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# The Role of ICT in Sustainable Development: The Ugandan Narrative

(Full Paper)

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### ABSTRACT

This article investigates the effectiveness of information and communications technologies in sustainable development among non-OECD economies that encapsulate its underlying beliefs and values. Specifically, we have developed a data-driven narrative by using Uganda as the subject of case analysis. We performed statistical analysis to study the significance of ICT as an enabler to the overall socio-economic development. There is a missing component comprising digital literacy and participation that have calls into question the mediating role of inclusive growth. Both our method and findings adopt generally accepted protocols for case studies. The contribution of this research is interpretivist in nature, and we recommend that similar studies need to be replicated by researchers across geographies and domains.

*Keywords:* Information technologies for development, digital divide and sustainable development goals.

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### THE SOCIO-ECONOMIC CONTEXT OVERVIEW

Uganda is a former British colony in the African subcontinent that became independent on 6th October 1962. Uganda is one of the least developed countries in the world and is ranked as one of the lowest in the African region (Ndiwalana *et al.*, 2012). However, like many other developing countries, Uganda has experienced consistent economic growth over the years. This article investigates the main reason for this economic growth and determines whether this is due to their expanding commercial exports through the lens of a data-driven narrative (Sharma & Ravindran, 2020). Given that most developmental perspectives are mostly through the lens of neo-classical World Bank, IMF (International Monetary Fund) or OECD (Organisation for Economic Co-operation and Development) analyses, such a narrative is overdue and attempts to make a contribution to the gap in this body of knowledge.

An improvement in the economy does not necessitate a reduction in poverty. As illustrated in figure 1, Uganda, when benchmarked with its neighbours, is on a growth trajectory. However, the poverty levels in Uganda keeps increasing even though their Gross Domestic Product (GDP) was increasing pre-COVID. Since COVID however, Uganda’s real GDP this year is projected to be between 0.4 and 1.7% compared to 5.6% in 2019. From this alone, we can suspect that corruption will play a large role in answering the main question of this report. Uganda finds itself with a very low Human Development (HDI) value of 0.528, which is 159th in the world (UNDP, 2020).

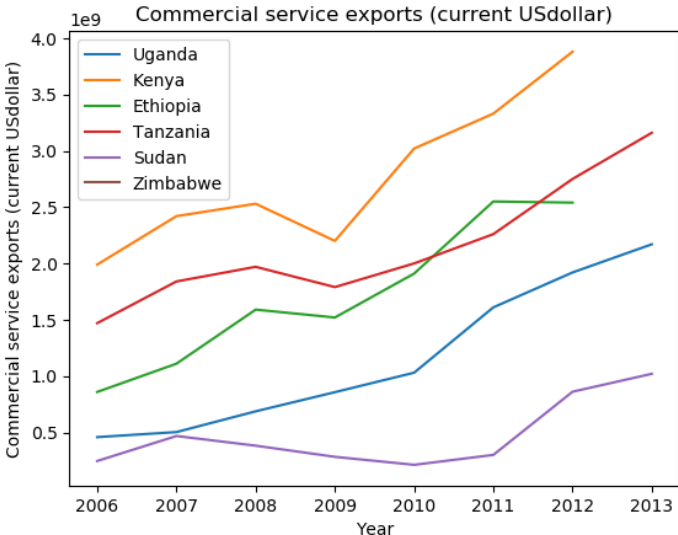


Figure 1: Commercial service exports of Uganda and similar countries.

The level of corruption in Uganda has seen a major increase in the last decade (Buntaine & Daniels, 2020). Uganda is the 137th least corrupt country in the world out of 180 countries (Trading Economics, 2019). Less than half of Uganda's population own a mobile phone, whereas this market is close to mobile phone saturation in countries such as South Africa (83%) and Kenya (87%). The current draft of the Vision is constrained however by the fact that Uganda has one of the lowest (14%) Internet penetration rates of the 10 African countries surveyed by Research ICT Africa (RIA) as part of the Global South After Access Survey conducted between 2017 and 2018. And amongst the participant countries Uganda has the second-poorest Networked Readiness Index (NRI) score, ahead of only Cameroon (Gillwald, 2019).

According to the World Economic Forum (WEF), Uganda's political and regulatory environment is very robust, but its market and infrastructural environments are poor (WEF, 2011). In terms of both readiness and use, the WEF sees the Ugandan government as doing satisfactorily; but businesses are slightly behind, while individuals are seen as still lagging, reflecting potential room for growth in terms of demand for ICT services.

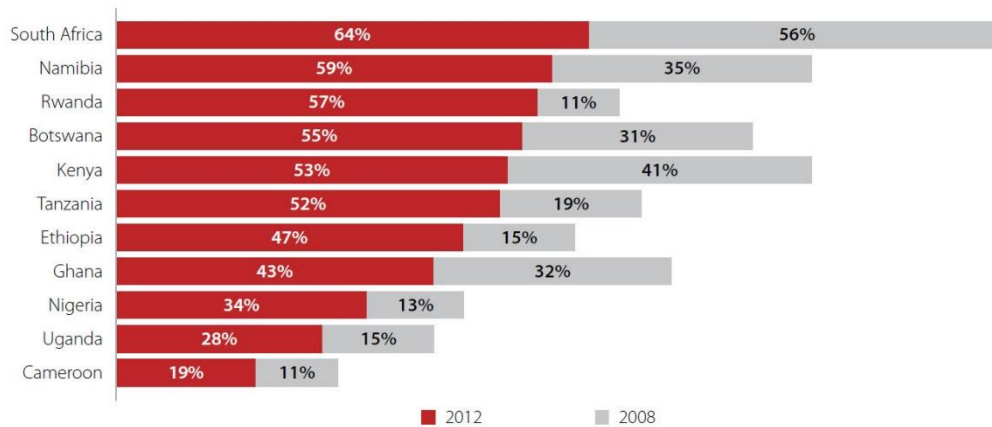


Figure 2: Daily Internet Use among web users in RIA Countries.

When considering the digital infrastructure, a key factor of competitiveness in the digital era, daily internet use has grown across Africa, as shown in Figure 2, and this increase may be attributed to better connectivity as a result of the landing of more undersea cables at the East African coast. However, the resulting retail price drops have not been as significant as expected. Internet use is also increasingly mobile because more users now have internet-capable handsets and other mobile devices, allowing internet connectivity. There is another body of theories that claims knowledge management (KM) provides the solution for leveraging ICT (cf. Sharma *et al.* 2008; 2009; 2012; 2016). This is evident because many sectors are influenced by KM for sustainable development. The analysis in this article uses data from the Uganda Sector Performance Review (SPR) based on the 2012 Research ICT Africa (RIA) Household and Individual ICT Access and Use Survey for Uganda, which delivered nationally representative results for households and individuals by using enumeration areas prepared by the Uganda Bureau of Statistics (UBOS) combined with suitable sample design.

Uganda's ICT sector has continued to grow over the last few years, driven by demand for both mobile voice and mobile internet services, with the ICT sector contributing 6% of the national GDP in 2010 (Ssewanyana *et al.*, 2007).

The most significant recent development in Uganda's ICT sector was the announcement in 2010 of the merger of the two regulators, the Uganda Communications Commission (UCC) and the Broadcasting Council (BC), to form one regulatory body, still known as the Uganda Communications Commission (UCC) (Ministry of Information and Communications Technology, 2010). The Ministry is supported by regulatory agencies that include the UCC – regulating the telecommunications sector and responsible for management and implementation related to the Rural Communications Development Fund; and the National Information Technology Authority Uganda (NITA-U) – regulating the IT sector and also responsible for roll-out and operation of the National Backbone and e-Government Infrastructure (Gillwald *et al.*, 2019). In the digital era, content and media as an innovation asset has been well-researched (cf Sharma & Wildman, 2009).

Fierce competition in mobile voice services has driven tariffs down to the point of eliminating price differentials between on-net and off-net calls. Despite this, Uganda is still poorly ranked in Africa in terms of mobile voice cost, and its interconnection rate is still higher than in neighbouring Kenya and Tanzania (Waema *et al.*, 2014). During the 2010-11 period, the number of Ugandan mobile subscribers increased by a record of 4.37million to a total of 16.7million. The RIA African Mobile Pricing (RAMP) Index shows that in Uganda in 2018 it would cost UGX 10 000—far above the means of a country with a GNI per capita of only USD 1 820, a per capita income level which the majority of the population live below. The 2018 RIA After Access Survey confirms that affordability of devices and services is the main constraint on uptake and use.

Access to the internet has improved, with Uganda having an estimated 4.8million internet users as of December 2011 – partially due to lowering of prices since the landing of new fibre optic undersea cables on the east coast of Africa. Retail internet charges have not, however, dropped as much as would have been expected given the new fibre access because there is no effective backhaul competition. Human capital is one of the essential for innovation and development (Sharma *et al.*, 2008; 2009). Individual internet access takes place predominantly via mobile telephony platforms, and access to computers remains very limited at only 4.8%. However, the perceived level of effectiveness of Uganda’s regulatory environment, historically evaluated as one of the best on the continent, has steadily declined.

This section provides an overview of ICT for sustainable development. The next section is a descriptive account of Uganda’s experiences with ICT-enabled development. Section 3 introduces a 4-pillar research framework adapted from Sharma *et al.* (2016) that serves as a lens for data analytics. Section 4 distils findings in the form of a narrative (cf. Sharma & Ravindran, 2020) that specifically discusses interesting caveats and policy imperatives. The article concludes with some thoughts for further research.

### ICT AND UGANDA’S GROWTH TRAJECTORY

The ICT services sector dominates Uganda’s GDP (contributing 45.1% in 2011-12), in comparison to industrial manufacturing (26.3%) and agriculture, forestry, and fishing (23.7%), as summarized in Table 1.

Table 1: GDP contribution by sub-sector

	2007-8	2008-9	2009-10	2010-11	2011-12
Agriculture, forestry, and fishing	21.4%	23.1%	23.6%	22.7%	23.7%
Industry	25.8%	24.7%	24.9%	25.3%	26.3%
Services	46.9%	46.4%	45.5%	46.2%	45.1%

Except during the financial year (2011-12), growth in services has outpaced growth in the industry sub-sector and agriculture, forestry, and fishing sub-sector in terms of GDP contributions, as shown in Table 1. One of the major components of the services sector is posts and telecommunications, which contributed 6% of GDP in the 2010 calendar year - primarily through foreign direct investment (FDI), employment, and paying taxes (Desai *et al.*, 2000). While competition has helped drive down ICT service costs, the costs are still high for Ugandans in low-income brackets. Typical costs, such as purchasing airtime or credit to call, include Pay-As You Earn (PAYE) 16.5%, Value Added Taxes (VAT) 27.9% and excise duty 9.4%, increasing the total cost by about 30%. While such taxes generate income for the government (see Figure 3), they also potentially stifle the growth and reach of telecommunications services.

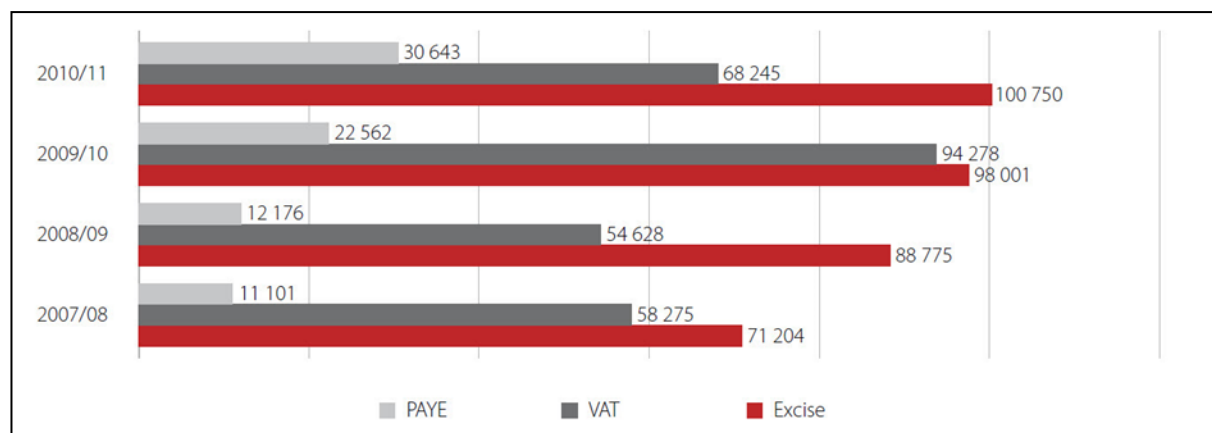


Figure 3: Telecommunications sector contributions to national tax revenues (UGX, millions).

Evidence of the role played by pricing in ICT use can be inferred from the fact that the price war amongst operators in 2009, which reduced the price of mobile voice services, resulted in the largest one-year growth in new mobile subscriptions to date, with 4.37million new subscribers added during 2010-11 (Kasigwa *et al.*, 2006). This subscriber growth also accounts for the surge in the telecommunications sector’s contribution to GDP – a contribution that doubled from 3.1% to 6.2% between 2009 and 2010.

Table 2: Growth rates of GDP sub-sectors

	2007-8	2008-9	2009-10	2010-11	2011-12
Total GDP growth	8.7%	7.3%	5.9%	6.7%	3.2%
Agriculture, forestry, and fishing	1.3%	2.9%	2.4%	0.7%	3%
Industry	8.8%	5.8%	6.5%	7.9%	1.1%
Services	9.7%	8.8%	8.2%	8.4%	3.1%

Over the past decade, telecommunications operators have made significant investments in the Ugandan economy, and have, in turn, reaped substantial revenues (as summarised in Figure 3).

However, in 2010-11, sector revenue dropped to US\$660 million from US\$669 million in 2009-10, partly due to the Ugandan shilling’s weakening against the US dollar (Avgerou, 2010). Mobile network operators derive their revenues from a range of services that include, according to the UCC (proportions in brackets and based on 2009 figures):

- Mobile operations (voice, SMS, mobile money, handsets, etc.) (63%);
- Domestic interconnection (16%);
- Fixed-line revenue (14%);
- Internet revenue (4%);
- International termination, roaming, etc. (2%); and
- Other (1%) (UCC, 2012).

ICTs provide an opportunity for nations to address the digital divide and reduce poverty while registering economic growth. Developed and some developing nations have seen the emergence of a vibrant ICT sector that significantly contributes to national GDP (Ssewanyana, 2007). It is this ICT sector that should be built, in most cases, through public-private partnerships. ICTs are enablers for economic growth because of their cross-cutting nature, thus affecting all sectors. Knowledge disparities cannot contribute to the growth of ICT. For this growth to occur, there has to be inclusion of knowledge and innovation to provide sustainable development (Sharma, 2018). Adoption and proper utilization of ICTs will lead, among others, to increased yields and quality production of goods and services. ICT industry can be resourced, properly managed, and mainstreamed into a significant contributor to GDP.

**ANALYTIC METHODS**

We performed statistical analysis to study the significance of ICT as an enabler to the overall socio-economic development of Uganda by adopting the research framework proposed by Sharma and his co-workers (Sharma *et al.*, 2016) after reviewing three other theories by International Telecommunication Union (2017), Palvia *et al.* (2018), and Bowles (3013). Deploying a “grounded theory” approach that examined 5 OECD economies in order to understand the nexus between ICT and growth, Sharma *et al.* (2016) prescribed a 4-pillar theory as illustrated in figure 4. They theorised that the Innovation, Human Capital, Governance, and Infrastructure capabilities of an economy will contribute to digital inclusion and participation of people and processes; and with digital literacy as absorptive capacity, sustainable development will be the outcome.

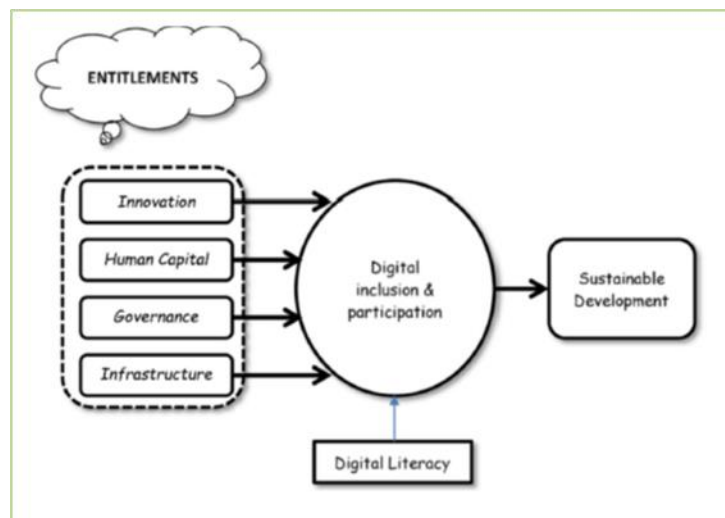


Figure 4: ICT for Development framework (source: Sharma *et al.* 2016, 641).

**Data Sources**

In our analysis, we use data from several sources. Firstly, for the indicators, we have used the World Development Indicators (WDI), which is a dataset compiled by the World Bank from officially-recognized international sources (World Development Indicators, 2016). We believe that this dataset can be trusted for the purpose of this report. Another set of indicators that we use come from the World Governance Indicators (WGI) dataset, which has also been compiled by the World Bank.

**Predictors (ICT Indicators)**

For the purpose of our analysis, we selected, on average, ten independent variables for manageability from each of the four pillars that constitute the ICT-4D model: Innovation, Human Capital; Governance; Infrastructure.

Through analysing our model, we hope to understand the correlation between our indicators and the outcome variables. More technically, we will create a multi-linear regression model using a Generalised Least Squares (GLS) method. Using each year (2006 to 2014) as observations, we face challenges in our modelling.

Firstly, we have a limited number of observations to use in our model. Using ten indicators from each of the four pillars of ICT development, we have 40 predictors trying to model eight observations (Sharma *et al.*, 2016). Hence, we face the classic statistical problem of dimensionality reduction. There are several strategies for this, such as PCA, ICA, but we chose to stick with a simple variable selection technique. To select the best indicators, we calculate the F-score of the indicator with respect to SSI. From this, we can calculate the p-value from which we can sort the indicators. We select the top four indicators to use in our multiple linear regression model. Four indicators have sufficient variance. Using this method, the selected variables were:

- Fixed telephone subscriptions
- Fixed telephone subscriptions (% of the population)
- Unemployment level of men (% of the male labour force)
- The time required to enforce a contract (days)

We violated an assumption of linear models that observations must be independent of each other. However, we found that we can still extract valuable information.

**Outcome (Dependent variable)**

The Sustainable Society Index, SSI, shows at a glance the level of sustainability of each of the 151 assessed countries, included in the SSI. It shows in a simple way the distance to full sustainability for each of the 24 indicators that build up the SSI. The SSI is used for monitoring the progress of a country on its way to sustainability, for setting priorities with respect to sustainability, to make comparisons between countries, for education purposes, and for further research and development.

The SSI has three dimensions, namely: Human Wellbeing, Environmental Wellbeing, and Economic Wellbeing. Human Well-being and Environment Wellbeing are the goals of a country, while Economic Wellbeing is needed to achieve maximum sustainability. Here we are comparing the three SSI dimensions. There is longstanding tradition in IS research of combining Critical Success Factors (CSF) and Delphi that measures to derive indication of success of socio-technical systems (Conrath & Sharma, 1992). We adopted a similar approach in this research.

Besides Human Wellbeing, the other two indicators are stable over the last eight years. Specifically, Human Wellbeing has had some variations worthy of further investigation. Compared to Uganda, the Human Well-being index for every other African country have shown a constant rise.

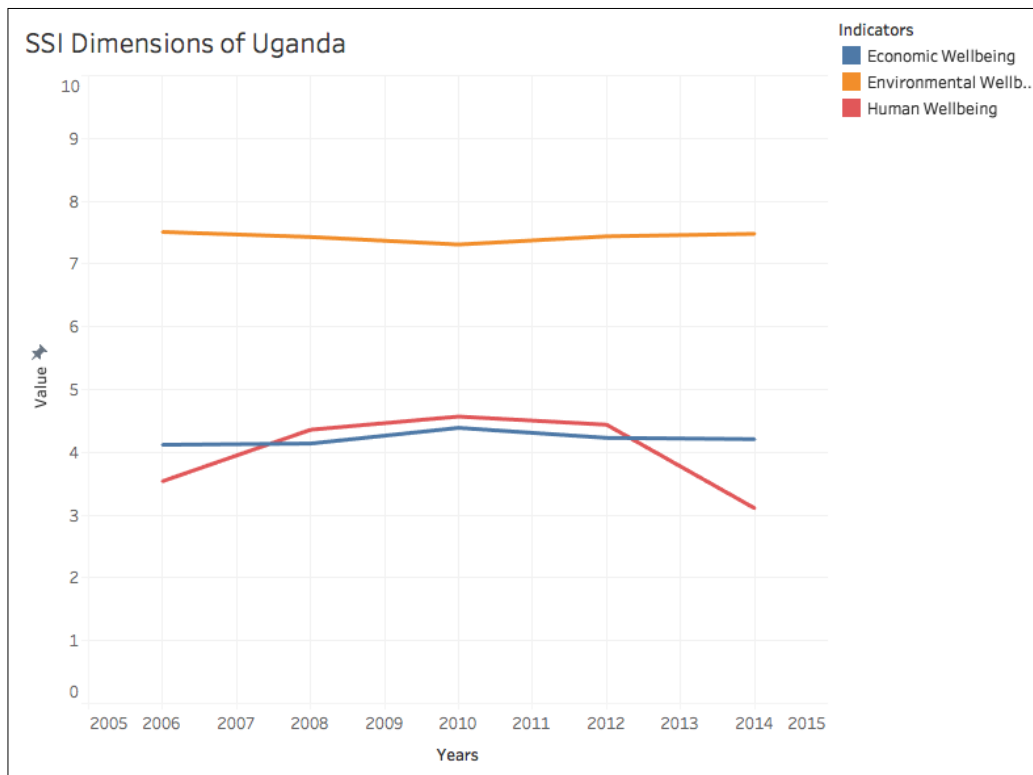


Figure 5: Uganda's Sustainable Society Index.

Clearly, Uganda has experienced a downfall in human well-being from 2012. We attribute it to the combination of the civil unrest which occurred in 2012 and continuing political uncertainties. In our analysis, we found out another interesting fact that the import of arms has seen a sudden rise in 2011-2012. This shows that the government has been spending more on the military, which could have gone into investing in social capital.

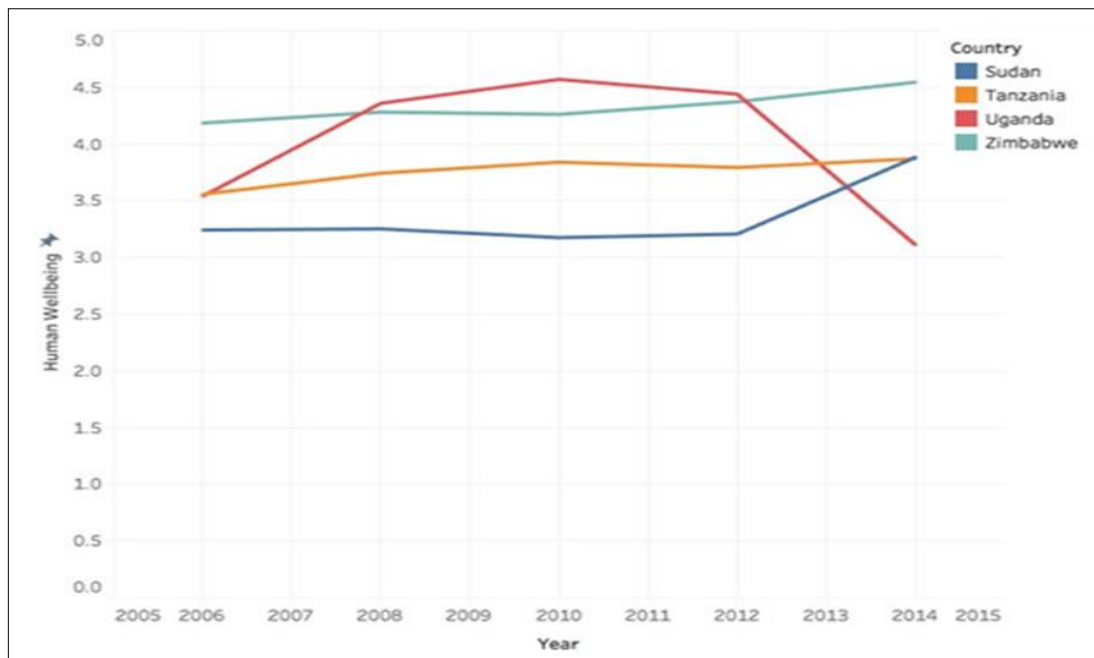


Figure 6: Human Wellbeing across African Countries.

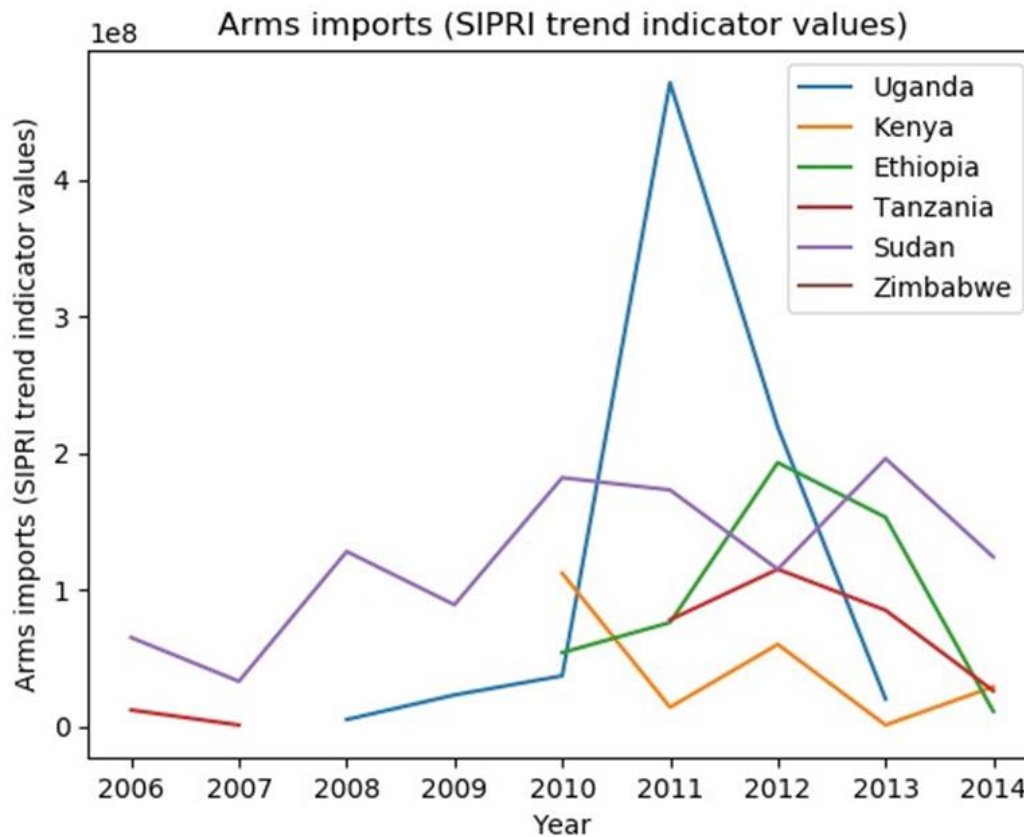


Figure 7: Arms Import Trends across African Countries.

### RESULTS AND DISCUSSION

Initially, we had modelled using the aggregate SSI as the output but found that the model was difficult to interpret. After modifying the model to use the Human Wellbeing index (of SSI), we were able to obtain a reasonable result. The first thing to note is that we have a high adjusted R2 value of 0.876, meaning that we can explain 87.6% of the model error. This is reasonably expected, given our small dataset. Of the four selected indicators, we can safely ignore the coefficients for two, namely, 'Unemployment level of men' and 'fixed telephone subscriptions.' The former has a p-value of 0.93, which is far beyond the regular threshold of 0.05, the latter is too similar to 'Fixed telephone subscriptions (% of the population)' whilst not providing any additional information.

Our model suggests that 'Fixed telephone subscriptions (% of the population)' plays a role in determining the Human Wellbeing of Uganda. The coefficient of 1.54 suggests that for every 1% point increase in fixed telephone subscriptions as a percentage of the population, the Human Wellbeing index will increase by 1.54. Similarly, the coefficient for 'Time to enforce contract' of -0.0059 suggests that if it takes a long time to enforce contracts, the Human Wellbeing index will decrease. Data-driven narratives may help in this case as they may help to present this data (Sharma *et al.*, 2020). Some of the data may be confusing but data-driven narratives solve this problem by making comparisons and conclusion.

In our research, we also compared Uganda with countries that are similar in terms of geographical region and previous human development status. Initially, the indicators from each category/pillar are compared with the different countries against their Human Wellbeing index (Ministry of Information and Communications Technology, 2011). For example, the number of mobile subscriptions was on the rise in Uganda, but when compared to other countries, Uganda's growth in this is also minimal. Even though there was a rise in the number of mobile subscriptions, the Human Wellbeing dimension has experienced a downfall from 2012



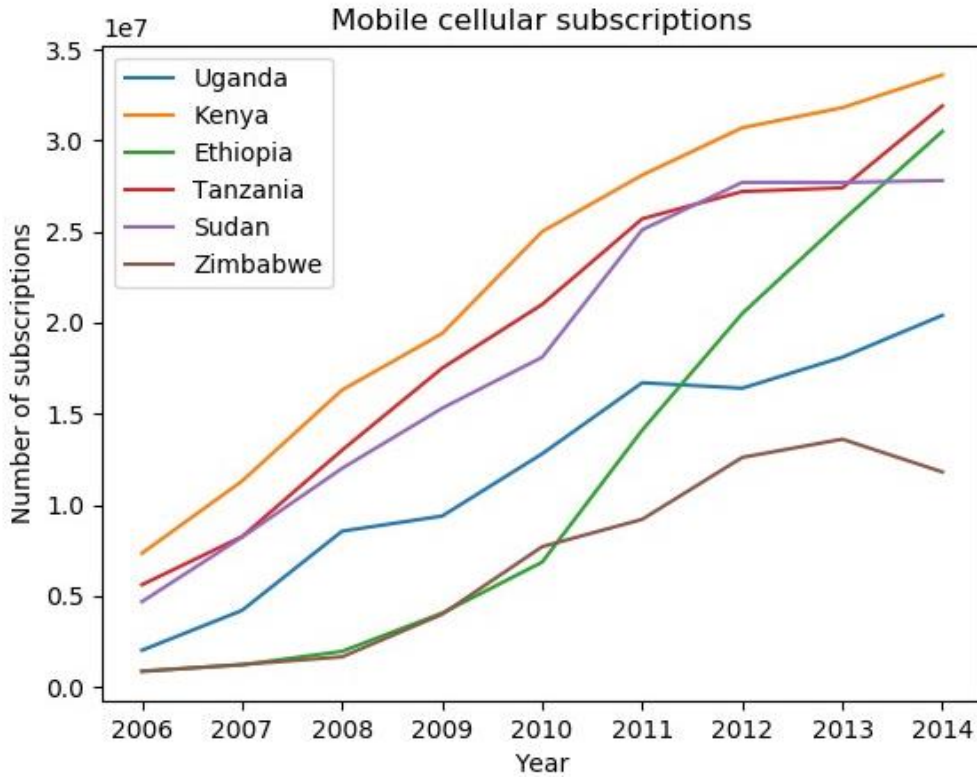


Figure 8: Mobile Cellular Subscriptions across African Countries.

This shows that the growth in the ICT sector did not have any positive effect on the sustainability of Uganda in the last few years. The other significant change in Uganda during these years was the increase in corruption. Uganda is one of the most corrupt countries, placed at 151st out of 176 countries. The control of corruption is the indicator used here to analyse its effect on the SSI; the Human Wellbeing dimension of SSI tends to have its effect from the lack of control in corruption.

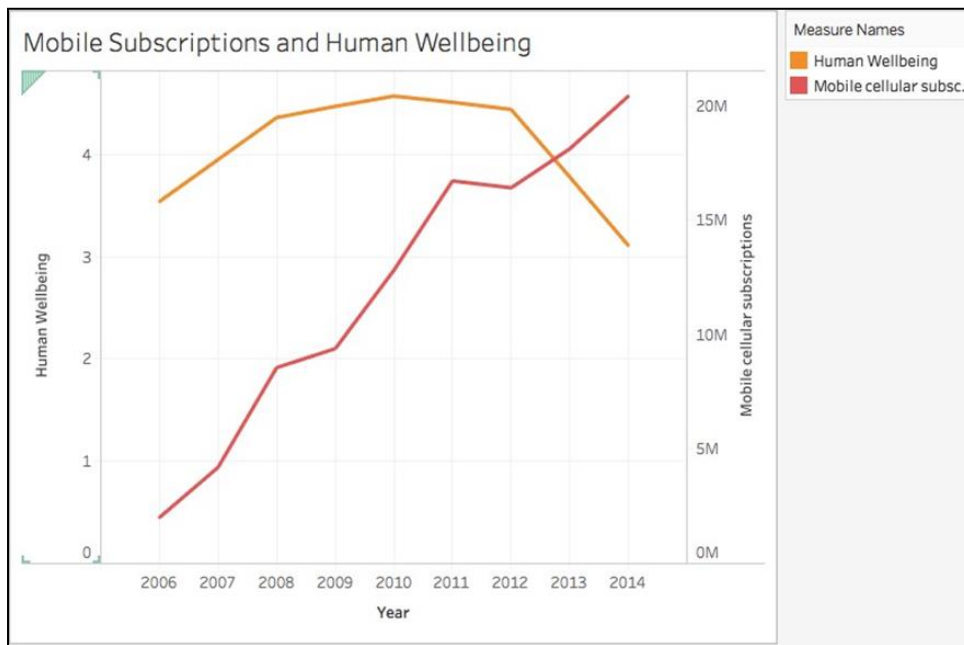


Figure 9: Human Well-being & Mobile Cellular Subscriptions Trend.

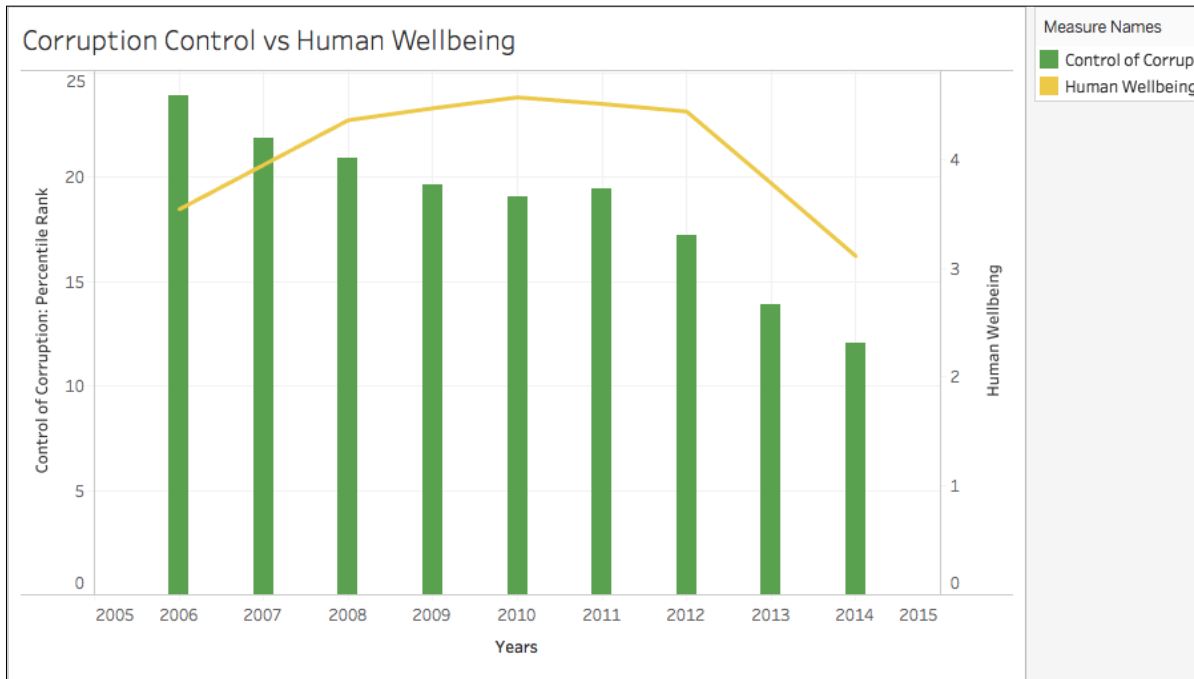


Figure 10: Corruption Control & Human Well-being across African Countries.

**Key Implications for Policy:**

Three key findings may be derived from modelling and analysis. 1) Uganda’s socio-economic development, as described by the SSI, has been stagnant in recent years. 2) Even though we expected ICT to have a large (statistically significant) effect on socio-economic development, we found that this was not the case. 3) The linear model we have created has limitations, but we have found that ICT does have a small (but nominal) effect on Human Wellbeing. As noted in the above analysis, Uganda saw a large increase in ICT investments, specifically in infrastructure, governance, human capital and innovation. This is entirely consistent with key benchmarks from OECD countries (Sharma *et al.*, 2013). However, Human Wellbeing was on a decline since 2012. Looking at other contributing factors, we suspect the corruption and civil war in Uganda to have played a significant role. This counteracts the effects of ICT on social sustainability. This idea is strengthened by the fact that the ICT industry contributes to a mere 6% of its total GDP. This is a red-flag and a lesson learnt that could be instructive for other developing nations whose priorities could be fundamental – nutrition, housing, security, education, health etc.

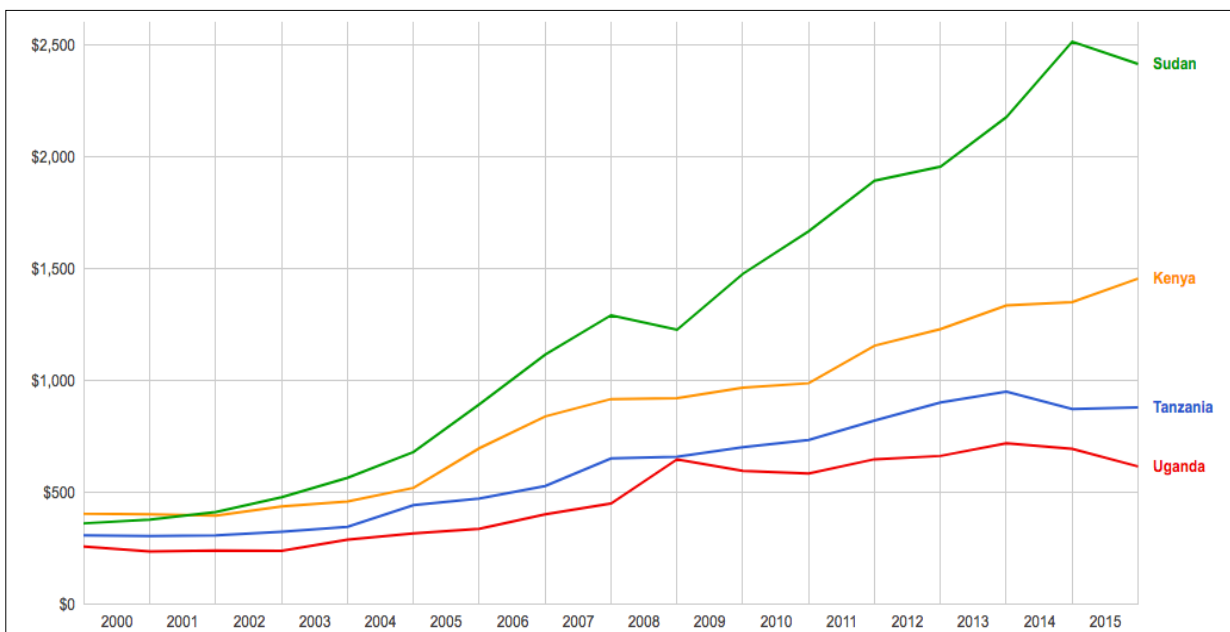


Figure 4: Long term view of Uganda's Economy.

Figure 11 illustrates the growth rate of Uganda relative to similar countries. While Sudan, Kenya, Tanzania, and Uganda all started with a similar GDP per capita in 2000, by 2014, Uganda did not even reach a quarter of Sudan.

### **Narrative of Trends**

Juxtaposed with the above narratives are noteworthy global trends that serve as caveats to the Ugandan growth story.

- The increased affordability of mobile phones and airtime have contributed to the low use of public payphones.
- Fixed-line internet subscriptions are going the way of fixed voice, but the growing availability of internet-enabled mobile devices is increasing internet access.
- The infrastructural capacity of operators will be challenged by increased internet use.
- Mobile money is now the primary method of sending money from one person or place to another.
- Access to customer data has enabled global e-commerce players such as Alibaba to develop creative ICT products.
- The coupling of mobile money services with disruptions of IP-voice services is attracting new over the top (OTP) services.

### **CONCLUDING REMARKS**

To recap, the effect of ICT on sustainable growth on Uganda has been ambiguous at best. This is in stark contrast to its outcome in other African and developing countries. A plausible reason for this anomaly could be that ICT policy has been poorly implemented. That is, while the indicators of access (Internet, mobility, and perhaps even affordability) may have been put in place to encourage usage, the participation and human development of Ugandans may not have taken place. Sharma (2018) attributes this to the lack of the phenomenon we call digital mis-transformation. This alludes to the notion that, despite significant investments in digital infrastructure and governance legislation, persisting knowledge disparities hinder more inclusive growth and development. After all, the multiplier effect and monte-carlo transformations across sectors of society presume a certain level of capability development and absorptive capacity. The current government of Uganda very seriously needs to think and design a set of platforms, applications and community strategies to enjoy the network effects of a digital knowledge society (Sharma *et al.*, 2016).

The case of Uganda, therefore, sadly, reminds academics and policy-makers that ICT indicators by themselves do not necessarily lead to desirable sustainable growth outcomes. The ICT penetration variables such as mobile phones and internet have positive and significant impact on current year's growth process Chatterjee (2020). Hassan (2005) and Goaid (2013) illustrated that ICT is an important part of economy's development process; it improves the productive capacity and competitiveness by connecting the country with the rest of the world. But, for low-income countries such as Uganda, the rapid accumulation of ICT may increase poverty and income inequalities because it eliminates unskilled workers and excludes poor people from workforce since they are not well furnished and qualified. That may have a negative impact on growth.

There is a missing piece comprising digital literacy and participation that calls into question the mediating role of inclusive growth. It is evident that wide access to ICT and capacity development are necessary building blocks of leveraging ICT. We are hopeful that such positivist narratives may be developed in future.

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