INFLUENCE OF ICT INFRASTRUCTURES AND HUMAN CAPITAL DEVELOPMENT ON FOREIGN DIRECT INVESTMENT IN WEST AFRICA

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Abstract

Human Capital development is argued as an attraction for Foreign Direct Investment (FDI) inflow to countries in the literature especially in the presence of enabling infrastructure as Information and Communications Technology (ICT). On this premise, the present study investigates the contribution of Human capital development as a result of the influence of Information and Communications Technology for Foreign direct investment inflow to West Africa. The study covered the period of 2010 to 2021 and comprised all sixteen West African countries which together reflect heterogeneity in their levels of ICT infrastructure, Human capital development and FDI inflow. Utilising panel data two-stage fixed effects, the present study finds that while Information and Communications Technology is statistically significant for boosting Human capital development on the one hand, on the other hand the Human capital development realized is not significant for boosting FDI inflow to West Africa. The study consequently recommends that greater access to ICT infrastructure by society should be encouraged, and ICT should be employed to greater effect in the delivery of services as education and health by service providers towards raising levels of human capital development. Further the quality of Human capital development compatible with desirable productive Foreign Direct Investment flowing into respective West Africa countries should be monitored and promoted with the aid of quality ICT by respective West Africa country governments, as FDI remains a major source of capital for the promotion of economic growth and sustainable development of emerging countries globally including West African countries.

***Keywords**: Information and Communications Technology, Human Capital development, Foreign Direct Investment, Sustainable Development.*

1. Introduction

High levels of human capital development are one of factors that attract foreign direct investment to host countries of the world, as this will boost the productivity of the subsidiaries of the foreign owned companies being established in the host country economies. However, in the context of developing countries in general especially those in Sub-Saharan Africa, improving their level of human capital development is of paramount importance if they are to

enjoy the priceless benefits of significant foreign direct investment inflow. This is because the economies are characterized by low levels of Human capital development and this has hindered the economic progress of such countries to date. Jhinghan (2011) highlights low human capital development as an obstacle to development, while Oluwatobi, Olurinola and Taiwo (2016) emphasise the need for greater access to education resulting from greater ICT use in education in order for greater levels of inclusive growth to be realized. However, the Plethora of research on Human capital emphasize its importance for growth (see, Zalle, 2019; Dinh Su & Phuc Nguyen, 2020) in general including covariates of growth as FDI (See Konara and Wei, 2019), Innovation (Samad, 2020), Environment quality and so on. Hausman, Rodrik and Velasco (2006) argue low human capital development as an obstacle to the achievement of significant returns to economic activity in developing countries.

Improving levels of Human capital will involve significant investment in resources that will boost employee skills, knowledge and competence to perform at the work place (Martin, Ciovica & Cristescu, 2013; Batalla-Busquets & Myrthianos, 2015). One of such resources given limited attention in the human capital literature is information and communications technology (ICT) which over the last two decades has featured increasingly in economies of the world on account of its significant contribution to improving productivity across all sectors of the economy as highlighted by Campisi, Nicola, Farhadi and Mancuso (2013). Among the effects of ICT on sectors of the economy in addition to improvements in organization and management is improvement in human capital (Moshiri & Nikpour, 2010). Human capital is argued by literature as critical for promoting the competitiveness and development of enterprises (Kucharčíková, Mičiak, & Hitka, 2018; Baigireyeva, Niyazbekova, Borisova & Ivanova, 2020). Further ICT infrastructure as the internet may provide a platform for SMEs to compete equally with large enterprises as highlighted by Tarutė and Gatautis (2014). This suggests that enterprises may combine ICT with Human capital to enhance their competitiveness. However, in the context of Sub-Saharan Africa countries, the inability of local enterprises to compete globally may be traced to low levels of information and communications technology adoption that is associated with low levels of human capital amongst other factors. This is despite high levels of ICT penetration in Sub-Saharan Africa countries especially over the last decade.

Foreign Direct Investment (FDI) as a form of capital in high demand by developing countries such as those of Sub-Saharan Africa in general and West Africa in Particular, remains critical for the economic progress including the address of various economic challenges. While there exists consensus regarding the invaluable benefits of FDI for a host country as highlighted by various FDI literature, including that of addressing unemployment, technology inflow and skills, poverty reduction and so on, for a country region as West Africa featuring potential incentives for FDI inflow as sizeable population, greater access to sea for international trade, high ICT penetration arising from the arrival of fibre optic submarine internet cables on the sea shores of African countries just over a decade ago as highlighted by Mensah and Traore (2022) and Warsame (2021), abundant natural resources, sizeable economy and so on, FDI inflow remains rather low.

West Africa, comprising countries as Nigeria, Ghana, Senegal, Cote D'Ivoire amongst other West African countries individually feature incentives for FDI inflow giving rise to the region's collective attraction especially in light of optimism of her future economic growth prospects. Multinational enterprises seek to exploit opportunities for greater profitability resulting from continued progress of the Africa country region. Consequently, this will enable West Africa continue with its prominent role in the continent of Africa for a variety of economic

achievements. On the other hand, declining FDI inflow to West Africa, portends adverse implications for the West Africa region in particular and Africa in general

ICT adoption in West African countries may through increasing levels of human capital development boost foreign direct investment inflow to West African countries. This is especially on account of high levels of mobile use, as well as low but rapidly rising internet use, in addition to other ICT mediums, which may promote improved quality of as well as wider access to education, health and training which together constitute human capital development. Further with a number of West African countries in close proximity to the Sea shores, the maximization of the opportunities provided by the fibre optic submarine internet cables on the sea shores especially since 2010 is inevitable such as through aiding the development of quality Human capital for improving the efficiency of the domestic economy in general. Dorożyńska and Dorożyński (2015) for instance argue a certain minimum level of education as a prerequisite for a country to attract and maintain foreign direct investment and maximize indirect effects connected with human capital. Multinational enterprises will consequently be attracted to West African countries as levels of Human capital improve given the role of human capital for efficiency of enterprises. Further the Multinational enterprises will incur low costs in training employees sourced locally within the host country which is consistent with the demand by enterprises for infrastructure that will result in reduced transaction costs for business.

Thus, this present study in light of the aforementioned, investigates the effect of Human capital development as a result of the role of ICT in boosting Foreign Direct Investment inflow to a panel of sixteen countries in West Africa. In particular, the study tests the singular hypothesis of whether given the contribution of ICT in light of substantial penetration in terms of Mobile phone use in particular, to Human capital development, FDI inflow is boosted in West Africa. While recent studies have explored the effect of ICT on human capital development (such as Oluwatobi, Olurinola, and Taiwo, 2016; Ejemeyovwi, Osabuohien and Osabohien, 2018; Khan, Ju, and Hassan, 2019; Orji, Ogbuabor, Anthony-Orji, Okoro, and Osondu, 2020), the effect of Human capital development on FDI (Makoni, 2019; Abbas, Moosa, and Ramiah 2022), and the role of ICT for FDI (Ibrahim, Yakubu and Sare, 2018; Warsame, 2021; Mensah and Traore, 2022), there exists no study to the best of the researcher's knowledge exploring the role of Human capital development on FDI resulting from ICT in general, and for West Africa in particular. This may, in relation, have contributed to bias of estimates by previous studies relating Human capital development to FDI without controlling for the potential role of ICT in the process. This study given the aforementioned brings together the strands of literature relating ICT to human capital development, ICT to FDI Human capital development to Foreign Direct Investment, thus highlighting the novelty of the present study in contrast to previous studies.

The novelty of this present study is further founded on the use of United Nations Human Development Index to measure human capital development rather than expenditure on education and health or outcomes as school enrolment or life expectancy which most previous studies on human capital development adopted. The United Nations Human Development Index is argued as a more appropriate measure of human capital development in this study than measures previously used to measure human capital development because it combines education, health and income into one composite measure and hence allows an assessment of improvements in education, health or income on the capabilities of the individual to contribute to productive activity. Further FDI in this study is measured as the share of Net FDI inflow in GDP which contrasts with FDI inflow adopted by most previous studies (Osabohien, Awolola,

Matthew, Itua & Elomien, 2020; Warsame, 2021; Mensah & Traore, 2022). This is on account that share of Net FDI inflow in GDP gives a measure of the economic value of Net FDI inflow to a country, in contrast to FDI inflow which merely indicates the size of FDI inflow and does not emphasize the economic value of FDI inflow.

The remainder of the paper is organized as follows: Section 2 reviews empirical literature relating to ICT, Human capital development and Foreign Direct investment, including the discussion of the heterogeneity of West African countries as well as trends in terms of selected indicators. In section 3, methodology of the study is discussed, while in section 4, results are presented, interpreted and discussed. The final section of the study, section 5 provides the conclusions and recommendations of the study.

2. Literature Review

The empirical literature on Foreign direct investment features overwhelming focus on Sub-Saharan Africa (SSA) countries in particular amongst developing countries. This highlights considerable research interest in Foreign direct investment inflow as a major source of capital for addressing SSA economic challenges, especially since the 1990s when developing countries, including those in SSA underwent reforms aimed at liberalizing their economies and has resulted in major benefits to the countries amongst which is increased capital inflows. Further correlated with the attraction of developing countries in general and SSA countries in particular of global FDI inflows is their economic growth, and to that effect a substantial literature relate FDI to economic growth both in respect of growth promoting FDI (Iqbal, Tang and Rasool, 2023) and in respect of FDI promoting economic growth (Nguyen, 2022; Chaudhury, Nanda, and Tyagi, 2020; Dinh, Vo, The Vo, and Nguyen, 2019). It is therefore in respect of the link between FDI and growth that ICT and HDI may be linked to FDI as they are correlated with economic growth.

The relation of both ICT and Human capital development to FDI may be further argued based on Endogenous growth theory of which proponents of the theory include Arrow (1962), Romer (1990), Lucas (1988) and which argues the rate of economic growth over the longer term to result from endogenous factors particularly, technical progress resulting from the rate of investment, the size of the capital stock, and the stock of human capital. The theory emphasizes increasing returns in contrast to neoclassical growth theory where growth is argued to result from exogenous factors as rate of Population growth and rate of growth in exogenous technology. Knowledge, investment in education, investment in research and development and innovation are all concepts that resonate with the endogenous growth theory as employed by the variants of endogenous growth theory. ICT may be related to FDI consistent with the leap frogging hypothesis of Steinmueller (2001) that technology aids developing countries to scale particularly challenging obstacles on their path to growth and development as it provides an incentive for FDI inflow to the host country by multinational enterprises in a foreign country. In relation Asongu and Odhiambo (2020) find based on the Generalized Method of Moments that both Internet penetration and mobile penetration overwhelmingly modulate FDI to induce overall positive net effects on various economic growth dynamics in 25 countries in Sub-Saharan Africa for the period of 1980-2014, while in Asia, Nipo, Lily, Idris, Pinjaman, and Bujang (2022) find that economic progress is boosted by the significant influence of selected ICT variables - fixed telephone subscriptions, mobile cellular subscriptions and Internet users.

Further the link of ICT and Human capital development for FDI may be explained by institutional fitness theory of FDI put forward by Wilhelms and Witter (1988) that highlights the roles of four main FDI Fitness Institutions, namely government, markets, education and socio culture all playing a role in the attractiveness of a country for FDI. Institutions, policies

and implementation give a country competitive advantage in the world market as regards FDI, and consequently, countries with high Institutional fitness experience a higher inflow of foreign direct investment than countries with low Institutional fitness. High Institutional Fitness means that a country's institutions are well-functioning, reliable, transparent and predictable. Thus Human capital to which ICT may contribute may relate to FDI through its contribution to the fitness of all the aforementioned four FDI fitness institutions, especially socio-culture, education and markets, while the government as the primary source for actions and policies shaping FDI and being at the apex of the FDI fitness pyramid, play their role in relation to the development of political capital for the attraction of FDI.

The current literature on human capital development highlights the important role played by ICT. Adeyeye, Ojih, Bello, Adesina, Yartey, Ben-Enukora., and Adeyeye, (2022) highlight the important role of ICT through its utilisation in health and education amongst other sectors of the domestic economy. In relation Oluwatobi, Olurinola and Taiwo (2016), found ICT to play a significant role in facilitating school enrolment at the secondary and tertiary levels of education unlike at the primary level and using knowledge economy framework for which panel data for 32 SSA countries that spans from 2001 to 2012 was employed. The study argues ICT as one of those factors that can be responsible for enabling school enrolment and access to education. Thus, by making education more accessible, ICT can facilitate inclusive growth. A further finding of the study was that a statistically significant and direct relationship exists between ICT infrastructure, its usage and school enrolment in SSA.

Ježić, Zaninović, and Škulić (2022) found comparing a panel data of developed and developing countries in relation to their level of development, a significant impact of ICT on human capital development only in the case of upper middle countries. Further the lagged value of the HDI was found to have significant and positive effects on the observed human development index. The result pinpointed that ICT is of great importance and is a relevant instrument that positively influences people's lives directly or indirectly. Similarly, ICT was found to accelerate labour productivity more quickly in ICT intensive industries than in less ICT intensive industries by Lefophane and Kalaba (2020) based on evidence from South Africa's manufacturing sector and consequently the study suggested the necessity for policy initiatives to promote ICT use with the goal of enhancing industry LP performance. Further Alžbeta, Martin, Miloš (2018) evaluating the effectiveness of investment in human capital in E-Business enterprise in the context of sustainability based on survey data, find that the effectiveness of the utilization of human capital and its investment in its development leads to an increase of performance and competitiveness of the enterprise within the context of sustainability. Similarly, assessing the extent of ICT diffusion across small enterprises and the impact of ICT usage on firm and labour productivity in India, Gupta and Kumar (2018) find ICT is advantageous for both large and small businesses, which necessitates swift policy action to upgrade them in this area. Selection and recruitment, training and development, Human resource planning, evaluation and compensation and human resource management efficiency are applications of ICT in Human resources based on evidence from Pearson's correlation by Piabuo Piendiah, Njamnshi, and Tieguhong, (2017) focussing on Cameroon mobile Telecommunication Sector and based on a survey of a sample of 120 Management, senior, junior and contract staffs of the 03 (three) main mobile telephone operators. A significant and positive link between the aforementioned Human resources activities and ICT use revealed ICT as an efficient tool in Human resource management of enterprises. Thus, enhancement of ICT use was suggested in improving efficiency of Human resources management.

Arvanitis, Loukis, and Diamantopoulou (2016) carried out a comparative study to examine the relationships for Swiss and Greek firms between indicators for the intensity of use of modern information and communications technologies (ICT), several forms of workplace organisation, and human capital, on the one hand, and several measures of innovation performance at firm level. For the Swiss firms, it was concluded that ICT contributes to innovation activities. For the Greek firms, the findings revealed that they exploit the innovation potential of ICT to make innovations at the level of both their processes and their products and services in order to overcome traditional fundamental weaknesses and inefficiencies. Similarly, Ahmed (2017) assessed the impact of information and communications technology (ICT) and human capital spillover effects on productivity on selected five countries of Association of Southeast Asian Nations, (ASEAN5), Malaysia, Indonesia, Philippines, Singapore, and Thailand, plus three East Asian Countries (China, Japan, and South Korea). The findings of the study were that physical capital, labor, ICT, human capital, and the instantaneous contribution of the quality of these factors boosted productivity, articulated as total factor productivity (TFP).

Fossen, and Sorgner (2018) investigate the effects of digitalization and artificial intelligence on individual transitions in the US labour market. Representative panel survey data was used to carry out the study and amongst the findings was the link of a larger risk of digitalization of an individual's current occupation with the higher likelihood of switching occupations or becoming non-employed. Further comparing entry into incorporated with that of un-incorporated entrepreneurship, that of the former is found to have no significant association with digitalization risk, while that of the latter is more probable at a medium level of digitalization risk. In addition, significant gender differences were found on the effect of digitalization on transitions into different types of entrepreneurship. Similarly, Efobi, Voufo, and Asongu,(2018) focussing on 48 African countries for the period 1990-2014 find based on Ordinary Least Squares, Fixed Effects and the Generalized Method of Moments regressions that expanding access to mobile, internet, and fixed broadband subscriptions promotes female economic participation. The results hold up well when country-level heterogeneity are controlled for.

Iqbal, Hassan, Peng and Khurshaid (2019) investigated the role of ICT and economic growth on human development in a panel study on five selected south Asian countries over the period of 1990-2016. The results suggest that mobile phone usage promotes human development, whereas internet usage does not do so. In addition, economic growth does contribute to the promotion of human development. Further Khan, Ju, and Hassan (2019) modelled the relationship between ICT, economic growth, and the human development index (HDI) considering urbanisation, foreign direct investment (FDI), and trade for the period from 1990 to 2014 in Pakistan. The empirical results reveal that ICT promotes human development index. Alongside economic growth which has a positive and significant impact on human development. It also discovered that urbanisation, trade, and FDI discourage human development in Pakistan. Human capital development may also be affected by power supply and hence together with ICT, Orji, Ogbuabor, Anthony-Orji, Okoro, and Osondu, (2020) find in respect of Nigeria as an emerging market economy that ICT, power supply which was proxied by electricity consumption and population impact positively on human capital development. This is consistent with findings by Nipo, Lily, Idris, Pinjaman, and Bujang (2023) that in raising individuals quality of life, increased ICT adoption and electricity access are essential in addition to good governance. Amongst the roles of ICT for boosting human capital development argued by Nipo, Lily, Idris, Pinjaman, and Bujang (2022a) is enhanced effective usage of internet on account of digital literacy as individuals take advantage of digital

opportunities as well as engage in digital activities in order to boost human capital as a strategy for improved socio-economic well-being.

Das and Drine (2020) investigated the association between the technology gap, educational quality, trade openness, and foreign direct investment in investigating why some countries lag while some are fast in catching-up as regards technology, considering a tripartite grouping—advanced North, dynamic emerging Southern engines of growth, and laggards in Sub-Saharan Africa. The technology gap between the African nations and emerging economies was measured using the metafrontier approach and the study found that development success is essentially predicated upon knowledge capabilities backed by human development, access to new technology, capacity to absorb new technologies. On the other hand, Africa's poor infrastructure, relatively poor business environment, and lack of human development are the most significant barriers to technology catch-up. Further results revealed that globalization while a means to opening new markets is more importantly vital for achieving higher productivity through technology transfers. Macroeconomic policies and sustained reform amongst other factors were argued as essential for accelerating the technology catch-up, and to put the African economies on a path to sustainable growth.

Mollins and St-Amant (2019) based on the observed slowdown of productivity in Canada examine the role of ICT. Utilising the two-sector models, which comprises a straightforward method with use and production effects and a method "à la Oulton (2012)" that emphasizes the importance of ICT pricing' relatively slow increase, findings of the study showed that ICT still helps to increase productivity, but that this contribution has decreased and is responsible for some of the productivity slowdown.

Ejemeyovwi, Osabuohien and Osabohien (2018) 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). This study engaged the generalized method of moments (GMM) in achieving its objective. The results demonstrated, among other things, that there was no statistically significant correlation between ICT investment and human development. The comparatively low investment in telecommunications along with the high cost of acquiring the technology in ECOWAS and severe policy environment may be factors for the non-significant influence of telecommunications investment on human development. In conclusion policies such as the enforcement of good institutions, stabilization of the political and economic variables in ECOWAS economies will encourage investment in telecommunications, which will enhance ICT adoption and human development.

Through FDI the contribution of Human capital development to a country has been argued. Abdouli and Omri (2021) investigates the links between FDI inflows, environmental quality, human capital, and economic growth in the Mediterranean region for the period of 1990–2013. The study found that a bidirectional causality exists between economic growth, FDI inflows, CO2 emissions, and human capital for all panels with exceptions to the Euro and Asian Mediterranean countries panel where unidirectional causality exists from FDI inflows to human capital as well as from human capital to FDI inflows. Hence human capital-FDI relationship can occur in both directions and in relation to Human capital affecting FDI inflow, Konara, and Wei (2019) examined the complementarity of human capital and language capital in foreign direct investment (FDI). It sought to show the extent to which MNEs can leverage Human Capital (HC) in a host country for FDI depends on Language Capital (LC) using extensive bilateral dataset covering 3315 country pairs during 1995–2008, and revealing a clear evidence on the moderating role played by LC in HC-FDI relationship. Conversely, FDI may play a role

in Human capital and in that respect Abbas, Moosa, and Ramiah (2021) find for developing countries that there exists no difference in the success of developing countries to attract FDI between firms seeking human capital and those seeking cheap labour regardless of proxy use for Human capital. The employee compensation turned out to be the most important factor for attracting FDI implying that multinational firms look for cheap and also skilled labour in the host country.

Makoni (2019) examined the effect of human capital development on foreign direct investment (FDI), using a panel of nine African countries, during the period 2009-2016. Building on from the eclectic paradigm, the results from the random effects model showed that human capital development positively influenced inward FDI, and that the relationship is statistically significant. Other FDI determinants that emerged were real exchange rate that was positive and very significant at 1%, while the lag of FDI and infrastructural development were positive and significant at 5%. Iqbal and Mumit (2017), suggested that only when the host country has a certain threshold level of human capital, Foreign Direct Investment contributes positively to economic growth through technology diffusion. It is also found that in general terms, the growth of human capital, and not the level of human capital, in the host economy interacts more strongly with Foreign Direct Investment to produce positive externalities. This indicates that countries can compensate for their lower levels of human capital stock by substituting it with higher rates of human capital growth. On the other hand, Miningou and Tapsoba (2017), while finding no significant relationship between the average years of schooling and FDI inflows find the external efficiency of the education system important for FDI inflows, especially in non-resource rich countries, non-landlocked countries and countries in the low and medium human development groups.

Azam, Khan, Zainal, Karuppiah, and Khan (2015) evaluated empirically the impact of foreign direct investment (FDI) on human capital for 34 developing countries over the time period ranging from 1981-2013. Amongst the controls employed in the estimated model for the study were GDP per capita, international remittances, and exports. The study revealed that the inward FDI has a statistically positive impact on human capital using the fixed-effects model. In relation, Abbas, Fagbemi and Osinubi (2020) assessed the interconnections between FDI and human capital development in Nigeria over the period 1981–2018. The findings revealed that the effect of FDI on human capital is insignificant in the long run, while it is significant in the short run. In addition, studies showed that a rise in FDI inflows to a certain rate, in the long-run, could result in a significant increase in the level of human capital development, suggesting that the magnitude of inward FDI matters in the economy. Suggesting further that as FDI inflows require sound technical know-how, and more skilled labour to work with or adapt to more advanced technologies, such could draw attention to improved human capital. Also vital for human capital development are economic freedom as investment freedom, business freedom and financial freedom which when interacted with FDI is significant for boosting Human capital development as highlighted by Korle, Amoah, Hughes, Pomeyie, and Ahiabor (2020) based on evidence from a panel data of 32 selected African countries from 1996 to 2017 exploring the foreign direct investment (FDI) and human development nexus. However an adverse influence of FDI for human capital is observed in relation to the interaction of FDI with property rights, trade freedom, government integrity and tax burden in Africa.

Human capital development may in light of the aforementioned related to FDI inflow play a role in the ICT-FDI relationship. Studies as Mensah and Traore (2022), Warsame (2021) Tandogan and Karis (2020), Pribadi et al (2019), Ibrahim, Yakubu and Sare (2018) all highlight the centrality of ICT infrastructure such as internet and mobile phones for FDI inflow. Further

in regard to access to credit as highlighted by Babajide, Oluwaseye, Adedoyin, and Isibor (2020) and engendering greater financial inclusion as argued by Uzoma, Omankhanlen, Obindah, Arewa, and Okoye (2020), information communications technology as Automated teller machines and other forms of financial technology may provide an incentive for FDI inflow. Economic growth may further be affected by Foreign Direct Investment, Human Development and Macroeconomic Condition as found by Ridha, and Risamawan (2020) in Indonesia where Foreign Direct Investment and Trade Balance had a negative and significant impact on Indonesia's long term economic growth. In the short run however, the study found no significant impact. Also found was that Human Development and Gross Fixed Capital Formation have a positive and significant impact on Indonesia's economic growth both in the long term and short term. Similarly, Olawumi (2019) investigates the effect of human capital development on economic growth, as well as controlling for country differences, in the BRICS economies – within the period of 1990 to 2017. According to their findings, a comparative analysis of results showed that China, Brazil and Russia were able to utilise their human capital to enhance economic growth more efficiently than South Africa and India.

Overview of West Africa

West Africa as a region of significant importance for the progress of Sub-Saharan Africa comprises 16 countries which are heterogeneous in terms of various characteristics as population size, GDP, resource abundance, and so on. Amongst the major countries in the region in terms of influence in Sub-Saharan Africa are Nigeria, Ghana and Cote D'Ivoire. Further Mobile Cellular Subscriptions amongst other ICT media in West Africa on the average is one of the highest for SSA thus highlighting the benefits derivable from operations by foreign enterprise in the West Africa market. However, Human capital development and FDI inflow have remained low in West Africa suggesting the existence of challenges in raising HDI level as well as that of FDI inflow to the region.

Figure 1 depicts the trend of the annual averages of each of Mobile cellular subscriptions, HDI and FDI inflow. While average MCS has been on the continuous rise from 2010 at about 55 per 100 individuals to 2020 at 99 per 100 individuals, average Human development index rose marginally from 0.46 in 2010 to 0.51 in 2020. On the other hand, average Net FDI inflow as a percentage of GDP from 2012 when it was 12% of GDP, it has been on the decline and 2014 onwards till 2020 was less than 5% of GDP.

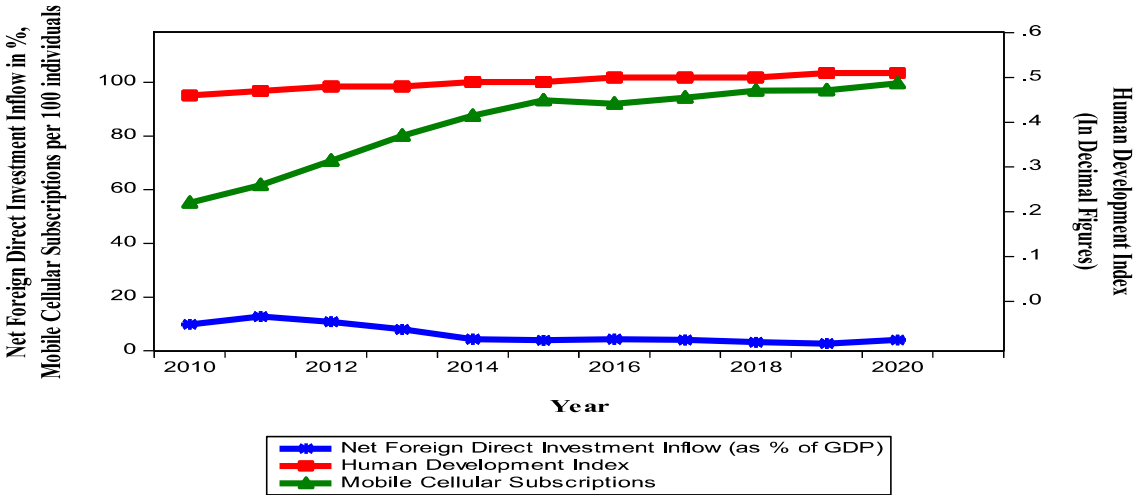

Figure 1. Trends of Average Net FDI inflow, Mobile Cellular Subscriptions, Human Development Index of West Africa from 2010 to 2020

Mobile cellular subscription as observed from Figure 1 has exhibited an upward trend from 2010 – 2015. Although it has been trending upward, from 2016-2020 the increase in mobile cellular subscription has been rising at a slower rate possibly reflecting the saturation of the mobile phone market in West Africa where unprecedented rates of Mobile phone penetration are observed, even when compared to that of most other Sub-Sahara African countries. Further, Human Development index in West Africa has maintained a flat trend from 2010 – 2020, indicating that HDI in West Africa has been on the same level without much increase over the years. Finally, net FDI inflow from 2014 to 2020, has remained on the same level although, from 2010-2013, it showed to have been dwindling indicating a reduction in the inflow of FDI as a percentage of GDP – reflecting the productiveness of FDI inflows for the West African countries. Thus based on the aforementioned, West Africa's ICT in terms of mobile use has not translated to improved outcomes in terms of Human capital development and FDI inflows.

Assessing the mean values of Mobile Cellular Subscription (MCS), Human Development Index (HDI) and Net Foreign Direct Investment (Net FDI) as a percentage of GDP for respective West African countries, Table 1 highlights heterogeneity in terms of all selected variables across West African countries over the period of 2010 to 2020 based on the mean values for all selected indicators. Cape Verde has the highest average values for Mobile Cellular Subscriptions and HDI at 101.45 per 100 individuals and 0.65 respectively. On the other hand, Niger has the lowest mean MCS and HDI at 36.91 per 100 individuals and 0.37. Further, mean Net FDI inflow as a percentage of GDP for all West Africa countries is at its lowest for Cote D'Ivoire at 1.1%, while it is at its highest for Liberia at 34.94%.

Table 1. Country Comparisons of Mean Values of MCS, HDI and FDI across West Africa from 2010 to 2020

Country	Mobile Cellular Subscriptions (per 100 individuals)	Human Development Index (In Decimals)	Net foreign Direct Investment Inflow (% of GDP)
Benin	85.09	0.52	1.69
Burkina Faso	76.64	0.42	1.72
Cabo Verde	101.45	0.65	6.32
Cote d'Ivoire	110.36	0.51	1.1
Gambia	109.27	0.47	4.35
Ghana	114.27	0.59	6.03
Guinea-Bissau	68.91	0.46	2.05
Guinea	79	0.45	4.6
Liberia	60	0.48	34.94
Mali	108	0.42	2.84
Mauritania	96.82	0.53	7.9
Niger	36.91	0.37	6.28
Nigeria	77.64	0.52	0.98
Senegal	95.82	0.5	2.79
Sierra Leone	66.45	0.43	10.98
Togo	64.27	0.5	4.41

Table 1 highlights heterogeneity in terms of all selected variables across West African countries over the period of 2010 to 2020 based on the average values for all selected indicators. Cape Verde has the highest average values for Mobile Cellular Subscriptions and HDI at 101.45 per

100 individuals and 0.65 respectively. On the other hand, Niger has the lowest MCS and HDI at 36.91 per 100 individuals and 0.37. Further, average Net FDI inflow as a percentage of GDP for all West Africa countries is at its lowest for Cote D'Ivoire at 1.1%, while it is at its highest for Liberia at 34.94%.

3. Methodology

The present study is focussed on all sixteen West Africa countries, namely: Benin Republic, Burkina Faso, Cape Verde, Cote' D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo. Data for the study spans the period of 2010 to 2020 on account of 2010 heralding the era of Significant ICT penetration to Countries in Africa as fibre optic submarine internet cables were installed on the sea shores of Africa, and many of the countries in West Africa have close proximity to the sea and will have benefitted in terms of their ICT penetration. 2020 is however the latest year of data for most variables employed in the specified model for the study. The ICT variable of focus for the present study is that of Mobile cellular subscriptions defined as the percentage of the population with mobile cellular subscription, as it is of highest penetration of all ICT variables for most African countries (World Bank 2020). Further Mobile cellular subscriptions, in addition to trade openness, GDP per capita growth and Foreign Direct Investment measured using Net FDI inflow as a percentage of GDP, were respectively sourced from the World Bank World Development Indicators. On the other hand, Human Development Index which is the proxy for Human capital development in the present study, was sourced from the United Nations Development Programme (UNDP), while Rule of Law was sourced from the World Bank World Governance Indicators (WGI).

The present research assesses the extent to which Human capital development as a result of the influence of ICT in the form of mobile cellular subscriptions can affect Foreign direct investment in West Africa region. The study is founded on the Wilhelms and Witter (1998) institutional fitness theory that argues four main FDI Fitness Institutions, namely government, markets, education and socio culture playing a role in the attractiveness of a country for FDI. Thus West Africa may incentivise multinational enterprises to foray countries through FDI inflow as ICT and Human capital together contribute to the fitness of the four FDI institutions according to the FDI fitness theory.

The model employed by the present study is based on the work of Ejemeyovwi, Osabuohien and Osabohien (2018). The model is specified as a two-stage model that will be estimated using Panel data Fixed Effects estimation, as ICT measured using Mobile Cellular Subscriptions in the first stage influences Human capital development, and then in the second stage of the regression, the predicted Human capital development affects Foreign Direct Investment. The choice of the fixed effects estimation for both stages of estimation is based on the appeal of fixed effects estimation controlling for unobserved country-specific differences across countries that may be time invariant. The model employed for the present study is as in Equation (1a) and (1b).

$$HDI_{it} = \alpha_0 + \alpha_1 MCS_{it} + \alpha_2 TRPN_{it} + \alpha_3 RLW_{it} + v_i + \varepsilon_t \quad (1a)$$

$$FDI_{it} = \beta_0 + \beta_1 \widehat{HDI}_{it} + \beta_2 MCS_{it} + \alpha_3 TRPN_{it} + \alpha_4 GDPPCGR_{it} + v_i + \varepsilon_t \quad (1b)$$

Where, HDI is Human Development Index (proxy for Human capital development), MCS is Mobile Cellular Subscriptions (Proxy for ICT), TRPN is Trade Openness, RLW is Rule of Law, FDI is Foreign Direct Investment, $\widehat{HDI}$ is predicted HDI from the Fixed Effects first stage regression, GDPCGR is GDP per capita Growth rate. v is country specific fixed effects, ε is

error term. i refers to individual West African countries where i=i-16, t is time period 2010 to 2020. α_0 and β_0 are respectively constants, $\alpha_1 \ldots \alpha_3$ are marginal effects of respective independent variables on HDI, while $\beta_1 \ldots \beta_4$ are marginal effects of respective independent variables on FDI.

From equation (1a) the central variable of interest is Mobile Cellular Subscription (MCS) while all other independent variables are control variables, while in respect of Equation (1b) the central variable of interest is $\widehat{HDI}$ with other variables being control variables. Further note that while both Equations (1a) and (1b) feature similar independent variables, they differ in respect of RLW which is featured in equation (1a) but excluded in equation (1b), and GDPCGR which is featured in equation (1b) but excluded in equation (1a).

With regards to the definition of variables, Human Development Index (HDI) ranges between zero and one with higher values depicting high human capital development. Mobile Cellular Subscription (MCS) is the individuals with mobile cellular subscription per 100, Trade Openness (TRPN) is the sum of the value of exports and imports as a percentage of GDP, Rule of Law (RLW) is a proxy for institution quality and ranges from -2.5 to 2.5 with higher values depicting stronger rule of law and hence stronger quality institutions and vice versa. GDP per capita growth rate is the rate at which GDP per capita from one year to the other is growing in percentage

4. Results and Discussion

The presentation of results of empirical analysis in relation to the tested hypotheses of the present study is preceded with the presentation of the descriptive statistics of the variables as in Table 2.

Table 2: Summarized Descriptive Statistics of Variables

Descriptive Statistics	Net FDI inflow (as a percentage of GDP)	Mobile Cellular Subscriptions (per 100 individuals)	Human Development Index (In Decimals)	Trade Openness (% of GDP)	Rule of Law (In Decimals)	GDP per capita Growth rate (%)
Mean	6.19	84.44	0.49	15.94	-0.63	1.61
Median	3.05	82.04	0.48	13.27	-0.66	2.23
Maximum	103.34	114.33	0.67	55.26	0.63	18.05
Minimum	-11.20	36.75	0.33	3.83	-1.59	-22.31
Std. Dev.	12.95	21.42	0.07	10.54	0.47	4.02
Observations	176	176	176	176	176	176

Net FDI inflow as a percentage of GDP has a mean of 6.19% while having a maximum of 103.34% and a minimum of -11.20%. Thus West Africa has experienced on average low FDI inflow with incidence of impressive FDI inflow as high as 103.34 per 100 individuals observed also. However, low FDI inflows as that of -11.20% of GDP is indicative of poor performance as regards FDI inflow at some point over the period of 2010 to 2020. On the other hand, Mobile cellular subscriptions have been high in West Africa given the mean of 84.44 per 100 individuals, while Human development index with a mean of 0.49, Rule of Law with a mean of -0.63, and GDP per capita growth rate with a mean of 1.61% have all been low on average in respect of West Africa. Thus West Africa has on average low level of Human capital development, low openness to trade, weak quality of institutions (reflected by Rule of Law), and poor rates of economic growth as reflected by GDP per capita growth.

The maximum values of Net FDI inflow (103.34%), Mobile cellular subscriptions (114.33 per 100 individuals), Human Development Index (0.67), and GDP per capita growth rate (18.05%) for West Africa is quite impressive. On the other hand, standard deviation of all variables except Human Development Index indicate sizeable variation in respect variables series, while the size of variation in Human development index series is marginal suggesting marginal improvements in HDI in West Africa on average over the period from 2010 to 2020.

Equation (1a) and (1b) as specified in section 3, were simultaneously estimated using Panel data fixed effects two-stage estimation. This was based on the argument that Human capital development as measured by the Human development index in the present study is influenced by ICT as measured by Mobile Cellular Subscriptions, and consequently influences FDI inflow.

Table 3. First and Second Stage Fixed Effects Estimations

Equation	(1a)	(1b)
Fixed Effects Estimation Stage	Stage One	Stage Two
Dependent Variable	HDI	FDI
C	0.460*** (0.000)	
HDI (predicted value)		50.349 (0.821)
MCS	0.000710*** (0.000)	-1.088** (0.051)
HDI*MCS		1.729* (0.105)
TRPN	-0.000491*** (0.000)	0.942*** (0.000)
RLW	0.0349*** (0.000)	
GDPPCGR		0.446** (0.027)
No. of Observations	176	176
No. of Countries	16	16
F-Statistics	98.69***	8.32***
R-Squared	0.2117	0.6535

***, **,* denote significance at 1%, 5% and 10%. P-values in parenthesis

The Relationship between human capital development, mobile phone and foreign direct investment is shown in Table 3 through the results of Panel data two-stage fixed effects estimation. The estimation results from the first stage of the panel data two stage fixed effects estimation is denoted equation (1a), while equation (1b) corresponds to the estimation results resulting from the second stage of the panel data fixed effects estimation. The estimations from both stages are both valid evidenced by the statistically significant F-statistic of each estimation

The panel data two-stage fixed effects estimation first stage regressions (equation 1a) from Table 3 reveals that ICT as measured by mobile cellular subscriptions (MCS) has a positive and statistically significant effect on Human capital development as measured by HDI (P-value =0.000). The coefficient of MCS is 0.000710. Thus MCS is significant in boosting HDI. In particular, a unit increase in MCS results in a 0.000710-unit increase in HDI. This indicates the importance of ICT as measured by mobile cellular subscriptions (MCS) for Human capital development in West Africa. However, the magnitude of the contribution of mobile cellular subscriptions to Human capital development in West Africa is small. This is despite the

sizeable penetration of mobile cellular subscriptions in the region. The findings of ICT boosting human capital in West Africa are consistent with arguments by Adeyeye, Ojih, Bello, Adesina, Yartey, Ben-Enukora., and Adeyeye, (2022) that ICT utilisation is essential for progress in a vast variety of sectors including health and education. Health and education are central components of human capital and hence as West African countries utilise ICT in health and education, it will reflect in improved Human capital. Further Orji, Ogbuabor, Anthony-Orji, Okoro, and Osondu, (2020), Iqbal, Hassan, Peng and Khurshaid (2019), and Khan, Ju, and Hassan (2019) provide consistent findings that ICT boosts Human capital development in line with the findings of this present study. Orji, Ogbuabor, Anthony-Orji, Okoro, and Osondu, (2020) however, as the present study focussed on Nigeria and is among few studies to have done so. Further consistent with Lefophane and Kalaba (2020) ICT in boosting human capital development may be reflected by improved labour productivity especially in the context of ICT intensive industries. On the other hand, contrasting with the finding of ICT boosting Human capital development is that of Ejemeyovwi et al (2018) who finds the effect of ICT for Human capital in West Africa not significant.

Further, from equation (1a) rule of law with a coefficient of 0.0349 (P-Value =0.000) is significant in boosting Human capital development in West Africa highlighting the importance of strong laws which will include intellectual property rights in the development of quality human capital. In West Africa. On the other hand, greater openness to trade (TRPN) with a coefficient of -0.000491 is significant for bringing about a decline in Human capital development in West Africa highlighting the adverse effects of openness to trade for the progress of an economy in promoting development of human capital.

The panel data fixed effects estimation second stage regressions (equation 1b) from Table 3 reveals that predicted Human capital development, which is the predicted Human capital development resulting from the preceding first stage regression (equation 1a), while promoting FDI inflow is insignificant (P-value =0.821). Hence Human capital development is not important for FDI inflow to West Africa in contrast to findings by Konara and Wei (2020) and this may reflect the incompatibility of the quality of human capital development in West Africa and the profitability objectives of multinational enterprises seeking to foray into West Africa countries through FDI inflow as they take advantage of the large market provided by the region.

The coefficient of MCS is -1.088. Thus MCS is significant in contributing to a decline in FDI to West Africa countries. In particular, a unit increase in MCS results in a 1.088-unit decrease in FDI. This indicates the importance of ICT as measured by mobile cellular subscriptions (MCS) for FDI inflow in West Africa and is consistent with findings by studies as Menash and Traore (2022) and Warsame (2021) highlighting the value of ICT infrastructure for GFDI inflow to Africa on account of the contribution of fibre-optic submarine internet cables on the seashores of African countries. However, the interaction of predicted HDI and MCS has a coefficient of 1.729 which while statistically significant and despite the significance of MCS does not provide evidence that greater HDI as ICT penetration in the form of mobile cellular subscription increases, results in improved FDI inflows. This is on account of evidence provided by the statistical insignificance of predicted HDI in Equation (1b).

Further, from equation (1b) GDPPCGR with a coefficient of 0.446 (P-Value =0.027) is significant in boosting FDI inflows in West Africa highlighting the importance of economic growth. Further, greater openness to trade (TRPN) with a coefficient of 0.0942 is significant for bringing about an increase in FDI inflow in West Africa highlighting the important role for the promotion of FDI inflows of greater openness to trade of the economies of West African countries.

Thus taking the findings of Equation (1a) and 1(b) together as regards IC, HDI and FDI, it is the case that the hypothesis that Human capital development as a result of the influence of ICT enables West African countries attract FDI is not supported by the findings of the present study. While ICT significantly boosts HDI in West Africa, the onward boost of FDI by HDI is not significant for FDI inflow to West Africa.

5. Conclusion and Recommendations

In conclusion, the present study investigated the extent to which Human capital development as a result of ICT- in particular Mobile Cellular Subscriptions, affects foreign direct investment to West Africa based on a panel data study of all sixteen West Africa countries from 2010 to 2020. The study engaged Panel Data Two-Stage fixed effects estimation with Human development index employed as the proxy for Human capital development and the proxy for Foreign direct investment (FDI) being Net FDI inflow as a percentage of Gross Domestic Product (GDP). The study found that while ICT was significant in boosting Human capital development, Human capital development did not boost significantly FDI inflow to West African countries. The study however contributed significantly to the Human capital and FDI literature in bringing together the strands in the literature on ICT and Human Capital development, Human capital development and FDI and ICT and FDI specifically in the context of West Africa. Future studies may extend the present research towards ensuring that West African countries benefit maximally of their favourable ICT penetration especially in respect of Mobile Cellular Subscriptions for their sustained growth and development.

A variety of recommendations emanate from the findings of the present study towards improving FDI inflow to West Africa via Human capital improvements. First greater access and usage of mobile phones in particular and ICT in general are essential for the promotion of greater levels of human capital development, thus mobile phones must be more affordable for individuals in West Africa as a tool for Human capital improvements in the region. Second, greater connectivity of mobile phones in West Africa should be encouraged by the governments of West Africa countries, in order for improved levels of Human capital development to be realised. Third, ICT should be employed to greater effect in the delivery of services as education and health by service providers towards raising levels of human capital development. Fourth, quality human capital development to the standard required by multinational enterprises entering host countries by FDI must of a necessity be promoted by respective country governments through greater use of ICT - in particular mobile cellular subscriptions featuring greater capabilities including quality mobile network connectivity, and the quality of Human capital must be continually monitored, for sustained FDI inflow to countries in West Africa. Finally, governments of West Africa countries should undertake initiatives that will promote increased rates of economic growth which will further provide opportunities to be exploited by Multinational enterprises as they seek for ample returns to their investment via FDI in West Africa countries.

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