

Factors Driving Industrialization in Africa: A Panel Two-Stage Least Square Approach

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Abstract

The study examined the factors that influence industrialization in Africa using annual panel data from 1990 to 2018. To avoid problems of endogeneity, we employed the Two-Stage Least Square (TSLS) approach to estimate the significant determinants of industrialization. We found that foreign direct investment, total natural resources, and financial development significantly and positively predicted industrialization. Trade openness had a significant and negative effect on industrialization. Human capital and inflation were not significant determinants of industrialization. We also demonstrate that a significant aspect of an economy's ability to industrialize is the synchronization of public policies in its external engagements. To leverage the importance and contributions of industrialization, governments of various African economies should strive to augment foreign direct investment, preserve and explore more natural resources, and intensify financial development.

Keywords

Human Capital, Industrialization, Financial Development, Foreign Direct Investment, Trade Openness

1. Introduction

Developing industries through a sustained effort remains a matter of social and economic importance to most countries. In terms of agenda-setting and problem-solving for countries, the 2030 Agenda for Sustainable Development (eradicating poverty and achieving equitable outcomes for the majority by promoting industrialization) remain the core national prerogatives (Sampath, 2016). Industrialization has been well recognized in a number of literatures to have several benefits, particularly in the long run, such as economic diversification, reduction

in the unemployment rate, transfer of technology, and improved welfare (Alvarez et al., 2015; Ahlstrom, 2010). This proposition appears to be reaffirmed in light of the recent economic crisis and the significant expansion of the financial services sector, which has re-emphasized the importance of manufacturing and the expansion of industries (Samouel & Aram, 2016). In recent times, most Sub-Saharan African countries have demonstrated a brazen effort towards the transformational shift from an import-dependent economy to an export-led economy catalyzed by the expansion of the industrial sector. It is however also true that these efforts by several African economies have not seen the light of day.

The industrial sector of most Sub-Saharan African countries has been generally defined to include manufacturing, mining, energy production and construction works (Asmah et al., 2016). Even though economic growth has generally been low in Africa, these components of the industrial sector have made appreciable levels of contributions to the current growth and development of most African economies whereas, in some instances, the contributions of the industrial sector to the overall economic growth have been deemed very small. For instance, in Ethiopia, whereas the service sector and the agriculture sector made 51.5% and 32.5% respectively to GDP growth, the industrial sector accounted for only 16.3% for the period 2005 to 2015 (Newfarmer et al., 2019). On the contrary, for two reasons, industrial development continues to be a driver of structural change and long-term growth (Dijkstra, 2000; Zattler, 1996). Firstly, industries, particularly in manufacturing, have experienced higher productivity growth and technological development as well as technological spillovers than other sectors of the economy. Secondly, countries that ignore industry rely on primary exports, which are subject to long-term trade terms deterioration.

To support the argument, numerous development economists and policy-makers agree that industrial development such as manufacturing is necessary for overall economic development (Rodrik, 2013; Chang et al., 2016). However, the preliminary conditions for structural transformation and industry-driven productivity growth are to a great extent absent in Africa (Newman et al., 2016). Following several decades of stagnant growth and failed government efforts to stimulate the manufacturing sector (Shinyekwa et al., 2016; Kamarudeen & Söderbom, 2013), it is past time for African countries to consider industries as potential engines of economic transformation. This is because a competitive industrial sector automatically diversifies the economy's productive and export base, reduces unemployment, and slows rural-urban migration, all of which contribute to growth and sustainable economic development (Iyoboyi & Ademola, 2016). Additionally, attaining an inclusive and sustainable growth is contingent on an economy's industrialization level, which can expedite structural transformation and diversification, among other things.

Clearly, despite the gaps in industrial performance among emerging economies, industrial development appears to receive less attention in literature Afri-

can countries. Most countries in Africa have drastically underestimated the continent's real potential for industrialization. However, few researchers have addressed the causes of Africa's late industrialization. In some instances, many African countries have experienced sustained growth for over a decade, with industrial output doubling in several cases, but little research has been conducted on the drivers of the observed economic growth and industrial development. Resultantly, it's difficult to establish a rational industrial policy in African countries where industry is undersized.

The extent of industrialization, to a very large extent, is determined by the current macroeconomic environment, as well as the dynamic and complementary nature of economic policies aimed at shifting resources from low- to high-productivity sectors. One of these policies is the liberalization of trade. According to [Shafaeddin \(2006\)](#), trade increases a firm's innovativeness, allowing it to expand its exports as well as its domestic market, thereby increasing overall economic productivity. [OECD \(2011\)](#) also posits that natural resources, both renewable and non-renewable, as well as ecosystem services, are part of a country's true wealth; they are the raw material from which all other forms of capital are created. They help to increase fiscal revenue, income and reduce poverty.

Under the above deliberations, it appears glaringly clear that African economies have not been adequately responsive in realizing the need for the promotion of industrialization. The daunting task however could be attributed to the impropriety in recognizing the macroeconomic environment that potentially augments or decline industrialization in Africa. Against this backdrop, the study sought to examine the factors that predict industrialization in Africa. To the best of the knowledge of the researchers, this paper is the first to employ TSLS approach to estimate a panel data on this subject matter. The advantage of employing TSLS is to prevent bias estimate arising from endogeneity of variables. Also, this paper presents, for the first time, evidence of predictors of industrialization from six variables in the same model. This increases the reliability and robustness of test results. Additionally, we cover a rich and long-spanning database to further increase the depth of analysis.

The remainder of this article is structured as follows: Section 2 reviews relevant literature on the subject. Section 3 deals with the research methods and framework adopted for the study. Whereas Section 4 elaborates the empirical results of the study, Section 5 provides the conclusion and policy implication.

2. Literature Review

This section details relevant empirical works of literature on the factors that are accountable for industrialization. Dynamics of interesting results have emerged from the studies that looked at drivers of industrialization. Commonly, evidence points to that fact that industrialization boosts economic growth and is determined by movements in macroeconomic variables.

[Saka and Olanipekun \(2021\)](#) examined the role of human capital in the rela-

tionship between the industrialization process and growth in Nigeria from 1980 to 2016. Based on the new growth theory attributed to Lucas (1988), and having employed the Two-Stage Least Square technique, firstly, they assert that industrialization is significantly important for economic growth. Secondly, they established that human capital growth can help to boost economic growth through industrialization. Their findings seem to appreciate the assumption that human capital is a significant predictor of industrialization. In the words of Raheem et al. (2018), human capital is considered to be the main driver of industrial development in the African region.

Similarly, Das and Drine (2020) investigate the link between Africa's technological gap, educational quality, and growth. Their findings suggest that the ability to absorb new technology is critical for economic growth and development success. Markedly, they found that the most significant barrier to industrial advancement and technological catch-up is Africa's poor human capital development and deteriorated infrastructure. Poor human capital development and very low health expenditure, according to a study by Oyinlola et al. (2020), are the challenges of Sub-Saharan Africa's industrial development. Thus, from the works above, evidence is clearly adduced to suggest that inadequate human capital supply to meet an economy's industrial demand is sufficient to cause industrial failure. As proffered by Shim et al. (2020), the ability of any country or region to progress its human capacity is of great help in promoting and maintaining industrial development.

In another perspective, authors have mentioned that the unflinching importance of natural resource availability to many nations has direct and indirect implications on economic growth. Oyinlola et al. (2020) submit that the availability of natural resources can play a crucial role in a nation's or a continent's industrial development. Udi et al. (2020) found, in South Africa, that total natural resource (TNR) which represents the natural endowments significantly and positively correlates with industrial development. The relationship observed, however, was classified as moderate. To this end, TNR has been suggested to positively influence overall economic growth. OECD (2011) points out that most advanced economies have built their extractive industries on the back of natural resources, thus, fostering an avalanche of economic benefits.

Amiri et al. (2019) used a panel analysis of 28 countries to look at the effects of natural resource rents and institutional quality on the performance of tradable and non-tradable sectors in resource-rich countries from 2000 to 2016. The panel estimates found evidence that improving institutional efficiency in natural resource-based countries improves the performance of these economies' manufacturing sectors by eradicating or removing the consequences of the natural resource curse phenomenon. Further research found that in natural resource-dependent countries, the ratio of value-added to manufacturing rises unless institutional quality is high. In support of the argument, Ben-Salha et al. (2018) used the Pooled Mean Group (PMG) estimation framework to evaluate the causal association between increased natural resource rents and economic growth in a sample

of top resource-abundant countries from 1970 to 2013. They discovered a long-term positive effect of natural resource rent on economic growth.

Havranek et al. (2016) also looked at how natural resource exports affected the economies of 15 former Soviet Union countries from 1996 to 2010. To overcome endogeneity and clustering issues among these countries, the study used a variety of panel estimation methods (TSLS and GMM). Following the disintegration of the Soviet Union, these countries displayed remarkable heterogeneity, resulting in distinctive cross-sectional variations. They conclude, according to the study, that natural resources have a crowding-out effect on manufacturing, except where domestic institutions are significant and of high quality.

Shafaeddin (2006) investigated whether a free-trade regime would aid or hinder the process of developing-country industrialization. To do so, he evaluated the validity of the “trade liberalization hypothesis” (TLH). He found a two-channel approach to answer his question: on the one hand, continued protection would result in inefficiency and a lack of ability to compete in the global market. Premature, universal, and all-encompassing trade liberalization, on the other hand, would result in de-industrialization, concentration in production and exports of primary commodities, resource-based products, simple labor-intensive industries, or assembly operations, and little ability to catch up and upgrade.

Umoh and Effiong (2013) used ARDL to establish the relationship between openness to trade and industry (manufacturing performance) in Nigeria for the period 1970-2008. The findings suggest that trade openness has a significant positive short- and long-term impact on manufacturing productivity in Nigeria. As a result, the researchers proposed that the manufacturing sector’s policy direction in Nigeria should be based on open policies and trade liberalization as a long-term strategy. Again, they established that reducing trade restrictions and implementing appropriate incentives are critical to reviving the sector’s performance.

Kothakapa et al. (2021) observed, between 1970 and 2014, the relationship between financial development and industrialization in low- and middle-income countries using a dynamic panel model. Their results indicate that there is a non-linear relationship between the two variables. More precisely, the findings indicate that financial development harms industrial development until a certain point, at which point the effect reverses. This evidence of a “U-shaped” relationship highlights the critical role of financial development in the industrialization process of developing economies but also highlights the relationship’s complexity. Similarly, Folarin (2019) found a significant positive effect of financial reforms on industrialization in Nigeria.

Megbowon et al. (2019) on the evaluation of the causal relationship between foreign direct investment (FDI) and industrialization from 26 SSAs found that China’s FDI outflow to SSAs is not enough to foster industrialization in Africa. Arguing further, they submit that African economies could however benefit from China’s outflow of FDI by optimising and, where necessary, amending future agreements in order to encourage or prioritize Chinese investment in sec-

tors with positive linkages. [Adegboye et al. \(2016\)](#), contributing to the discourse on the relationship between FDI and industrialization for 46 African countries, postulate that the inflow of FDI is anticipated to boost domestic firms' investment, technological capabilities, and overall industrial performance.

[Khan and Ssnhadji \(2001\)](#) make a contribution to the discussion on the response of industrialization to macroeconomic variables with inflation as the predictor variable. They observed that the differential in threshold levels for the effects of inflation on growth between industrial and developing countries could be due to the former's higher level of conventional taxation than the latter. Similarly, [Kaldor \(1976\)](#) also found that inflation has a dampening effect on developing and industrial activities but the effect is much lower for industrial economies.

3. Data and Methodology

3.1. Data

This study used secondary panel data covering 27 Sub-Saharan Africa (SSA) from 1990 to 2018. The variables that were covered in this study were industrialization (INDU) as the outcome variable, foreign direct investment (FDI), total natural resource (TNR), trade openness (TO), financial development (FD), human capital (HC), and inflation (INF) as predictor variables. The study period was chosen because of data availability. [Table 1](#) presents the list of countries

Table 1. Data, source, measurement and empirical justification of variables.

27 Sub-Saharan African Countries used in the study			
Benin	Cote d'Ivoire	Mauritius	South Africa
Botswana	Eswatini	Mozambique	Tanzania
Burkina Faso	Gabon	Namibia	Togo
Burundi	Gambia	Niger	Uganda
Cameroon	Ghana	Nigeria	Zambia
Congo DR	Kenya	Rwanda	Zimbabwe
Congo Republic	Malawi	Sierra Leone	
Variable	Measurement	Source	Empirical Support
Industrialization (INDU)	Manufacturing value added (% of GDP)	WDI	(Opoku & Yan, 2019 ; Shahbaz et al., 2018).
Foreign direct investment (FDI)	Foreign direct investment, net inflows (% of GDP)	WDI	(Haudi & Cahyono, 2020 ; Huynh et al., 2020)
Total natural resource (TNR)	Total natural resources rents (% of GDP)	WDI	(Havranek et al., 2016 ; Amiri et al., 2019)
Trade openness (TO)	Trade (export + import) % of GDP	WDI	(Ngo et al., 2020)
Financial development (FD)	Domestic credit provided by financial sector (% of GDP)	WDI	(Shahbaz et al., 2018 ; Duarte et al., 2017)
Human capital (HC)	Index of human capital per person, based on years of schooling and returns to education	WDI	(Barro & Lee, 2013 ; Psacharopoulos, 1994)
Inflation (INF)	Consumer prices (annual %)	IFS	(Sabir et al., 2019 ; Erdogan & Unver, 2015)

WDI = World Development Indicator (World bank), IFS = International Financial Statistics (IMF).

used in the study and the summary of the description of data. Countries involved in the study and data used were index based on attempted efforts by the countries to make significant investment towards investment. Within the period 1990 to 2018, Africa's desire to improve and promote industrial development opens up the conversation for discussing industrialization.

3.2. Methodology

After passing the preliminary test, the study used the Two Stage Least Square (TSLS) method to estimate the relationships between the selected predictor variables and the outcome variable. Angrist and Imbens (1995) argue that the TSLS technique is frequently used to address the problem of "simultaneous equations bias, omitted variable or endogeneity". SLS is also used to correct for errors in the dependent and independent variables and likely biased estimates of OLS. On this premise, in each case, an endogenous variable serves as an exogenous variable and vice versa, forming a simultaneous equation system (Iyoboyi & Ademola, 2016). The TSLS employs instrumental variables to estimate model parameters and is divided into two stages.

The TSLS method is used in this study because it focuses on examining the impact of macroeconomic variables on industrialization with the lag of each explanatory variable used as instruments in addition to growth (GDPpc) and domestic investment. The first stage entails determining the proportions of endogenous and exogenous variables that can be attributed to the instruments. On a given set of instruments, it entails estimating an OLS regression for each variable in the model. In the second stage, the original equation is regressed with all variables replaced by the fitted values from the first stage regression. Finally, the TSLS estimates are derived from the coefficients of this regression.

To avoid of issues of biased estimation and spurious regression estimates, all variables were log-transformed. The model for regression estimated is hereby defined as:

$$\ln \text{INDU}_{it} = \ln \text{FDI}_{it} + \ln \text{TNR}_{it} + \ln \text{TO}_{it} + \ln \text{FD}_{it} + \ln \text{HC}_{it} + \ln \text{INF}_{it} + \varepsilon_{it} \quad (1)$$

Subsequently, with TSLS, the relationship between the dependent variable and the independent variables is described as:

$$Y = \gamma_0 + X_{1\gamma_1} + \rho \hat{s} + v \quad (2)$$

where \hat{s} is the fitted value from the first-stage regression, γ_0 is a constant, X_1 is the row vector of covariates, γ_1 is a vector of coefficient, ρ is the approximate percentage return, and v is also defined as $v = \{\varepsilon + \rho[S - \hat{s}]\}$, and S is a predictor outcome while ε remains the error term.

4. Result and Discussion

In this section, the empirical analyses are presented. Firstly, preliminary results consisting of unit root test, and descriptive statistics and test of multicollinearity are presented, and the regression estimates are presented next (Table 2).

Table 2. Panel unit root tests.

Variables	Level		Difference	
	LLC	IPS	LLC	IPS
lnINDU	1.158**	1.801**	12.317***	14.175***
lnFDI	16.215***	9.993***	14.883***	17.929***
lnTNR	2.390**	2.951**	11.795***	14.147***
lnTO	1.868**	2.013**	10.534***	13.957***
lnFD	2.405**	2.381***	20.479***	21.470***
lnHC	3.911**	9.166***	19.527***	18.524***
lnINF	8.342***	9.006***	21.110***	23.135***

LLC = Levin, Lin, & Chu (2002), IPS = Im, Pesaran, & Shin (2003), ** = p -values less than 0.05, *** = p -values less than 0.01.

The presence of unit root investigated by the Levin, Lin and Chu (LLC) (2002) and Im, Pesaran and Shin (IPS) (2003) demonstrate that there is an absence of unit root at both level and difference. It suffices to mention therefore that the regression estimates could be examined at both $I(0)$ and $I(0)$. The lag length of 2 was determined by Schwarz's Information Criterion (SIC). As a result, in this study, the TSLS is applied on the log-transformed variables at level (Table 3).

From Table 3, the skewness and kurtosis value, holistically, suggest that the data is normally distributed. Byrne (2010) and Hair et al. (2010) assert that for data to be thought of as normal, it must have a skewness value between -2 to $+2$ and a kurtosis value between -7 to $+7$. Also from the correlation matrix, in line with Prunier et al. (2015) and Dormann et al. (2013), it bears mentioning that there is no problem of multicollinearity among the predictor variables since no correlation coefficient of above 0.7 was observed. In the views of Prunier et al. (2015) and Dormann et al. (2013), a case of multicollinearity can be assumed if the correlation value among the explanatory is 0.7 or more.

The empirical results obtained and presented in Table 4 provide the Two-Stage Least Square estimates of the predictors of industrialization in Sub-Saharan Africa. From the results, the coefficient of foreign direct investment (FDI), total natural resources (TNR), trade openness (TO), and financial development (FD) are statistically significant suggesting that changes in these indicators of various African economies potentially accounts for the movement in their industrial development.

From Table 4, the results indicate that industrialization (INDU) in Africa positively and significantly responds to changes in the level of foreign direct investment (FDI). It implies that an increase in foreign direct investment is associated with a corresponding increase in the level of industrial development, and a decline in the level of foreign direct investment leads to a corresponding decline in industrialization. The finding is similar to early studies (Megbowon et al.,

Table 3. Descriptive statistics and correlation matrix.

	lnINDU	lnFDI	lnTNR	lnTO	lnFD	lnHC	lnINF
Mean	2.341	0.434	1.795	4.102	2.541	0.543	1.870
Std.	0.508	1.581	1.638	0.447	0.869	0.249	1.199
Max	3.687	3.675	4.088	5.169	4.666	1.069	6.242
Min	0.427	-8.927	-6.745	2.208	-0.800	0.033	-3.305
Skw	-0.423	-1.866	-2.007	-0.234	-0.108	-0.042	-0.433
Kts	4.519	6.705	3.096	3.732	3.732	2.117	5.286
Obs.	662	662	662	662	662	662	662
	lnINDU	lnFDI	lnTNR	lnTO	lnFD	lnHC	lnINF
lnINDU	1						
lnFDI	-0.107	1					
lnTNR	-0.225	0.022	1				
lnTO	0.074	0.338	-0.283	1			
lnFD	0.254	-0.012	-0.529	0.332	1		
lnHC	0.044	0.233	-0.292	0.441	0.452	1	
lnINF	0.049	-0.091	0.088	-0.091	-0.214	-0.009	1

Std. dev = standard deviation, max = maximum, min = minimum, Obs = number of observations, Skw = Skewness, Kts = Kurtosis.

Table 4. TSLS estimates.

Variable	Coefficient	Std. Error	t-Statistic	P-value
lnFDI	0.931**	0.403	2.309	0.0213
lnTNR	0.999***	0.296	3.373	0.0008
lnTO	-18.991***	2.639	-7.197	0.0000
lnFD	1.563**	0.780	2.003	0.0456
lnHC	10.675	7.401	1.442	0.1497
lnINF	-0.222	0.464	-0.479	0.6319
C	71.539***	8.628	8.292	0.0000
<i>R-squared</i>	<i>0.1755</i>			
<i>F-statistic</i>	<i>17.1325***</i>			
<i>Instrument rank</i>	<i>9</i>			
<i>No (cross-sections)</i>	<i>27</i>			

** = *p*-values less than 0.05, *** = *p*-values less than 0.01, C = Constant.

2019; Adegboye et al., 2016). From the result, it could be deduced that industrial growth has benefitted largely from the inflow of FDI into Africa. This can be attributed to the fact that most FDIs are directed towards setting up industries and/or to the manufacturing sector of the economies. The other reason for the observed positive relationship is that domestic firms in Africa benefit from FDI

via enhanced contemporary production and management systems.

Similarly, from **Table 4**, it could be observed that total natural resource positively affects the industrial development process of Africa. The result points out that an increase in the total natural resources rent serves as a breeding platform for enhanced industrialization in Africa. Arguing further, the result gives an indication that the more available the stock of natural resources is in an economy, the more attractive the economy appears for industrial activities. Generally, natural resources serve as a feed (raw material production) for the industrial sector of most economies. To a very large extent, the success rate of most manufacturing industries is dependent on the consistent and reliable availability and provision of raw materials. The result is consistent with [Ben-Salha et al. \(2018\)](#).

Trade openness, on the other hand, had a significant and negative impact on industrialization in Africa. From **Table 4**, the coefficient of the trade openness (TO) was negative suggesting that in Africa, as trade openness increases, industrial development declines. The evidence to this effect could be vested in the thrust of trade policies and strategies adopted in Africa. Most Africa economies are primary commodity-dependent with less attention on value-added manufacturing export. As a result, most export-promotion strategies and import-substitution strategies have not yielded the expected returns. Secondly, lessening trade restrictions have opened the way for the export of more primary commodities as against value-added export that could be harnessed from improving industrialization. The results confirm the protectionist approach to trade that opening an economy through trade suffocates the industrial productivity by suppressing infant industries to fold up due to competition. The study contradicts the views of [Umoh and Effiong \(2013\)](#). To a very large extent, because of import exceeding export in most instances, terms-of-trade are predominantly unfavorable for SSAs, and this often leads to the emergence of trade policies that fail to address the link between trade and industrial development.

Also, financial development is observed to have a significant and positive effect on industrialization in Africa. The result in **Table 4** suggests that a favorable financial development strategy enhances industrialization. Consequently, the increase in the level of financial support and enhancement in the flexibility of financial intermediation in African countries would provide adequate access to finance and its related activities needed for the private sector advancement and foster the zeal to industrialization. Lending to industry-promotion sectors of economies at a reduced and bearable interest rate has the potential to boost industrial development. This finding is consistent with [\(Adeleye et al., 2020; Folarin, 2019\)](#).

Even though human capital emerged as an insignificant predictor of industrialization in Africa, there was a positive regression coefficient suggesting that an improvement in the human capital structure of an economy could enhance industrial development. The insignificant relationship emphasizes that SSA countries have not provided the needed human resource-based training that fits

industrial purposes. Likewise, inflation was found to be an insignificant determinant of industrialization in Africa.

5. Conclusion and Recommendation

The study principally sought to provide answers to contentions of what drives industrialization in Africa. With data span from 1990 to 2018, a Two-Stage Least Square approach was employed to test the extent of causal linkages that moves from foreign direct investment (FDI), total natural resource (TNR), trade openness (TO), financial development (FD), human capital (HC), and inflation (INF). It was found that foreign direct investment (FDI), total natural resource (TNR), trade openness (TO), and financial development (FD), were significant determinants of industrialization whereas human capital development and inflation were observed as insignificant determinants of industrialization. Whereas FDI, TNR, and FD were positively related to industrialization, TO was negatively related to industrialization.

The results provide policy directions for SSAs government and policymakers for enhancing industrial development and subsequently ripping the benefits that imbibe in it. Industrialization has been proven to be an engine of economic development, and promoting the economic welfare of the population through employment and poverty reduction channels. As result, governments of various economies must endeavor to strengthen and intensify the factors that promote industrialization. Firstly, governments should establish investment promotions centers and mandate them with a special focus on transfiguring the inflow of FDI to the value-added manufacturing sector. Specifically, capital inflow such as the transfer of technology could be channeled to the promotion of industrial development.

Also, we recommend that rich-resource economies should protect their natural resource availability and seek for avenues to enhance their productivity. Reducing environmental degradations and hazardous activities could contribute to natural resource build-up and purposeful usability. Accordingly, efforts should be made at exploring more industry-driven resources to feed the raw material requirements of the industrial sectors.

Trade liberalization policies should be targeted at fostering export-promotion strategies that recognize industrial development, import-substitution strategies that feed the industries with the needed technology and factors of production. Additionally, a strategic and a more robust approach to trade restrictions should be looked at. Specifically, natural resources in Africa (mostly primary commodities) must be managed sustainably. From the result of this study, it could be pronounced that most African countries have not fed its local industries substantially. Rather, these primary commodities have been mostly sold to the international market to feed developed trading partners' industries outside the African landscape, and this potentially denies effort to promote in-house industrialization.

To achieve sustained economic growth through industrialization, central banks of African economies must optimize effort at making industrial development a top priority by creating the enabling financial leverage for the industrial players to take opportunities. To do this, credit services to the industrial sector should be provided at minimal interest rates, and that the cost of credit to industrial production (manufacturing) should be considerably lowered to facilitate the capitalization of the sector's prospects.

Limitation and Further Research

The study makes remarkable contributions to literature and policy dialogue on industrialization in Africa. Despite the importance and the effort to provide substantially relevant information and scope for this study, we believe the study could not provide coverage for all Sub-Saharan African countries. From methodological point of view, further research could provide more evidence in a time-frequency domain by employing time-frequencies techniques such as wavelet analysis. Further research could also test for predictors for industrialization with other macroeconomic variables such as political stability and institutional quality.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Adegboye, F. B., Ojo, J. A., & Ogunrinola, I. I. (2016). Foreign Direct Investment and Industrial Performance in Africa. *The Social Sciences, 11*, 5830-5837. <http://docsdrive.com/pdfs/medwelljournals/sscience/2016/5830-5837.pdf>
- Adeleye, N., Osabuohien, E., & Asongu, S. (2020). Agro-Industrialisation and Financial Intermediation in Nigeria. *African Journal of Economic and Management Studies, 11*, 443-456. <https://doi.org/10.1108/AJEMS-02-2019-0078>
- Ahlstrom, D. (2010). Innovation and Growth: How Business Contributes to Society. *Academy of Management Perspectives, 24*, 11-24. <https://doi.org/10.5465/AMP.2010.52842948>
- Alvarez, S. A., Barney, J. B., & Newman, A. M. (2015). The Poverty Problem and the Industrialization Solution. *Asia Pacific Journal of Management, 32*, 23-37. <https://doi.org/10.1007/s10490-014-9397-5>
- Amiri, H., Samadian, F., Yahoo, M., & Jamali, S. J. (2019). Natural Resource Abundance, Institutional Quality and Manufacturing Development: Evidence from Resource-Rich Countries. *Resources Policy, 62*, 550-560. <https://doi.org/10.1016/j.resourpol.2018.11.002>
- Angrist, J. D., & Imbens, G. W. (1995). Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity. *Journal of the American Statistical Association, 90*, 431-442. <https://doi.org/10.1080/01621459.1995.10476535>
- Asmah, E. E., Armah, M., Brafu-Insaidoo, W., & Peprah, J. (2016). *The Economy of Ghana*. Edsam Printing and Publishing.

- Barro, R. J., & Lee, J. W. (2013). A New Data Set of Educational Attainment in the World, 1950-2010. *Journal of Development Economics*, *104*, 184-198.
<https://doi.org/10.1016/j.jdeveco.2012.10.001>
- Ben-Salha, O., Dachraoui, H., & Sebri, M. (2018). Natural Resource Rents and Economic Growth in the Top Resource-Abundant Countries: A PMG Estimation. *Resources Policy*, *74*, Article ID: 101229. <https://doi.org/10.1016/j.resourpol.2018.07.005>
- Byrne, B. M. (2010). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming (Multivariate Applications Series)* (Vol. 396, p. 7384). Taylor & Francis Group.
- Chang, H. J., Hauge, J., & Irfan, M. (2016). *Transformative Industrial Policy for Africa*. Economic Commission for Africa.
- Das, G. G., & Drine, I. (2020). Distance from the Technology Frontier: How Could Africa Catch-Up via Socio-Institutional Factors and Human Capital? *Technological Forecasting and Social Change*, *150*, Article ID: 119755.
<https://doi.org/10.1016/j.techfore.2019.119755>
- Dijkstra, A. G. (2000). Trade Liberalization and Industrial Development in Latin America. *World Development*, *28*, 1567-1582.
[https://doi.org/10.1016/S0305-750X\(00\)00040-1](https://doi.org/10.1016/S0305-750X(00)00040-1)
- Dormann, C. F., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., Lautenbach, S. et al. (2013). Collinearity: A Review of Methods to Deal with It and a Simulation Study Evaluating Their Performance. *Ecography*, *36*, 27-46.
<https://doi.org/10.1111/j.1600-0587.2012.07348.x>
- Duarte, L. D. R. V. et al. (2017). The Relationship between FDI, Economic Growth and Financial Development in Cabo Verde. *International Journal of Economics and Finance*, *9*, 132-142. <https://doi.org/10.5539/ijef.v9n5p132>
- Erdogan, M., & Unver, M. (2015). Determinants of Foreign Direct Investments: Dynamic Panel Data Evidence. *International Journal of Economics and Finance*, *7*, 82-95.
<https://doi.org/10.5539/ijef.v7n5p82>
- Folarin, O. E. (2019). Financial Reforms and Industrialization: Evidence from Nigeria. *Journal of Social and Economic Development*, *21*, 166-189.
<https://doi.org/10.1007/s40847-019-00075-z>
- Hair, J., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Pearson Educational International.
- Haudi, H. W., & Cahyono, Y. (2020). Analysis of Most Influential Factors to Attract Foreign Direct Investment. *Journal of Critical Reviews*, *7*, 4128-4135.
- Havranek, T., Horvath, R., & Zeynalov, A. (2016). Natural Resources and Economic Growth: A Meta-Analysis. *World Development*, *88*, 134-151.
<https://doi.org/10.1016/j.worlddev.2016.07.016>
- Huynh, C. M., Nguyen, V. H. T., Nguyen, H. B., & Nguyen, P. C. (2020). One-Way Effect or Multiple-Way Causality: Foreign Direct Investment, Institutional Quality and Shadow Economy? *International Economics and Economic Policy*, *17*, 219-239.
<https://doi.org/10.1007/s10368-019-00454-1>
- Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, *115*, 53-74.
[https://doi.org/10.1016/S0304-4076\(03\)00092-7](https://doi.org/10.1016/S0304-4076(03)00092-7)
- Iyoboyi, M., & Ademola, A. S. (2016). The Institutional and Policy Environment and the Quest for Industrialization in Nigeria. *Journal of Economics and Behavioral Studies*, *8*, 13-25. [https://doi.org/10.22610/jeb.v8i2\(J\).1251](https://doi.org/10.22610/jeb.v8i2(J).1251)

- Kaldor, N. (1976). Inflation and Recession in the World Economy. *The Economic Journal*, 86, 703-714. <https://doi.org/10.2307/2231447>
- Kamarudeen, S., & Söderbom, M. (2013). *Constraints and Opportunities in Rwanda's Industrial Sector*. IGC Working Paper. <http://www.theigc.org/wp-content/uploads/2014/09/Kamarudeen-Soederbom-2013-Working-Paper.pdf>
- Khan, M. S., & Ssnhadji, A. S. (2001). Threshold Effects in the Relationship between Inflation and Growth. *IMF Economic Review*, 48, 1-21.
- Kothakapa, G., Bhupatiraju, S., & Sirohi, R. A. (2021). Revisiting the Link between Financial Development and Industrialization: Evidence from Low and Middle Income Countries. *Annals of Finance*, 17, 215-230. <https://doi.org/10.1007/s10436-020-00376-y>
- Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*, 108, 1-24. [https://doi.org/10.1016/S0304-4076\(01\)00098-7](https://doi.org/10.1016/S0304-4076(01)00098-7)
- Lucas, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22, 3-42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Megbowon, E., Mlambo, C., & Adekunle, B. (2019). Impact of China's Outward FDI on Sub-Saharan Africa's Industrialization: Evidence from 26 Countries. *Cogent Economics & Finance*, 7, 1-14. <https://doi.org/10.1080/23322039.2019.1681054>
- Newfarmer, R., Page, J., & Tarp, F. (2019). *Industries without Smokestacks: Industrialization in Africa Reconsidered* (p. 480). Oxford University Press. <https://library.oapen.org/handle/20.500.12657/25128>
- Newman, C., Page, J., Rand, J., SHEMELES, A., Söderbom, M., & Tarp, F. (2016). *Made in Africa: Learning to Compete in Industry*. Brookings Institution Press. <http://library.oapen.org/handle/20.500.12657/25778>
- Ngo, M. N., Cao, H. H., Nguyen, L. N., & Nguyen, T. N. (2020). Determinants of Foreign Direct Investment: Evidence from Vietnam. *The Journal of Asian Finance, Economics, and Business*, 7, 173-183. <https://doi.org/10.13106/jafeb.2020.vol7.no6.173>
- OECD (2011). *The Economic Significance of Natural Resources: Key Points for Reformers in Eastern Europe, Caucasus and Central Asia*. OECD Publishing. http://www.oecd.org/env/outreach/2011_AB_Economic%20significance%20of%20NR%20in%20EECCA_ENG.pdf
- Opoku, E. E. O., & Yan, I. K. M. (2019). Industrialization as Driver of Sustainable Economic Growth in Africa. *The Journal of International Trade & Economic Development*, 28, 30-56. <https://doi.org/10.1080/09638199.2018.1483416>
- Oyinlola, M. A., Adedeji, A. A., & Bolarinwa, M. O. (2020). Exploring the Nexus among Natural Resource Rents, Human Capital and Industrial Development in the SSA Region. *Economic Change and Restructuring*, 53, 87-111. <https://doi.org/10.1007/s10644-018-09243-3>
- Prunier, J. G., Colyn, M., Legendre, X., Nimon, K. F., & Flamand, M. C. (2015). Multicollinearity in Spatial Genetics: Separating the Wheat from the Chaff Using Commonality Analyses. *Molecular Ecology*, 24, 263-283. <https://doi.org/10.1111/mec.13029>
- Psacharopoulos, G. (1994). Returns to Investment in Education: A Global Update. *World Development*, 22, 1325-1343. [https://doi.org/10.1016/0305-750X\(94\)90007-8](https://doi.org/10.1016/0305-750X(94)90007-8)
- Raheem, I. D., Isah, K. O., & Adedeji, A. A. (2018). Inclusive Growth, Human Capital Development and Natural Resource Rent in SSA. *Economic Change and Restructuring*, 51, 29-48. <https://doi.org/10.1007/s10644-016-9193-y>
- Rodrik, D. (2013). Unconditional Convergence in Manufacturing. *The Quarterly Journal*

- of Economics*, 128, 165-204. <https://doi.org/10.1093/qje/qjs047>
- Sabir, S., Rafique, A., & Abbas, K. (2019). Institutions and FDI: Evidence from Developed and Developing Countries. *Financial Innovation*, 5, 1-20. <https://doi.org/10.1186/s40854-019-0123-7>
- Saka, J., & Olanipekun, D. B. (2021). Human Capital Development and Industrialization in Nigeria: Implication for Economic Growth. *Religación*, 6, 280-295. <https://doi.org/10.46652/rgn.v6i27.776>
- Samouel, B., & Aram, B. (2016). The Determinants of Industrialization: Empirical Evidence for Africa. *European Scientific Journal*, 12, 219-239. https://www.academia.edu/download/45514128/Publication_Aram-Sam_ESJ_1.pdf
- Sampath, P. G. (2016). Sustainable Industrialization in Africa: Toward a New Development Agenda. In *Sustainable Industrialization in Africa* (pp. 1-19). Palgrave Macmillan. https://doi.org/10.1007/978-1-137-56112-1_1
- Shafaeddin, M. (2006). *Does Trade Openness Helps or Hinders Industrialization?* MPRA Working Paper, 4371. <https://mpra.ub.uni-muenchen.de/4371>
- Shahbaz, M., Bhattacharya, M., & Mahalik, M. K. (2018). Financial Development, Industrialization, the Role of Institutions and Government: A Comparative Analysis between India and China. *Applied Economics*, 50, 1952-1977. <https://doi.org/10.1080/00036846.2017.1383595>
- Shim, J., Park, Y., Chu, H. J., & Choi, S. J. (2020). National Human Resource Development in Korea. In *Human Resource Development in South Korea* (pp. 13-34). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-54066-1_2
- Shinyekwa, I., Kiiza, J., Hisali, E., & Obwona, M. (2016). The Evolution of Industry in Uganda. In C. Newman, et al., Eds., *Manufacturing Transformation: Comparative Studies of Industrial Development in Africa and Emerging Asia* (p. 191). Oxford Scholarship Online. <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>
<https://doi.org/10.1093/acprof:oso/9780198776987.003.0010>
- Udi, J., Bekun, F. V., & Adedoyin, F. F. (2020). Modeling the Nexus between Coal Consumption, FDI Inflow and Economic Expansion: Does Industrialization Matter in South Africa? *Environmental Science and Pollution Research*, 27, 10553-10564. <https://doi.org/10.1007/s11356-020-07691-x>
- Umoh, O. J., & Effiong, E. L. (2013). Trade Openness and Manufacturing Sector Performance in Nigeria. *Margin: The Journal of Applied Economic Research*, 7, 147-169. <https://doi.org/10.1177/0973801013483505>
- Zattler, J. (1996). Trade Policy in Developing Countries. *Intereconomics*, 31, 229-236. <https://doi.org/10.1007/BF02927154>