

THE RELATIONSHIPS BETWEEN ECONOMIC, CULTURAL FACTORS, AND THE NETWORK READINESS OF AFRICAN NATIONS: A TEN-COUNTRY DATA ANALYSIS

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Abstract: This paper examines the relationships between cultural and economic factors, on the one hand, and the network readiness of African countries, on the other. For illustration purposes, data from ten (10) countries on the continent was used for analysis. The data came from reputable secondary sources, including the World Bank. A conceptual framework was developed, and relevant hypotheses tested. Correlation analysis and a series of multiple regressions were used to analyze the data. The results showed that the dimensions of culture related to individualism and masculinity and national economic wealth were positively related to network readiness. Further, the study's results indicated that economic wealth of a nation was a better predictor of its ability to participate in and benefit from information and communication technologies (ICT) use for socio-economic development than cultural values and orientations. The study's implication for policy making and research are discussed.

Keywords: National culture, economy, network readiness, Africa, ICT for development

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1. INTRODUCTION

According to the futurist, Toffler (1980) in his book, *The Third Wave*, the world's civilization is at a stage where information, knowledge, and to some extent, Information and Communication Technologies (ICT) are among its most valuable assets. Indeed, ICT is critically important in the policy decisions of developed countries that continue to invest heavily in such products (Turner, 2001; Bui et al., 2003; Erunbam and de Jong, 2006). On the other hand, less developed parts of the world, including Africa, are only beginning to grasp how ICT-enabled services could be used to hasten development (Molla, 2000; G8 DOT Force, 2001; Ifinedo, 2005; 2006). Development reports (e.g. G8 DOT Force, 2001) and academic studies (e.g. Odedra et al. 1993; Avgerou, 1998; Bui et al., 2003; Mbarika et al., 2005; Ifinedo, 2005; Ifinedo, 2006) indicate that African countries are not fully ready to integrate into the information age. Several world bodies, including the United Nations have also recognized the debilitating nature of this imbalance (UN ICT Task Force, 2004; WEF, 2007). For example, the former United Nations Secretary General, Kofi Annan commented:

"Countries where most people don't have access to this [information] technology cannot play a full part in the new global economy, ... And, the countries which are least integrated into the global economy are, not surprisingly, those with the highest proportion of very poor people" (People's Daily, 2000).

In the same vein, Avgerou (1998, p. 4) writes that "At the present, most developing countries are severely disadvantaged within a global economy which is increasingly more technology and information intensive: Unequal distribution of resources, such as telecommunications and technical skills, causes concern about the ability of developing countries to participate in the emerging world economy." African countries cannot afford to stand by the sideline and watch as the rest of the world integrates into this network economy (InfoDev, 2007; Ifinedo, 2005). A recent report on Africa stated "that future socio-economic development will need to embrace the use of ICT" (InfoDev, 2007, p.5).

In the developed countries, cross-country studies on the use of ICT for development have appeared (e.g., Caselli and Coleman, 2001; Comin and Hobijn, 2004; Waarts and van Everdingen, 2005; Erunbam and de Jong, 2006). Erunbam and de Jong (2006, p. 203) comment: "[w]hile some countries are receptive to [technological] changes, other countries appear to be less so." Differences across nations (and regions) have been attributed to influences stemming from both economic and non-economic factors, i.e., "national culture." Comin and Hobijn (2004), Caselli and Coleman (2001), and Gregorio et al. (2005), among others, suggest that national income levels and wealth could explain the differences among countries when it comes to each adopting ICT products and services. On the other hand, other researchers (e.g., Nath and Murthy, 2004; Waarts and

van Everdingen, 2005; Erunbam and de Jong, 2006) have shown that the influence of national culture could explain the divergence.

Our understanding of the factors impacting network readiness among countries in Africa is limited. Bridges.org (2001) suggests: "... the unique cultural and historical environment of a region must be taken ... to truly gauge the country's e-readiness [similar network readiness] for the future." This paper is motivated, in part, by the need to fill this gap in the research. What do we know about African countries' readiness for the network world? Which factors should the continent pay more attention to in order to integrate into the information age? And, what would the impacts of selected exogenous factors be on such an indicator? Suffice it to say that answers to the foregoing questions would be welcomed by policy makers on the continent and elsewhere (see G8 DOT Force, 2001).

Studies have discussed reasons why societies in Africa and in other comparable developing regions of the world lag behind advanced regions on the use of ICT for development, and terms such as "digital divide" have surfaced to underline such differences across nations (see e.g., Odedra et al. 1993; Avgerou, 1998; Udo and Edoho, 2000; Mbarika et al., 2005; Ifinedo, 2005; 2006). However, not many studies have investigated the relationships between national culture and economic, on the one hand, and the network readiness of Africa's countries, on the other. National culture and economic considerations, which previous studies have noted as being crucial in how nations adopt and use ICT, will be used in this study's model. The two factors were chosen for illustration purposes, as it would be simplistic and spurious to suggest that African countries' inability to fully integrate into the information age is attributable only to cultural and economic factors. Even in the context of network readiness assessment, it is accepted that a host of other factors may impact the preparedness of nations to use ICT for development (Bui et al., 2003; Ifinedo, 2005).

2. BACKGROUND

2.1 Network readiness of nations

The degree of preparation of a nation to participate in and benefit from ICT for socio-development is assessed by the Network Readiness Index (NRI) (WEF, 2007). Other organizations and researchers (e.g. Bui et al., 2003; Ifinedo, 2005) have used *e-readiness* to describe the same concept. The measure is developed by the World Economic Forum (WEF), and it accepts that ICT products and services have important roles to play in the advancement of societies and economies. The NRI provides scores for some 122 countries. It consists of three sub measures that assess the following: (a) - the supporting environment for ICT in a country, (b) - the readiness of the country's key stakeholders [individuals, business and governments], (c) - the usage of ICT among these stakeholders

2.2 National culture (cultural factors)

Hofstede (2001) defines culture as the collective programming of the mind which distinguishes the members of one group from another. The work of Hofstede has been widely recognized as the most dominant framework for theory development and validation in cross-cultural studies, and several studies have used it (e.g., Myers and Tan, 2002; Waarts and van Everdingen, 2005; Erunbam and de Jong, 2006). The four main

cultural dimensions in Hofstede's typology are briefly described below. The four main cultural dimensions in Hofstede's typology are explained as follows: The Power Distance Index (PDI) measures the degree of equality, or inequality, between people in the country. The Individualism (IDV) index measures the degree to which a society reinforces individual or collective achievement. The Masculinity (MAS) "focuses on the degree the society reinforces, or does not reinforce, the traditional masculine work role model of male achievement, control, and power" (ITIM, 2009). The Uncertainty Avoidance Index (UAI) measures a society's level of tolerance for uncertainty and ambiguity. Table 1 shows the scores of each dimension for the countries used in this study.

2.3 National economy (economic wealth)

It has been shown that the use and adoption of ICT across countries differ by the amount of wealth available to any given country (Caselli and Coleman, 2001; Bui et al., 2003; Comin and Hobijn, 2004; Gregorio et al., 2005). The Gross Domestic Product (GDP) per capita is among the most widely used measures for comparing the wealth of nations. It refers to the value of the total goods and services produced within a nation in a given year, divided by the average population for the same year (see the World Bank, 2007). Likewise, the World Bank also makes available data for GDP purchasing power parity (PPP). This measure gauges national wealth or standards of living across countries by adjusting for differences in the cost of living in different countries. The data for the selected African countries in this paper is presented in Table 1. Importantly, an attempt was made to select countries from the geographical regions (sub-regions) of Africa.

Table 1. A summary of the variables used in the study

| Country | Economic climates | | National cultural dimensions | | | | NTR |
|--------------|---------------------------------------|-------------------------------|------------------------------|-----|-----|-----|------|
| | GDP per capita US\$ (2007 est.) | GDP-ppp (US (2007 est.) | PDI | IDV | MAS | UAI | |
| South Africa | \$10,600 | \$467.6 bil. | 49 | 65 | 63 | 49 | 4.00 |
| Egypt | \$5,400 | \$431.9 bil. | 80 | 38 | 52 | 68 | 3.44 |
| Ethiopia | \$700 | \$55.07 bil. | 64 | 27 | 41 | 52 | 2.55 |
| Nigeria | \$2,200 | \$294.8 bil. | 77 | 20 | 46 | 54 | 3.23 |
| Algeria | \$8,100 | \$268.9 bil. | 80 | 38 | 52 | 68 | 3.41 |
| Kenya | \$1,600 | \$57.65 bil. | 64 | 27 | 41 | 52 | 3.07 |
| Benin | \$1,500 | \$12.18 bil. | 77 | 20 | 46 | 54 | 2.83 |
| Zambia | \$1,400 | \$15.93 bil. | 64 | 27 | 41 | 52 | 2.75 |
| Mali | \$1,200 | \$14.18 bil. | 77 | 20 | 46 | 54 | 2.96 |
| Tanzania | \$1,100 | \$43.49 bil. | 64 | 27 | 41 | 52 | 3.13 |

Legend: bil. = billion; NTR = network readiness

3. RESEARCH FRAMEWORK AND HYPOTHESES

The research framework of this study is shown in Figure 1. It suggests that national culture and economic factors positively impact nations' network readiness. Reports and studies have shown that the diffusion of technological innovations has been relatively

slower in developing parts of the world partly due to unfavorable economic conditions (see e.g., Caselli and Coleman, 2001; Comin and Hobijn, 2004; UNECA, 2007; InfoDev, 2007). Others have indicated that differing cultural values and orientations may be the causes of disparities with regard to the diffusion of innovations (e.g., Hofstede, 2001; Waarts and van Everdingen, 2005; Erunbam and de Jong, 2006). In brief, the foregoing detail provides some rationale for the proposed conceptualization. Next, the hypotheses to be tested are formulated.

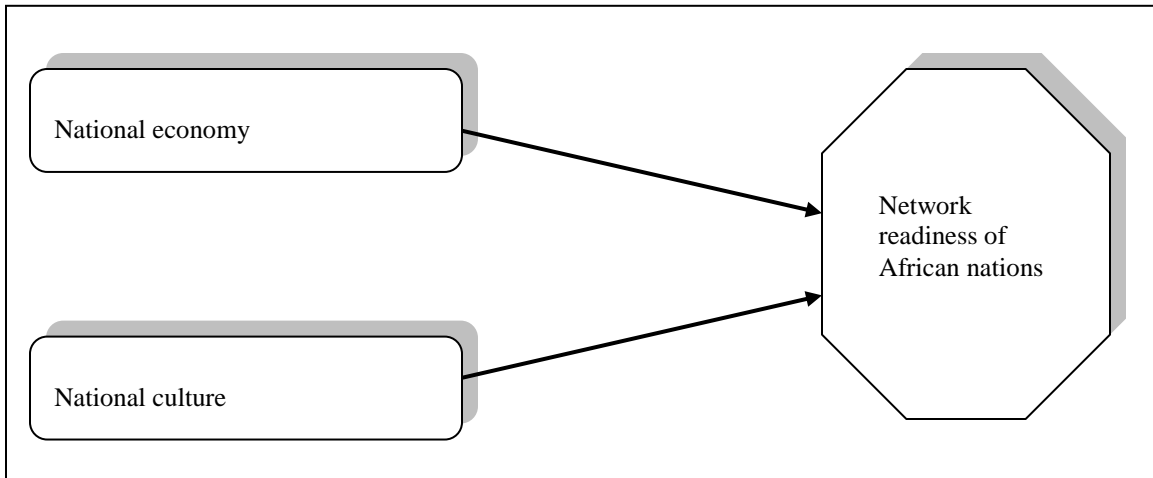


Figure 1. The research framework

The global data for the network readiness shows that several high and middle-income countries have higher scores on the index than do their poorer counterparts (WEF, 2007). Other studies (e.g., Caselli and Coleman, 2001; Nath and Murthy, 2004; Comin and Hobijn, 2004; Gregorio et al., 2005) have also shown that wealthier countries tend to have more access to resources to build on potential of ICT-enabled services such as e-business and e-government, which invariably help to increase their network readiness. Given the critical importance of economic resources in enhancing a country’s capability to adopt and use technological innovations for development, it is likely that wealthier African countries will have higher network readiness scores than those with lesser economic resources. Thus, it is hypothesized that:

H1: There will be a significant positive relationship between national economic climates and network readiness for African countries.

It is reasonable to suggest that countries with high Power Distance Index (PDI) scores would have lower network readiness because in such nations the “inequalities of power ... have been allowed to grow within the society” (ITIM, 2009). Waarts and van Everdingen (2005, p. 305) note that “centralized decision structures, authority and the use of formal rules are therefore often the characteristics of organizations in countries with a high degree of power distance.” In other words, entities in countries with high PDI scores would expect their governments and other higher authorities to provide leadership roles for most initiatives, including the adoption of ICT products for developmental purposes.

In contrast, it is more likely that entities in countries with lower PDI scores would be autonomous in their use of such products. Thus, it is hypothesized that:

H2a: Countries in Africa with higher PDI scores will have lower network readiness index scores

In brief, in more individualistic societies, emphasis tends to be placed on the performance of the individual rather than that of the group (Hofstede, 2001). According to Kovačić (2005, p.147), “time management [issues] would be [considered] important and any technology that could help individuals to perform more efficiently would be highly regarded and quickly accepted.” The foregoing may suggest that countries with higher IND scores would be the ones with higher network readiness scores. That is, such countries would not find it difficult to use ICT-based products for development. Thus, it is predicted that:

H2b: Countries in Africa with higher IND scores will have higher network readiness index scores

As was noted above, the MAS dimension describes the extent to which any society reinforces masculine achievement and control. It is to be expected that regions where material success and achievement are valued highly would equally have high network readiness scores. Kovačić (2005, p. 147) notes, “it could be argued equally well that in a country with high masculinity there would also be a positive attitude toward implementing ICTs if these technologies improve performance, increase the chance of success and support competition, which are all key factors of a masculine culture.” To some degree, this foregoing assertion could be interpreted to mean that more masculine societies are prepared and ready to use ICT products and services for advancement. It is hypothesized that:

H2c: Countries in Africa with higher MAS scores will have higher network readiness index scores

UAI refers to how a society deals with uncertain and ambiguous situations that it may confront. Countries with strong uncertainty avoidance would be averse to adopting or accepting new technological products and services, including IT-related ones. On the contrary, nations with lower uncertainty avoidance scores would be more likely to adopt ICT-based initiatives for development. Nath and Murthy (2004) found positive relationships between the diffusion of the Internet and UAI. Thus, it is hypothesized that:

H2d: Countries in Africa with higher UAI scores will have lower network readiness index scores

4. RESEARCH METHODOLOGY

Data for this study came from reputable sources, including the World Bank, and the World Economic Forum (WEF, 2007). As was noted above, the cultural dimensions of each country was obtained from the work of Hofstede (2001), which is also kept online

at: http://www.geert-hofstede.com/hofstede_dimensions.php (ITIM, 2009). For illustration and simplicity purposes, this study used ten (10) countries, which are shown in Table 1. As noted above, effort was made to include countries from the sub-regions – North, West, South, and East - of the continent. The economic variables used to gauge national wealth or economic strengths across the chosen countries included GDP per capita and the GDP-PPP. The summaries were extracted from the World Bank (2007) and CIA World Factbook (2007). The GDP and GDP-PPP variables were transformed and normalized with a logarithmic function, i.e., *ln*. Pearson’s correlation and regression analysis were used for data analysis on the SPSS 14.0 software.

5. DATA ANALYSIS

The correlation matrix is shown in Table 2. It can be seen that the two variables used to operationalize national economic wealth have strong positive relationships with network readiness. (The correlations were significant at the 0.01 level). As such, the hypothesis, H1 can not be rejected. With regard to the cross-cultural dimensions, the data analysis found support for the following hypotheses: H2b and H2c. No support was found for the other two cultural dimensions, i.e., H2a and H2d. (The correlations are significant at the 0.01 level).

Table 2. The correlation matrix for the variables

| | InGDPc | InGDPP | PDI | IDV | MAS | UAI | NTR |
|--------|----------|----------|---------|----------|----------|---------|-----------------|
| InGDPc | 1 | .781(**) | -.027 | .799(**) | .901(**) | .499 | .901(**) |
| InGDPP | .781(**) | 1 | -.054 | .659(*) | .676(*) | .436 | .786(**) |
| PDI | -.027 | -.054 | 1 | -.567 | -.175 | .710(*) | -.232 |
| IDV | .799(**) | .659(*) | -.567 | 1 | .851(**) | .072 | .822(**) |
| MAS | .901(**) | .676(*) | -.175 | .851(**) | 1 | .254 | .884(**) |
| UAI | .499 | .436 | .710(*) | .072 | .254 | 1 | .232 |
| NTR | .901(**) | .786(**) | -.232 | .822(**) | .884(**) | .232 | 1 |

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).
Legend: InGDPc = ln (GDP per capita); InGDPP = ln (GDP-PPP); Power Distance Index (PDI); Individualism (IDV); Masculinity (MAS); Uncertainty Avoidance Index (UAI); NTR = network readiness

In order to gain a deeper understanding of the effect of the exogenous factors on the network readiness variable, stepwise regression analysis were performed on the dataset. The effects of economic wealth and national culture were separately regressed on the dependent construct: network readiness. Next, all the variables together were regressed on the dependant variable. The three regression models used are represented as follows:

$$NTR_j = \alpha + \beta_1 IDV_j + \beta_2 MAS_j + \beta_3 UAI_j \dots\dots\dots(1)$$

$$NTR_j = \alpha + \beta_1 GDP_j + \beta_2 GDP-PPP_j \dots\dots\dots(2)$$

$$NTR_j = \alpha + \beta_1 GDP_j + \beta_2 GDP-PPP_j + \beta_3 IDV_j + \beta_4 MAS_j + \beta_5 UAI_j \dots\dots\dots(3)$$

The α s and β s are parameters to be estimated, and the subscript j are use to indicate the countries. SPSS 14.0 dropped the PDI variable perhaps due to the insignificant nature of this particular dimension in the model. In all the analyses, multicollinearity was not seen to be a major problem for the study. The effect of multicollinearity was assessed by checking that the variance inflation factor (VIF) of each variable was not beyond acceptable limits. The t statistic and its significance value are used to test the null hypothesis that the regression coefficient is zero. The coefficient of determination, R^2 is used to assess the amount of the variation explained by the regression model. The results in Table 3 show that 70% of the variation in the model is accounted for when only the cultural variables were regressed on the dependent construct. Seventy eight percent (78%) of the variations in the main construct was explained by the economic indicators.

Table 3. Regression analyses results of each of the factors on network readiness

| Independent variable | Unstandardized Coefficients | Standardized Coefficients | | | R ² | F | Sig. |
|----------------------------------------------------------|-----------------------------|---------------------------|-------|------|----------------|------|------|
| <i>Cultural variables regressed on Network readiness</i> | | | | | | | |
| (Constant) | | Std. Error | t | Sig. | 0.70 | 8.03 | .016 |
| IDV | .008 | .011 | .771 | .470 | | | |
| MAS | .037 | .022 | 1.691 | .142 | | | |
| UAI | .003 | .012 | .262 | .802 | | | |
| <i>Economic variables regressed on Network readiness</i> | | | | | | | |
| (Constant) | .314 | .660 | .476 | .649 | 0.78 | 16.9 | .002 |
| lnGDPc | .332 | .113 | 2.950 | .021 | | | |
| lnGDPP | .060 | .071 | .839 | .429 | | | |

When all the factors together were regressed on network readiness index construct (see Table 4), again 78% of the variation in the model is accounted for. The seemingly high R^2 s (in all the analyses) suggest that the exogenous factors considered in this study are relevant to the dependent variable, at least in the context of the data used for this study.

Table 4. Regression analyses of all the factors on network readiness

| Independent variable | Unstandardized Coefficients | Standardized Coefficients Std. Error | t | Sig. | R ² | F | Sig. |
|----------------------|-----------------------------|-----------------------------------------|--------|------|----------------|------|-------|
| (Constant) | .821 | .803 | 1.022 | .364 | 0.78 | 7.39 | 0.038 |
| IDV | .341 | .250 | 1.367 | .243 | | | |
| MAS | .076 | .074 | 1.028 | .362 | | | |
| UAI | -.002 | .011 | -.198 | .853 | | | |
| lnGDPc | .009 | .026 | .357 | .739 | | | |
| lnGDPP | -.018 | .015 | -1.204 | .295 | | | |

6. DISCUSSIONS AND CONCLUSION

The purpose of this study is to increase our understanding of the network readiness of Africa's countries. To that end, data from ten (10) countries on the continent were used in this preliminary analysis. The premise is that by researching the network readiness of Africa's countries vis-à-vis such factors as national culture and economic wealth, among others, Africa's policy makers would gain insights into issues that could hasten the integration of the continent into the emerging global network economy (and information age). From the perspective of the selected countries in this study, this paper has shown that there is a strong relationship between some dimensions of national culture, i.e., individualism and masculinity and economic wealth, on the one hand, and network readiness, on the other.

For the economic wealth variables, the data showed that wealthier African countries are better poised to reap the benefits of using ICT for development in the information age. Such countries are the ones with relatively higher network readiness index scores. More importantly, the economic wealth of a nation was found to be more important in its capability to use ICT for development than its cultural norms and values. (The percentage of the variation explained by economic indicators alone in the model compares with the result for all the factors combined) (Please see Table 4). This information implies that the more economic resources an African country possesses, the more likely it is for it to integrate into the evolving network world. Cultural values and norms, though important, may not be as critical as the availability of economic resources.

The statistical analysis using data for the ten Africa's countries provides support for two out of the four hypotheses that were formulated for the relationships between national culture and the network readiness index. The result showed that there was a negative relationship between PDI and network readiness as predicted; however, the relationship was seen to be insignificant. This result permits us to suggest that stakeholders across African societies might have fully understood the value and import of ICT for development to such an extent that support from a higher authority is no longer considered vital in shaping perceptions. This conclusion may be at odds with conventional wisdom suggesting that strong leadership on the African continent is needed in moving forward technological-related initiatives (G8 DOT Force, 2001; Mbarika et al., 2005; Ifinedo, 2006; InfoDev, 2007). Similarly, the data did not provide support to the prediction that African countries with strong uncertainty avoidance would be averse to adopting or accepting new technological products and services, including IT-related ones. This permits the suggestion that all the countries hold comparable view of the benefits of ICT. Overall, a prior study in the literature by Nath and Murthy (2004) offered an analogous interpretation to our result; they reported that the PDI may not permit meaningful conclusions with regard to ICT and cultural issues.

Masculinity was found to be positively related to network readiness, confirming the proposition that countries with preferences for material success and achievement would value and use ICT products to their advantage more than their counterparts with lesser inclinations toward such things. In the same vein, countries with higher individualistic scores tended to outperform those with lower scores on the network readiness index. This

may suggest that African countries that encourage the exploitation of technological innovations for the benefit of the individual rather than for the group will continue to fare favourably in their quest to reap the benefit of the information age. Researchers (e.g. Comin and Hobijn, 2004; Waarts and van Everdingen, 2005; Erunbam and de Jong, 2006) have suggested a nexus between the individual use of technological innovations and the advancement of the nation state. Naturally, African societies tend to place more emphasis on “the group” than on the individual (Hofstede, 2001). In that regard, the result suggests that countries in the region where attention is paid to the individual would have more capacity for the information age. This finding, by no means, is suggesting that ICT adoption has stalled in collectivistic countries. Evidence from China and elsewhere speaks to this reality (Chau et al., 2008). Rather, what is suggested, based on the study’s data, is that individualistic countries appear to outperform group-oriented cultures with regard to their network readiness index scores.

This study offers implications to both researchers and policy makers. The degree of data’s variability for the relationships between the selected factors infers that the Africa’s countries cannot be taken as a monolith, at least in the context of network readiness assessment. Although African countries have relatively poor scores on the network readiness index, it may be misleading to lump all the countries on the continent into one pot. This study has shown that there are salient differences that should not be overlooked. For example, the NRI scores for South Africa and Egypt are significantly higher than those of Zambia and Malawi (see Table 1). Researchers are alerted to relevance of such factors as national culture and economic climates vis-à-vis technological innovations. This present effort complements the works of others (Odedra et al. 1993; Molla, 2000; Mbarika et al., 2005) that have discussed ICT and developmental issues on the African continent. In particular, the statistically significant relationships in the study’s variables make a contribution to the growing body of knowledge on developmental ICT issues in Africa. Empirical evidence in this study provides support for the studies of others (e.g. Caselli and Coleman, 2001; Comin and Hobijn, 2004; Gregorio et al., 2005) that have highlighted the relevance of economic resources for the diffusion of technological innovations across countries.

Recently, WEF (2007) notes that some African countries have started to spend heavily on ICT products with a view to redressing their poor network readiness in the global economy. This is an encouraging move; however, external assistance may be required to help the less economically endowed countries on the continent that are unable to marshal resource for such investment. This would ensure that no country is left far behind in the new order. It is worth noting that the selected factors and variables used in this study are not claimed to be the only influences that could impact a nation’s capability to harness ICT for development. More insights on other influences are expected.

As we conclude, it is important to highlight some of the limitations in this work. Some of these relate to the selection of the countries. We are hard-pressed to say that the selected countries unequivocally reflect patterns and trends in the other countries in Africa. Moreover, our choice of ten, though varied and comprehensive, might be limiting. A larger sample of countries might permit a deeper insight. Lastly, there is a fundamental

flaw in Hofstede's work wherein "culture" in a nation-state is assumed to be monolithic (e.g., Myers and Tan, 2002; Walsham, 2002). It is known that even in one single nation there are different cultures. Walsham (2002) in critiquing Hofstede's cultural typology suggests that other frameworks and approaches may be more applicable to developing societies. This research did not take such approaches into account. Further, the network readiness index proposed by the WEF (2007) has its limitations, and this might have impacted this study's analyses. Future studies could address some of the limitations discussed herein. Other research methods and frameworks could be used. Similar efforts to this one in comparable regions of the world could be undertaken to facilitate comparative insights. Lastly, the impact of other relevant factors such as human capital not considered here could be examined.

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