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HUMAN CAPITAL DEVELOPMENT AND MANUFACTURING OUT-PUT IN NIGERIA: AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) ANALYSIS

[1]RASAQ AKONJI DANMOLA,
[1] Department of Economics,
Lagos State University, Ojo, Lagos, Nigeria

[2]KAYODE, IBRAHIM KADIRI
[2] Department of Administration,
National Open University of Nigeria, Lagos, Nigeria

&

[3]OLOGBAN FOLASHADE OLUWAYEMISI
[3]Lagos State University of Education,
Oto-Ijanikin, Lagos State, Nigeria

Abstract

This paper examines the impact of human capital development on the Nigerian Manufacturing out-put in Nigeria. Theoretical growth models ad macroeconomic evidence suggest that human capital accumulation in form of both foreign and domestic capital in the manufacturing sector is an important factor influencing per capita income growth in the country. However, Hideki et al. (2005) highlighted the relevance of measurement errors, and incorrect specifications may have affected early macroeconomic studies that found a weak correlation between growth in the Manufacturing sector and human capital accumulation. . We therefore investigate the relationship between human capital development and the manufacturing out-put in Nigeria with time series data which covers periods 1981-2021. Employing the endogenous modeling approach cast within the autoregressive distributed lag (ARDL) framework, the bounds testing analysis shows the presence of cointegration between Manufacturing out-put and human capital development indicators. The findings of the study also indicates that human capital development indicators have positive impact on the Manufacturing out-put in Nigeria within the periods under consideration; In addition, their effects were greatly statistically insignificant. Further evidence shows that equilibrium is fully restored for any distortion in the short-run. On this basis of the emanating findings, this study proffered the need for government to invest more in human capital development process and endeavours prioritize the health and education sectors budgeting considering their growth driving potentials in Nigeria. More so, government should put more emphasizes on technical education which will emphasizes on human capital in the use of technological tools from Primary, Secondary, Tertiary schools up to its workforce and lastly, more funds should made available to Research and development as it affect Manufacturing production.

Keywords: Bounds Test, Manufacturing Out-put, Endogeneity, Human Capital Development, Nigeria.

1:0 Introduction

Technology capability and human capital's relative contributions to growth in the manufacturing sector has long been the subject of discussion, both theoretically and empirically. For instance, Romer (1990) claimed that economic growth generally depends on research and development (R&D) and spillovers from the R&D process, but Lucas (1990) found that human capital is a primary factor of economic growth. In the endogenous growth model, human capital is a major driver of rising returns and the disparity in growth rates between developed and undeveloped nations (Lucas, 1988; Romer, 1986). Rebelo subsequently improved and expanded the concept (1991).

Economic growth, according to Greenhalgh & Rogers (2010), is a rise in the production of economic goods and services from one time period to the next. The academics argued that estimates like the Gross Domestic Product (GDP) are often used to quantify economic growth in terms of the increase in the aggregated market value of new products and services produced (GDP). Similar to what academics have suggested, human capital is an intangible asset or characteristic that is not disclosed on a company's balance sheet. It can be categorized as the monetary worth of a worker's education and training. This comprises qualities that employers admire, such as loyalty and timeliness, as well as assets like education, training, intelligence, talents, and health. Schooling is one of the factors that is thought to be effective in raising human capital, particularly formal education that has been assessed and standardized by the government, which has the power to do so. To promote economic progress, education must be improved, especially in developing nations like Nigeria, where impressive results have been attained. As the percentage of educated workers rises, a nation's economy becomes more productive because educated workers are better able to complete activities that call for reading and critical thought. Nigeria now struggles to give its population access to inclusive, high-quality education. In comparison to other African countries, the country has substantially lower literacy rates. By raising the standard of workers, education encourages technical innovation and effectively spurs economic growth. Since education contributes to enhancing the quality of human resources, it is essential to the success of both technological and human capital development. The success of technical skills, development of technology capabilities, and economic progress in Nigeria is determined by education development strategies (Machado, 2015).

The availability of human resources (human resources) is crucial to sustaining business operations (Martin & Whiting, 2016). However, not all businesses recognize the value of human resources, and as a result, they disregard the rights of current workers. Because an organization cannot succeed without some amount of human knowledge and abilities, human resources are crucial. The growth and productivity of the company depend on the development of the human resources. The people who operate a business are an asset worth investing in. If they can improve their own productivity via development, the organization will start to experience productivity increases. Innovative human capital is now a key component due to the knowledge economy's and technology's rapid development. Employees are now considered vital assets for the survival and growth of the business rather than just resources. Human resources are being transformed into what is known as "human capital" in this period.

The skills, knowledge, capacity, and characteristics of labor that affect their level of productivity and income are measured by what is known as human capital (Serrat, 2017). In theory, managing

human capital is a part of managing human resources; however, managing and developing human capacities as a resource places a greater emphasis on developing knowledge and skills that can support the growth of an organization or firm. Human resources are valued assets that are advantageous to the organization or firm, but human capital elevates them to a higher degree than simple resources. Human resources are such an important asset that they can even be compared to a portfolio of investments where their performance can grow and be compounded. As a result, human capital does not consider human resources to be a cost or liability that lowers the organization's profitability. When employees are utilized to their full potential as resources, the concept of human capital emerges and develops. Employees need to be willing to "squeeze" their knowledge, skill, and innovation for the growth and advancement of the organization. Because employees are a finite resource, their productivity will decline as they age. Organizations or businesses aim to contribute and create value to grow their human resources before these resources "run out."

There is a constant need for comprehensive staff training and development in the present industrial setting where technical advancement in technological innovation is outperforming all other aspects of life. Employees are managed by the organization in a way that enhances workability, enabling them to deliver higher-level performance (Jones & Jenkins, 2018). The strategic method for managing people in an organization effectively so that they give it a competitive edge is known as human resource management. Its goal is to maximize staff performance in support of a company's strategic goals. One of the most important aspects of human resource management is training and development. The majority of firms see training and development as being a crucial component of human resource development. Training can be defined as an activity intended to enhance or build new competencies or skills in an employee while they are performing their current duties in order to improve performance or productivity. Employees learn specific skills through "training," while their personalities and managerial abilities are developed through "development."

The business does not forget to offer incentives to foster employee loyalty along with improving knowledge and performance. Offering employees alluring incentives and perks like allowances, annual bonuses, and other facilities would not only encourage them but also increase their understanding of the value of sticking with the company. Economic development is heavily reliant on human capital. The main engine for the nation's sustainable growth is human capital (Ricciardelli, 2017). Performance within an organization is impacted by its culture. Employee motivation is significantly influenced by organizational culture. Only a business with a strong culture can increase employee motivation. Improvements in staff performance follow as a result (Kustono, 2020). The effectiveness of education is influenced by a teacher's performance. Whereas a key technique for boosting human capital is education (Ingsih et al., 2020); a well-educated workforce that is highly motivated can aid the firm in achieving its goals and objectives. Consequently, it is possible to refer to this group of people as organizational assets (Rahaman et al., 2020).

A crucial component of attempts to strengthen the economy is the connection between economic growth and the growth of human capital. In addition to promoting economic progress, this development also has the potential to advance social welfare and the fight against poverty (Hess, 2016). Along with the production components of labor and financial capital, the economy is also driven by two other significant variables: technology and human capital. Although they are non-

physical assets, technology and human capital have a significant impact on output. The stock of behaviors, skills, social skills, and personality traits (such as creativity) that are manifested in the capacity to do work and generate economic value is known as human capital. According to the theory of neoclassical economic growth, labor, physical capital, and the presence of exogenous elements from technology are all considered to have a role in the initial approach to assessing economic growth. A development of contemporary economic theory, the endogenous growth model, addresses the importance of human capital in understanding the economic growth of a nation or region within a nation (Felipe et al., 2019).

Solow (1956) offered a fundamental theory of economic growth in which savings were the primary driver of economic expansion, is always cited in early studies of economic growth. The development of economic growth analysis serves as a foundation for the importance of human capital in boosting economic growth (Hahn et al., 2016).

To understand how human capital contributes to economic progress, both micro and macro perspectives can be explored. Human resources are important in increasing employee performance at the micro level such that it has an impact on output. Technology skills and production process improvements can be influenced by knowledge. This knowledge leads to production process efficiency, which has the ability to boost productivity. On the other hand, the presence of knowledge will increase people's production skills, which will boost productivity. At the macro level, human capital is viewed as a property of population-based human resources that promotes overall or aggregate economic growth (Jia & Tomasic, 2017). Both micro and macro human capital are recognized as crucial components of economic expansion. Raising welfare has consequences, including lowering poverty and unemployment rates that could result from the existence of constantly evolving human capital. An investment in human capital is funding schooling or some type of on-the-job training to raise the standard of the labor force. These investments offer benefits to both the individual and the economy as a whole. Higher productivity benefits the economy as a whole while increasing earnings benefit individuals.

Government involvement in raising the standard of human resources is crucial in developing nations like Nigeria. This will likely have an impact on raising the degree of social welfare, which will subsequently lead to raising macroeconomic growth. Nigeria has diverse conditions, and each location has a distinct culture. An initial and additional analysis of Nigeria's economic situation is provided by this study of the contribution of human capital and technology capabilities. The government can then enact measures to promote and expedite the development of human capital when it becomes one of the components that plays a crucial role (Duffield et al., 2019).

The economy of Nigeria and other nations depends on economic growth (Rodionov et al., 2020). The welfare of the entire population is something that is sought to be achieved through economic growth. The key factors determining the success of efforts to strengthen the economy and spur economic growth are technology capability and human capital development.

Nigeria's primary source of per capita output, like any other emerging or developed nation with a market economy, is a growth in productivity (Adelakun, 2011). Growth in per capita output is a vital element of economic well-being. Only people can make technology and equipment productive since they are the result of human ideas. The development of a

successful program depends on the originality and creativity of human beings. Additionally, problems including inequitable distribution of skilled labor in Nigeria, inappropriate use of human capital there, and a subpar reward structure that impedes the growth and success of human capital related to the approach have not been fixed. Nigeria has an extremely high rate of illiteracy, a large portion of the workforce is uneducated, and they use antiquated resources, tools, and industrial methods. As a result of their extremely low marginal productivity, they generate little real income, little savings, little investment, and little capital formation as a result. This article investigates how technology and human capital contribute to Nigeria's economic growth in light of the aforementioned problems.

1:1 Technological Transfer and Human Capital Development

Human capital is a vital element of industrial competitiveness and with the pace of technical changes in the world and the spread of information technologies and intensifying global competitiveness, the need for skill development has become even more commanding. More importantly, the patterns of skills needed for competing in the "new economy" have changed as well as the institutional structures around them. Thus, while general industrial development in the past required simple improvement in the general level of education, the emerging competitive setting calls for greater emphasis on high-level specialized training, with the private sector extending the learning process in the firm. These dimensions cannot, however, be captured with quantitative data at least on a national basis. It does not take into account the quality, completeness and relevance of formal education and it ignores important forms of skill formation such as on-the-job training.

In response to current global market changes, most of the firms have embraced the notion of human capital as a good competitive advantage that will enhance higher performance. Human capital development becomes part of an overall effort to achieve cost effectiveness and firm‟s performance. Hence, firms need to understand that, human capital would enhance employee satisfaction and improve performance. Although, there is a broad assumption that human capital has a positive effect on firm's performance, the notion of performance for human capital remains largely indisputable. The constantly changing business environment requires firms to strive for superior competitive advantages via dynamic business plan which incorporate creativity and innovativeness. This is essentially paramount for their long-term sustainability and undoubtedly, human resources input plays an important role in promoting firm's competitiveness, (Barney, 1995). At a glance, substantial studies were carried out on human capital and their implications on the firm's performance on widely basis and obviously, human capital enhancement will result in greater competitiveness and performance (Sanusi, 2003). The human capital projection can be captured from the government expenditure on health and education sectors in the county's national budgets for the past thirty years which can be presented below:

Table 1: Public Expenditures on Health and Education

Year	Public Expenditures on	
1980-1989	1.774	6.527
1990-1999	3.077	7.481
2000	2.735	10.165
2001	4.386	5.869
2002	5.314	9.208
2003	3.237	6.48
2004	4.591	7.201
2005	3.983	6.669
2006	5.557	8.695
2007	4.998	7.789
2008	4.287	6.178
2009	5.02	6.525
2010	5.011	6.598
2011	5.245	7.281
2012	5.281	7.921
2013	6.027	6.752
2014	5.219	7.293
2015	5.382	7.365
2016	6.091	6.939
2017	5.129	7.285
2018	5.017	7.381
2019	5.643	6.824
2020	5.298	6.852

Source: Central Bank of Nigeria Statistical Bulletin 2020

The government's commitment to the education sector fluctuated between 1980-1989 and 2010 as shown in the table 1 above. Throughout the years, a steady fall and rise (shocks) were recorded with a peak of 10.2 percent in 2000. It fell to 6.6 percent in 2003, rose again to 8.9 percent in 2006, and after that year, the percentage of government's expenditure on education declined. This situation is not encouraging given the population and the need for R & D in the country, this state of affair in education in the country is contrary to the United Nation Educational, Scientific and Cultural Organisation (UNESCO)"s benchmark for developing countries of spending about 26 percent of the annual budget on education. The budgetary allocation to health and education have been consistently low over the years up to year 2020 and which violated UNESCO advised of 26 percent from the National budget.

1:3 Nigerian's manufacturing sector, Technological Transfer and Research and Development (R & D)

The acquisition of knowledge could not be discountenance in the country's quest for national development. The technology could either be derived from research and development, technology transfer or adoption of new technology. The Nigeria's activities in the above three areas are quite limited. Quite regrettably, economic transformation programmes of the Federal government have given little or no attention to the issues of technology. Frascati

Manual (2002) defines R & D as creative work undertaken on a systematic basis, in order to increase the stock of knowledge to devise new applications. Research is a process of organized inquiry or search for new knowledge based on scientific method. R & D produces technology, which is a form of knowledge that is used to enhance the productivity of the factor of production, to spur economic growth, address societal concerns such as health and ultimately improve living standard (OECD, 2003). Theoretically, long-term economic growth is driven by the accumulation of knowledge-based factors of production, such as R&D and human capital, which prevent the marginal return to physical capital from falling below profitable levels. Unfortunately, R & D remains one of the weakest links in Nigeria's development process.

Table 2: Trends in Technology Acquisition in Nigerian Manufacturing Sector

Year	**Import of capital Goods as percent of total imports**	**Imports of Technology as percent of total Sales**
1996-2000	40.3	79.9
2001-2005	39.4	80
2006-2010	26.2	140.8
2011-2015	24.0	142.7
2016-2020	22.1	214.6

Source: Central Bank of Nigeria Statistical Bulletins 2011

The country has recorded a very low spending, both from private firms and government and this, indeed, delayed the technology transfer process in the manufacturing sector. In the past, Nigeria's technological transfer policy favoured technology imports, which can be shown in the table 2 above. The table 2 shows a remarkable increase in the ratio of technology importation to total output in the manufacturing sector. The heavy reliance of the Nigerian manufacturing firms on imported machinery and equipment is a reflection of the weak industrial base of the country. This situation also reflects that insignificant backward and forward linkages exist among the industries in the Nigerian manufacturing sector. Thus, because of the implication of heavy dependence on the importation of production machinery for foreign exchange demand, there is a need to quickly revitalize the industrial base of the economy and promote the Nigerian manufacturing sector. The technology adopted in the Nigerian manufacturing sector is quite old and outdated and the effect of FDI flows to this is quite low, compared to the volume of FDI that goes to the oil sector. Likewise, the weak linkage between the oil sector and the manufacturing sector negatively affect any possible spillover effects from this type of FDI. It is also instructive to note that the low levels of absorptive capacity in the economy limit the country's ability to effectively utilize the technological assets available to her.

It becomes imperative to note that R & D does not play a simple role in the development of a country. The world leaders as well as the emerging economies have engaged in various in-depth R & D activities, which enable them to continuously improve the various sectors of the economy and by extension, the manufacturing sector. Furthermore, given the relevance of the R & D to productivity growth and economic performance, it is generally agreed that government has a role in encouraging appropriate R & D levels and expenditures (OECD,

2003). Leading countries of the world have set-up specific funding mechanisms to promote R & D and among these countries are US, China, South-Africa, Ghana and Egypt. This strategy has impacted on national out-put and development. Having realized the vital role of innovation in socioeconomic development, the Nigerian government has incorporated innovation into its recently approved science and technology policy. The adoption of the Science, Technology and Innovation (STI) policy become imperative for the Nigerian government as a result of its national aspiration of becoming one of the top 20 largest economies by the year 2020. However, the aspiration is still faced with challenges of ineffective policy instruments, poor R & D coordination and inadequate funding among others. R & D in science, technology and innovation (STI) activities has not been given a serious attention by Nigerian government. The poor devotion of the government's expenditure to R & D can be attributed to the abundant of natural resources in the country, hence, little attention were given to R & D. Nigeria shifted from an agrarian economy in the 1960s to the present petroleum economy and petroleum accounted for approximately 90 percent of the country's foreign exchange and 76 percent of the government's total revenue (CBN, 2010). This situation has prevented the country from engaging in R & D exploitation believing that the revenue of the petroleum products is sufficient for the governmental activities.

1:4 Information and Communication Technology (ICTs) and the Nigerian's Manufacturing sector

Information and Communication Technologies (ICTs) is at the heart of technical change both in industrialized and developing countries. As their potential advantages are being realized and their costs continue to fall, such technologies are being applied throughout all sectors of the economy. In the developing countries, the spread of ICTs brings new opportunities to lower the gap by shrinking economic distances and bringing about instant and economic access to information. They also ensure that firms reach the markets in new ways, which was not envisaged in the past. It is partly in response to this underlying economic reality that many governments in developing countries are coming up with national ICT strategies to come up with "Knowledge Societies" to aid their development efforts (Mansell and When, 1998). While general traditional basic infrastructure, discussed earlier on, remains as a major factor in economic development, ICTs are growing their relevance in industrial competitiveness, most especially in technology-intensive activities.

Table 3: ICTs Infrastructure in Nigeria

Year	**Internet Users (per 100 people)**	**Fixed Broadband (per 100 people**	**Mobile Cellular (per 100 people)**		
2017	**15.9**	0.04	42		
2018	**20**	**0.05**	**48**		
2019	**24**	**0.06**	**55**		
2020	**28.4**	**0.13**	**59**		

Source: World Development Indicators (2020)

This section uses Internet Users (per 100 people), Fixed Broadband Internet and Mobile Cellular Subscriptions (per 100 people) as proxies of ICT infrastructure. Data are reliable and available for most countries in the world. It is clearly shows that most of the Sub-Sahara Africa countries, Nigeria inclusive, are clearly lagging behind in ICTs. ICTs infrastructure in Nigeria and some African countries are shown thus in table 3. The table shows the state of ICT in Nigeria when compared with other African countries, which clearly shows that Nigeria is lagging behind other countries like South-Africa and Egypt, using the above parameters considered under ICTs infrastructure. This will definitely have negative impact on the state of industrialization in the country.

2.0 Literature Review

The productivity of an economy is greatly influenced by its human capital. It is thought that two economies with the same amounts of labor, physical capital, natural resources, and technology can yield different outputs due to differences in human capital (Denis, 2017).

The same as physical capital and technology, people are a form of capital. A qualitative component of human resources is human capital. A person's capacity for productivity will depend on the qualitative aspects of their human resources, such as their knowledge and abilities. A strong education and physical condition can boost one's abilities and knowledge (Calkin, 2018).

Similar to investing in real estate or structures, spending on health and education will result in future benefits. A person's health and knowledge will improve as a result of spending money on education, training, and health, which will raise their productivity and income in the long run. Human productivity has an effect on output, which in turn has an effect on education and health. Economic growth will accelerate when production rises overall. Education and health are crucial elements of human capital; as a result, they have an effect on economic growth (Rajan, 2020).

Many economists, including Xu and Li (2020), have conducted prior empirical studies on human capital, technology, and economic growth at the national and cross-national levels. They found a positive and significant relationship between human capital and economic growth, while the quality of human resources is a reflection of human capital, an important factor inherently present in people that affects work performance or success and consists of knowledge, skills, and abilities.

Economic growth has an impact on rising population wealth and wellbeing, and economic growth is influenced by the quality of human resources. As a result, investing in human capital is crucial to boosting economic growth (Morris & Oldroyd, 2020).

Many academics discovered in the 1960s that variations in capital creation and other input factors were insufficient to fully explain why there were so many variations in economic growth. It has only lately come to light that many things that were once thought of as "residual" actually contribute to economic growth. Here, residual refers to an investment in the caliber of human capital and technical development. Investments assist in the learning and training process that results in the development of human resources. In following

economic research, this concept became known as "Human Capital. "Human capital must be developed and increased, much as other forms of production capital like machinery and equipment. Education and training are two ways to do this. A trained and professional workforce will result from training and education. Businesses also make investments in human capital by employing personnel to manufacture goods and oversee operations. The ultimate asset, however, is the caliber of the information and skills that those individuals possess and how they apply them to the advantage of the organization in which they work. Because it is tied to people, human capital cannot be transferred like machinery or equipment, making it a crucial component of production. In order to replace human capital, we must also replace the individuals. Since human capital is non-physical in nature, it can only be observed through adjustments in performance following human training and education. Education and training are significant factors in raising output. Development of human resources improves productivity and develops workforce skills. People with more education tend to obtain employment more quickly, whereas those with less education have a harder time doing so and, even if they do, are more likely to lose their jobs because they lack the necessary skills. According to empirical research, human capital with a high degree of education can lower unemployment (Felipe et al., 2019).

Higher educated workers perform more complicated job, which necessitates additional training at their place of employment. When businesses hire educated employees, they see a return on their investment. A highly educated workforce can provide advantages including highly competent and content workers, fresh and innovative ideas, and even higher profits and investment. Businesses with educated employees are also more productive and capable of making useful new inventions. Investment in education is a crucial component of a nation's efforts to lower unemployment. This suggests that if a nation wishes to boost the upward trend of its labor force participation rate, it must invest more in human development, particularly in education. This investment in human capital through education not only lowers the unemployment rate but also boosts the labor force participation rate, which directly affects worker pay and the nation's economic growth trend in a positive way (Billett, 2020).

Alfada (2019) came to the conclusion that economic growth and human capital have a favorable and significant impact in Indonesia. Technology and human capital, according to Banerjee and Roy (2014), had a positive impact on India's economic growth. According to Han and Lee (2020), boosting the quality of human resources and economic growth were strongly correlated with each other. Since health is a component of human capital, the quality of both health care and education is crucial to human capital. Thus, it may be inferred that health and education are crucial elements of human capital that influence economic expansion. The effectiveness of healthcare and education systems has a favorable impact on raising levels of human capital, which in turn affects economic growth rates.

The size of Indonesia's population is one of its key strengths in terms of development. Prosperity will be produced, which is what development aims to do, if the population's full potential can be developed through a development program and then used in profitable economic activity. A nation won't be able to accomplish anything in the future if it doesn't start improving the skills and knowledge of its citizens and utilizing the potential effects on economic growth. Additionally, because there would be a greater workforce as a result of this

high population, it presents difficulties for national growth. The issue of not having enough jobs to support the constantly growing workforce frequently becomes a barrier to progress. Planning for economic development is typically initially focused on growth rather than income distribution. Economic growth is a top objective for short-term development in a country like Indonesia with a huge population. A problem in and of itself can be population expansion. Economic growth cannot keep up with population expansion, which has an effect on inflation and lowers welfare. High population growth will have a significant impact if it is not balanced with an increase in human resources. However, population increase will be the expansion of human resources and labor participation if it can be effectively controlled through education and training. Because of the additional labor that may be used as a driver of economic growth, population growth will therefore be advantageous in this situation because economic growth can keep up with and even exceed population expansion. Consequently, population expansion can improve the population's standard of living and income (Cornock, 2018).

As a short-term development objective, economic growth in Indonesia places an excessive amount of focus on rapid growth and pays comparatively little attention to long-term interests, such as attention to the field of education to develop human resources. Indonesia is lags far behind in terms of funding allocations for its education sector, even when compared to nations in the Asian region (Leibo, 2018).In order to stimulate economic growth with sufficient levels of job participation and the development of high-quality human capital, population growth can be achieved through increasing work participation and improving population welfare. Every year, the requirement for everyday consumption grows along with the population, necessitating an increase in national revenue. In addition to the supply side (production) and the demand side (consumption), population growth necessitates increased employment. Economic growth that is not accompanied by increases in employment or the development of human capital can have an adverse effect on income disparity and the economy as a whole since it can worsen poverty. Economic expansion leads to increased work participation and employment, which is followed by the development of human resources through the education and training system (Wirth et al., 2018). An increase in total output (goods and services), or Gross Domestic Product, has an impact on labor participation (GDP). Economic growth, as it relates to macroeconomics, is the change in GDP (Felipe et al., 2019).

Economic expansion and human capital have a close relationship. By enhancing people's knowledge and abilities, human capital has an impact on economic growth and can contribute to the development of an economy. Knowledge and human capital are significant drivers of economic progress; the greater the impact of human capital on economic growth, the higher its quality. Quality human capital, like physical wealth, is a resource that may help people, households, enterprises, and the nation economically (Wensley& Evans, 2020).

Technology improves productivity and enhances human performance; therefore, it only makes sense that it would promote economic growth. It is generally acknowledged that technology is the primary factor influencing the economic development of nations, regions, and cities. Prosperity depends on the more efficient production of more and better goods and services, which is made possible by technological advancement. Human capital is the key to

accelerating economic growth because it is required to grasp technologies and enhance performance.

3:0 Theoretical Framework and Methodology

The theoretical framework of this work is anchored on the endogenous growth model where persistent economic growth is based on human capital accumulation (see Lucas, 1988; Romer, 1990; and Romer, 1994). The advocate of the endogenous growth models argued that growth rate of output is endogenously determined within the economic environment. The result of these models is based on the fact human capital is the major determinant of the growth process of an economy. The theoretical consideration of this study is based on the fact that from the generalization of the human capital production technology as a driving force of growth and the linking channels of human capital investment in developing countries in which associated consensus is still controversial in literature.

Park (2004) opined that investments in human capital are largely influenced by individual optimization decisions anchored on the market incentives and government subsidies. In spite of the fact that endogenous growth models show that a society with the rising incentives for human capital investments would bring about higher growth, it is not unambiguous on how the social incentives for human capital should be structured across different education levels. This is very significance issue since different structures will bring about different compositions of human capital in the population which may or may not have differential effect on the productivity growth. In reference to this study, we opined that private investors possess economic incentives in respect to profit and asset growth for human capital investment in developing countries, but the government possess social or welfare incentives on investment and consumption on human capital development. The study submissions indicates that both private and public sectors involve in heavily in human capital development process required for driving economic growth over time. This has been earlier opined by Ram (1986), Josephat *et al*. (2000), Niloy *et al*. (2003), and Adesoye *et al*. (2010) with varied methodological approach.

Based on the above submission, let us look at hypothetical economy where finished output is influenced by two distinct factors of production, physical capital and labour. In a Cobb-Douglass production function analyses with constant return to scale technology:

$$Y_t = A_t K_t ß L_t^{1-ß}, (0< ß < 1) \qquad \text{Eq 1}$$

Where Y_t, K_t and L_t denote gross domestic product, physical capital stock, and total labour force at time t. Time-variant technological level (A_t) is influenced by factors contributing to the enhancement of efficiency and knowledge environment.

Following Park (2004), endogenous growth models of Lucas (1988), Romer (1990), and Jones (1995) provide theoretical frameworks where human capital enhances productivity growth. Other studies including works of Bartel and Lichtenberg (1987), Foster and Rosenzweig (1996), and Berman *et al*. (1998) have suggested that human capital enhances the adoption of technology or that human capital is complementary to technology use.

Benhabib and Spiegel (1994), and Bils and Klenow (2000) introduce models where average human capital in the population influences the productivity growth. Following these empirical works, this study considers human capital per labour influencing the rate of technological progress. Consideration of human capital effect in relation to productivity growth is shown as:

$$A_t / A_t = \tilde{\imath} + \phi H_t / L_t \qquad \text{Eq 2}$$

Where $A_t = \partial A_t / \partial_t$, $\tilde{\imath}$ is constant growth rate of technological progress, H_t represents the aggregate of the capital present in the economy, L_t is labour force (or economy's labour supply) and ϕ denotes the human capital effect on the productivity of growth.

Given that hit is the human capital of an individual i at time t aggregate human (H_t) is defined as the sum of the human capital of individuals presents in the economy.

$$H_t = \sum^{n}_{i=1} h_{it} \qquad \text{Eq 3}$$

Where n is the population size of the country. Hence, incorporating equation (Eq 3 into the (Eq 1) and taking natural logarithm and introducing the stochastic term, yields the expression:

$$\text{Log } Y_t = \text{Log} A_t + ß \text{Log} K_t + (1- ß) L_t + y H_t + u_t \qquad \text{Eq 4}$$

3.1 Model Specification and Estimation Procedure

The expression (Eq 4) is the theoretical model that defines the effect of human capital on economic growth. In this study, we modified equation (5) as follows:

$$RGDPm = f\_(GCF, GEE, GEH, LBF, TECI) \qquad \text{Eq 5}$$

Therefore, equation (Eq 5) forms the theoretical specified model for this study. Here, GDP is gross domestic product, GCF is Gross capital formation, GEE is government total expenditure on education, GEH is government total expenditure on health, LBF is labour force, while TECI represent Technology index and t is time. The variables in the right hand side of equation 5 represent the human capital development indicators.

In line with the aim of this study, the long-run and short-run impact of human capital development on manufacturing out-put is captured employing the autoregressive distributed lag (ARDL) framework. In the past 20 years, a series of methods like the Engle and Granger (1987) and the full information maximum likelihood method of Johansen co- integration (Johansen, 1988; Johansen and Juselius, 1990) have been used to test the existence of long run relationship among variables. But this study employed a relatively new method known as the autoregressive distributed lag model (ARDL). The ARDL approach to cointegration test, otherwise known as the bounds testing approach, was introduced by Pesaran and Shin (1999) and latter improved on by Pesaran *et al.,* (2001). The statistic underlying the procedure is the Wald or *F*-statistic in a generalized Dickey-Fuller type regression, which is employed to test the significance of the variables under consideration in a conditional unrestricted equilibrium correction model (UECM). The ARDL approach has many benefits several advantages over other traditional techniques.

Basically, bounds test approach includes two stages. The first stage is to investigate the presence of long run relationship among the variables under consideration. The ARDL framework for this study is formulated as follows:

$$GDPmt = \partial_0 + \Pi_1 GDPm_{t-1} + \Pi_2 GCF_{t-1} + \Pi_3 GEE_{t-1} + \Pi_4 GEH_{t-1} + \Pi_5 LBF_{t-1} + \Pi_6 TECI_{t-1} + \sum^a \alpha_i \Delta GDPm_{t-1} + \sum^b \text{ɬ}_i \Delta GCF_{t-1} + \sum^c \gamma_i \Delta GEE_{t-1} + \sum^d \phi_i \Delta GEH_{t-1} + \sum^e u_i \Delta LBF_{t-1} + \sum^f \text{ə}_i \Delta TECI_{t-1} \quad \textbf{Eq 6}$$

Where ∂_0 is the drift component, Δ is first-difference operator and ^ a, b, c, d, e and f are the optimal lag lengths for each incorporated series. Note that there is no reason that the lag-length terms are equivalent to each other. The second part of the equation with ɑ, ɬ, ɣ, ϕ, u and ə represents the short-run dynamic multipliers of the model whereas the parameters @" represent the long-run multipliers. Note that the terms with summation sings are used to model the short-run dynamic structure. Appropriate lag length is selected based on the Akaike Information Criterion (AIC) before the selected model is estimated using the ordinary least squares (OLS) method. For annual data, Pesaran and Shin (1999) recommended choosing a maximum of 2 lags from which the lag length that minimizes the criteria is selected.

The second stage involves the estimation of the following conditional ARDL (a, b, c, d, e and f) long-run model:

$$GDPmt\text{-}1 = \partial 0 + \sum^a \alpha_i \Delta GDPm_{t-1} + \sum^b \text{ɬ}_i \Delta GCF_{t-1} + \sum^c \gamma_i \Delta GEE_{t-1} + \sum^d \phi_i \Delta GEH_{t-1} + \sum^e u_i \Delta LBF_{t-1} + \sum^f \text{ə}_i \Delta TECI_{t-1} \quad \textbf{Eq 7}$$

Where all variables are as previously defined, estimation of equations (7) involves the selection of the optimal lag orders of the ARDL (a, b, c, d, e and f). Finally, short-run dynamic parameters of the model associated with the long-run estimates can be obtained by estimating the following error correction model given as:

$$\Delta GDPmt\text{-}1 = \partial 0 + \sum^a \alpha_i \Delta GDPm_{t-1} + \sum^b \text{ɬ}_i \Delta GCF_{t-1} + \sum^c \gamma_i \Delta GEE_{t-1} + \sum^d \phi_i \Delta GEH_{t-1} + \sum^e u_i \Delta LBF_{t-1} + \sum^f \text{ə}_i \Delta TECI_{t-1} + \eta ECM_{t-1} + \varepsilon_t \quad \textbf{Eq 8}$$

Where ECM is the error correction term (representing the residual of the co-integrating equation) and η represents its coefficient which measures the speed of adjustment. The error correction coefficient shows how quickly the variables converge to equilibrium (i.e., speed of adjustment back to long-run equilibrium after a short-run disturbance) and should be statistically significant and negatively signed.

3:2 Data Requirements and Sources

The time series data required for this study are Gross domestic product from manufacturing sector, Gross capital formation, Human capital development index, Expenditure on health, Education and labour supply (proxied by labour force). These data were sourced from the Central Bank of Nigeria (CBN), Statistical Bulletin, and the National Bureau of Statistics (NBS).

4:0 Results and Interpretation

Table 4: Descriptive Statistics

	GDP	GEE	GEH	TECI	GCF	LBF
Mean	3.041468	148.2076	89.74776	2.797483	59.74364	43.499238
Median	3.647187	57.95664	24.52227	1.922490	163362.5	40973000
Maximum	15.32916	646.7475	423.3298	11.90588	4009729	65170639
Minimum	-13.12788	0.162154	0.041315	1.012562	8999.760	4128000
Std. Dev.	5.385440	193.8386	123.8775	2.572817	97.2321.7	113.94345
Skewness	-0.819168	1.238292	1.338238	2.494278	2.950896	-0.574416
Kurtosis	4.620614	3.330855	3.630589	8.570034	6.777330	6.126820
Jarque-Bera	7.054502	10.57861	14.14544	9.067219	52.80570	12.89103
Probability	0.029531	0.004995	0.000814	0.002411	0.000000	0.000733
Sum	1253438	1908214	1053574	2642912	17893093	1.87E+04
Sum Sq. Dev.	1.13E+11	1.49E+11	8.15E+10	2.43E+42	2.80E+13	4.97E+15
Observation	41	41	41	41	41	41

Table 4 shows the descriptive statistics of the variables used. The mean value is the sum of all the values in the data divided by total number of values. Given by the result, Government expenditure on Education has the highest mean value of 148.2076 which indicate that a data on Government Education are more spread out. The variable with the least mean value is Technology Index, what this suggests is that data on Technology Index are less spread out.

Examining the standard deviation, one can deduce that only Government Expenditure on Education has the highest value which signifies that data points on Government Expenditure on Education are far away from the mean that is spread out over a wider range of values.

As for skewness, it is regarded as the measure of the asymmetry of the probability distribution of a real valued random variable about its mean. The Skewness value can be positive or negative or undefined. It can be deduced from the distribution that three (3) of the variables viz-a-viz Government Expenditure on Education, Government Expenditure on Health and Technology Index are skewed to the right which means that the mean is greater than the mode and this is positive skewness. Only the RGDP is skewed to the left which signifies negative skewness. This implies that the tail on the left hand side is longer than the tail on the right hand side.

Kurtosis shows the degree of outliers in a distribution. If the Kurtosis is greater than three (3), then the dataset has a heavier tail than a normal distribution. If the Kurtosis is less than three (3) , then the dataset has lighter tail than a normal distribution . The values for asymmetry and Kurtosis between -2 and +2 are considered acceptable.

In order to prove normal univariate distribution (George and Mallery,2010), Hair et al (2010) and Bryne (2010) argued that the data is considered to be normal if skewness is between -2 and +2 and Kurtosis is between -7 and +7 in order to prove normal univariate distribution.

As for Jarque Bera tests, it is a goodness of fit that determines whether or not sample data have skewness and kurtosis that matches a normal distribution. The test statistics of the Jarque Bera is always a positive number and if it is far from zero (0), it indicates that the sample data do not have a normal distribution. The probability value of all the co-efficient of the variables namely, RGDP, GEE, GEH, TECI and LCF are statistically significant at 5% level of significance.

4:1 Unit Root Test Results

The results of the DF-GLS unit root test are displayed in Table 5. The DF-GLS test statistics indicate that all the series were non-stationary at level but become stationary at first difference. This implies that the null hypothesis of non-stationarity for all the variables is rejected at first difference of each series. Most importantly, the results show that we can confidently apply the ARDL methodology to our model.

Table 5: Summary of DF-GLS Unit Root Test Results

	DF-GLS Statistics		
Variables	Level	First Difference	Conclusion
GDPmt	2.195035	-1.542423***	1(1)
GEEt	1.434064	-2.578627***	1(1)
GEHt	-0.167879	-4.679368**	1(1)
TECIt	2.321896	-2.475721***	1(1)
GCFt	1.679626	-2.465774***	1(1)
LBFt	-2.177673	-8.397562**	1(1)

Note: Superscripts *, ** and *** denote rejection of the null hypothesis of existence of unit root at 1%, 5% and
10% significance levels respectively. Model includes intercept only with lag selected based on Akaike Information
Criteria (SIC).
Source: Authors Computation (2022) using E-Views 10

The ARDL bounds test for the presence of long-run relationships in equation 6 are reported in Table below. The bounds *F*-test for cointegration test yields evidence of a long-run relationship between economic growth and human capital development indicators. The computed *F* statistic, (.) _ = 7.63, is greater than the upper bound of the 1% critical values resulting in the rejection of the null hypothesis of long-run relationship between the examined variables. This evidence rules out the possibility of estimated relationship being spurious.

Table 6 : Bounds Test Results for Cointegration Relationship
Critical Bounds Value of the *F*-statistic

	1%		5%		10%	
K	1(0)	1(1)	1(0)	1(1)	1(0)	1(1)
5PS	1.67	2.25	1.12	3.40	1.08	3.13
5N	2.47	4.16	1.36	3.50	2.61	3.69

Calculated *F*-statistics
Fc(GDPm/GEE,GEH,TECI,GCF,LBF)= 7.63

Note: The lag structure was selected based on the Schwartz Information Criterion. K is the number of regressors.
PS Pesaran et al. (2001:300), Table CI (iii), Case III: Unrestricted intercept and no trend, N Narayan (2004),

The long-run estimated model revealed that government expenditure on education and health, labour force, primary and tertiary enrolments had positive but insignificant effect on economic growth. The impact of government gross capital formation and secondary enrolment on economic growth was found to be statistically insignificant and negative. It is only tertiary enrolment at lag one that has significant impact on economic growth in the long-run.

The diagnostic test result indicated that the residual generated from the long-run estimates used as error correction term in the short-run model estimates presented in Table 8 is normally distributed, not serially correlated, and the variance of the error term are homoskedasticity. This indicates that the estimated long-run model is structurally stable and provides reliable estimates for policy simulation.

Table 7: Estimated Long-run ARDL Model

	Dependent Variable: GDPm			
Variable	Coefficient	Standard Error	t-Statistic	Probability
C	155.7202	17720.27	0.008788	0.9931
GDPmt-1	0.681849	0.170600	3.996767	0.0009
GEEt-1	0.020460	0.203640	0.100469	0.9211
GEEt-2	0.312445	0.174117	1.794451	0.0905
GEHt-1	0.021044	0.224776	0.093623	0.9265
TECIt-1	0.035628	0.228164	0.156297	0.0152
GCFt-1	-0.010550	0.009289	-1.135764	0.2718
LBFt-1	0.000128	0.000235	0.544023	0.5935
R-Squared	0.99	**D.W Statistic**		2.08
Adjusted R-Square	0.98	**F-Statistic**		173.7470
Wald F-Statistic		**Prob(F-statistic)**		0.0000
Residual Normality Test				
Jarque-Bera			Prob(J.B)	0.4501
Breusch-Godfrey Serial Correlation LM Test				
F-Statistic	1.851691		Prob. F(2, 15)	0.1742
Obs*R-Squared	5.544169		Prob. Chi-Square(2)	0.0625
Heteroskedasticity Test: Breusch-Pagan-Godfrey				

F-statistic	3.781786	Prob. F(10,17)		0.0078
Obs*R-squared	19.31670	Prob. Chi-Square(10)		0.0364

Source: Authors Computation (2022) using E-Views 10

Similarly, the short-run estimates of human capital development on economic growth in Nigeria between 1980 to 2021 are presented in Table 8 below. The short-run estimates were iterated at different lag lengths and the optimal lag of one was determined using the Akiake and Schwarz information criteria. The error correction term co-efficient that explains the speed of adjustment from any distortion in the short-run to its long run equilibrium stood at -0.1245. This implies that 10.6% of any disequilibrium is restored in the first year.

Table 8: Estimated Short-Run ARDL Model

	Dependent Variable: ΔGDPm			
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
C	3056.168	2364.520	1.163557	0.7623
ΔGDPmt-1	0.184275	0.269028	0.572394	NA
ΔGEEt-1	-0.023834	0.517879	-0.218766	0.6384
ΔGHEt-1	0.324775	0.431561	1.335476	0.1822
ΔTECIt-1	0.050654	0.017419	2.652327	0.0234
ΔGCFt-1	0.006941	0.017938	0.674422	0.2675
ΔLBFt-1	6.54E-05	0.004154	0.339473	0.7413
ECMt-1	-0.105942	0.034782	-2.280567	0.0431
S.E. of Regression	7856.078		**Durbin-Watson Statistic**	1.749431
Akaike Criterion	21.60630		**Hannan-Quinn Criterion**	21.95188
Schwarz Criterion	21.58169			

Source: Authors Computation (2022) using E-Views 10

5:0 Conclusion and Recommendation

This study examined the influence of human capital development on the manufacturing out-put proxied by the contribution of Manufacturing out-put to the Gross Domestic product (GDPm). The paper employs the theoretical framework based on the endogenous growth model that argues that human capital based on technological production is a motivational factor in promoting manufacturing out-put. The study was between 1980 and 2021, using the autoregressive distributive lag (ARDL) framework.

The bound testing analyses show the presence of cointegration among the variables under consideration in the ARDL model. The test shows a long-run relationship among the variables in the model and the variables indicate a positive impact on the manufacturing out-put in

Nigeria within a period under consideration, but the impact were statistically insignificant. In addition, the study also shows that the equilibrium in the study is fully restored for any distortion in the short-run. It is imperative to note that based on the findings, government need to budget more funds in accelerating human capital development in the country, most especially on Education and Health sectors.

In addition, a research team that will bring together the educational sector and the industrial sector through research carried out in Nigeria's educational institutions should be intensified. This move will create a forum for more interactions between educational institutions and the industrial sector. Such interactions will make the research more relevant to the needs of the manufacturing sector, and provide solutions to problems currently facing it. It can be seen that experimental research is the major type of research being conducted in most industrialized countries. Although basic research is equally important for new scientific knowledge, experimental and applied research is the major type of research for transforming the economy. With increased finance for R & D, there will be a reduction in the dependency on imported industrial goods and promote local production of industrial of goods through improvement in the quality and quantity of human capital available in the manufacturing sector.

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