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INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION AND INNOVATION FOR SUSTAINABLE ENTREPRENEURSHIP.

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ABSTRACT

ICT adoption has experienced an increasing trend in the past two decades and simultaneously, achieving sustainability in entrepreneurship is the major goal of every entrepreneur; this study seeks to empirically investigate ICT adoption's contribution to sustainability in entrepreneurship. The objective of this study is to examine the relationship between ICT adoption and sustainable entrepreneurial development in Western Africa. Panel data on ECOWAS countries were collected and estimated using econometric tools for the purpose of the study. The findings show that a positive statistically significant positive relationship exists between ICT adoption and sustainability in entrepreneurship. The outcome of this study is expected to have microeconomic and macroeconomic implications for sustainability in entrepreneurship within and outside ECOWAS.

KEYWORDS: ICT, Sustainable Entrepreneurship, Innovation, ECOWAS.

1. Introduction

Sustainability in entrepreneurship¹ is an important contributor to the global economy and it consists of an entrepreneurship endeavor being innovative in several ways and on a continuous basis. Sustainable entrepreneurship is measured by innovation which is measured by research and development for which there are several types of innovation include disruptive innovation, indigenous innovation. Notably, information communication technology (ICT) is very important for a sustainable entrepreneurship in the 21st century any business that is not ICT compliant in this century is liable not to stand the test of time. [1] and [2] stated that in the western world most ICT entrepreneurs have taken over from the traditional entrepreneur this is evident in the United States of America (USA) in cases such as Google, Facebook, Whatsapp, Amazon.

¹ Sustainable entrepreneurship in this study is premised on the persistent research and development (innovation)



Western Africa is characterised by differences in the levels of ICT adoption [3] as well as innovation. ICT adoption is an element of the knowledge-based economy and is driven mainly by globalization forces, which play a vital part in economic growth and development [4] [3], ICT is one of the indices used to measure the degree of sophistication of a country's investment climate. ICT is an efficiency-enhancing instrument that saves time. ICT is a technological dimension alongside the manufacturing of electricity, transport, which are vital indicators of the level of financial advancement achieved by an economy, and considering the present trend towards globalization, ICT could be an instrument to achieve this objective.

Entrepreneurship is the process of surveying a business environment to identify opportunities to improve it, marshalling resource and acting to maximize such operation. Entrepreneurship businesses usually start as small and medium scale enterprises. [5] indicated that there is no usually accepted definition for SMEs, it could be described on terms of capital outlay, number of staff, sales turnover, investment in fixed capital, plant or equipment, market share, and growth level. [5] further observed that entrepreneurship is a significant financial variable that has attracted the attention of government, scientists in both developed and developing countries, and that government and non-governmental organizations have made several attempts to encourage entrepreneurship as it contributes to the nation's general development.

In relation to literature on ICT adoption and entrepreneurship sustainability, [6] empirically analysed ICT adoption for sustainable development in Small Medium Enterprise (SMES) in both US and China and used the grounded theory to code cases and interview. From the study more labels were given to China, the following challenges were found; high cost of ICT fees, low salary, low knowledge and education fear of technology. From the study, ICT was more adopted in the United States than in China because more businesses in the States understand the usefulness of technology to business expansion.

[1] worked on Information communication and technology entrepreneurship and Small Medium Scale Enterprise. The aim of their research was to examine measures of ICT entrepreneurship and to assess the predictive validity of small business innovation on sustainability ICT entrepreneurship. The study also showed the interrelatedness of ICT to SMEs by developing a conceptual model which offered new constructs, new variables were used to measure ICT entrepreneurship such as; entrepreneurship skills development, team based entrepreneurial activities and experimental activities, while variables such as improved time to market for new innovations, average prototyping speed, budget spent on R and D were used to measure innovations. The researchers proved that ICT entrepreneurship played a very important role in national economic development.

[7] performed a research and attempted to answer two fundamental questions in their study, including the extent to which African institutional growth has influenced its innovative production and the extent to which African countries' innovative production is improved at institutional growth. A sample of 40 nations was used to answer the above questions between 1962 and 2012 and the baseline equation was estimated using the system Generalized method of moment estimation technique. The result reviewed that control of corruption, regulatory quality and government effectiveness are the three basic institutional measures that affect innovation in the African region. The researchers thus recommended that African policy makers should consider innovation driving policies and improve the available institution.

[8] described an entrepreneur as any individual who, by investing his scarce funds in the undertaking, coordinates other production factors and can bear the danger of uncertainty. [9] also described an entrepreneur as an individual with thoughts, originality, vision, and foresight as to what to produce or how to make it best. A lot has been said about entrepreneurship and some empirical work has been explored but an empirical study to investigate the degree of impact of ICT adoption on entrepreneurship sustainability (research and development) has been left out in literature, hence, this study.

From observation, there seems to be a shortage on empirical literature analysing the role of ICT adoption on sustainable entrepreneurship (innovation) to the best of the researchers' knowledge. In light of this, the main objective of this study is to empirically assess the relevance of ICT in achieving sustainable entrepreneurship in ECOWAS as a contribution to knowledge. This is achieved through panel data fixed and random effects techniques of estimation and discussion of results. The other objectives are to describe the trend of ICT adoption on entrepreneurship sustainability. The remainder of this paper is as structured as follows: section 2 documents the methodology of the study. The empirical analysis and discussion of findings are in section 3 while the conclusion and recommendations are then highlighted in section 4.

2 Methodology

2.1. Theoretical Review.

Technology Acceptance Model (TAM)

[10] introduced the technology acceptance model. This model was created to examine why ICT is accepted or rejected by customers and how to encourage their adoption. On order to foresee its acceptance, [10] carried out a survey in a group of 40 Master of Business Administration students of Boston University and 112 users at the Canada IBM. TAM posits that the acceptance and adoption of an information technology by a user is based on two factors: perceived utilities and perceived ease of application. Perceived utility denotes the level to which the user believes the adoption of the technology will help to enhance the individual's productivity and job performance while the 'perceived ease of application', represents how easy the usage of the technology is. According to the model, the use of data technologies is efficiently determined by the intention of use presented by the person. This will then be determined by the individual attitude of use with regard to the actual use of the scheme and by perceived usefulness, each having a comparative weight.

2.2 The Empirical Model

The basic empirical model upon which the premise of this study is built is the fact that for entrepreneurial sustainability to occur, innovation must occur and for innovation to occur, the components such as institutional quality, human capital and technical knowledge and financial availability must be available [11]. This study further augments the model by introducing the ICT adoption component, there by intending to investigate the role of ICT adoption in achieving sustainability in entrepreneurship. Hence, this study explains that for entrepreneurship sustainability (innovation) to be achieved, a number of factors must be present such as institutions,

human capital, financial availability, and other variables should be put in place. The implicit functional form of the model is given as:

$$S_{it} = f(\text{intus}_{it}, \text{tse}_{it}, \text{rule}_{it}, \text{credit}_{it}) \quad (1)$$

The model can be specified explicitly as:

$$S_{it} = A \cdot \text{intus}_{it}^{\alpha_2} \cdot \text{tse}_{it}^{\alpha_3} \cdot e^{\text{rule}_{it} \alpha_4} \cdot \text{credit}_{it}^{\alpha_5} \cdot \mu_{it} \quad (2)$$

Furthermore, linearising equation (2), the double log of the function will be taken. This is shown in equation 3 below:

$$\log S_{it} = \log \alpha_1 + \alpha_2 \log \text{intus}_{it} + \alpha_3 \log \text{tse}_{it} + \alpha_4 \text{rule}_{it} + \alpha_5 \log \text{credit}_{it} + \mu_{it} \quad (3)$$

Where: S_t represents entrepreneurship sustainability in West Africa at time 't' which is proxied by innovation which was captured by number of scientific and technical journals [12]; [11] The choice of innovation as a measure of sustainability is as a result of the fact that for entrepreneurship businesses to grow there is a need for research and development which implies innovation into new ways of doing old things or new ideas to solve existing problems. Furthermore, the "amount of scientific and technical journal articles" is a good proxy to capture the existence of new ideas and new ways of doing old things to increase productivity and save time which guarantees entrepreneurship sustainability.

ICT adoption is measured by the amount of internet users which is used to capture technology usage for which is expected (*apriori*) to contribute to entrepreneurial sustainability positively and significantly overtime. The amount of "internet users" as a proxy has been used in literature by [13], [14], [15] The *apriori* expectation shows that α_2 is expected to be greater than zero ($\alpha_2 > 0$) which implies that an increase in ICT adoption should have an impact on the entrepreneurial sustainability, hence, the thesis of this study.

Human capital is measured by tertiary school enrolment rate (percentage of gross enrolment) which captures the percentage of the total enrolment rate for each year in each of the selected countries [11]. The selection of this tertiary enrolment rate to capture human capital in this model is as a result of 1) tertiary enrolment rate shows the level of human capital available in the study area of interest and 2) the limits given by data availability. Other measures of human capital from literature (for which data availability was a problem) are personnel involved in research and development [16]; adult literacy rate [17].

Institution is represented in this study by rule of law ($RULE_{it}$). Institutions reflect the regulations, policies and formal structures that enhance the behavior of the country's economic agents. Institutional frameworks include efficiency of government, quality of regulation, control of bribery, rule of legislation, and others. Rule of law is important to this model because one of the key criteria for attracting entrepreneurship through foreign and domestic investment is impressive institutional performance in terms of government efficiency, rule of law, corruption control and regulatory quality.

Financial sector domestic credit is depicted by $CREDIT_{it}$. The domestic credit includes loans, overdrafts, non-equity securities purchases, trade credits, and other receivable accounts that create a repayment claim. Financial institutions' existence of national credit is essential for the model as finance (capital) plays a vital role in sustainability of entrepreneurship. The *apriori* expectation indicates that the domestic credit is expected to contribute positively and significantly to

entrepreneurship sustainability [3] [18] [19]. To eliminate omitted variable prejudice that could change the reliability and validity of the estimated coefficients to be obtained from the research, the incorporation of these factors is appropriate.

2.3 Sources of Data and Variable Description

The variables included in the Eqn (2) model are described in Table 1. The information sources are also presented.

Table 1: Variables Definition, Mean and Source of Data

Data	Identifier	Data Source	Measurement
Entrepreneurial sustainability - (Scientific and Technical Journal)	SCIJ	[20]	Unit
Number of Internet Users	INTUS	[20]	Unit
Tertiary school enrolment rate	TSE	[20]	Percent of gross
Institution	RULE	[21]	Constant US\$
Domestic credit by financial institutions	CREDIT	[20]	Percent of GDP

Source: Compiled by the Authors'

3. Results and Discussions

3.1 Econometric Results

The analytical method used in this study is the panel Fixed effect (FEM) and Random effect (REM) regression (which addresses potential issues such as the individual fixed effects inherent in the panel dataset). Usually the Hausman test is conducted after the FEM and REM to determine the most suitable between the two. It would be possible to use the estimated coefficients to determine the degree of connection and effect between interest variables. The crucial factor in interpreting the most appropriate and reliable model outcome between the REM and the FEM is: if the FEM was executed first before the REM and the Chi-Square probability value of the hausman test is less than 0.05, the FEM is best suited if vice versa, the FEM is best suited for estimation. In addition, the use of the FEM means the existence of individual particular fixed effects while the selection of the REM implies the lack of the particular impacts of the person. The Hausman test outcome is shown in Table 2 below:

Table 2: Hausman Test Result:

Chi 2(4): 21.57	
Prob Value: 0.0002	
Decision Rule:	
Fixed Effect	Random Effect
Accept	Reject

Table 3: Panel Estimation Results

Dependent variable: Entrepreneurship sustainability	REM	Robust REM
ICT adoption	0.265 (4.66)*	0.265 (4.02)*
Tertiary school enrolment	0.211 (1.72)**	0.211 (1.72)**
Rule of law (Institution)	0.03 (0.33)	0.03 (0.33)
Domestic credit provided by financial sector	0.087 (0.57)	0.087 (0.57)
Constant	0.03 (0.12)	0.03 (0.12)
F-statistics		61.40
Prob> F	0.000	0.000
Wald Chi2(5)	310.63	90.15
Corr (U _i , X _b)	0	0
Number of Observations	105	105
Number of groups	14	14

Note: The values in the round parenthesis ‘()’ are the t statistic values; * indicates that the coefficients are significant at 5percent level. **denotes that the coefficients are significant at 10 percent level.

Source: The Authors’

While juxtaposing the connection between ICT adoption and sustainable entrepreneurship, the outcome in terms of individual statistical significance shows that in ECOWAS, ICT adoption has a statistical influence on sustainability of entrepreneurship at a meaning rate of 5 percent. In particular, an increase in the proportion of ICT adoption results in a less than proportionate rise in sustainability of entrepreneurship (0.26 percent). In addition, the statistically significant outcome of the coefficient is positive. This demonstrates that the implementation of ICT in ECOWAS has a beneficial impact on entrepreneurship sustainability. This means increased use of the internet, mobile technology, and Investment in ICT has a significant and positive impact on the sustainability of entrepreneurship in ECOWAS, which further means that ECOWAS achieves apriori expectations. This shows that improving technology is crucial for company sustainability (tiny, medium and large scale). This study's favorable outcome is compatible with [6].

Enrolment in tertiary schools in ECOWAS showed a favorable and substantial connection of 5 percent importance with sustainability. More specifically, a percent increase in tertiary school enrolment leads to a less than proportionate increase (0.21) in entrepreneurship sustainability. This conforms to economic theory since tertiary school enrolment is an appropriate and available measure of human development that proves that an educated individual will have more to

contribute to entrepreneurial exploits compared to an individual with lesser education experience and acquisition. Thus, an increase in the education attainment of entrepreneurs has a positive influence on the sustainability of an entrepreneurship endeavour and hence, making the business stand the test of time.

Rule of law (institution) estimation result showed a positive but not significant relationship with entrepreneurship sustainability. More specifically, a percent increase in rule of law leads to a less than proportionate increase (0.03 percent) in entrepreneurship sustainability. The result conforms to apriori expectation, which shows that institutional improvement by the ECOWAS policy makers will contribute to sustainability in entrepreneurship but the statistically non-significant result could be accounted for by the currently relatively weak institutions existing in ECOWAS and Sub-Saharan Africa as a whole. Thus, an attempt to improve institutional quality of the ECOWAS countries will be a good attempt to contribute positively to sustainability in entrepreneurship in ECOWAS.

Domestic credit provided by private sector (a measure of financial development) showed a positive but not significant relationship with entrepreneurship sustainability. More specifically, a percent increase in domestic credit by the private sector leads to a less than proportionate increase (0.08 percent) in entrepreneurship sustainability. The result conforms to apriori expectation, which shows that financial development in ECOWAS will positively influence sustainability in entrepreneurship but the statistically non-significant result could be accounted for by the relatively low financial development in the ECOWAS region. Thus, an attempt to improve financial development in the ECOWAS countries will be a good attempt to contribute positively to sustainability in entrepreneurship in ECOWAS.

ICT adoption contributes to sustainability in entrepreneurship through the inclusion of access and reduction in Market-related transaction expenses (i.e. time and travel savings) and support market boundaries development [22], [14], [3]. A working scheme (system) with the use of ICT adoption accompanied by other equipment is M-Pesa (a mobile phone-based money transfer, funding and micro-financing service that is readily used to handle economic transactions with a mobile device) for farm purposes. The adoption of ICT by a large amount of companies will lead to sustainability of entrepreneurship (which will be the test of time).

In addition, ICT adoption is an efficient means of exploiting this chance for developing countries (Zimbabwe— e-Hurudza phones; India — Reuters Market Light; Zambia — MRIAgro prepaid voucher; Kenya— M-Pesa, iCow). Implementation of ICT transits to improve efficiency through the instant dissemination of data that reduces the information gap between separate clients for different purposes (supply and demand) of each value chain that exists across SMEs. In particular, the usefulness of ICT implementation in achieving entrepreneurial sustainability includes: economic market access to resources and knowledge of present financial policies; labor market symmetry and synchronization of data supply and demand; Foreign exchange market—to be updated in actual time (spontaneously) in an economy with exchange rate data and other global data

4. Conclusion and Recommendation

The result of this study shows that in ECOWAS, ICT adoption plays a significant role in achieving sustainability in entrepreneurship, which follows the apriori expectation. The Hausman test

certified the robust random effect estimation result to be reliable for inference and policy analysis. The empirical result of this study shows that ICT adoption and tertiary school enrolment positively and significantly affect entrepreneurship sustainability at five percent and ten percent level of significance respectively. Furthermore, financial development and institutions influence entrepreneurship sustainability positively but the influence was not statistically significant at five of ten percent level of statistical significance.

From the findings above, it is recommended that small, medium and large-scale businesses in ECOWAS should increase ICT compliance as it has been seen to improve entrepreneurship sustainability empirically. Ways that ICT adoption could contribute to entrepreneurship sustainability as highlighted by the study are through information symmetry, and better value chain interaction across various economic sectors. Furthermore and more importantly, research and development for new ideas, products and processes should be taken seriously, given priority and be put at the forefront of the activities of business (small, medium and large) as this will help improve the level of productivity across board.

Just as it can be obtained in empirical studies, we have recognized an area for future studies such as examining the determinants of sustainability of entrepreneurship in ECOWAS in order to make the study robust by the utilisation of quantitative research techniques to complement this comprehensive survey. Furthermore, a comparative study of the impact of ICT adoption on entrepreneurship sustainability could be investigated between the different nationalities of the globe or between the different income groups of the globe in order to recognize and assess the quantity of impact between each category and to arrive at a conclusion that would add to the literature on the subject matter.

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