entrepreneurship there could be a digital divide between the developed and developing economies. In addressing this possible digital divide, we proffered a solution through a model we developed recently at Elizade University for auditing ICT infrastructure projects in a developing economy. We isolated and fully analyzed the sub-Saharan Africa data from the two reports and present our model in this paper. We argue that the model will address the specific shortcomings of the region in terms of strengthening its ICT infrastructure, and will improve the framework for innovation and entrepreneurship.

KEYWORDS: **BIG DATA, ENTREPRENEURSHIP, ICTS, INFRASTRUCTURE, NRI**

1. INTRODUCTION

The impetus for this paper is to address a number of the recommendations of The Global Information Technology Reports 2014 & 2015 (Bilbao-Osorio et al., 2014; Di Battista et al., 2015), published by World Economic Forum, regarding sub-Saharan Africa slow progress in developing its ICT infrastructure, especially by expanding the share of the population covered by, and having access to, mobile phones and expanding the number of internet users. It further stresses that strong ICT infrastructure can be achieved through improving the framework conditions for innovation and entrepreneurship in order to avoid what it termed as a new digital divide. In addressing this possible digital divide in terms of ICT infrastructure in sub-Saharan Africa, Oriogun, et al., (2015) proposed a model for auditing ICT infrastructure projects in developing economies. We believe that this model will assist government and ICT regulatory bodies in alleviating

poverty and to improve the lives of indigenous communities by building the capacity of target populations to harness the opportunities that ICTs offer.

The Global Information Technology Report 2014 & 2015 (Bilbao-Osorio et al., 2014; Di Battista et al., 2015) offers benchmark for ICT uptake in a world of *Big Data and ICT for inclusive growth* in terms of what has been termed as the Networked Readiness Index - NRI. Commonly known as the 3Vs, The Gartner IT Glossary (2015) defines *Big Data* as high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making . In the context of this paper, we are using the term *Networked* to mean *adaptation and/or implementation of Information Communication Technologies (ICTs)*. This paper will first analyze through descriptive statistics, the 35 Sub-Saharan Africa countries from the 148 countries investigated by The Global Information Technology Report worldwide, this will be followed by explanation of our proposed model to address the (Bilbao-Osorio et al., 2014; Di Battista et al., 2015) Networked Readiness Index in detail, making references to aspect of our framework that will particularly deal with the inadequacies of ICT infrastructure in the region, followed by some tentative remarks through a brief discussion and finally some concluding remarks.

2. THE GLOBAL IT REPORT AND NETWORKED READINESS INDEX FOR SUB-SAHARAN AFRICA (2014 2015)

The Global IT Report (Bilbao-Osorio et al., 2014) and the Networked Readiness Index (NRI) were created over 13 years ago based on a new way of organizing and managing economic activity in terms of the new opportunities and the impact that the Internet provided for businesses (Information Technologies Group, 2000; Dutta et al., 2012)

Table 1: NRI Ranking / Scoring for 35 Sub-Saharan Africa Countries -Adapted from (Bilbao-Osorio et al., 2014)

Sub-Saharan Position in 2014 (from 35 countries)	Sub-Saharan Africa Country in 2014 Report	NRI Ranking / Score 2015 (from 143 countries)	NRI Ranking / Score 2014 (from 148 countries)	Sub-Saharan Position in 2014 (from 35 countries)	Sub-Saharan Africa Country in 2014 Report	NRI Ranking / Score 2015 (from 143 countries)	NRI Ranking / Score 2014 (from 148 countries)
1	Mauritius	45 (4.5)	48 (4.31)	19	Swaziland	125 (3.0)	126 (3.00)
2	Seychelles	74 (4.0)	66 (4.02)	20	Mali	127 (3.0)	127 (3.00)
3	South Africa	75 (4.0)	70 (3.98)	21	Gabon	122 (3.0)	128 (2.98)
4	Rwanda	83 (3.9)	85 (3.78)	22	Ethiopia	130 (2.9)	130 (2.95)
5	Cape Verde	87 (3.8)	89 (3.73)	23	Cameroon	126 (3.1)	131 (2.94)
6	Kenya	86 (3.8)	92 (3.71)	24	Malawi	133 (2.8)	132 (2.90)
7	Ghana	101 (3.5)	96 (3.65)	25	Lesotho	124 (3.0)	133 (2.88)
8	Botswana	104 (3.4)	103 (3.43)	26	Sierra Leone	*Excluded in 2015*	134 (2.85)
9	Namibia	102 (3.5)	105 (3.41)	27	Benin	*Excluded in 2015*	135 (2.82)
10	Gambia, The	108 (3.3)	107 (3.38)	28	Burkina Faso	132 (2.8)	136 (2.78)

11	Zambia	114 (3.2)	110 (3.34)	29	Mozambique	129 (2.9)	137 (2.77)
12	Nigeria	119 (3.2)	112 (3.31)	30	Madagascar	135 (2.7)	139 (2.74)
13	Senegal	106 (3.3)	114 (3.30)	31	Mauritania	138 (2.5)	142 (2.61)
14	Uganda	116 (3.2)	115 (3.25)	32	Angola	140 (2.5)	144 (2.52)
15	Zimbabwe	121 (3.1)	117 (3.24)	33	Guinea	142 (2.4)	145 (2.48)
16	Liberia	*Excluded in 2015*	121 (3.19)	34	Burundi	141 (2.4)	147 (2.31)
17	Cote d ivoire	115 (3.2)	122 (3.14)	35	Chad	143 (2.3)	148 (2.22)
18	Tanzania	123 (3.0)	125 (3.04)				

The concept of *Big Data* relate to every conceivable data that we make use of on a daily basis as humans can be captured and studied as part of what has been termed as *Big Data*. From a total of 49 countries in Sub-Saharan Africa, The Global Information Technology Report 2014 (Bilbao-Osorio et al., 2014) captured 35 countries as shown in Table 1, therefore, only 71.42% of the countries in Sub-Saharan Africa countries were represented. The average NRI 2014 value is 4.12 (average of the lowest score 2.22 Chad and the highest score of 6.06 for Finland). However the average of the highest 12 (35%) of the 35 Sub-Saharan Africa countries captured in the study is 3.67 (Mauritius 4.31; Seychelles 4.02; South Africa 3.98; Rwanda 3.78; Cape Verde 3.73; Kenya 3.71; Ghana 3.65; Botswana 3.43; Namibia 3.41; The Gambia 3.38; Zambia 3.34; Nigeria 3.31). We observe in Figure1, a graphical representation of sub-Saharan Africa Networked Readiness Index scores for 2014 (Adapted from GITR 2014 using 54 NRI indicators)

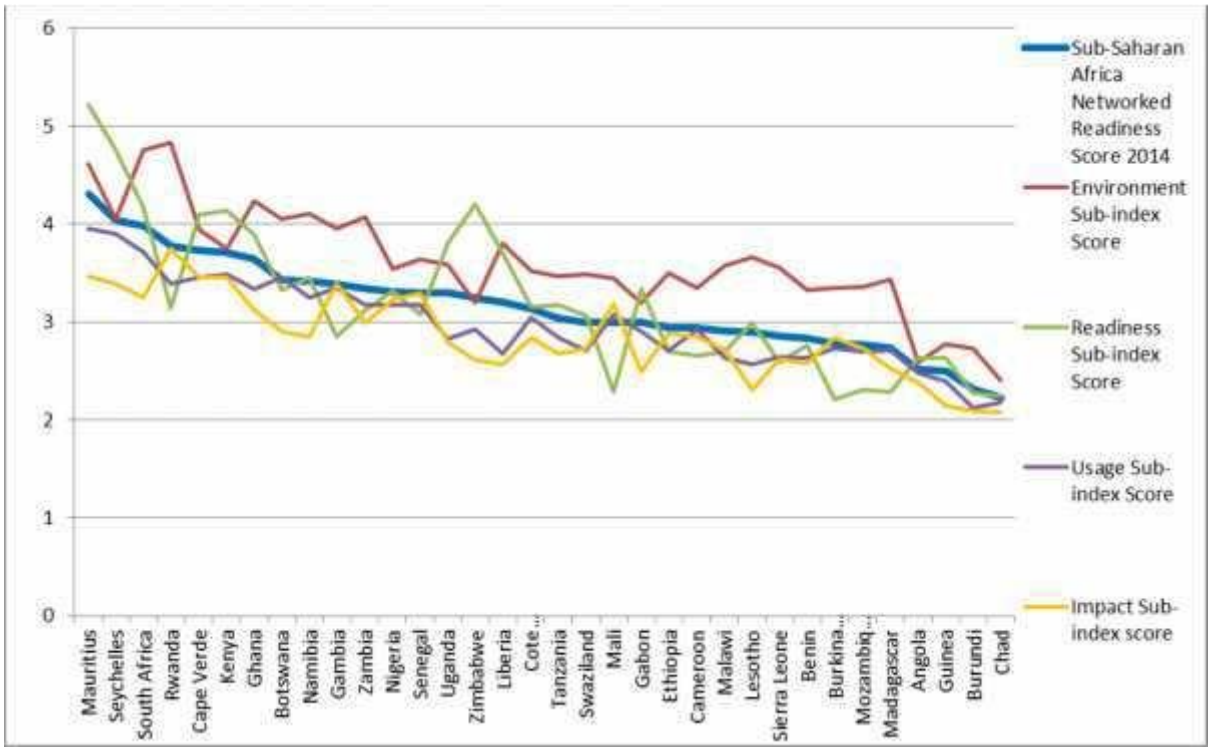

Figure 1: Graphical Representation of Sub-Saharan Africa Networked Readiness Index 2014 Scores (Adapted from Bilbao-Osorio et al. (2014) using 54 NRI indicators)

3. ANALYSIS OF THE NRI SCORES FOR SUB-SAHARAN AFRICA 2014 2015 INCLUSIVE

The analysis of the Global Information Technology Report 2014 for Sub-Saharan Africa included 35 countries as listed in Table 1. The remaining 14 countries (South Sudan, Democratic Republic of Congo, São Tomé and Príncipe, Central African Republic, Republic of the Congo, Equatorial Guinea, Djibouti, Eritrea, Somalia, Comoros, Sudan, Guinea-Bissau, Niger and Togo) were not covered in the report - Bilbao-Osorio et al. (2014), and Liberia, Sierra Leone, Benin were omitted from the report in 2015. The term Environment in this paper refers to Political and regulatory environment as well as the Business and innovation environment in the context of the Networked Readiness Index (NRI) framework. The *Affordability* of ICT *Infrastructure* has to match the appropriate knowledge and *Skills* acquisition before the environment is deemed to be at the state of Readiness. Furthermore, the Environment has to interact with Business, *Government* and *Individual* in order to have meaningful state of Usage of available information communication technologies (ICTs) resources. There must also be a method of measuring both the economic and social impacts of the ICT infrastructure environment before we can measure what has been termed as the Networked Readiness Figure 1 shows the overall scores for the 35 sub-Saharan Africa included in the Networked Readiness Index study of 2014. This is closely followed by the sub-indices for Environment, Readiness, Usage and Impacts accordingly. On a scale of 1 to 7 scoring regime, sub-Saharan Africa average is 3.27 (maximum score of 4.31 for Mauritius and minimum score of 2.23 for Chad). The country scoring the maximum NRI for 2014 worldwide is Finland with a score of 6.04. The average NRI 2014 score worldwide is 4.14 (minimum score Chad 2.22, and maximum score Finland 6.04). In terms of statistics, from the 148 countries that took part in the study, we can safely infer that NRI (Dutta et al., 2012). From Figure 2, it is evident that there was no data for Liberia, Sierra Leone and Benin as there were no 2015 NRI scores for these countries. It is possible that the reason for this may be due to the Ebola crisis when the data was being gathered, especially in Liberia and Sierra Leone.

The Di Battista et al. (2015) report did not explain the reason for excluding Benin in its 2015 NRI scores. According to Di Battista et al. (2015) the scores of the NRI showed that the ICT revolution has not extended worldwide. They claim that the capacity of a country to benefit from ICTs is strongly influenced by its stage of development . They concluded that:

The performance of sub-Saharan Africa is particularly disappointing: 30 of the 31 countries included in the sample appear in the bottom half of the NRI rankings. The only exception is Mauritius, at 45th. This country has progressed three places since last year and eight since 2012. Among the large economies of the region, Nigeria drops seven places to 119th. South Africa drops five to 75th it is now third in the region behind Mauritius and Seychelles (74th). In contrast, Kenya (86th, up six) has been slowly improving since 2012 p.14 Di Battista et al. (2015) noted further that: *the developing world still lacks universal, reliable, and affordable Internet. The lack of proper ICT infrastructure and cost of fixed broadband access, mobile broadband is becoming the technology of choice, but it remains prohibitive in too many countries. p.26*

59.14% of the maximum score was achieved worldwide (4.14 / 7.0). If we separate the scores of developing countries in sub-Saharan Africa (a total of 35 countries for this study), we discover that only 46.71% of the maximum score (3.27 / 7.0) was achieved from this sample population. This is one of the reasons that Bilbao-Osorio et al. (2014) suggest that sub-Saharan Africa need to develop a more solid ICT infrastructure, and should also improve the framework conditions for innovation and entrepreneurship in order to avoid the emergence of a new digital divide in what Bilbao-Osorio et al. (2014) referred to as possible age of digital revolution

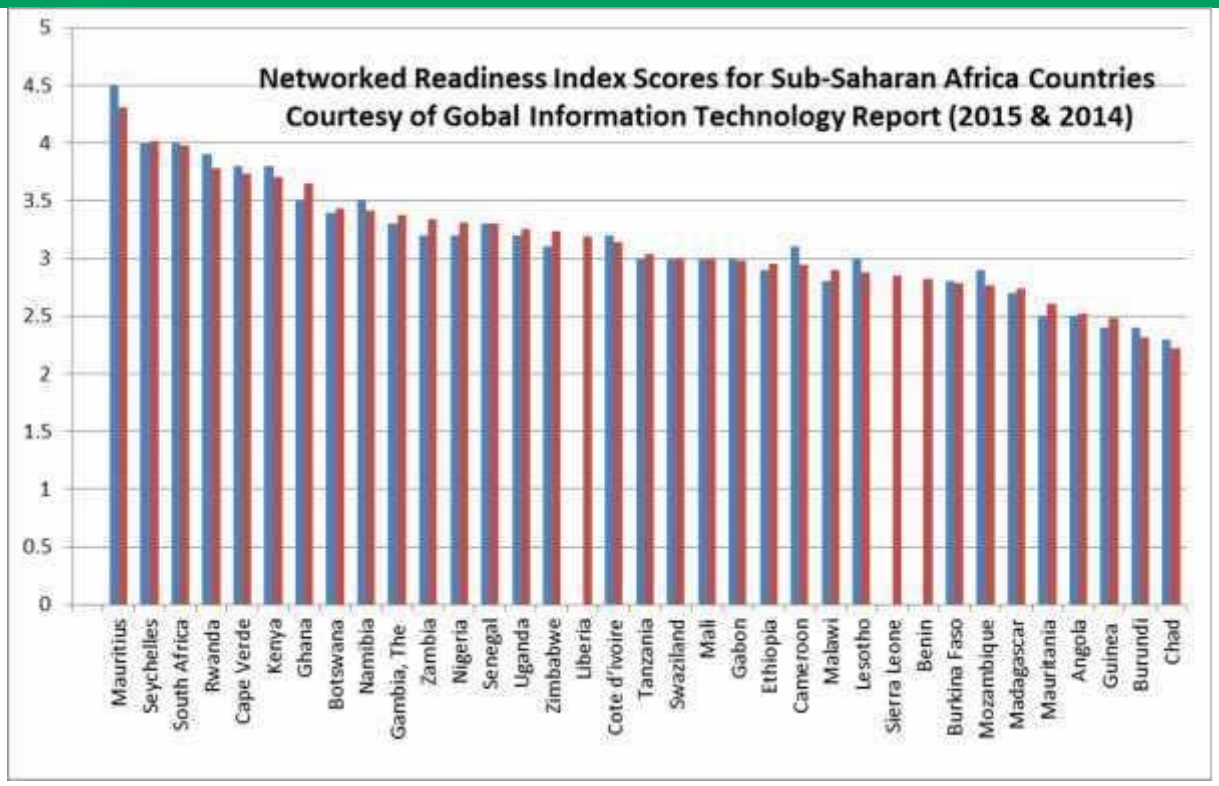

Figure 2: NRI Scores for 35 sub-Saharan Africa Countries (adapted from Di Battista et al. 2015; Bilbao-Osorio et al. 2014)

In Figure 2, the Sub-Sahara Africa countries considered in the (Bilbao-Osorio et al. 2014; Di Battista et al. 2015) reports are shown with the range of their NRI scores.

4. A MODEL FOR AUDITING ICT INFRASTRUCTURE PROJECTS IN DEVELOPING ECONOMIES

We offer our model for auditing ICT infrastructure projects in a developing economy (see Figure 4) as a way of addressing some of the shortcomings identified in the Global Information Technology Reports (Bilbao-Osorio et al. 2014; Di Battista et al. 2015). At the heart of the model are government and ICT regulatory bodies making policies that will have profound influence on ICT investments and use. The model is also robust enough to be able to alleviate poverty and improve the lives of indigenous communities by building the capacity of target populations to harness the opportunities that ICTs offer.

We offer our model for auditing ICT infrastructure projects in a developing economy (see Figure 4) as a way of addressing some of the shortcomings identified in the Global Information Technology Reports (2014 and 2015). At the heart of the model are government and ICT regulatory bodies making policies that will have profound influence on ICT investments and use. The model is also robust enough to be able to alleviate poverty and improve the lives of indigenous communities by building the capacity of target populations to harness the opportunities that ICTs offer. Figure 4 shows our published model for auditing ICT infrastructure projects in a developing economy

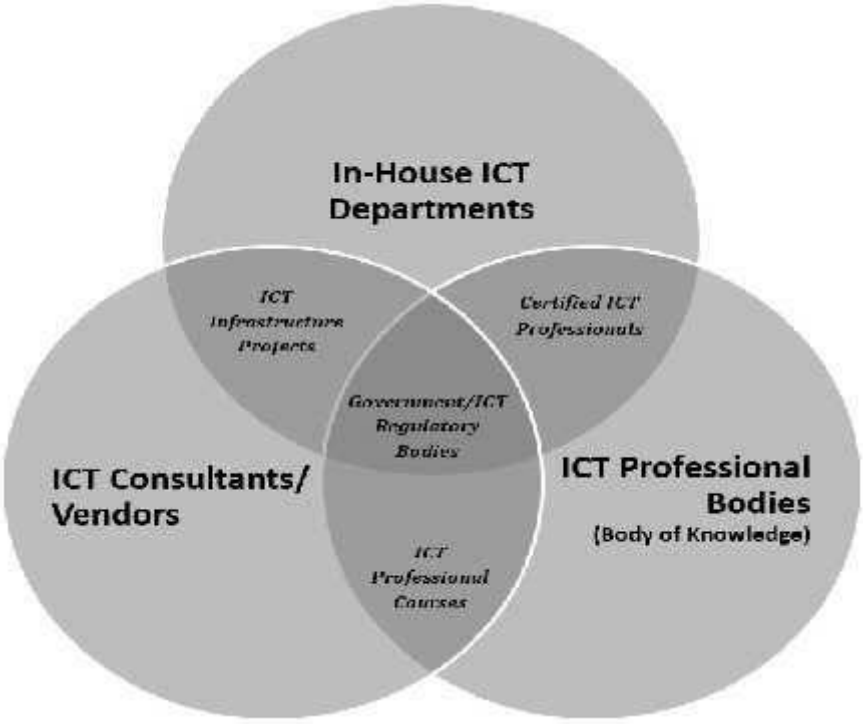

Figure 4: A Collaborative Model for Auditing ICT Infrastructure Projects in Developing Economies (Oriogun, et. al, 2015)

The model defines four key stakeholders (this ultimately will include any other possible users of the ICT infrastructure projects) in ICT project delivery in developing countries. These stakeholders are; the government/ICT regulatory bodies, ICT professional bodies, ICT consultants and in-house ICT departments. The inter-relationship amongst these groups creates synergies captured by the proposed model as well. These synergies are encapsulated in ICT professional courses, certification of ICT personnel, together with the actual ICT projects. This knowledge will come from both higher education and from professional certification.

4.1 Stakeholders in the Model for Auditing ICT Infrastructure Projects in Developing Economies

Government, through ICT regulatory bodies plays a pivotal role in auditing ICT infrastructural projects. This is done through setting national policies, standards, specifications and requirements to govern the execution of projects. Within the context of developing countries, this role cannot be ignored as best practices are yet to be developed and adopted in many parts of the industry. The model recognizes the pivotal role of government in the process by bringing together and regulating the activities of all the other stakeholders in the delivery of ICT infrastructure projects. At the heart of the model are government and ICT regulatory bodies making policies that will have profound influence on ICT investments and use. The intersections of the three major sectors of the model will provide incentives for ICT education and training at all levels, make provisions for strengthening ICT education and training, provide incentives for private sector research and development, together with a transparent ICT infrastructure audit.

The second stakeholders recognized by the model are ICT professional bodies. These are formal associations of ICT practitioners which have as their focus the development and advancement of the various ICT disciplines and technologies. In collaboration with government regulatory bodies, the professional bodies have the responsibility to

develop and maintain a professional body of knowledge in ICT. This knowledge is then codified and disseminated through ICT professional courses to create a pool of certified ICT professionals. Hence, the model provides for these professional bodies to regulate the quality and quantity of ICT competencies possessed by the practitioners of the discipline.

The third recognized stakeholders by the model are ICT Consultants, they are assumed by the model to mean companies set up in order to provide ICT goods and services. Naturally, the proposed model requires that these consultants/vendors provide these goods and services in collaboration with the in-house ICT departments of the organizations they consult for. This provision of goods and services is done through what this paper recognizes as ICT infrastructure projects. These projects are codified modules of work to be done in order to meet a specific need of the client. In cooperation with the in-house ICT department of the client, and in conformity to policies of government, these projects are defined and executed.

The model requires all companies wishing to undertake ICT infrastructure projects to have our fourth and final stakeholders, in-house ICT department. This is crucial so that proper technical specifications for the project as well as assessment of work done can be handled by an in-house team of competent ICT practitioners. The size and mix of professionals in these in-house ICT departments will vary based on the size and nature of the organization in question. However, these departments should be staffed by personnel who possess the requisite skill in their various ICT sub-disciplines to effectively carry out the work of the organization. This requisite skill is determined through certification. In the context of this model, it is expected that the practitioners in this in-house ICT department possess both theoretical as well as hands-on knowledge of the ICT tools and techniques to be deployed in the infrastructure projects.

5. DISCUSSION

We are particularly interested in the Networked Readiness Index (NRI) for sub-Saharan Africa, as the authors of this paper are from Nigeria, and are working and operating from Nigeria. We observe that from a total of 49 Sub-Saharan Africa countries, only 35 were included in the analysis, there was no particular reason supplied in (Bilbao-Osorio et al. 2014; Di Battista et al. 2015) to explain the rational for not including the 14 countries that were excluded. We are however of the opinions that since a number of these excluded countries are undergoing some radical social and economic conflicts and unrest, this might have been one of the reasons for their exclusion. As the share of the population in this region having access to mobile telephone, and the use of the internet is expanding, the ICT infrastructure is still in its infancy compared to majority of the developed countries.

It was mentioned in the (Bilbao-Osorio et al. 2014) report that a number of countries in sub-Saharan Africa are slow in their uptake of ICT, with no sign of improvement in the near future. The authors cautioned that the gap may hamper their capacity to support further economic and social development as the positive impacts of ICTs become more and more apparent p17. We believe that our proposed model for auditing ICT infrastructure projects in developing economies is an idea tool to address a number of concerns raised in the reports (Bilbao-Osorio et al. 2014; Di Battista et al. 2015) of the last two consecutive years.

6. CONCLUSION AND FUTURE WORK

In conclusion, in order for business and innovation ecosystems to flourish, we offer our model for auditing ICT infrastructure projects to the IT community that, when implemented, will address the specific shortcomings of the region in terms of strengthening its ICT infrastructure, and will improve the framework for innovation and entrepreneurship. The model requires all companies wishing to undertake ICT infrastructure projects to have an in-house ICT department with competent, reliable, dependable, trustworthy

professional ICT practitioners. The four major stakeholders in our proposed model for ICT project delivery in developing countries are: the Government/ICT regulatory bodies, ICT professional bodies, ICT consultants and in-house ICT departments. The inter-relationship amongst these groups creates synergies captured in the model. These synergies are encapsulated in ICT professional courses, certification of ICT personnel, together with the actual ICT projects. This knowledge will come from both higher education and from professional certification. Our future work on the model is to begin to gather empirical data from governments, private and public sector organizations from Sub-Saharan Africa countries in order to recommend a detailed framework for promoting and developing ICT infrastructure projects, such that future Networked Readiness Index for the region will be much enhanced and comparable to that of the developed economies.

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