

The Impact of Human Capital on Industrial Development in Sub-Saharan Africa

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Abstract

In any economy, human capital development has been identified as an important factor in lowering unemployment and boosting the number of entrepreneurs. However, the impact of human capital on long-term industrial development in sub-Saharan Africa has received insufficient attention. During the period 1986-2018, the study focused on the impact of human capital development on industrial development in sub-Saharan Africa. Primary enrolment, secondary enrolment, tertiary enrolment, and total labour force were used to measure human capital, whereas industrial development was measured by industrial value-added. The study found that human capital contributes to industrial development as the human capital indicators have a positive and significant impact on industrial value-added. The study also found that physical capital exerts a negative impact on industrial development while the impact of trade openness is mixed.

Keywords: : human capital; industrial value-added; GMM; sub-Saharan Africa

1. INTRODUCTION

Human capital has been highlighted as a factor of increased productivity in the literature. According to Simon-Oke (2012), adequate human capital investment is a driver for increased productivity and economic growth. Trostel et al., (2002), Vandenbussche, Aghion & Meghir (2006), Li & Wang (2016), and Dias & Tebaldi (2012), among others, have emphasised the importance of human capital for economic productivity. Human capital, according to Popoola et al. (2019), is the acquisition of individuals' knowledge, ideas, talents, and other "invisible" assets that can be used to create economic value. Human capital, according to Akinlo

and Oyeleke (2020), is a crucial critical element in the research sector, as it is the engine behind the production of new ideas that underpin technical progress, as Romer (1990) remarked.

Human capital is predicted to be a primary driver of industrial productivity in Sub-Saharan Africa since a well-equipped human capital base might promote the industrial innovation needed for long-term development. According to Adejumo, Olomola and Adejumo (2013), the higher the level of training, the greater the skill level of a country's labour force, which is projected to improve overall economic development. However, according to Benhabib and Spigel (1994), Guisan (2005), and Mottaleb (2011), the industrial sector has performed poorly in comparison to industrialised countries over the years. The lack of essential skills to drive technology production and use has been connected to the industrial sector's poor performance.

Many studies have looked at the contributions of human capital to economic development, as opposed to its role in industrial development, according to the literature. Studies like Dauda (2012), Ajetomobi and Ayanwale (2005), Narasaiah (2007), Olomola (2007), and Akinlo and Oyeleke (2020) have looked into the impact of human capital on economic growth, but the number of studies focusing on the connection between human capital and industrial development is few. Examining the association between human capital and industrial growth in Sub-Saharan Africa is particularly significant at this time since, according to Akinlo and Oyeleke, the level of education has improved in recent decades (2020).

According to Gyimah-Brempong et al. (2006), African countries invest a significant amount of their national budget on higher education to make it accessible to residents. According to the Africa–America Institute (2015), Africa has the highest returns on higher education investments (21 percent), which is the highest in the world. We expect human capital to contribute to the development of the industrial sector in sub-Saharan Africa as a result of these factors. This research will enhance the body of knowledge in the following ways. First, utilising both education and health measures of human capital, this study will look at the impact of human capital on industrial development.

According to the literature, research that looked at the connection between human capital and industrial development failed to use both education and health as indicators of human capital. Because health and education as measures of human capital cannot be properly substituted for each other, the inability of past research to include health human capital may cause their conclusions to be skewed by omitted variables. Second, because the majority of studies on human capital and industrial growth are time-series studies, few studies are concentrating on Sub-Saharan Africa. According to Glewwe, Maiga, and Zheng (2014), the sub-Saharan African (SSA) region is recognised for low economic growth, low productivity, and low higher education enrolment when compared to other regions. In recent decades, however, economic growth, productivity, school enrolment, and human capital development have all improved. As a result, this research will shed light on the functions of human capital in industrial growth and give empirical evidence that will aid policymakers in formulating policies that would help the region increase its industrial output. The other parts of this study are arranged in the following order. Section 2 presents the literature review. Section 3 contains the methodology used in the study. Section 4 deals with the presentation and discussion of results. Section 5 concludes the study.

2. LITERATURE REVIEW

Using panel data for the fourteen major Indian states from 1980 to 2000, Amin and Mattoo (2008) looked at the impact of human capital endowment on state economic performance. Human capital (national enrollments) had a positive and significant effect on value-added in total manufacturing and registered manufacturing firms, according to the study. In a study spanning the years 1970 to 2000, Isaksson (2010) found that human capital has a positive and significant impact on manufacturing per capita. Changes in human capital also have a significant impact on industrial growth per capita. Karim and Shabbir (2012) investigated the impact of human capital components on industrial development in Malaysia from 1981 to 2010. The findings revealed that human capital aided in the expansion of the manufacturing sector. Adejumo et al. (2013) evaluated the impact of human capital development on industrial growth in Nigeria between 1980 and 2010. They employed the ordinary least squares regression technique. Human capital boosts industry value-added growth, according to the study. In Indonesia, Dey and Ellis (2013) used average years of schooling as a proxy for human capital in a similar study. Human capital has a significant negative impact on manufacturing value-added in a variety of industries, according to the study, particularly in the areas of electric machinery, paper and goods, and printing and publishing. Fang and Chao (2015) found that the degree of human capital (average years of schooling) has a positive and significant effect on the development of the tertiary industry in China's Shandong Province from 1996 to 2010. Olarewaju et al. (2021) investigated the impact of human capital on manufacturing value-added in Nigerian companies. In order to investigate the specific effects of human capital on industrial value-added, the researchers used Spearman Correlation.

High school education, formal training, and research all have a good and significant impact on industrial production, according to the study. Saka and Olanipekun (2021) used Two-Stage Least Squares to investigate the role of human capital in the connection between industrialisation and growth in Nigeria. The research spans the years 1980 to 2016. Male and female literacy rates, as well as male and female life expectancies, were disaggregated in the study. The research found that industrialization boosts economic growth, and that male literacy rates can help boost growth by complementing the industrial process.

3. METHODS

Following the work of Anyanwu (2018) who based his methodological framework/model on Haraguchi (2016). We express the functional form of the equation as;

$$Ind_{it} = f(pri_{it}, sec_{it}, ter_{it}, lab_{it}, exp_{it}, phy_{it}, open_{it}) \quad 1$$

where Ind is the industrial value-added, pri is the primary school enrolment, secondary school enrolment, tertiary school enrolment, exp represents life expectancy, phy is the physical capital and open is the trade openness.

By expressing equation 1 in econometric form and include the error term, it becomes

$$Ind_{it} = \beta_1 Ind_{it-1} + \beta_2 pri_{it} + \beta_3 sec_{it} + \beta_4 lab_{it} + \beta_5 exp_{it} + \beta_6 phy_{it} + \beta_7 open_{it} + u_{it} + \varepsilon_{it} \quad 2$$

is the lagged industrial value-added, μ_i signifies country-specific effect, $\varepsilon_{i,t}$ is the error term

Estimation procedure

To minimise the problem of endogeneity, Arellano and Bond (1991) suggested a difference GMM that uses instrumental variables to deduce the GMM of corresponding moment conditions. The idea of this method is to eliminate the individual fixed effect by proceeding with the first difference of the regression equation in the first place. Thereafter, the lagged variable will be regarded as the corresponding instrumental variable of endogenous variables in the difference equation. However, this method produces poor estimates according to Bond et al., (2001), because it suffers severe weak instruments problems, particularly in a finite sample. To solve this problem, Arellano and Bover (1995) and Blundell and Bond (1998) introduced a system GMM estimator in which GMM is applied to a system of two equations: an equation in differences instrumented by lagged levels and an equation in levels instrumented by lagged differences. According to Bond et al. (2001), system GMM can solve heterogeneity problems, taking care of omitted variable bias, measurement error and potential endogeneity issues that frequently affect growth models when using static models. Aali-Bujari et al. (2017) stated that the system GMM estimator also has an advantage over other estimators, as it produces unbiased results in a small sample.

Variables and sources

We use an unbalanced panel of annual data for the period from 1986 to 2018. The annual data are from 36 sub-Saharan African countries. The availability of data greatly determines the choice of the period and countries included in this study. The dependent variable in this study is the industrial development measured industrial value-added. Following Siddiqui and Rehman (2016) and Ogdari and Awokuse (2018), human capital is proxied by educational and health human indicators. Among scholars, there is no agreement on the best measure of education human capital. We use gross primary school enrolment, gross secondary school enrolment and gross tertiary enrolment to measure education human capital. Regarding health human indicators, life expectancy is used as a proxy. Sachs and Warner (1997), Bhargava et al. (2001), Weil (2001), Bloom et al. (2004) and Akinlo and Oyeleke (2020) also used life expectancy to proxy health human capital. According to Murray and Lopez (1997), life expectancy is highly connected to sound health and low morbidity. However, to provide a robust check, we also use the total labour force to proxy human capital. Labour force encompasses people who are of ages 15 and above, engaging in economic activities related to the production of goods and services during a specified period. It includes people who are presently employed and people who are unemployed but seeking work as well as first-time jobseekers. Physical capital is proxied by gross capital formation. We expect a positive relationship between physical capital and economic growth. For the control variables, we use trade openness, which is very important to economic growth. Both import and export can encourage economic growth through efficiency, adoption of modern technology and efficient utilisation of resources. As used in this study, trade openness is the sum of export and import as a percentage of GDP. We expect trade openness to stimulate economic growth. All the data are obtained from World Development Indicators (World Bank, 2020).

Table 1: Summary of Statistics of variables

Variable	Mean	Min	Max	Std. Dev.
Industrial value-added	1,032	2.09e+10	5.98e+07	1.11e+11
Physical capital	2.9153	1.2280	4.1185	0.4993
Primary school enrolment	4.4567	3.1495	5.0524	0.3479
Secondary school enrolment	3.2771	1.2852	4.6954	0.7362
Tertiary school enrolment	1.1883	1.5669	3.7037	1.0552
Labour force Total	14.9202	11.4355	17.9214	1.3871
Life expectancy	3.9868	3.2647	4.3109	0.1321
Openness	4.0496	2.2122	5.1693	0.4552
Population	0.8952	2.9086	2.0941	0.5135

4 RESULTS AND DISCUSSION

The result of the impact of human capital on economic growth in sub-Saharan Africa using the two-step GMM is presented in Table 2. The table consists of five models. In model 1, primary school enrolment is used as the human capital indicator. In model 2, secondary school enrolment is used as an indicator of human capital. In models 3 and 4, tertiary enrolment and total labour force are used as indicators of human capital respectively. In the last column, life expectancy is used to measure health human capital.

Starting with the variable of interest, in column 1, primary enrolment contributes to industrial value-added. The coefficient of primary enrolment is positive and significant at 1%. This is consistent with Adejumo et al., (2013) who found a positive relationship between primary enrolment and industrial value-added. The positive impact of primary enrolment on industrial value-added might be due to an increase in primary enrolment in the region over the years. According to the Africa–America Institute (2015), the number of pupils enrolled in primary education in Africa has increased dramatically. The number of pupils enrolled in elementary schools greater than doubled between 1990 and 2012, from 62 million to 149 million. In column 2, the coefficient of secondary school enrolment is positive and significant at 1%. This implies that secondary school enrolment contributes to industrial value-added. This also supports the findings by Adejumo et al., (2013). Tertiary enrolment contributed to industrial value-added. The coefficient of tertiary enrolment is positive and significant at 1%. This positive and significant of tertiary enrolment might be due to massive investment in higher education in the region. Gyimah-Brempong et al., (2006) stated that African countries have been spending a high proportion of their national income on higher education to make it accessible to citizens. The Africa–America Institute (2015) confirmed that Africa recorded the highest returns (21%) to investments in higher education, which is the highest in the world. Labour force produces an insignificant positive effect on industrial value-added. The health human capital measure enhances industrial value-added. The various indicators of human capital indicators have a positive sign and significantly enhance industrial value-added except labour which is not significant. This is expected because when human capital is efficient and sufficient, innovation and productivity will increase in the industrial sector. Innovation results in the creation of new products and improved quality products, and hence, the output capacity will be enhanced. Human capital also plays a major role in technology adoption, which is one of the most important factors in modern-day productivity through the importation of equipment and fascination of ideas.

On the control variables, the coefficient of physical capital is negative and significant at 1% in all the models. This indicates that physical capital has a detrimental effect on industrial value-added. Trade openness produces a mixed result. The coefficient of trade openness is negative and significant in all the models except in model 3 where it is positive and significant. Population contributes to industrial development. The coefficient of the population is positive and significant in all the models. The positive effect of the population growth might not be due to the size of the population. However, it might be due to the efficiency, skill, quality of the manpower.

On the diagnostic tests, the study employed four fundamental criteria to determine the validity status of the estimated models. According to the first two criteria (i.e., AR(1) and AR(2)) the first-order autocorrelation is accepted in all the models except in model 3 where first-order autocorrelation is rejected. However, the second-order autocorrelation is rejected in all the models. Likewise, the Hansen test confirms that the instruments used are valid in all the models.

Table 2: Results of Human Capital on Industrial Development

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Lagged industrial value-added	1.009*** (0.000)	1.014*** (0.000)	1.004*** (0.0000)	1.0291*** (0.000)	1.022*** (0.000)
Primary school enrolment	5.410*** (0.000)				
Secondary school enrolment		5.680*** (0.000)			
Tertiary school enrolment			8.741*** (0.000)		
Total Labour force				4.520 (0.199)	
Life expectancy					3.841** (0.000)
Physical capital	-1.131*** (0.000)	-7.779*** (0.000)	-2.310*** (0.000)	-1.640*** (0.000)	-1.051*** (0.000)
Openness	-4.831*** (0.000)	-3.671* (0.053)	1.411*** (0.000)	-2.970** (0.038)	-2.980*** (0.000)
Population	4.191* (0.063)	3.031*** (0.000)	2.081*** (0.000)	2.970*** (0.001)	7.915*** (0.000)
AR(1) p-value	0.079	0.078	0.282	0.079	0.077
AR(2) p-value	0.612	0.336	0.342	0.335	0.340
Hansen test	0.709	0.457	0.398	0.756	0.720
Observation	583	588	421	529	580
No of countries	36	36	36	36	36
No of observation	34	34	34	34	34

Notes: All the variables are in logs aside from democracy accountability. The p-values for system GMM estimates are in brackets. ***, ** and * represent the significance of the individual coefficients at 1%, 5% and 10% levels, respectively. The Sargan test is for over-identifying restrictions. AR(1) and AR(2) represent the Arellano-Bond test of first-order and second-order autocorrelation, respectively.

5. CONCLUSION AND IMPLICATION OF FINDINGS

The study examined the impact of human capital on industrial development in sub-Saharan Africa using a dynamic GMM model consisting of 36 sub-Saharan African countries. The study used various human capital indicators such as primary enrolment, secondary enrolment, tertiary enrolment, total labour force and life expectancy are used. The study found that all the indicators of human capital except total labour force significantly impacted industrial development. The study also found that physical capital has an inverse effect on economic growth. The study found that population significantly contributed to industrial development while the impact of trade openness is mixed.

Based on the positive effect of human capital on industrial development found in this study, the following implications can be drawn. First, there is a need for various governments in sub-Saharan Africa to invest more funds in the education sector to reposition the sector to be able to produce human resources needed to sustain the desired long-term growth of the region and to prepare the future human resources that can transform the economy of the region. Education funding is very low in sub-Saharan African countries compared to developed countries. The provision of educational facilities and a conducive environment for learning will enhance the quality of the manpower produced which can aid the transformation of the industrial sector. Second, the policymakers need to invest more in human capital by organising regular training, seminar, conferences for the workforce and even organising overseas training for them to improve the quality of the workforce. The study established a negative association between physical capital and industrial development. This suggests that the policymakers need to provide more infrastructure and improve on the available infrastructure to enhance the productivity of the industrial sector. The existence of a competent workforce without the available facilities will greatly affect the quality of the products of the industrial sector and as well as the output.

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