Information Communication Technology Access and Use towards Energy Consumption in Selected Sub Saharan Africa

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ABSTRACT

Major new opportunities abound from energy integration among regions in Africa with the sole aim of reducing transaction costs and with the role of Information Communication Technology (ICT), it would take energy from where it is easily affordable to places where it is needed. Given the hullabaloo over the net energy-saving impact of ICT, this study takes on a new perspective, that is, employing household energy consumption, to ascertain the use of ICT by household in accessing energy. The study reconnoiters the degree to which Energy integration among the five regional power pools in Africa can achieve ending energy poverty among regional adherents by means of three measures of energy sustainability, explicitly: energy security, energy equity and environmental sustainability. The study utilizes the Pooled Ordinary Least Squares technique on data from the SSA economies over the period 2000-2019. The study expects the results to help in suggesting the need for the acceleration of ICT development in Africa (Sub-Saharan) nations, given the universal communal mission of sustainable energy consumption.

Keywords: Technology and Distribution, Common Knowledge, Aggregate Energy Consumption, Sustainable Development, Green Technology, ICT-based

JEL Classifications: O330, D8, Q430, QO10, Q4, Q550, O300, D13

1. INTRODUCTION

Towards a way of supportable advancement for Africa, bearings prompting clean energy have become clearer for strategy making. As a model of advancement, it accentuates an improvement procedure that coordinates energy worries in objective seven into financial and social goals to guarantee that group of people yet to come have adequate assets for their turn of events. It gives chance to economies to develop and create while likewise utilizing assets in a feasible way that doesn’t dirty the environment and make wellbeing concerns. There is no uncertainty that economic improvement is the most favored methodology for accomplishing advancement destinations as embodied in the practical improvement objectives (SDGs) of the United Nations (Akinyemi et al., 2019).

The power hole alludes to both the gracefully request ambiguity in network associated areas and the inadequacy of access in off-lattice locales. Shutting the power hole in Sub-Saharan Africa (SSA) is a multidimensional assignment with focal ramifications for how to outline the district’s energy issue in general (Hilty et al., 2010; Avila et al., 2017). The Africa Union perceives this potential and expectations that Africa Continental Free Trade Agreement will go far toward accomplishing its objective of 20% ozone harming substance decrease by 2030 by showing ICT for energy effectiveness through energy mix among the different Power Pools (Houghton, 2014). All partners need to guarantee that the impact of ICT on the energy segment is utilized lengthways with the other energy arrangements. Joined Nations has ordered 12 ICT-put together advancements with potential contact with...
respect to the energy segment to acknowledge manageable turn of events. African Countries ought to think about every one of these advancements in the energy arrangement (Fugas et al., 2016). The youngsters in African nations are a lot of sharp about the ICT, and government should capitalize on it by giving stable force and power in ICT applications, for example, matrix the board, load examination, sensors for remote estimating, chips and controllers for observing, brilliant meters and mechanized dispatch programming (Amin and Rahman, 2019).

On this note, the current investigation takes a gander at the field multiplied by these two primary issues: ICT’s own energy utilization and ICT’s capability to instigate energy effectiveness over the economy. In the examination’s way to deal with these issues, the investigation grasps energy mixes to decrease the energy awkwardness among African countries. The examination’s goals are to feature the pattern of energy utilization, and inspect the effect of energy joining towards energy gracefully. To accomplish this goal, the investigation uses the Pooled Ordinary Least Squares method of estimation. The rest of the paper is designed as follows. Segment 2 arrangements with issues identifying with writing goal, the investigation uses the Pooled Ordinary Least Squares method of estimation; segment 3 gives the exploration technique as appear to be appropriate for the investigation and data about the SSA nations. Area 4 gives exact outcomes and the last segment closes the paper.

2. BRIEF REVIEW OF LITERATURE

The present improvement of ICT being in transit of energy sparing is still under discussion. While numerous investigations uncovered that the ICT had an energy sparing impact (Schulte et al., 2016; Zhang and Liu, 2015; Kramers et al., 2014) with considers contended that it could animate energy use through different instruments Cho et al., 2007; Saiddi et al., 2017; Saorsky, 2012), and a few examinations noticed the distinctions of ICT’s effects among parts (The European Commission, 2008) or gatherings of economies (Ishida, 2015). As indicated by Takase and Murota, 2004, the general effect can be separated into a pay impact and a replacement impact. Concerning the salary impact, the ICT as a sort of universally useful innovation, is extensively identified with creation action and private life which include energy use, so its advancement can prompt energy request by invigorating financial development (Zhou and Zhou, 2018). With respect to replacement impact, the ICT area may diminish energy use by supplanting the customary areas, given that the ICT part and its items are generally less energy concentrated (Takase and Murota, 2004; Zhou and Zhou, 2018; Romm, 2002). Additionally, Hilty and Harcheu (2017) contended that, while the above impacts occurred in short and medium term, the most mixing effect of ICT on human conduct and society may happen over the long haul.

In Akinyemi et al. (2019), coordinating physical framework is an important however insufficient condition for accomplishing further territorial reconciliation and expanded exchange among African nations (UNECA, 2010). Featuring the job of territorial coordination in power maintainability in Southern Africa, Montmasson-Clair and Deonarain (2017) opined that three key components are significant in utilizing provincial mix to add to improved power manageability in the SAPP area. These variables incorporate fit arrangements and administrative systems, sufficient basic organizations and specialized framework, and composed execution. Likewise, there is additionally the presence of intensity pools. Force pools have been seen as the best and best system for handling Africa’s energy issues (Niyimbona, 2005) and furthermore amplifying Africa’s unevenly conveyed energy assets. There are five territorial force pools in Africa, to be specific SAPP, WAPP, Central Africa Power Pool (CAPP/PEAC), East Africa Power Pool (EAPP) and Comite Maghrebin de l’Electricite (COMELEC) which is the North Africa locale. A force pool is characterized as a gathering of associations that work their capacity frameworks together for shared advantages (UNECA, 2010). As indicated by Avila et al. (2017), provincial co-operation, which is upgraded by power pools and cross-border transmission systems, will be basic to shutting the power hole in SSA. Its advantages go from economies of scale to a solid and secure gracefully of energy, streamlining of assets, energy cost differential, justifying venture and expanding the volume of power exchange, among others. It can likewise lessen reliance on petroleum product imports by empowering huge concentrated sustainable assets to be shared (Avila, 2017).

ICT improvement can animate monetary development with not exactly proportionate increment of energy use (that is, energy efficiency improvement.) if the ICT doesn’t identify with energy profitability improvement, we ought to reexamine its job in accomplishing our practical advancement objectives and should start relating approaches. Be that as it may, as far as we could possibly know, existing investigations only here and there concentrated on such a point of view. Albeit a few scientists noticed that ICT could improve energy efficiency (Salahuddin and Alam, 2015; Shahiduzzaman and Alam, 2014), shockingly such a perspective right now needs support from observational examinations. To summarize, regardless of whether ICT can advance energy reserve funds at the macroeconomic level is as yet a significant under-banter issue. To comprehend the connection among ICT and energy utilization, past examinations gave distinctive effect instruments. Among these instruments, energy profitability improvement is a key measure to accomplish supportable energy utilization in the hypothesis. Subsequently, exact examinations on the connection among ICT and energy profitability can give new confirmations with respect to the above discussion.

3. METHODOLOGY AND DATA

3.1. Model Specification

Literature of both theoretical and empirical literature such as Shahbaz et al. (2014) and Zheming et al. (2018) the general model detail of the energy/power consumption work appears in condition/equation 1.

\[
ENC = f(MOT, INSTI, ENI, GDPGR, TRD)
\]  

(1)

Where EC, ICT, INSTI, ENI, GDPGR, TRD stands for energy consumption, mobile technology, institutions, energy intensity, GDP growth rate and trade openness.
Equation 1 is changed into equation 2 when introduced as an econometric estimation model.

\[
ENC = \beta_0 + \beta_1 ICT + \beta_2 INSTI + \beta_3 ENI + \beta_4 GDPGR + \beta_5 TRD + \epsilon
\]

Note: \(\beta_0\) is the intercept, \(\beta_1\) represents the coefficient of mobile technology, \(\beta_2\) is the coefficient of institutions, \(\beta_3\) is the coefficient of energy intensity, \(\beta_4\) is the coefficient of GDP growth rate, \(\beta_5\) is the coefficient of trade, and \(\epsilon\) is the error term. In this analysis, only significant coefficients are interpreted giving the ceteris paribus argument, therefore mobile technology (ICT), energy intensity, GDP growth rate and trade are the variables with significant parameter estimates which all have a positive relationship except GDP growth rate.

Regarding the justification of the variables in the model and the respective apriori expectations, Sadorsky (2012) says that a positive relationship exists among ICT and energy/power consumption. Be that as it may, as indicated by Horner et al. (2016) and Han et al. (2016), ICT was found to have negatively affected energy utilization. Inglesi-Lotz and Morales (2017) expressed that more elevated levels of training had a critical positive effect on energy utilization in creating nations. Yan et al. (2018) ICT had a significant positive relationship that exists between each explanatory variable and the dependent variable. Therefore mobile technology (ICT), energy intensity, GDP growth rate and trade are the variables with significant parameter estimates which all have a positive relationship except GDP growth rate.

4. RESULTS AND DISCUSSION

4.1. Pattern of Energy Consumption and Electricity Access in SSA

4.1.1. General access to electricity in SSA

Access to electricity Africa (sub-Saharan) has particularly improved throughout the years, as seen in countries like Ethiopia, Ghana, Ivory Coast and Kenya. The pace of electrification has almost tripled between the years 2000 and 2012, and in 2014, power efforts surpassed growth for the first time as 50% SSA population do not have access to electricity making it the largest concentration of people in the world without electricity access as explained through the International Energy Agency shown in Figure 1:

SSA is becoming aware of the importance of investment in sustainable clean energy establishments as opposed to the customary enormous scope frameworks as appeared in Table 1, which depend for the most part on oil and coal. What’s more, its natural advantages, renewables energy is probably going to contribute towards economic development too. ICT of energy frameworks empowers utilities to keep up lattice solidness and unwavering quality, screen the network and recognize purposes of disappointments, diminish tasks and upkeep costs, enhance and gauge energy creation and broaden the operational lifetime of benefits (Bloomberg, 2017; OECD, 2005) (Table 3).

4.1.2. Summary of Africa’s energy pool generation

With around 48 nations in SSA, 21 nations have an all-out capacity generation of under 200 Mega Watts. South Africa (SA) produces 45% of the mainland all out power age while North Africa creates 30% and the remainder of Africa (48 out of 54 nations) creates 25%. Normal jolt level situations at 24% which is the most minimal in creating nations. As a rule, about 25% of the created energy is inaccessible at some random time. Force blackouts in days out of every year are as per the following: Burundi (144), Tanzania (63), Senegal (25) days while Continental normal is 56. In West Africa, generators utilized as back-up provisions represent 17% of intensity created and this is because of successive blackouts. SSA is the main area on the planet where per-capita get to rates are diminishing. As of late, over 60% of SSA will in any case need access to power by 2020 with the expense of Electricity progressively costly in SSA contrasted with different pieces of the world. Electrical matrix operational misfortunes are around 23% contrasted with
the worldwide normal of 10% with just 10% of the populace approaching lattice influence, 75% of these are rich individuals. Under 2% of the country populaces of Malawi, Ethiopia, Niger, and Chad approach electrical force (Othieno and Awange, 2016).

4.2. Econometric Analysis
The study confirms from the Pooled OLS result in Table 4 the viability of the Household ICT adoption – Energy Consumption hypothesis in SSA. The results in terms of general significance shows a good overall fit for the model as well as joint significance. This is shown by the value of the R Squared, Adjusted R Squared and the F statistic. The R Squared and Adjusted R Squared are acceptable due to the fact that they lie between 0.1 and 0.5 as acceptable for any standard panel dataset. The F-statistic is acceptable because its probability value (P value) is significant at 5% significance level (<0.05).

The findings are shown in Tables 5 and 6 also confirms the findings in Table 4 of a positive and significant relationship on the ICT - energy consumption nexus in sub-Saharan countries. The individual statistical significance shows that in SSA, further confirms the viability of the ICT adoption – Energy Consumption hypothesis statistically at 5% level of significance also. More specifically, the value of the statistically significant coefficient of mobile technology (the measure of household ICT adoption) impacts the energy utilization to further drive the economy as seen in Matthew et al. (2018); Fubara et al. (2019); Ejemeyovwi et al. (2019). This demonstrates innovative improvement because of information is basic to human turn of events (Ejemeyovwi et al., 2018; Ejemeyovwi and Osabuohien, 2018). The positive critical aftereffect of this examination is predictable with Ejemeyovwi et al. (2019).
Table 4: Pooled OLS results for ICT energy hypothesis in SSA

| Dependent variable | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
|--------------------|--------------------|--------------------|--------------------|--------------------|
| Mobile Technology  | 1.45* (1.77)       | 1.30* (2.41)       | 1.36* (2.53)       | 1.47* (2.63)       |
| Human Capital Quality | −31.95 (−1.28)     |                   |                    |                    |
| Public Administration | 2.24 (0.06)       |                   |                    |                    |
| Property Right and Rule-Based Government | −25.27 (−0.83) |                   | −24.8 (−0.98) |                    |
| Business Regulatory Environment |                   |                    |                    |                    |
| Energy Intensity   | 10.31* (2.67)      | 11.05* (3.90)      | 10.05* (3.73)      | 10.38* (4.11)      |
| Gross Domestic Product Growth Rate | −1.61 (−0.46) | −2.55 (0.98) | −1.87 (−0.53) | −2.09* (−0.60)  |
| Trade              | 0.39 (0.67)        | 0.64* (0.98)       | 0.45 (0.75)        | 0.37 (0.59)        |
| F-statistics       | 5.22               | 4.84               | 5                  | 5.06               |
| Prob. > F          | 0.0002             | 0.0004             | 0.0003             | 0.0003             |
| R Squared          | 0.1448             | 0.1358             | 0.1396             | 0.14               |
| Adj R Squared      | 0.1171             | 0.1077             | 0.1117             | 0.11               |
| Root MSE           | 183.33             | 184.29             | 183.89             | 183.73             |

Table 5: LSDV results for ICT energy hypothesis in SSA

| Dependent variable | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
|--------------------|--------------------|--------------------|--------------------|--------------------|
| Mobile technology  | 0.36* (2.30)       | 0.47* (3.46)       | 0.52* (3.75)       | 0.49* (3.63)       |
| Human capital quality | 20.37 (1.65)      |                   |                    |                    |
| Public administration | 25.9 (1.45)       |                   | −11.79 (-0.55)     | 9.72 (0.60)        |
| Property right and rule-based government |                   |                    |                    |                    |
| Business regulatory environment |                   |                    |                    |                    |
| Energy Intensity   | 3.08 (0.88)        | 2.44 (0.71)        | 1.58 (0.47)        | 1.56 (0.46)        |
| Gross domestic product growth rate | −3.40* (-4.24) | −3.73* (-4.49) | −3.29* (-3.89) | −3.48* (-4.27)  |
| Trade              | 0.27 (0.99)        | 0.24* (0.87)       | 0.15 (0.53)        | 0.23 (0.84)        |
| F-statistics       | 5.22               | 194.19             | 191.60             | 191.68             |
| Prob> F            | 0.0002             | 0.0000             | 0.0000             | 0.0000             |
| R Squared          | 0.1448             | 0.96               | 0.96               | 0.96               |
| Adj R Squared      | 0.1171             | 0.96               | 0.96               | 0.96               |
| Root MSE           | 183.33             | 37.88              | 38.13              | 38.12              |
| No. of Obs         | 160                | 160                | 160                | 160                |
| Year Dummies       | Yes                | Yes                | Yes                | Yes                |
| Region Dummies     | Yes                | Yes                | Yes                | Yes                |

Table 6: REM and FEM results for ICT energy hypothesis in SSA

| Dependent variable | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
|--------------------|--------------------|--------------------|--------------------|--------------------|
| Mobile technology  | 0.36* (2.30)       | 0.38* (2.45)       | 0.47* (3.46)       | 0.48* (3.62)       |
| Human capital quality | 20.37 (1.65)      | 19.46 (1.62)      |                    |                    |
| Public administration | 25.94 (1.45)     | 24.45 (1.40)      | −11.79 (-0.55)     | −14.32 (20.83)     |
| Property right and rule-based government |                    |                    |                    |                    |
| Business regulatory environment |                    |                    |                    |                    |
| Energy Intensity   | 3.08* (0.88)       | 3.92 (1.62)        | 2.44 (0.71)        | 3.45 (1.09)        |
| Gross domestic product growth rate | −3.40* (-4.24) | −3.73* (-4.49) | −3.71* (-4.52) | −3.29* (-3.87) |
| Trade              | 0.27 (0.99)        | 0.24 (0.87)        | 0.27 (0.99)        | 0.15 (0.53)        |
| Wald chi2          | 32.19              | 31.45              | 31.45              | 29.65              |
| Prob> chi2         | 0.0000             | 0.0000             | 0.0000             | 0.0000             |
| F-statistics       | 217.71             | 219.09             | 215.16             | 214.87             |
| Prob> F            | 0.0000             | 0.0000             | 0.0000             | 0.0000             |
| R Squared          | 0.05               | 0.07               | 0.07               | 0.08               |
| No. of Obs         | 160                | 160                | 160                | 160                |
| Corr (U, X)        | 0.11               | 0.10               | 0.17               | 0.10               |
| Hausman Test       | 0.95               | 0.96               | 0.97               | 0.95               |
The discoveries of this investigation on the connection among ICT and energy consumption in sub-Saharan nations show comparable aftereffects of a positive relationship with Pothitou et al. (2017) which uncover a positive connection among ICT and energy consumption in the European Union nations for the two examinations. This feature the most ideal approach to improve the energy part in Africa through provincial participation. Access to present day energy services is basic for financial turn of events.

5. CONCLUSIONS AND RECOMMENDATIONS

The study was enthused by the argument on the importance ICT in the energy sector. The study utilized panel data for SSA nations within the period 2000 to 2019. The study is considered vital because of the challenges SSA faces in meeting her energy demand and closing the gaps in the energy system to reduce energy poverty. This study argues that an improvement ICT utilization as well as regional cooperation will bring about improvement that will make available SSA countries end energy poverty. The investigation suggests that regional energy participation and combination is one of the most encouraging and financially savvy choices for Africa to promote the advancement of its energy segment, so as to pick up the ecological, social and monetary advantages gathering from an increasingly productive utilization of assets. Four significant advantages are related with local energy coordination: improved security of gracefully, better financial proficiency, and upgraded natural quality.

Future investigations could likewise expand this work by distinguishing extra transmission channels, especially relevant ones, through which ICT infiltration influence the activities requiring energy/electricity consumption in rural areas in the sub-Saharan regions. Another area of further research could be on the impact of institutions on the implementation and penetration of ICT in sub-Saharan regions or specific countries. Also, areas of further research could include the unidirectional relationship between ICT use, institutional policies and energy efficiency.

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