
ICT investments, human capital development and institutions in ECOWAS

Jeremiah O. Ejemeyovwi,
Evans S. Osabuohien and
Romanus Osabohien*

Department of Economics and Development Studies,
College of Business and Social Sciences,
Covenant University,
Ota, Nigeria
Email: jeremiah.ejemeyovwi@covenantuniversity.edu.ng
Email: evans.osabuohien@covenantuniversity.edu.ng
Email: romanus.osabohien@covenantuniversity.edu.ng
*Corresponding author

Abstract: The study explores the linkage between the investment in information and telecommunication technology (ICT) and human capital development on economic transformation in Economic Communities of West African States (ECOWAS). It further examines how investment in ICT and human capital development can transform the economies of ECOWAS members. This study engaged the generalised method of moments (GMM) in achieving its objective. The findings, among others, showed that investment in ICT did not have a statistically significant relationship with human development. Factors responsible for the non-significant impact of investment in telecommunications on human development could be attributed to the relatively low investment in telecommunications accompanied with high cost of acquisition of the technology in ECOWAS and harsh policy environment. Thus, policies such as the enforcement of good institutions, stabilisation of the political and economic variables in ECOWAS economies will encourage investment in telecommunications, which will enhance ICT adoption and human development.

Keywords: development; Economic Communities of West African States; ECOWAS; economic transformation; human capital; investment in ICT; trade.

Reference to this paper should be made as follows: Ejemeyovwi, J.O., Osabuohien, E.S. and Osabohien, R. (2018) 'ICT investments, human capital development and institutions in ECOWAS', *Int. J. Economics and Business Research*, Vol. 15, No. 4, pp.463–474.

Biographical notes: Jeremiah O. Ejemeyovwi is a postgraduate student of the Department of Economics and Development Studies, College of Business and Social Sciences, Covenant University, Ota, Nigeria.

Evans S. Osabuohien is the Head of the Department of Economics and Development Studies, Covenant University, Ota, Nigeria. He has over 13 years teaching and research experience in international and institutional economics. He has successfully executed many research projects and won numerous awards, including: Alexander von Humboldt Foundation's Fellowship (Germany, 2013–2014) and Swedish Institute's Doctoral Fellowship (Sweden,

2009/2010), among others. He has over 70 scholarly publications and has attended conferences/workshops across the world. He is a member of numerous learned societies.

Romanus Osabohien is a postgraduate student of the Department of Economics and Development Studies, College of Business and Social Sciences, Covenant University, Ota, Nigeria.

This paper is a revised and expanded version of a paper entitled 'Mobile technology adoption and inclusive growth: dynamic panel evidence from West Africa' presented at Covenant University Conference on E-Governance in Nigeria (CUCEN), Covenant University, Ota, Nigeria, 7–9 May 2017.

1 Introduction

Inefficient telecommunication base accompanied with feeble investment in human capital development (HCD) within Economic Community of West African States (ECOWAS) region and the glaring disparity between communication, health services and the indicators of education has made it difficult to fully understand the dynamic issues of economic transformation agenda in this region (Shuaibu and Oludayo, 2016; Aziz et al., 2015; Efobi and Osabuohien, 2015).

Telecommunications in business are referred to as the essential elements in that business that enhance production, transmission and processing information (Grace et al., 2004). Effective communication and efficient expenditure in education to develop human capital have been known to be a go-between national development in all countries including ECOWAS. Making education and health services available to individuals is one of the better methods of enhancing the value and worth of human resources in any given nation (Ishola and Alani, 2015). Telecommunication sector in ECOWAS sub-region is still at the low ebb and also has experienced pressure that intricate with inter-ministerial challenges and state developers (Minges and Gray, 2002). In the same vein, HCD is still one of the vital means to upsurge economy and remains as the major determinant of economic performances both at the micro and macro levels (Bloom and Canning, 2003). Health is a form of human capital and Schultz (1992) argued that quantity of population is not a real determinant of efficient production and stressed that the qualities of investment in education and health to hike the development of human capital base is a major factor in determining how soon an economy can be transformed.

Irrespective of the increase in government and scholars attention in the subject matter, numerous questions with respect to the development of efficient telecommunication system, development of human capital base and the transformation agenda of the African economy has not really been answered. The core of these questions point to the fact the observed relationship existing among investment in human capital and telecommunication industries in the quest for economic transformation in Africa is yet to be understood (Lawanson, 2009; Caglayan et al., 2013). The rationale behind this is that countless number of researches has been conducted to investigate how investment telecommunication and investment in education will help in developing human capital in ECOWAS region to spur economic development have yielded different conclusions (Ogujiuba and Adeniyi, 2004; Osabuohien, 2008). Also, a positive co-integrating

correlation has been established to exist between the development of human capital and economic transformation of this region (Ndulu, 2004). Similarly, the effect of accumulation of expenditures both the recurrent and capital on school (education) and health (human capital) accordingly is yet to be properly tackled by scholars (Binder and Geogiadis, 2011).

It has been found by various studies that insufficient expenditure in education and health has overtime constrained inclusive growth in Africa and hinders most vulnerable citizens (Baro and Lee, 2013; Aziz et al., 2015). While others have concentrated on various aspect, for example, weak institutional framework of developing countries (UNDP, 2009; Acemoglu et al., 2014; Osabuohien, 2008; Osabohien et al., 2017), while Southiseng (2013) and Waema (2002) focused on infrastructural aspect. These studies stressed the vital roles which human capital plays in the pathway to economic transformation, but they did not take into consideration the generalised way of harmonising the predictors of HCD and telecommunications that has continued to take the lead of ECOWAS economic transformation agenda and health and education can be seen to be beneficiaries and are looked as investments in the development of human capital, which obviously lead to economic development (Shuaibu and Oludayo, 2016).

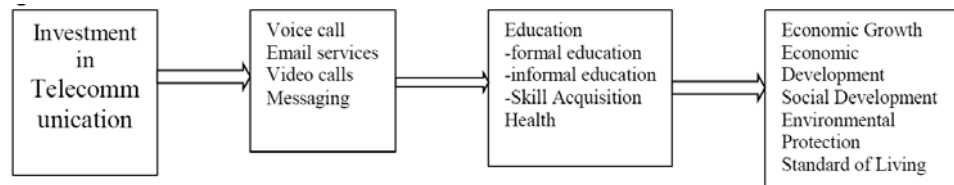
The remaining part of the study is structured as follows: Section 2 reviews the literature relating to information and telecommunication technology (ICT) investments, HCD and the role of mobile phone penetration and inclusive development. The data and methodology are discussed in Section 3; Section 4 presents the empirical results and the implications; while Section 5 concludes the study.

2 Insight from extant literature

Saying that one of the main problems the world is facing in recent years is how a sustainable economic transformation can be achieved is stating the obvious (Oluwatobi and Ogunrinola, 2011; Efobi and Osabuohien, 2015). International Monetary Fund (IMF, 2002) viewed sustainable economic transformation (SET) in four perspectives, as it comprises of economic development, economic growth, social development and environmental protection. Consequently, Lyakurwa (2007) sees HCD as a lighter that can light individuals' choices and opportunities, enhance standard of living via developed skills and information and on the long-run achievement of SET.

This subsection draws insight from literatures that are of relevance to this study which is shown herein. The 21st century is now seen as ever-growing search for ways to rapidly transform their economies, while modern growth theory opined that communication has a role to play in this search (Grace et al., 2004; He, 2013).

Maden and Savage (1998) referred to telecommunications as services which are able to replace other means of communication (especially, postal service and personal travel, which consume more energy, time and money). A well trustable system of telecommunication can spawn fresh communication (partially due to the fact that it relates directly and indirectly with several production, processing and distributive roles. Majorly, market depends on information flow for the generation and production of new information; Figure 1 shows the link between telecommunications, HCD and economic transformation.

Figure 1 Links between telecommunications, HCD and economic transformation

Source: The authors

Figure 1 presents the interaction between telecommunications, HCD and economic transformation. Human capital which can be developed through education (formal and informal), skill acquisition or training, health, relates to communication in form of telephones which provide services that enhance trade through voice call, e-mail communication, twitter communication, Whatsapp conversations between business partners both local and international and this translates into economic growth, economic development, standard of living, among others.

Available and consistent telephone services eliminate certain physical barrier on organisational communication, enhancing production via efficient administration in both the public and private sectors, making it easy to implement across various structures and locations, helping the evolution increasingly. Duboff (1980) argued that the dawn of the telegraph created various internal control economies for industries and at the same time minimised external costs, thereby contributing immensely to the USA economic development. Telecommunications enable industries to extend component manufacturing across broader range of nations, enhancing the diverse service linked activities that are outsourced. This raises effective supply chain management, expansion and improves the logistics of moving goods and services across national borders. The development of communication systems and liberalisation of regional trade is a main factor in sustainable economic transformation (Adelakun, 2011).

Many studies have been carried out to explain how communication system and investment in human capital contributes to economic transformation in this era that the world has turned to a global village (Alexander, 1996; Sen, 1999; Grubb and Lazerson, 2004; Balcerzak, 2016). Rastogi (2002) views human capital as resources and ability, that a person has; while Romer (1990), relates human capital to the key source of production. Following Rosen (1999), human capital can be seen as an expenditure which makes individuals to be more productive. Similarly, Frank and Bernanke (2007) views it as a set of factors like education, skills acquisition and creativity which influence the Marginal Physical Product Labour (MPPL) of an employee, in the same vein, HCD can be seen as an investment or expenditure in education, health service and labour training which increases production capacity in the labour market (Balcerzak, 2016).

Enhancing HCD in African countries is now a key issue to be addressed by scholars and those in the helm of affairs. Some literature stressed that insufficient expenditure on education and health are the main bane of the performance of human capital in Africa (Omojimate, 2011; Asaju et al., 2013; World Bank, 2010). Oluwatobi and Ogunrinola (2011) study agrees with the above studies that economic growth can be sustained through effective and efficient government expenditure on health and education to

develop human capital, but Acemoglu et al. (2014) study disagrees with Oluwatobi and Ogunrinola (2011). Acemoglu et al. (2014) pointed out that government expenditure on education and health are required for the attainment of economic growth and development of any region, in the case of Africa, weak institutional framework remains the main hindrance to economic growth and development in Africa.

3 The empirical model and method of analysis

3.1 The empirical model

While the world economy is moving towards a more information driven society (that is, moving to the creation of information, communication and technology (ICT) built facilities, adoption of research and development for sustainable growth), skill acquisition and the HCD has become the main problem for scholars, both at the local and international stages (Adelakun, 2011). However, a positive effect has been exerted on the economy by efficient communication, education and vocational skill exercises. Human capital theory (HCT) was coined in 1960s and since then, lots of researches tried to solve this issue as it relates to HCD. HCT sees training and education as investment in skill acquisition (Schultz, 1992). It can be argued that due to high expectation on feedback investments (returns on investment), the populace decide on the nature of education they acquire as a means of enhancing production base. Following the HCT, the more the labour force is educated, information made available to them or skills acquired, the easier it is for an industry to espouse modern technologies, hence strengthening proceeds on education and training. Empirical literature pointed out proofs that agreed with the combined impact of information on human capital.

This study adopts the Schumpeterian growth model. The implicit function of the model is seen as follows:

$$Y_t = f(A_i S_i X_i) \quad (1)$$

where $A_{it} = INVIT_{it}$; $S_{it} = RULE_{it}, PSE_{it}$; $X = GDPPCGR_{it}, CREDIT_{it}$.

Where Y represents human development, A represents investment in telecommunications which is a proxy for technology adoption in this study; S represents socio-economic settings such as institutions – while X represents the endogenous growth components.

This empirical model is related closely to Andres et al. (2016) with the exception of the inclusion of investment in telecommunications. The model includes some of their covariates and our main variables of interest. This study is interested in the relationship between investment in telecommunications and inclusive growth. The main reason for the choice of co-variates is the fact that for human development to be achieved, institutions and other control variables such as economic growth variables, credit and so on in this model are to be present. The explicit form of the model is given as:

$$Y_{it} = \alpha_0 + \alpha_1 Y_{it-1} + \alpha_2 INVIT_{it} + \alpha_3 PSE_{it} + \alpha_4 RULE_{it} + \alpha_5 CREDIT_{it} + \alpha_6 GDPPCGR_{it} + \mu_{it} \quad (2)$$

where Y_{it} represents human development index (HDI) which represents inclusive growth of country 'i' at time 't', $INVIT$ stands for investment in telecommunications which represent the technology (A); PSE_{it} represents primary school enrolment; $RULE_{it}$ represents institution; $CREDIT_{it}$ represents domestic credit provided by financial sector; $GDPPCGR_{it}$ represents gross domestic product growth rate in the Schumpeterian growth model while Y_{t-1} represents the lagged dependent variable (to eliminate omitted variable bias).

The dependent variable, HDI is used as a proxy for HCD. ICT investment is proxied by 'investment in telecommunications' variable as in literature (Bankole et al., 2013). Primary school enrolment, institutions – rule (Binder and Geogiadis, 2011) and credit are necessary control variables essential to the Schumpeterian growth model to capture human development.

The major variable of interest in this study is the 'investment in telecommunications'. The a-priori expectation states that its coefficient should have a positive sign. This implies that, an increase in investment in telecommunications should account for a statistically significant increase in human development, hence, $\alpha_2 > 0$.

Also, due to the dynamic nature of the model (the addition of the lagged dependent variable in the model), to achieve estimates that are best, linear, unbiased and efficient (BLUE), address the issue of endogeneity and reverse causality, the generalised method of moments (GMM) technique was used.

3.2 Data sources and description

This study, with a view to achieving its objectives, utilises two major methods of analysis. They include descriptive and econometric techniques. The former employs charts and tables to assess the trend of investment in telecommunications and HCD in ECOWAS while, the econometric analysis employs the GMM technique to evaluate the impact of mobile technology adoption on inclusive growth.

The variables identifier, the definition, indicators, the source of data and unit of measurement of the utilised data are presented in Table 1.

Table 1 Variables definition and source of data

<i>Data</i>	<i>Identifier</i>	<i>Data source</i>	<i>Measurement</i>
Human development index	HDI	UNDP (2015)	US\$ (number)
Investment in telecommunications	INVIT	World Bank (2016a)	number constant US\$
Primary school enrolment (pupils) – female	PSE	World Bank (2016a)	
Institution	RULE	World Bank (2016b)	
Domestic credit by financial institutions	CREDIT	World Bank (2016a)	
Gross domestic product per capita growth rate	GDPPCGR	World Bank (2016a)	

Source: Compiled by the authors

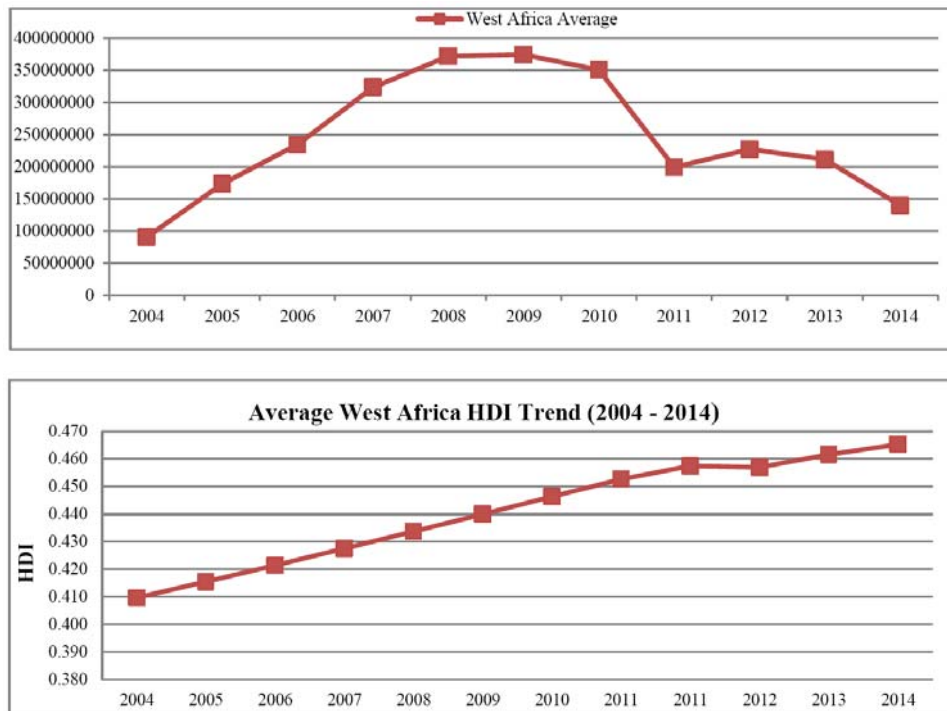
4 Results and discussions

4.1 Patterns of mobile technology adoption and inclusive growth in West Africa

ECOWAS consists of 16 countries in West Africa. The countries are Benin, Burkina Faso, Cape Verde, Cote d’Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Senegal and Togo. However, the Gambia was left out for the purpose of this study to reduce panel attrition. The variable used to proxy HCD was HDI which was sourced from United Nations Development Project (UNDP, 2015) while the other variables used in the model were sourced from World Development Indicators (World Bank, 2016a).

Statistics show that within the period of 2004 and 2015, investment in telecommunications in Nigeria and Ghana were the highest in the industry, while the lowest were Cape – Verde and Togo. Nigeria had US\$1.07billion by 2004, US\$2.13 billion by 2011 and US\$1.36 billion in terms of investment in telecommunication. Ghana’s investment in telecoms by 2004 was US\$80.6million while by 2014, it was US\$151million. Cape-Verde as at 2006, had US\$16 million and US \$5.3 million by 2011 as investment in telecoms. Togo, despite the fact of incomplete data update, had investment in telecoms by 2009 being US\$44 million; 2014 being US\$26 million.

Figure 2 Investment in telecoms (\$US) in ECOWAS (see online version for colours)



Source: Authors’ computation using data from World Bank (2016a)

HDI is a clear indicator of HCD. It is an index which measures the average achievement in the three basic aspects of human development – health, education and decent standard of living (UNDP, 2015). The values of the HDI lie between: 0.1 to 1.0; the higher the value of the HDI, the higher the human development in that country, and vice versa. The maximum and minimum values show that the HDI grew as high as 0.65 which was found in Cape Verde at 2014 and as low as 0.28 in Niger as at 2004. The trend of the average HDI for West Africa has been increasing almost consistently until it was interrupted in 2011 and remained at the same level till 2012 before it experienced a further increase.

4.2 *Econometric results*

The GMM consists of two types – difference GMM and system GMM. The difference GMM approach and its extension to the ‘system GMM’ context, are techniques of estimations designed for situations with ‘small T, large N’ panels: few time periods and many individual units, a linear functional relationship, one left-hand variable that is dynamic – depending on its own past realisations, right-hand variables that are not strictly exogenous, fixed individual effects, implying unobserved heterogeneity and autocorrelation within individual units’ errors, but not across (Baum, 2013). Given the dynamic nature of the datasets, the GMM estimator takes care of the problems usually associated with such data type such as endogeneity bias amongst others.

The first condition for the interpretation of the GMM results is to observe the Sargan test statistics, the AR (1) and AR (2) and to compare the number of instruments against the number of groups. The Sargan test checks for the validity of the internal instruments that was used in the SGMM. The results below show that the *p*-value of the Sargan test for the results satisfy the rule of thumb that at 5% level of significance (*p*-value > 0.05), the instruments are valid and were not over-identified. AR (1) and AR (2) tests for the presence of autocorrelation of the first order and second order. Given that the value of the AR (1) and AR (2) of the model in this study is not statistically significant (> 0.05), there is absence of autocorrelation of the first order and second order. In terms of the comparison of the number of instruments against the number of groups, the rule of thumb says that the number of groups should be higher than the number of instruments. The number of groups are higher than the number of instruments for the three columns. Therefore, this confirmation renders the result from this study reliable for policy analysis and recommendation.

From Table 2, investment in telecommunications in ECOWAS seems to have a non-statistically significant relationship or impact on human development which goes against the *a priori* expectation which posits that investment in telecommunication is expected to have a positive impact on human development due to the fact that investment in telecommunications increases the adoption of ICT in terms of internet adoption and mobile cell phone subscription. From columns 1, 2 and 3, the GMM result 1 (at lag 2 2) shows a positive relationship existing between investment in telecommunications and human development while the GMM results 2 (at lag 3 3) and 3 (at lag 4 4) showed a negative relationship between the two major variables of interest.

Countries at all levels of development invest in ICTs regularly, ECOWAS is not exempted. Previous researches on ICT investments have treated ICT investments as a homogenous concept (Ngwenyama et al., 2006; Morawczynski and Ngwenyama, 2007), a heterogeneous concept (Kim et al., 2008; Bankole et al., 2013) involving different dimensions – hardware and software, internal spending and so on. This study adds to the

literature that treated ICT investments as a homogenous concept and the results show a positive result at the first lag (2 2) and negative results at lag (3 3) and lag (4 4).

The worrisome negative impact of the GMM results show that investment in telecommunications do not transmit successfully to a positive effect on HCD in ECOWAS. This could be attributed to factors like the non-significant (relatively low) investment enough to lead to HCD; possible misappropriation of funds and corruption which could emphasise the role of the economic and legal institutions (which also had a negative impact on human capital development); the non-awareness and non-attractiveness of the telecommunication sector due to the capital insensitivity in the telecommunications sector; the slow adoption of ICT in terms the implementation and inculcation into the sectors such as education, agriculture and health in ECOWAS countries.

Table 2 SGMM results

Human capital development (−1)	0.88*	1.20*	1.13
	(0.00)	(0.00)	(0.14)
Investment in telecommunications	5.07	−5.27	−5.09
	(0.10)	(0.57)	(0.88)
Primary school enrolment	−.0014	−.0028	−.0017
	(0.53)	(0.44)	(0.86)
Rule of law (institution)	−.0059	−.0139	−.0089
	(0.54)	(0.52)	(0.86)
Domestic credit provided by financial sector	−.00006	−.00001	−.00006
	(0.48)	(0.54)	(0.90)
GDP per capita growth rate	0.0009	0.0007	0.0006
	(0.40)	(0.21)	(0.70)
Constant	−.0140	0.040	0.028
	(0.75)	(0.50)	(0.85)
AR (1)	0.58	0.37	0.85
AR (2)	0.36	0.37	0.82
Sargan test	0.12	0.85	0.57
Prob > F	(0.000)	(0.000)	(0.000)
Number of instruments	8	8	8
Number of groups	15	15	15

Notes: The values in the parenthesis ‘()’ are the probability values *and ** denotes that the coefficients are significant at 1% and 5%, respectively.

Dependent variable: HCD.

Source: Authors’

5 Conclusions

This study was motivated by the debate on the role of investments on telecommunications as a significant contributor to human development and it provides an empirical investigation on the effects of investments on telecommunications on human

development for the period 2004 to 2014. This is deemed crucial based on the relatively low investment in telecommunications compared to other regions and the slow level of ICT adoption witnessed in some ECOWAS countries while some others experience fast levels of adoption of ICT adoption.

This study argues that an improvement in investment in telecommunications in the member countries will provide one of the required structures that will increase ICT adoption which will in turn increase human development. To achieve the stated objective of finding the impact, the study engaged an econometric analysis which is the GMM technique. The findings showed that investment in telecommunications did not have a significant relationship with HCD. Factors responsible for the negative impact of investment in telecommunications on human development could be the relatively low investment in telecommunications accompanied with high cost of acquisition of the technology in ECOWAS; the tight policies that discourage foreign investors such as the NITDA Tax (practiced by Nigeria) which demands a separate tax from all ICT companies that make a turnover of over one million within a certain period of time; political and economic instability which discourages investment. These factors have a crucial role to play on investment in telecommunications which affect the impact of investment in telecommunications on human development.

Thus, efforts and policies such as the installation of good institutions, stabilisation of the political and economic variables in ECOWAS economies will encourage investment in telecommunications which will be laudable in enhancing ICT adoption, human development. This action will go as far as; provide employment, reduce brain drain syndrome and intensify the penetration as well as competitiveness of ECOWAS export products. It is also recommended that the use of cutting edge ICT facilities should be encouraged and enforced by private and public companies, institutions offering health care services, education services, agriculture and financial services to improve efficiency by reaching out across physical barriers to increase coverage for everyone overtime.

Acknowledgements

It also draws some insights from the first author's Masters Dissertation. Thus, helpful comments received during the seminar presentation at Department of Economics & Development Studies, Covenant University, Ota, Nigeria, 3rd May 2017, are appreciated. The authors appreciate the useful comments from the anonymous reviewers. The views expressed are the authors'.

References

- Acemoglu, D., Gallego, F. and Robinson, J. (2014) *Institutions, Human Capital and Development*, Working Paper 19933 [online] <http://www.nber.org/papers/w19933>.
- Adelakun, O.J. (2011) 'Human capital development and economic growth in Nigeria', *European Journal of Business and Management*, Vol. 3, No. 9, pp.222–239.
- Alexander, K. (1996) *The Value of an Education*, Simon & Schuster, MA.
- Andres, R.A., Amavilah, V. and Asongu S.A. (2016) *Linkages between Formal Institutions, ICT Adoption and Inclusive Human Development in Sub Saharan Africa*, African Governance and Development Institute, AGDI Working Paper, WP/16/026.

- Asaju, K., Kajang, T. and Anyio, S. (2013) 'Human resource development and educational standard in Nigeria', *Global Journal of Human Social Science*, Vol. 12, No. 1, pp.1–8.
- Aziz, M., Nusrate, S. and Sheela, D. (2015) 'The impact of political regime and governance on ASEAN economic growth', *Journal of Southeast Asian Economies*, Vol. 32, No. 3, pp.375–389.
- Balcerzak, A.P. (2016) 'Multiple-criteria evaluation of quality of human capital in the European Union countries', *Economics & Sociology*, Vol. 2, No. 9, pp.155–175.
- Bankole, O.F., Kweku-Muata, O. and Brown, I. (2013) 'The impact of ICT investments on human development: a regression splines analysis', *Journal of Global Information Technology Management*, Vol. 2, No. 16, pp.59–85.
- Barro, R.J. and Lee, J-W. (2013) 'A new data set of educational attainment in the world, 1950–2010', *Journal of Development Economics*, Vol. 104, No. C, pp.184–198.
- Baum, C.F. (2013) 'Dynamic panel data estimators', *Applied Econometrics*, EC823, pp.1–50.
- Binder, M. and Geogiadis, G. (2011) *Determinants of Human Development: Capturing the Role of Institutions*, Cesinfo Working Paper, 3397.
- Bloom, D. and Canning, D. (2003) 'The health and poverty of nations: from theory to practice', *Journal of Human Development*, Vol. 4, No. 1, pp.47–71.
- Caglayan, M., Dahi, O. and Demir, F. (2013) 'Trade flows, exchange rate uncertainty, and financial depth: evidence from 28 emerging countries', *Southern Economic Journal*, Vol. 79, No. 4, pp.905–927.
- Duboff, A.B. (1980) 'Business demand and development of telegraph in the United States, 1844–1860', *Business History Review*, Vol. 54, No. 4, pp.461–477.
- Efobi, U. and Osabuohien, E. (2015) 'Technological utilization in Africa: how do institutions matter?', in Majumdar, S., Guha, S. and Marakkath, N. (Eds.): *Technology and Innovation for Social Change*, pp.67–84, Springer, New Delhi.
- Frank, R.H. and Bernanke, B.S. (2007) *Principles of Microeconomics*, McGraw-Hill/Irwin, New York.
- Grace, J., Kenny, C. and Zhen-Wei Qiang, C. (2004) *Information and Communication Technology and Broad-Based Development: A Practical Review of Evidence*, World Bank Working Paper No. 12.
- Grubb, W. and Lazerson, M. (2004) *The Education Gospel: The Economic Power of Schooling*, Harvard University Press, MA.
- He, Q. (2013) 'Price scissors and economic growth: the role of openness', *Pacific Economic Review*, Vol. 1, No. 18, pp.60–78.
- International Monetary Fund (IMF) (2002) 'Development, social development and environmental protection', *World Summit on Sustainable Development*, Johannesburg, 26 August to 4 September.
- Ishola, A. and Alani, R. (2015) 'Human capital development and economic growth: empirical evidence from Nigeria', *Asian Economic and Financial Review*, Vol. 2, No. 7, pp.813–827.
- Kim, Y.J., Kang, H., Sanders, G.L. and Lee, S.T. (2008) 'differential effects of it investments: complementarity and the effect of GDP level', *International Journal of Information Management*, Vol. 28, No. 8, pp.508–516.
- Lawanson, O.I. (2009) *Human Capital Investment and Economic Development in Nigeria: The Role of Health and Education*, Oxford University Press, Oxford.
- Lyakurwa, W.M. (2007) 'Human capital and technology for development: lessons for Africa', *African Development Bank-AfDB Annual Meetings Symposium Shanghai*, China, 14–17 May.
- Maden, G. and Savage, S. (1998) 'CEE telecommunications investment and economic growth', *Information Economics and Policy*, Vol. 10, pp.173–195.
- Minges, M. and Gray, V. (2002) *Internet on the Mekong: Lao PDR Case Study* [online] <http://www.itu.int/asean2001/reports/material/LAO%20CS.pd> (accessed 5 April 2006).

- Morawczynski, O. and Ngwenyama, O. (2007) 'Unraveling the impacts of investments in ICTs, education and health on development: an analysis of archival data of five West African countries using regression splines', *Electronic Journal on Information Systems in Developing Countries*, Vol. 29, No. 5, pp.1–15.
- Ndulu, B.J. (2004) 'Human capital flight: stratification, globalization, and the challenges to tertiary education in Africa', *JHEA/RESA*, Vol. 2, No. 1, pp.57–91.
- Ngwenyama, O., Andoh-Baidoo, F.K., Bolou, F. and Morawczynski, O. (2006) 'Is there a relationship between ICT, health, education and development? An empirical analysis of five West African countries from 1997–2003', *Electronic Journal on Information Systems in of Developing Countries*, Vol. 23, No. 5, pp.1–11.
- Ogujiuba, K.K. and Adeniyi, A.O. (2004) *Economic Growth and Human Capital Development: The Case of Nigeria*, Central Bank of Nigeria Publication.
- Oluwatobi, S.O. and Oluranti, O.I. (2011) 'Government expenditure on human capital development: implications for economic growth in Nigeria', *Journal of Sustainable Development*, Vol. 4, No. 3, pp.72–80.
- Omojimiti, B.U. (2011) 'Building human capital for sustainable economic development in Nigeria', *Journal of Sustainable Development*, Vol. 4, No. 4, pp.98–102.
- Osabohien, R., Osabuohien, E. and Urhie, E. (2017) 'Food security, institutional framework and technology: examining the nexus in Nigeria using ARDL approach', *Current Nutrition and Food Science*, Vol. 13, No. 4, pp.1–10.
- Osabuohien, E.S. (2008) 'ICT and Nigerian banks' reforms: analysis of anticipated impacts in selected banks', *Global Journal of Business Research*, Vol. 2, No. 2, pp.67–76.
- Rastogi, P.N. (2002) 'Knowledge management and intellectual capital as a paradigm of value creation', *Human Systems Management*, Vol. 21, No. 4, pp.229–240.
- Romer, P.M. (1990) 'Endogenous technological change', *Journal of Political Economy*, Vol. 98, No. 5, pp.75–102.
- Rosen, M.L. (1999) 'The political economy of the resource curse', *World Politics*, Vol. 51, No. 2, pp.297–322.
- Schultz, T.P. (1992) *The Role of Education and Human Capital on Economic Development: An Empirical Assessment*, Center Discussion Paper, Economic Growth Center, Yale University.
- Sen, A. (1999) *Development as Freedom*, Oxford University Press, Oxford.
- Shuaibu, M. and Oladayo, P. (2016) 'Determinants of human capital development in Africa: a panel data analysis', *Oeconomia Copernicana*, Vol. 7, No. 4, pp.523–549.
- Southiseng, N. (2013) 'Human resource management in the telecommunications sector of Laos', *International Journal of Research Studies in Management*, Vol. 2, No. 2, pp.3–20.
- UNDP (2015) *United Nations Development Programme* [online] <http://hdr.undp.org/en/data> (accessed 28 December 2016).
- United Nations Development Programme (UNDP) (2009) Human Development Report.
- Waema, T.M. (2002) *ICT Human Resource Development in African: Challenges and Strategies*, ATPS Special Paper, No. 10.
- World Bank (2010) 'Knowledge, productivity and innovation in Nigeria: creating a new economy', *World Development Indicators – WDI, 2016 Data Set*, The World Bank, Washington DC.
- World Bank (2016a) *World Development Indicators*, World Bank Publications [online] <https://data.worldbank.org/data-catalog/world-development-indicators> (accessed 27 December 2016).
- World Bank (2016b) *World Governance Indicators*, World Bank Publications [online] <http://info.worldbank.org/governance/wgi/#home> (accessed 27 December 2016).