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HUMAN CAPITAL DEVELOPMENT AND INDUSTRIALISATION IN NIGERIA: IMPLICATION FOR ECONOMIC GROWTH

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ABSTRACT

This paper examines the role human capital plays in the relationship between industrialisation process and growth in Nigeria spanning the period 1980 to 2016. The theoretical framework is rooted from one of the new growth theories traceable to Lucas with emphasis of human capital role in growth. Through some modifications, we result to two simultaneous equation models, one with growth as dependent variable and the other, industrialization as dependent variable. Human capital is disaggregated into male and female literacy rates, male and female life expectancy and other control variables are used as explain the growth and industrialization variables. The Two-Stage Least Squares adopted gives expected outcome in most cases of the two model estimations. It is shown that

Introduction:

Theories and empirical studies have shown a strong link between human capital, industrialization and growth particularly in the modern world with the notion that the former plays a significant role during the industrial revolution. Based on Galor (2005), the European region is characterized by a less important contribution of human capital in the process of production during the first phase of industrial revolution and further pointing out that education was useful in the religion, social and national goals attainment. The basis for this argument was the

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industrialization process is germane for economic growth and likewise, male literacy rates can complement industrial process to improve growth. In the same vein, stable growth facilitates the process of industrialization while human capital variables too play relevant role in same process. Identification of the workings of the Nigerian state would be a good foundation to the step towards ameliorating the problems of capacity building and industrialization in Nigeria.

Keywords: *Industrialization, Human Capital, Dependent Variable, Growth, Capacity Building, Relationship and Nigeria.*

Knowledge acquired through education or skills by an average work force enhance productivity which in turn fosters economic growth. Continuous emphasis on this fails to popularise the role of science and entrepreneurship in the distribution of skills.

Recent research on contemporaneous economies takes into cognisance the importance of education in the attainment of entrepreneurial skills for industrial development (Hanushek and Kimko, 2000; Gennaidi, Porta, Lopez-de-Silanea and Shleifer, 2013). Understanding the link between human capital development and industrialisation becomes paramount for economic growth process and more importantly, human development creates the channel through which expansions of people's capabilities could give rise to opportunities for economic empowerment.

Nigeria faces a wide range of human capital challenges, including second lowest primary school enrollment rate globally (65%), a high incidence of child labour, a low tertiary education attainment rate of 25-54 age group and a low quality of staff training rate (Human Capital Report, 2016). These challenges have made the country to be ranked low in human capital development and literacy rate at the World Economic Forum in 2016. Since the last two decades, Nigeria has remained low in the world's human capital index compared to the developed countries. This is not only based on the inadequate technical know-how but also on shortage of the required skill needed in specific stage of production. Therefore, the performance of

the Nigeria's industrial sector has not been encouraging over time as its contribution to the Gross Domestic Product (GDP) has been grossly inadequate. For instance, from 2005 to 2014, the share of the industrial sector in GDP fell from 28.3% to 20.7%.

This paper is justified by clearly demonstrating the link between human capital development and industrialisation and the role the former plays in industrialisation-economic growth relationship.This is a deviation from most studies in this area.In line with this, the objectives of this paper are: First, it examines the relationship between human capital, industrialisation and growth by taking into consideration the gender composition of the educated in the country. Second, it considers whether gender composition in human capital can complement or substitute industrial process for growth improvement and third, the use of Two-stage Least Squares technique enables us to correct for the correlation of errors in the regression, hence, it produces a more reliable results.

The remainder of this paper is organised as follows. Section 2 presents the stylised facts of human capital development, industrial policies and growth pattern in Nigeria. Literature review is presented in section 3. The theoretical framework and methodology appear in section 4. Section 5 is the discussion of the findings. Conclusion and policy implication of the findings are documented in 6.

Human Capital Investment and Industrialisation in Nigeria: Implication for Economic Growth

Human Capital Development in Nigeria

Nigeria's government in collaboration with international agencies had made efforts to achieve a high level of human capital development. Essentially, the development of human capital promotes industrialization and growth, this channel seems to be extremely important for education at all levels. Human capital enables the absorption of superior technologies from leading countries (Barro, 2001).

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Figure 1 shows the trends in literacy rate and government expenditure on education in Nigeria. For the purpose comparison, the trends in male and female literacy rates are depicted. In all the years, male literacy rate is higher than female literacy rate with an average gap of 20%. In the 1980s male literacy rate ranged from 53% to 55% and female literacy rate was between 30% and 35%.

In 1999, Nigerian government in line with its initiatives on "education for all" re-launched the Universal Basic Education (UBE). At this time, UBE programs were extended to include students in the Junior Secondary School (JSS). Thereafter, the literacy rate increased to 68% for male and 45% for female in 2005. In the last decade, male literacy rate increased marginally, on average, it was 69%. An appreciable increase of 5% in female literacy rate was recorded in 2016 (see figure 1). Available statistics shows that female literacy rate in 2016 stood at 50% due to reorientation of Nigerians by government, non-governmental organization and international agencies on girl-child education. Nonetheless, human capital development policies in Nigeria are yet to reduce the gap between male and female sexes.

In 1980s and 1990s, government expenditure on education was very low (less than ₦50 billion). The ratio of the public expenditure on education to GDP was less than 2%. Nonetheless, improvement was recorded thereafter following Federal Government education for all policy. Although government expenditure on education has shown steady increase from 2000 to 2013, recent statistics show decline between 2014 and 2016. In the last 10 years, government budget for education has significantly improved but still below the UNESCO recommendation. For example, in 2016 the share of education in total budget was 9% far below the 26% recommended by UNESCO.

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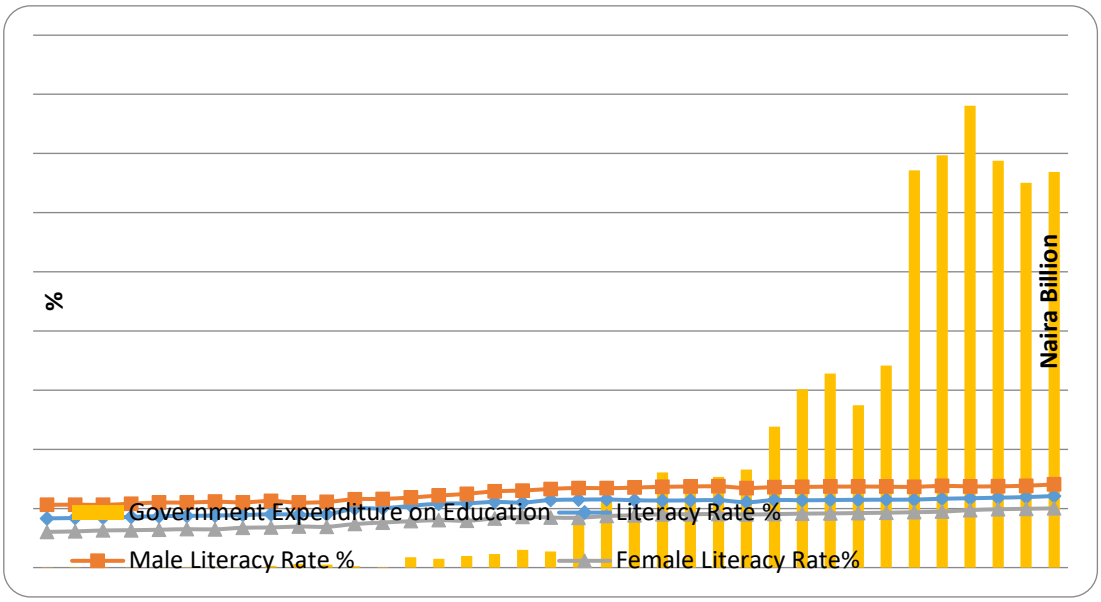

Fig 1: Literacy Rate and Government Expenditure on Education in Nigeria

Human capital development in Nigeria can also be assessed based on enrollment in primary, secondary and tertiary[1] education. Table 1 shows secondary enrollment rates in Nigeria and some selected developing and developed countries. The statistics of secondary school enrollment in Nigeria reflects low human capital development. For instance, between 1980 and 1984 secondary school enrollment rate was 15.3%; this figure is quite low compare to some Africa countries and the United States (WDI, 2016). In the same period, the enrollment rate in Egypt was 52.5% and United States was 92.2% (see table 2). Although the rate of secondary school enrollment in Nigeria rose between 1985 and 1989 to 26.5%; this figure later declined between 1990 and 1994. An assessment of the secondary school enrollment in Nigeria compared to other developing and developed countries show that on average, Nigeria has recorded a low rate of enrollment (less than 55%) as against 92.8% in Mauritius and 97.6% in United States in 2015 (WDI, 2016). Although, most of these government policies yield positive results, secondary school enrollment rate in Nigeria is still far below most developing countries.

[1] Due to inadequacy of data, tertiary enrollment would not be examined

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Table 1: Secondary School Enrollment Rates in Nigeria and Some Selected Countries

Country	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015
Egypt	52.53	62.60	72.94	74.02	81.00	68.79	81.73	N/A
Ghana	39.19	37.42	35.95	35.75	36.16	45.62	46.89	61.41
Kenya	30.22	40.07	N/A	38.52	42.20	54.10	N/A	N/A
Mauritius	47.49	46.73	55.31	71.01	81.40	88.33	92.76	95.70
United States	92.19	94.75	74.74	75.56	94.18	95.71	95.49	97.61
China	35.58	34.72	42.58	56.58	61.25	74.58	91.34	94.30
Nigeria	15.31	26.54	23.89	24.57	28.73	34.90	48.54	53.74
India	32.09	45.68	45.53	47.81	57.42	68.41	73.97	N/A
Netherlands	94.14	125.11	132.65	122.52	120.56	129.37	135.47	N/A
Norway	94.95	109.48	116.57	114.28	113.19	112.51	112.99	N/A

Source: Authors' computation based on data from World Bank Development Indicator

Performance of Nigeria's Industrial Sector

Industrialisation is essential for growth and human capital development stimulates this process. Government policies on industrialization in Nigeria had achieved little success. One of the major reasons for this is that most industrialization policies rested on large state-owned enterprises and targeted capital intensive industries.

Manufacturing sector in Nigeria has failed to go through the needed transformation crucial for it to play a leading role in economic growth. The manufacturing sector in Nigeria is very weak, many industries established such as iron and steel, cement, textiles as well as refineries had either shut down or operating below the full capacity. The technology base of the Nigeria's manufacturing sector cannot drive a sustainable growth process. Needed skills are insufficient due to the low quality or slow rate of human capital development. In addition, the sector has faced a huge challenge of infrastructure, mostly related to power and transportation UNESCO (2016). These had led to escalating costs of many manufacturing industries and reduced their competitiveness in the international market. The average manufacturing capacity utilization was below 50% in most of the years. On average, between 1995 and 1999 it was 31.8%, there was improvement from 2010 to 2014, but fell to 48.5% in 2016 (see table 2).
The industrial index shows some appreciable increase from 1980 to mid 1990s. However, it witnessed a decrease between 1995 and 1999. One of the major reasons for the fall in the industrial index in this period is the high cost of importation of raw materials due to depreciation of domestic currency. Thereafter, marginal increase was observed up to 2016. Although recently, moderate improvements were recorded, the performance of the industrial sector in Nigeria is below the desired level.

Table 2: GDP Growth and Industrialisation Index

Year	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2016
Industrialization Index	106.16	122.8	158.94	136.38	145.68	151.32	157.46	158.5
Manufacturing Capacity Utilization	57.4	40.7	37.6	31.8	49.18	43.35	55.82	48.5

Authors' computation based on data from CBN Bulletin

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Nigeria's Economic Growth

Economic growth in Nigeria has not been sustainable. For instance, the average annual growth rate of real GDP between 1980 and 1984 was -3.4% (see figure 2). This negative growth occurred a decade after the oil boom era of 1973. Further, low GDP growth was recorded during the Structural Adjustment Programme (SAP). Under the SAP Nigeria's government reformed its foreign exchange system, trade policies, and business and agricultural regulations. Notwithstanding, economic growth after the SAP was only a little higher than they were in the early 1980s.

Improvement in the economic growth was observed between 2000 and 2010. Some of the policies of the government after the return of democracy in 1999 were geared towards stimulating growth through the attraction of Foreign Direct Investment and the promotion of export. As part of the economic reform programs in this period, Nigerian government introduced the National Economic Empowerment and Development Strategy (NEEDS). The objective of the NEEDS was to increase the standard of living through varieties of reforms, such as, privatization, deregulation and liberalization. Nigeria's economy responded positively to some of these initiatives of the government. On average, between 2000 and 2004 economic growth was 11.52%. Since the fall in oil price in the mid-2014, Nigeria's economy growth trajectory has been downward. The Nigerian economy continues to face serious macroeconomic challenges and is in a recession for the first time in decades. Gross domestic product (GDP) growth for 2016 stood at -1.5% (Africa Economic Outlook, 2017).

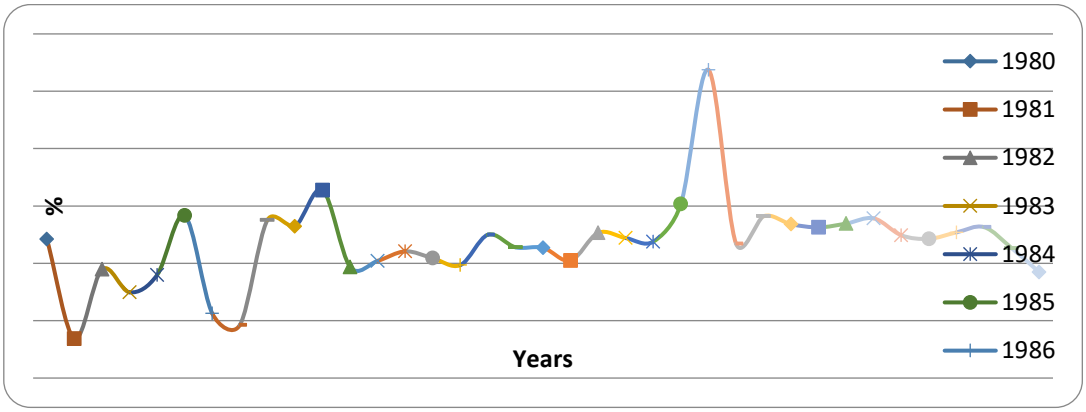

Fig 2: Nigeria's Economic Growth

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Literature Review

Theoretical Review

The Neo-classical growth model of 1950s and 1960s forms the starting point for the theoretical relationship between human capital and growth. A model of long run growth was developed by Solow (1956). This shows that output is produced by two factors of production, capital and labour. In the steady state, growth in per capita income increases as unexplained technological change per effective labour increases. The constant capital labour ratio equals the constant per-capita income. Solow model concluded that convergence in income per capita across countries depends on identical production function, savings rates and labour force growth rates. Some extensions of the neoclassical growth model include the contribution of Lucas (1988). The model considers reconstructing the neo-classical theory of growth and international trade by adding features that are consistent with the recent economic development. Three models are developed, first, a model emphasizing physical capital accumulation and technological change, a model on human capital accumulation through schooling and a model that deals with human capital through learning-by-doing. Mankiw, Romer and Weil (1992) explore the effect of adding human capital to Solow model, assuming a constant return to scale and same production function for physical capital, human capital and consumption. In the model, the presence of human capital accumulation increases the impact of physical capital on income.

Romer (1994) show that new growth model differs from the previous models as it explains the effectiveness of labour as knowledge and models its evolution overtime. Human capital differences explain the slow rate of growth and convergence in some economies. In the endogenous growth model, growth is driven by the accumulation of human capital which is acquired through formal education or through on the job learning-by-doing (Connolly, 2004).

The theoretical model of Ramcharan (2004) categorise human capital into unskilled, low skilled and high skilled. In the paper, the composition of human capital stock determines not only the dynamic pattern of

educational investment, but the steady state level of educational attainment. Tunrnovsky (2011) present a two-sector linking human capital accumulation and income inequality. The model is based on certain modification of the theories of Uzawa (1965) and Lucas (1988) in which there are two productive factors, unskilled and human capital. Each agent has endowment of unskilled labour but has different initial levels of human capital. The model assumes that aggregate human capital generates externality in which the economy can achieve a sustainable balanced growth path. Productivity is increased in the human capital sector which raised the growth rate.

Empirical Studies

The relationship between human capital and growth in both developed and developing economies has been extensively studied and has generated more controversies in the literature. Nonetheless, diverse evidences were obtained from various empirical studies. One reason for these mixed evidences is that the impact of education on industrial development and growth has varied widely across countries because of institutional differences, educational quality and labour markets constraints.

Using a panel dataset covering 19 OECD countries from 1960 to 2000, Vadenbussche, Aghion and Meghir (2006) identify two channels, namely, innovation and imitation through which human capital leads to technological improvements. Two major findings are discernible. First, the growth in OECD countries is due to skilled human capital rather than that of total human capital. Second, skilled human capital has a stronger growth-enhancing effect in the economies which are closer to the technological frontier. The study emphasized the role of skilled human capital in promoting growth through technological progress.

Earlier studies had shown mixed results on the relationship between expenditure on education and economic growth. The effect of public investment in education on economic growth in Korea and Mexico was studied by Kim and Hong (2010). The findings suggest that investment in education should be such that is in line with the Country's industrial policy,

which in turn must match with the country's development stage. Curs, Bhandari and Steiger (2011) used panel data from 1970 to 2005 to investigate whether the exclusion of the private higher education system within a state could lead to bias estimate on the relationship between state higher education spending and economic growth. States with large private higher education institutions have a negative relationship on economic growth. However, states with large public education institutions have positive relationships on growth. This implies that public expenditure on education contribute to growth more than private institutions.

Conrad (2011) posits that human capital accumulation through government spending on education propels economic growth through two channels. The channels through which it affects growth are the manufacturing and service sectors. Using dataset from India, Gopalakrishna and Rao (2012) explore the links between human development and economic growth. The findings suggest that there are inter-regional disparities in human development. The result shows that there is a positive link between public expenditure and human development. The effect of public expenditure on human development is higher than its effect on economic growth.

Fleisher, Li and Zha (2010) assess the effect of physical, infrastructure and human capital on regional growth pattern in China. It was revealed that human capital positively affects output and productivity growth. Both the direct and indirect effects of human capital on total factor productivity were obtained. The direct effect comes from domestic innovation activities, while the indirect impact is a spillover effect of human capital on total factor productivity growth. Teixeira and Fortuna (2010) examine human capital, research and development and trade relationship in Portuguese economy. Using cointegration technique, it was shown that investing in human capital and research and development from knowledge and technology of advanced countries improves economic progress and trade of developing countries.

The importance of cognitive skills of human capital on economic growth was examined by Hanushek (2013). The findings suggest that attention to

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school quality would make developing countries to be more successful in closing the gaps with developed countries. Further, it was revealed that developing countries can achieve their long run economic performance through school quality. Using panel data from EU countries, Pelinescu (2015) reveal a positive and significant relationship between GDP per capita and innovative capacity of human capital and qualification of employees measured by secondary school education. However, a negative relationship between education expenditure in GDP and GDP per capita was obtained.

Few studies in Nigeria had shown the link between human capital and growth without a detail analysis on the channel of the effect. For instance, Adejumo, Olomola and Adejumo (2014) study the effect of human capital on industrial growth in Nigeria between 1980 and 2010. Human capital has statistically significant effect on industry value-added. However, the effect of human capital on industrial output remained low. Shuaibu and Oladayo (2016) investigate the determinants of human capital development in 33 Africa countries between 2000 and 2013. Some factors that significantly influence human capital include public expenditures on health and education, institutions and economic growth.

Most of the empirical studies accessed had only shown the relationship between human capital, industrialisation and economic growth without investigation whether gender differences could change the results. This study intends to fill this gap by decomposing human capital into male and female sexes and examine their effect on industrialization and economic growth.

Theoretical framework and Methodology

Theoretical Framework

Division of new growth theories is traceable to Lucas (1988) and Romer (1990). The former takes human capital as a factor of production possessing skills with rivalry and excludability nature. The latter sees human capital as 'knowledge' and 'ideas' possessing non-rivalry nature even though is partly excludable.

In Romer (1990), endogenous growth occurs as a result of accumulating technology (or knowledge) and thus establishing a relationship between the level of human capital and growth. In the Lucas theory, which is based on non-decreasing marginal returns, human capital formation itself creates endogenous growth. By implication, for growth to be achieved, it requires same effort to produce and extra unit of human capital without considering the level of human capital. Other choices exist such as increasing quality of human capital over time and knowledge transfer from generation to generation (L'Angevin and Laib 2005). These are in most cases not accounted for thus creating a gap in the model of Romer (1990).

A unique feature of Lucas (1988) theory is that human capital is seen as a factor of production so that constant or increasing marginal returns to human capital accumulation can determine endogenous growth However, growth becomes endogenous only if there are constant or increasing returns thus making Lucas-Uzawa model (Lucas 1988; Uzawa 1965) to likely be applicable to economic development.

We consider the standard equation where per capita formation exists with human capital as input. Given non-decreasing returns and assuming constant returns to scale:

$$\dot{h}_{c_t} = h_{c_t}\gamma(1-u_t) - \delta h_{c_t} \tag{1}$$

Where $\dot{h}_{c_t}$ denotes increase in capital stock, and δ measures its depreciation. The $\gamma(1-u_t)$ denotes human capital formation with γ being a technical parameter that indicates possible factors influencing the efficiency of investment in human capital and $(1-u_t)$ represents the time spent on human capital accumulation. Independent of its level, equation (1) may be written as:

$$\frac{\dot{h}_{c_t}}{h_{c_t}} = w_h = \gamma(1-u_t) - \delta \tag{2}$$

Equation (2) indicates growth of the per capita human capital stock which can be regressed on the time spent on acquiring human capital and the constant term represented by the depreciation. On the overall, there tends

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to be a link between the per capita human capita growth and the time spent for the formation of human capital. Marginal returns exist given that γ is positive, constant or increasing. In equation 2 which assumes constant returns, γ is positive. Without constant marginal returns, then this equation transforms into

$$\frac{h_{ct}^{'}}{h_{ct}} = w_h = \gamma(1-u_t)^{\gamma-1} - \delta \quad (3)$$

Where γ >1 indicates increasing returns, γ < 1, diminishing returns and γ =1, constant returns.

The endogenous growth models developed in most cases explain little about the framework for analysing problems relating to growth in less developed economies. A feature of these economies is the presence of abundance and deficiency in terms of wealth simultaneously. Just as there are the rich individuals in possession of capital so there are the poor with little income and thus less strength to save and invest in both physical and human capital. This is the case of dualism in which the rich and the poor coexist.

On the basis of the dualism under discussion, we consider the rich and the poor individuals existing in an economy. We equally consider the involvement of these individuals in the industrial sector in which the workers are employed in a single aggregative sector that produces a single good. The individuals invest in human capital employed in the production sector. Human capital in this case refers to the set of specialised skills which accumulate over the period. Such skills possessed by these individuals are not easily substitutable and so the process of capital accumulation defers for the two individuals. While the population size of either individual is normalised to unity, each individual is also assumed to be identical. There are also the assumptions of full employment and perfect competition between labour and capital market.

The profit maximisation rule ensures that single production sector behaves competitively with the employment of labour and capital. The rich individuals help the poor to accumulate human capital and thus a fraction of total time of rich individual $(1-z)$ is deducted by government and hence

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allocates a fraction of the remaining z in production while a poor individual would allocate $(1-v)$ fraction of total time in production. Suppose h_r and h_p respectively represent the skill level of the rich and the poor individual in question so that the production function is:

$$y = \pi(azh_r)^{\alpha}(1-\mu)h_p)^{\beta}k^{1-\alpha-\beta}h_r^{\in r}h_p^{\in p} \quad (4)$$

Where $0<\alpha<1,\ 0<\beta<1,$ and $\in_r>0, \in_p>0$ indicate parameters measuring the magnitude of the effect of human capital of both the rich and the poor individual on production. In terms of input, the production function satisfies the constant returns to scale but increasing returns to scale if we factor in external shocks. y is level of output and the aggregate physical capital which constitutes the physical capital owned by the rich (k_r) and the one owned by the poor (k_p) individuals is represented by $k = k_r + k_p$.

We again assume that the mechanism such as education of human capital accumulation for the rich individuals follows that of Lucas (1988) so that human capital accumulation rate is proportional to the time or simply effort put in for such skill acquisition by the rich. Therefore,

$$\dot{h}_r = m(1-a)zh_r \quad (5)$$

Here, $(1-a)$ indicates the fraction of the time (non-leisure) put in to obtaining the own skill level. Also, $0<a<1$ and m is a constant but positive indicating the productivity parameter of human capital formation of rich individuals.

The process through human capital formation take is different for the two groups of individuals. The training conducted by the rich individuals enhances the skill formation of the poor. This is to enable them take part effectively in production process. Given this situation, each rich individual gives out

$(1-z)$ fraction of its time in this training while poor individuals spend u fraction of time not for leisure but for learning skills. The integration of the effort level put by the poor individual in learning and the time the rich individuals spend in training together with the external effect associated

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generally form the additional skill acquired by the poor worker. Thus, this is expressed as:

$$h_p^{'} = \{(1-z)h_r\}^{\lambda}(uh_p)^{1-\lambda-\theta}h_r^{\theta} \quad (6)$$

With $0<\lambda<1$ and $\theta>0$. $z=1, h_p^{'}=0$ and so h_p steadily becomes low.

Equation (6) demonstrates the relevance of human capital in industrialisation in the sense that the skills acquired by the poor individual together with those acquired by the rich would make a substantial impact in the production process. The unified growth theory (Galor, 2011), underlines that the adaptation to the changing technological environment increases the extent of technological progress and role human capital plays in the production process. Thus, industrialisation process triggers the gradual recognition of the role human capital plays in this process.

Methodology

Our baseline model for this paper is rooted from the new theory of growth discussed in the theoretical framework particularly the one traceable to Lucas (1988). This growth theory sees human capital as part of physical person which embodies knowledge and ideas subject to no rivalry conditions but partly excludable. The baseline model is obtained through modification of equation (4) to include other relevant determinants of growth. The linear model specification is:

$$gr = \alpha_0 + \alpha_1 ltr_m + \alpha_2 ltr_f + \alpha_3 le_m + \alpha_4 le_f + \alpha_5 id_x + \alpha_6(ltr_m * id_x) + \alpha_7(ltr_f * id_x) + \alpha_8 pv_i + \varepsilon_1 \quad (7)$$

Where gr is output growth captured by the growth rate of gross domestic product, ltr_m is human capital for male captured by the male literacy rate, ltr_f indicates human capital for female captured by the female literacy rate, le_m is life expectancy for male, le_f represents life expectancy for female, id_x is industrialisation index, pv_i indicates poverty incidence, $(ltr_m * id_x)$ captures the interaction between human capital for male and the industrialisation index while $(ltr_f * id_x)$ also indicates the interaction between human capital for male and the industrialisation index .

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The relationship between human capital and industrialisation is modeled as follows:

$$id_x = \beta_0 + \beta_1 ltr_m + \beta_2 ltr_f + \beta_3 le_m + \beta_4 le_f + \beta_5 pv_i + \beta_6 gr + \varepsilon_2 \quad (8)$$

In equation (7), both literacy rate and life expectancy are disaggregated into male and female counterpart. This is take gender into consideration. Life expectancy variable is included as a component of human capital. Human capital should accompany knowledge, physical strength and wellbeing to be able to increase output growth. Industrialisation index on the right hand side explains the role of industrialisation process plays in growth. The interactive term is to demonstrate whether literacy rate for male or female complements or serves as substitute for industrialisation in facilitating output growth in each case. Poverty incidence is included due to the disparity between the rich and the poor individuals and the existence of inequality. Similar definitions go for equation (8) except that industrialisation is dependent on literacy rate, life expectancy, poverty incidence and growth in this case. The disturbance terms in each equations are ε_1 and ε_2 which are independently and identically distributed $\varepsilon_1, \varepsilon_2$

We expect that $\alpha_0, \alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 > 0, \alpha_8 < 0$, α_6 and α_7 may come with ambiguous signs, $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 < 0$ and $\beta_6 > 0$

Having passed through the preliminary test, the paper employs the Two Stage Least Square (TSLS) in estimating the relationships in equations (7) and (8) on the basis that endogenous variable serves as exogenous and vice-versa in each case forming a simultaneous equation system. The TSLS is a special case of the instrumental variables regression consisting of two distinct stages. The first stage is concerned with finding the portions of the endogenous and exogenous variables attributable to the instruments. It involves estimating an OLS regression of each variable in the model on the given set of instruments. A regression of the original equation with all the variables replaced by the fitted values from the first stage regression is carried out in the second stage. Finally, the coefficients of this regression come out to be the TSLS estimates.

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Data Sources

Due to data inadequacy in a specific source, the paper employs various sources of data. Data on life expectancy for each of male and female is obtained from the World Health Organisation (WHO), data on Literacy rate in each case, GDP growth and the poverty incidence data is obtained from the World Development Indicators (WDI) while the industrialisation index comes from the Central Bank Statistical bulletin (CBN). The data is collected from 1980-2016, the period of the study.

Results and Discussion

Table 3: Descriptive Statistics

variable	Mean	median	Std dev	skewness	kurtosis	J-B prob
Gr	6.176	6.467	4.497	0.400	5.136	0.018
idx	4.934	4.982	0.174	-1.393	4.282	0.001
lef	3.885	3.858	0.046	1.107	2.728	0.022
lem	3.854	3.821	0.057	0.821	2.047	0.062
ltrf	0.408	0.423	0.063	-0.318	1.714	0.205
ltrm	0.628	0.665	0.062	-0.411	1.434	0.090
pvi	0.544	0.581	0.124	-0.264	1.962	0.352

Source: Authors' computation

The descriptive statistics shown table 3 demonstrates that growth rate comes with the highest mean and median values (6.176, 6.467) during the period followed by the industrialisation index (4.934, 4.982). The growth in their mean values may be connected to the previous growth in these variables. Recently, their growth has been retarded owning some economic imbalance. Their high standard deviations further show their rate of fluctuations over same period. Female literacy rate comes with the lowest mean and median values (0.408, 0.423). This could be explained by the reduction in the rates of schooling among the females. The Growth variable is most fluctuating around the period as demonstrated by the standard deviation (4.497); this further explains the high growth rates experienced

in the past. Female life expectancy variable has the lowest standard deviation (0.046) and thus least fluctuating. Only three variables are positively skewed, namely, growth, female life expectancy and male life expectancy variables during the period. All the variables have positive coefficients of kurtosis demonstrating their peakedness. However, only female literacy rate and poverty incidence variables are normally distributed at the 5% level.

Table 4: Test for stationarity Results

Variable	Test Equation	ADF	t-statistic	Order of integration	Decision
Gr	C, linear trend	-3.540	-4.948	I(0)	stationary
idx	C, linear trend	-3.581	-4.541	I(1)	stationary
lem	C, linear trend	-3.548	-11.457	I(2)	stationary
lef	C, linear trend	-3.548	-1.107	--------	non stationary
ltrf	C, linear trend	-3.544	-6.188	I(1)	stationary
ltrm	C, linear trend	-3.544	-5.515	I(1)	stationary
pvi	C, linear trend	-3.544	-5.504	I(1)	stationary

Source: Authors' computation

Next is test for stationarity as observed in table 4. The test equation for all the variables falls under constant and linear trend. The Augmented Dickey Fuller (ADF) test shows that only the growth variable is found stationary at its level, male life expectancy variable at its second difference. Every other variable is stationary at its first difference except for the female life expectancy which is non-stationary. The results meet the condition that most economic variables are stationary their first differences.

Table 5: TSLS Regression Results

:	Coeff.	Std error	Prob.	:	Coeff.	Std error	Prob.
c	-69.284	333.860	0.837	*c*	246.381	160.327	0.136
idx	0.533	2.092	0.801				
lef	-4.224	3.027	0.175	*lef*	-3.485	7.061	0.626
lem	4.918	2.818	0.093	*lem*	3.175	7.372	0.670
ltrf	0.998	7.686	0.898	*ltrf*	5.945	2.985	0.056
ltrm	0.447	9.290	0.989	*ltrm*	-4.210	2.228	0.069
ltrf _ idx	-0.015	0.052	0.773				
ltrm _ idx	0.001	0.063	0.989				
pvi	-3.615	10.266	0.728	*pvi*	-15.554	34.828	0.659
AR(1)	-0.168	0.226	0.464	*AR*(1)	0.706	0.162	0.000
R^2	0.213				0.778		
DW	1.544				1.425		
Instrument rank	19				17		
Prob.(J-statistic)	0.002				0.000		

Source: Authors' computation

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Estimation of the growth and industrial index equations is shown on table 5. Starting from the key explanatory variables for the growth equation, both the male and female literacy rate variables come with positive coefficients as expected. The results further show that knowledge and skills acquired by females (0.998) have more impact on the economy compared to those acquired by the males (4.918). However, coefficient of life expectancy for male (4.918) demonstrates that males become physically active to contribute to the economy as they grow old unlike the female (-4.224). The index of industrialisation coefficient (0.533) demonstrates the positive contribution of industrialisation on the economy. Industrialisation facilitates growth of output and increases market size of a nation. The interactive term coefficient is positive for male literacy rate and industrialisation (0.001) implying that knowledge and skills acquired by male complement industrialisation to improve growth performance. On the other hand, knowledge and skills acquired by females can substitute industrialisation to accelerate growth as shown by the interactive term coefficient (-0.015). However, following the unequal level of literacy rates among the females compared to those of the males, complete substitution may not in isolation lead to growth acceleration unless complemented by other technological supports. Coefficient of poverty incidence variable follows the expected sign (-3.165). Increasing poverty level is highly inimical to growth as both supply and demand sides of the economy are negatively affected.

For the industrial index equation, behaviours of the explanatory variables are similar to what occurs in the growth equation but this time except that the industrial index is explained now and growth variables is included among the explanatory variables. The growth variable here essentially explains the role the economy plays in industrialisation. As expected the coefficient (0.108) shows that as economy experiences boom, then industrialisation is further enhanced through production efficiency. Male literacy rate (-4.210) impact on industrialisation process is not as expected. This may be explained by the huge unemployment conditions the economy has long been experiencing. However, female literacy rate impact

on the economy as expected. Similar to the growth equation, male life expectancy (3.175) can increase industrialisation process as physical strength and activity still continue the men growth old. Increasing poverty as shown by the coefficient (-15.554) does not in any way improve the process of industrialisation in Nigeria.

All the variables explaining industrialization process have better explanatory power as about 78% of the variations in the industrialisation process have been explained. In both equations, we have added the AR terms to account for serial autocorrelation in the estimation. Autocorrelation in both cases is controlled and is not seen a major problem particular in the growth equation where the Durbin-Watson value is 1.54. Generally, the two models are adequate as demonstrated by the probability of the J-statistic.

Conclusion

This paper has examined the role that human capital plays in the relationship between industrialisation and growth in Nigeria. The role of human capital in industrialisation cannot be left out just as industrialisation process cannot be left out of the growth process. The income inequality arising from the frequent use of physical capital was checked and hence this necessitated concentration on the human capital resources. Despite this, there still exists a setback in the development of human capital for growth and industrialisation in Nigeria. Basic mechanisms through which such capacity building can take are grossly inadequate. This is further worsened by the lingering economic crisis leading to unemployment, low production base, among others. There is therefore the need to identify the general workings of the system as this would serve as a basic foundation to the solution of the economic woes. It like a system of equation, once one is solved, others get solved.

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