Innovations

Green Climate Finance and Industrial Development in Africa (2017-2023)

Okwor E.Emmanuel

Lecturer ; Dept. of Banking and Finance , Evangel University,Akaeze, Ebonyi State.

Eneoli, O.Calistus

Ph.D. Student: Banking and Finance Dept. University of Nigeria, Enugu Campus.

Anichebe.N.A .

Lecturer: Dept of Business management, Evangel University,Akaeze, Ebonyi State.

Aniakor Cosmas .C

Lecturer: Dept of Banking and Finance, Institute of Management and Technology (IMT) Enugu.

Onyeka Stanley Chukwuedo

Lecturer: Dept of Accountancy, Alex Ekwueme – Federal University Ndufu-Alike ,Ebonyi State.

Nkama .O.Nkama

Lecturer ; Dept. of Accounting, Evangel University,Akaeze, Ebonyi State.

Abstract: The investigation analyzed the impact of green climate finance on industrial development in Africa from 2017 to 2023. Green climate finance refers to funding acquired from various financial sources, to support climate change adaptation and mitigation efforts for the benefit of humanity. It was considered as the independent variable.The process of developing and expanding industries in an economy through the utilization of innovative technologies that enhance efficiency, speed, and quality of work, resulting in a rise in a company's production levels and profitability. Industry (including construction) value added represent Industrial development as the dependent variable. Inflation was utilized as the control variable in the analysis. Previous studies in this area often overlooked including all African countries benefiting from green climate finance in their sample, thus motivating this study. The

sample comprised the African countries that received aid through green climate finance during the specified timeframe. Several preliminary tests were conducted, including panel unit root test, parameter stability test, co-integration test, and error correction model. Hypotheses were assessed using panel ARDL model. The coefficient of the explanatory variable is 6.5731 and its corresponding probability value is 0.5712 .There is evidence of positive and non-significant impact of green climate finance on industrial sector contribution to GDP in Africa. The study recommend that donors and host countries should jointly be engaged during the implementation stage for proper accountability.

Key words: *Green Climate Finance; Industrial Development; Panel ARDL; GDP; Inflation Rate.*

1.1 Introduction

Green industrialization is a crucial indicator of a nation's ability to effectively address environmental challenges, improve environmental performance, and promote sustainable industrial development. The focus on enhancing green industrial efficiency has become a central theme in economic advancement, garnering significant attention from academia and policymakers.

The advancement of African economies towards industrialization has consistently lagged behind that of other emerging and developed nations. Various factors, both internal and external, contribute to this sluggish rate of structural transformation, including excessive government intervention in local economies, misguided investment strategies, and overprotection of emerging sectors. Externally, factors such as declining export revenues and stagnant production due to an unfavorable global climate also play a substantial role.

Climate finance refers to financial support obtained from a variety of sources - public, private, and alternative, at different levels - to aid in endeavors related to climate change adaptation and mitigation. International agreements like the Paris Agreement and the Kyoto Protocol require financially capable countries to provide support to those less affluent and more susceptible to climate change. Given the varying capacities of nations in addressing climate change, climate finance is crucial for both mitigation and adaptation efforts, as significant financial resources are required to reduce emissions and cope with the impacts of a changing climate.

The disparity between industrialization efforts in Africa and those in other developing nations is not only significant but also gradual and contingent on the chosen path, as the industrialization process differs from past successes in industrialization. Some African policymakers advocate for adopting the industrial strategies of Asia, inspired by the achievements of rapidly growing emerging economies, particularly China. This strategy involves government intervention in the

economy to facilitate structural changes, delineating clear industrial pathways, transitioning from agriculture to industry, and moving from labor-intensive sectors to high value-added industries. To narrow the development gap and succeed in this pursuit, African economies must cultivate a competitive environment to attract both local and foreign investments crucial for their structural transformation and reduction of unemployment. Nevertheless, Africa faces a dilemma as it embarks on its industrialization journey amidst global efforts to combat environmental degradation through stringent environmental regulations, diverging from the industrialization trajectories of developed economies.

It is imperative for all governments and stakeholders to comprehend, evaluate, and stimulate the necessary financial resources for developing nations. A comprehensive strategy for distributing resources that tackle both adaptation and mitigation is deemed appropriate. The principal objective of the Paris Agreement is to reorient financial flows towards reduced greenhouse gas emissions and climate-resilient growth. An evaluation of the current status of assistance provision and mobilization is encompassed in the global inventory mandated by the Agreement. The Paris Agreement also underscores the importance of enhanced predictability and transparency in financial assistance. The principle of "common but differentiated responsibility and respective capacities" within the Convention stipulates that affluent country Parties should provide financial resources to assist developing country Parties in achieving the objectives of the UNFCCC. The Paris Agreement, despite introducing the concept of voluntary contributions from other Parties for the first time, also emphasizes the obligation of wealthy nations. While recognizing the significance of public funds, prosperous country Parties should also take the lead in mobilizing climate finance from diverse sources, mechanisms, and channels. This endeavor should be guided by the needs and priorities of developing country Parties, while also supporting nation-led strategies. Such endeavors in the mobilization of climate finance should represent a progression from previous endeavors.

1.2 Statement of the Problem:

Africa is confronted with the challenge of not having achieved success in narrowing its development gap. In order to address this issue, African economies must establish a conducive atmosphere to attract both local and foreign investments, which are essential for their economic restructuring and alleviation of unemployment. However, Africa finds itself in a dilemma. While advanced economies have advanced through industrialization, leading to substantial greenhouse gas emissions, African economies are embarking on their industrialization path amidst global efforts to address environmental degradation by enforcing stringent regulations. This situation presents Africa with a complex

predicament as it pursues industrialization while conforming to new global environmental norms.

Due to its classification as one of the most impoverished regions globally with underdeveloped human resources, Africa encounters obstacles in obtaining and effectively utilizing green technologies. Moreover, the projected climate financing requirements for Africa between 2020 and 2030 stood at $2.5 trillion. Nonetheless, as of 2020, only 12% of this amount had been mobilized, with the continent receiving a mere 3% of the total worldwide climate finance (Climate Policy Initiative, 2022). The African Development Bank (AfDB) asserts that Africa holds substantial potential for expansion in the realm of climate funding.

1.3 Objective of the Study
The objective of the study is to examine the impact of green climate finance on industrial development in Africa from 2017 to 2023.

1.4 Statement of Hypothesis
H_1 :Green climate finance does not impact industrial development in Africa from 2017 to 2023.

1.5 Scope of the Study
The research investigates the influence of green climate finance on the industrial progress in Africa within the period 2017 to 2023. The foundation year of the investigation is established upon the economic analysis of Africa in 2017, which explores strategies to exploit the benefits of swift urbanization for advancing industrialization and facilitating structural transformation. The African countries that benefited from the green climate funding were used out fi fty four countries in Africa .These countries are Algeria, Angola, Burkina Faso ,Cabo Verde, Cammeroon, Chad, Congo, Cote Ivoire, Egypt,Ghana/Mozambiq,Guinea,Kenya,Lesotho ,Liberia,Madagascar,Malawi/Lesotho,Mali,Maurituis,Morrocco,Mozambiq/Zambia,N amibia,Niger,Nigeria,Rwanda,South   Sudan,Tanzania,Togo,Tunisia,Uganda and Zambia.

2.0 Review of Related Literature
2.1 Concept of Green Finance:
Green finance, as defined by the United Nations Environment Programme Finance Initiative (2007), pertains to financial mechanisms that prioritize environmental considerations, including various products such as loans, credit cards, insurance, and bonds. The rise of green finance is linked to the overall progress of the financial industry. Similarly, Noh (2010) and Hyomnyoktan (2012) argue that green finance holds notable sway in the financial sector, stemming mainly from international

public finance, private sector finance, and domestic public finance, thereby enhancing the financial landscape of all countries. Wang et al. (2019) elaborate on green finance as a form of financial innovation, functioning as a new policy tool designed to tackle environmental challenges. They observe that green finance bears resemblance to conventional financial practices.

2.2 Concept of Industrialization:

Industrialization is a concept denoting a series of economic and societal procedures associated with the discovery of more effective techniques for generating value, collectively referred to as "industry" or "the secondary sector." This stands in opposition to the primary sector, encompassing agriculture, hunting, fishing, and resource extraction, as well as the tertiary sector, comprising services. The proliferation of industrial activities commenced notably in the late 17th Century, progressively transitioning from manufacture to machinofacture. While historical examinations of industrialization primarily concentrated on the Industrial Revolution, contemporary economic geographers are presently intrigued by the global economic terrain. Economic modifications can be classified into occurrences (rapid isolated changes) and processes (gradual cumulative changes). Unlike an occurrence, industrialization evolves gradually over time within a framework, such as a nation or area, through a sequence of analogous occurrences. The establishment of a lone industrial facility in a predominantly agrarian locale does not denote industrialization, but a succession of such occurrences impacting the local economy signifies a process molding the regional economy. In this context, two pivotal conceptual differentiations must be acknowledged. Initially, it is imperative to discern between quantitative economic expansion and qualitative economic metamorphosis. Simply inaugurating new industrial facilities in an already industrialized area does not epitomize industrialization but rather indicates continuous industrial or economic expansion.

The term "industrialization" should specifically allude to the qualitative metamorphosis in the economy when an agrarian-centered economy is substantially influenced by novel industrial establishments to the extent that it can no longer be classified as agrarian. Essentially, industrialization is an attribute of economic advancement stemming from the organized accumulation of economic occurrences. Establishing the threshold for identifying industrialization is paramount. While a solitary industrial occurrence may not embody industrialization, the query arises as to when it becomes pertinent to acknowledge such a phenomenon. Scholars in the realms of geography, economics, history, and sociology pertinent to industrialization have conventionally tackled this matter informally, relying on practical judgment and specific yardsticks. There exist three primary approaches

for evaluating industrialization in a national or regional economy. The initial approach entails contrasting the contribution of the secondary sector (manufacturing industry) to the gross domestic product with that of the primary sector (agriculture, fishing, hunting, and raw material extraction). The second approach compares the workforce in industry with that in agriculture. The third method, more subjective and geographically inclined, gauges industrialization by visually scrutinizing a region's topography. Industrial activities induce substantial alterations to the physical environment (e.g., infrastructure development), rendering them more conspicuous than intricate social phenomena like exploitation, racism, or social hierarchy.

2.3 Theoritical Framework:

This section outlines various theories of sustainable finance. The theories discussed include the priority theory of sustainable finance, the resource theory of sustainable finance, the life span theory of sustainable finance, and the positive signaling theory of sustainable finance.

2.3.1 The Priority Theory of Sustainable Finance:

It is postulated that the level of commitment exhibited by economic agents in the pursuit of sustainable finance goals within a particular country or region serves as an indication of the significance attached to the sustainable finance agenda in that specific area (Wilson, 2010). Evaluation of this commitment can be conducted based on three criteria: (i) the extent of collaborative, individual, and collective actions taken by economic agents to achieve sustainable finance objectives, (ii) the speed at which a consensus is reached, and (iii) the timeliness of measures implemented to achieve sustainable finance goals. Economic actors typically harbor diverse priorities that can be hierarchically arranged from least to most vital. The ranking of sustainable finance goals among a list of priorities by economic actors mirrors the importance accorded to these objectives. Nonetheless, these priorities might undergo changes over time in response to evolving local or global circumstances. When sustainable finance emerges as a top priority among economic actors at a specific point, it signifies a high level of commitment and significant efforts directed towards attaining sustainable finance objectives (Kuhn, 2020). Conversely, if economic actors fail to prioritize the sustainable finance agenda, it implies a lack of seriousness and minimal endeavors towards sustainable finance goals during that period (Krauss, Krüger, and Meyer, 2016).

The prioritization of sustainable finance objectives is not devoid of repercussions. Such a choice could entail the relinquishment of other crucial goals until the sustainable finance targets are achieved, leading to a scenario where one objective is traded off for another. These trade-offs can be quite costly, potentially resulting in the abandonment of prioritizing sustainable finance goals over other essential

objectives. For example, developing nations with pressing economic development requirements, like enhancing GDP per capita, may not perceive the significance of prioritizing sustainable finance goals, deeming them less vital for economic development needs. The core implication of prioritizing sustainable finance theory is that the emphasis on sustainable finance goals is contingent on the importance assigned to other significant objectives during prioritization. This theory offers two primary advantages. Firstly, it acknowledges that economic actors have numerous critical priorities, enabling the inclusion of sustainable finance goals as an additional priority. Secondly, it furnishes economic actors with a platform to articulate the importance or precedence given to sustainable finance goals. This prioritization declaration can be conveyed through public declarations in the media or other communication channels.

2.3.2 The Life Cycle Theory of Sustainable Finance:

The concept emanates from Vernon's theory on the product cycle, positing that the enthusiasm for sustainable finance is influenced by the life cycle of sustainable finance products, encompassing various elements within the domain of sustainable finance like products, services, instruments, schemes, policies, and activities. According to this assertion, sophisticated economic entities possess an understanding of the life cycle of sustainable finance products, commencing from their inception as a novel concept, progressing through growth, maturity, and eventual obsolescence. This understanding enables economic agents to formulate individual forecasts concerning the anticipated lifespan of particular sustainable finance products. Subsequently, based on these projections, economic actors can determine whether to participate in sustainable finance in the immediate future, distant future, or abstain from involvement entirely. Hence, the level of endorsement for sustainable finance and the promotion of the transition from conventional to sustainable financing by economic entities rely on their interpretation of the duration of specific sustainable finance products.

2.3.3 The Concept of Resource Theory in Sustainable Finance:

It is hypothesized that the variations in human-produced assets, which can aid in the realization of goals in sustainable finance, constitute the reasoning behind the diverse levels of success witnessed among different nations in reaching their sustainable finance objectives. The contention is posited that particular nations possess superior human-generated assets, providing them with a competitive edge in achieving their sustainable finance goals and transitioning towards sustainable finance, unlike other nations. For instance, certain countries are endowed with ample foreign reserves, fiscal surpluses, minimal external debts, well-established financial sectors, sophisticated financial technology platforms, stringent financial

regulations and oversight, effective climate change monitoring mechanisms, comprehensive sustainability education, a populace inclined towards sustainability, and a significant number of institutional investors willing to partake in sustainable finance mechanisms. Nations endowed with such abundant human-generated assets gain a comparative advantage, enabling them to effortlessly accomplish their sustainable finance objectives and at a swifter pace in comparison to nations lacking these assets. Furthermore, nations with ample human-generated assets can transition more rapidly from conventional/mainstream finance to sustainable finance when juxtaposed with countries experiencing limited foreign reserves, substantial budget deficits, high external debts, emerging financial sectors, inadequate financial technology platforms, deficient financial regulations and oversight, and a scarcity of institutional investors prepared to engage in sustainable finance mechanisms. The principle of resources in sustainable finance proposes that economic entities in nations possessing plentiful human-generated assets can expeditiously attain sustainable finance objectives compared to those in countries with restricted human-generated assets. Hence, each nation should be empowered to progress towards their sustainable finance targets at their individual pace and in accordance with the resources at their disposal. Nations with limited human-generated assets might encounter delays in accomplishing sustainable finance objectives, while others could face obstacles in meeting any of their sustainable finance goals due to constraints in human-generated resources.

2.3.4 The Theory of Positive Signaling:

The proposition posits that economic entities have a tendency to divulge positive information concerning their dedication to achieving sustainable financial objectives in order to convey favorable progress to external stakeholders who may provide backing for their initiatives (Quatrini 2021; Park 2018). Economic entities possess the choice to disclose optimistic details about their intentions for sustainable finance through public declarations in the media or by offering supplementary voluntary financial and non-financial data in their yearly reports. For instance, corporations can present statistics on their most recent sustainable financial tools or eco-friendly bonds to attract investors keen on supporting enterprises with a focus on sustainability. Such revelations aid in drawing investors interested in eco-friendly bonds. Similarly, a government might declare its intention to enact a national strategy for sustainable finance. This declaration not only enhances the nation's standing in terms of sustainability but also showcases the nation's preparedness to receive external technical assistance in implementing a national sustainable finance policy, drawing substantial foreign direct investments geared towards green projects within the country. The potency of the positive signaling theory of sustainable finance lies in the function of information disclosure in mitigating

information gaps between investors and entities. Nevertheless, this theory also presents constraints. Initially, revealing specifics about sustainable finance does not ensure that economic entities will conform to the disclosed information. Moreover, frequent circulation of positive information regarding sustainable financing by corporations could potentially serve as a strategy to mask negative information, such as when a company has recently incurred significant losses in its fossil fuel-related investment portfolio and subsequently announces favorable news about its sustainable investment strategies.

Natural resources play a pivotal role in propelling the process of industrialization, especially in Africa, corroborating the research findings of Nkemgha et al. (2022) concerning African economies. The ample availability of natural resources in Africa leads to additional capital accumulation for the economy through earnings from resource exploitation, which can be channeled towards investments in various industrial sectors. As emphasized by Nchofoung et al. (2022), the provision of foreign aid can impede industrial advancement due to instances of misappropriation by public officials in Africa, where a significant portion designated for development purposes is frequently diverted elsewhere. Furthermore, Gennaioli et al. (2012) contend that an excessive reliance on external sources of financial aid obstructs the operation and progress of manufacturing sectors, a circumstance of particular relevance for regions like Africa, comprised of numerous low-income nations dependent on foreign aid. The excessive dependence on these external funding channels poses the risk of triggering abrupt economic downturns, particularly evident during periods of global crises. This vulnerability was underscored at the onset of the COVID-19 pandemic when international donors decreased their aid contributions, with some even contemplating complete cessation of financial assistance to Africa. These instances underscore the fragility of economies heavily reliant on foreign aid in unproductive sectors.

2.4 Emprical Review:

A cluster of academics has directed their research towards examining the significance of green finance in the sustainable development of China. Li et al. (2021) applied the wavelet power spectrum technique to scrutinize the role of green finance in China following the COVID-19 pandemic. Their primary outcomes substantiated a unidirectional causal linkage between renewable energy and green finance in China. In a recent scholarly inquiry, Zhou and Xu (2022) assessed the impact of green finance on regional ecological advancement in China. The outcomes derived from their analysis utilizing the generalized method of moments (GMM) framework unveiled a U-shaped association between these two variables.

Zhu et al. (2022) have delved into the function of green finance in China's developmental aspirations. By examining yearly data from 1986 to 2019, they

unearthed a positive correlation between green finance and environmental advancement in China. Investigating the nexus between green finance and environmental innovation at the local level in China, Irfan et al. (2022) demonstrated that green finance exerts a positive influence on green innovation across all regions of China through the application of the panel Vector Auto regression (VAR) technique and annual data from 2010 to 2019.

Lin et al. (2022) scrutinized the influence of green finance in curbing CO_2 emissions in China from 2007 to 2018. Validation from a dynamic spatial Durbin model affirmed the efficacy of green finance in reducing carbon dioxide emissions in China. Meanwhile, Zhang et al. (2022) endeavored to ascertain how green finance facilitated green development at the urban city level in China from 2002 to 2019. The principal discoveries underscored the contribution of green finance in diminishing urban energy consumption.

Hou et al. (2022) directed their attention to five provinces in China in 2017 to evaluate the impact of green financial policies on augmenting environmental quality. Employing a difference-in-differences model, they deduced that the effects of green finance vary among the provinces under investigation.

Abbasi et al. (2022) juxtaposed the repercussions of green and fossil fuel energy sources on climate change in China. Through the utilization of dynamic ARDL and annual data spanning from 1980 to 2018, they ascertained that the adoption of green energy yields immediate and enduring beneficial effects on CO_2 reduction. In a separate inquiry, Lin and Qiao (2022) probed the integration of green electricity into daily routines to aid China in mitigating environmental pollution. Their primary findings unveiled that competitively priced green electricity could serve as an incentive for individuals to utilize it, leading to decreased carbon emissions in China.

Zhu et al. (2022) have elaborated on the importance of green energy sources in alleviating CO_2 emissions derived from fossil fuels in rural China between 2007 and 2018. Their findings have underscored the enduring and significant influence of green energy resource development on environmental preservation in rural regions of the nation.

In the investigation by Wang et al. (2023), an examination was conducted on the carbon dioxide emissions related to net energy in China. Through empirical evidence, it was substantiated that the advancement of green energy positively impacts industrial productivity within the country. Similarly, the study by Zhang et al. (2023) affirmed the favorable influence of green energy reservoirs on the expansion of agricultural land in China. The enhancement of agricultural land via policy interventions could be further reinforced by the incorporation of renewable energy sources. A review of recent studies indicates that numerous inquiries have been carried out on green finance in China; however, it is noted that these analyses

lack practical guidance for policymakers. Hou et al. (2022) have demonstrated that the influence of green financing on climate challenges in China significantly varies across different provinces.

In the domain of the interplay involving green finance, green innovation, and industrialization, with green innovation assuming a regulatory function, the existing body of literature seems to be limited. Despite examinations on the correlation between sustainable development, green finance, and industrial structure (Wang and Wang, 2021), along with the mechanisms connecting green finance and green innovation (Huang et al., 2022), the specific tripartite relationship remains largely unexplored. Other research studies have explored the mediating role of green supply chain integration in linking green manufacturing practices and sustainability performance (Afum et al., 2020), the effects of environmental taxation policies on industrialization (TchapchetTchouto et al., 2022), and the impact of gender disparities on the moderating role of green financing in eco-innovations (Saha et al., 2022). Despite the scarcity of literature directly addressing the nexus between green finance, green innovation, and industrialization, the studies outlined in this section propose a feasible connection among these factors. Thus, initiating this investigation could enrich the discourse surrounding the intersection of green finance and industrialization.

A study conducted by Yu et al. (2021) aimed to assess the repercussions of limited access to financial resources on the development of China's green sectors. The research also sought to evaluate the potential of green finance policies in mitigating this issue by fostering innovation in the green sector and minimizing the impacts of financial constraints. The findings indicated that green finance policies notably mitigate the influence of financial constraints on innovation within green sectors. Nevertheless, this impact is more prominent for state-owned enterprises and marginally less discernible for privately-owned enterprises seeking financial backing. Dong et al. (2022) validated that green finance substantially stimulates green innovation across various Chinese enterprises from 2008 to 2020. Prior studies have highlighted that access to green credit boosts corporate research and development, facilitates eco-innovation, encourages upgrades in industrial structure, and technological advancements (Chen et al., 2019; Wu et al., 2019; He et al., 2018). An alternative viewpoint in the literature proposes that direct financing (investment in green securities) proves more effective than indirect financing (green credit) for the progression of green enterprises (Lin et al., 2018).

Wang and Wang (2021) carried out an investigation to examine the impact of green finance on the enhancement of China's regional industrial structure from 2008 to 2020. Through the application of the gray correlation technique, they were able to empirically assess the connection between the variables. Subsequent to the gray

correlation analysis, the GMM model was utilized to comprehend the magnitude and direction of the influence of green finance on the improvement of industrial structure. The outcomes were classified according to distinct industrial levels. The association between green finance and production value was notably conspicuous in the tertiary sector, indicating that green finance exerts the most significant impact in this domain in China, fostering rapid advancement and facilitating the development of the industrial sector. Nevertheless, the results varied across different regions in China, despite all exhibiting positive effects. The study resulted in robust policy suggestions, emphasizing the significance of advancing green technology, educating professionals in green finance, establishing infrastructure for green finance, and enhancing international cooperation. A considerable portion of existing research has predominantly concentrated on developed nations, OECD member states, and the Asia-Pacific region, with limited investigations delving into the correlation between green finance and industrialization in Africa and its sub-regions. This creates an opportunity for the present study to bridge this void and provide policy insights for the region, particularly in economies with low incomes.

Huang et al. (2022) in their analysis explore the mechanisms through which green finance influences green innovation. They utilized data from 30 Chinese provinces spanning the period from 2009 to 2017 and constructed a green finance index. By employing spatial Durbin and panel threshold models, they investigated the interaction between these variables. Their findings revealed a significant positive autocorrelation between green finance and green innovation. Both the coefficients for the direct effect and the indirect effect indicated that green finance was found to have a considerable positive impact on green innovation. Ultimately, in terms of the threshold results, the effect of green finance on green innovation diminishes with the reinforcement of environmental regulatory measures. As a result, they recommend the implementation of governmental trickle-down strategies in managing green finance and consider the relaxation of environmental regulations.

2.5 Gap in Literature:

Most of the empirical studies in this particular context are perceived to be constrained by our existing knowledge. Numerous of these investigations have concentrated on the correlation between green finance and energy, green finance and economic growth, or the modernization of one or more countries utilizing measures like mean GDP and population magnitude. Nevertheless, the study employed African nations that had obtained financing for green climate ventures in 2017 and 2018 as the sample group, with their industrial input to GDP as a measure of performance from 2017 to 2023. It was noted that the funding for industrialization schemes typically has a prolonged duration, thus a seven-year timeframe is considered adequate for forecasting returns.

3.0 Methodology

3.1 **Research Design:**

The research design of this study, which primarily concentrates on the analysis of the causal relationship and influence of green climate finance on industrial development, is grounded in ex post facto and analytical research design. Commencing the examination post-occurrence allows for reliance on existing data. A key feature of ex-post facto research design is the researcher's incapacity to manipulate these variables, rendering it well-suited for this study.

3.2 Nature and Source of Data:

The data were acquired from secondary sources, which are conveniently available as they have been processed and consolidated beforehand. These secondary data are easily found in the World Development Indicator and Green Climate Finance Portal. Therefore, the data collection process depends on documentation methods to gather the essential information on all African nations that received green climate funds in 2017 and 2018.We applied the prevailing exchange rate as at 2017 and 2018 respectively for conversion of CFA, POUNDS STERLIN and any other currency to dollar as were given to these African countries through the African Development Bank (ADB) ,so as to align with time value of money as at that time.

3.3 Model Modification and Adoption:

Wang and Wang (2021) carried out an investigation that analyzed the influence of green finance on the enhancement of China's regional industrial framework spanning from 2008 to 2020. The utilization of the gray correlation technique was employed in order to empirically examine the association between the various variables. Subsequently, the gray correlation technique was substituted with the ARDL model to evaluate the effects of green climate finance on industrial progress within specific African nations between 2017 and 2023.

3.3.1 ARDL Equation:

$IND/GDP_{t-1} = \beta_0 + \beta gcff_{t-1} + INFL_{t-1} + \mu$

IND/GDP = Ratio of industrial contribution to GDP

β_0 = the intercept

$\beta gcff_{t-1}$ = The coefficient of explanatory variable (green climate finance fund) at a time t

$INFL$ = Inflation rate.

t-1 = The lag of time

3.4 Unit Root Test

Statement of Hypothesis:

$H_{0:}$Series has a unit root

$H_1:$ $H_{0\,is}$ not true

Decision: Reject the null hypothesis if the augmented Dickey-fuller statistic (ADF) is more negative than the critical value at 5% level of significance, otherwise accept the null.

Table 1: Unit root Table

VARIABLE	ADF Start	5% critical value	Probability value	Order of Diff
IND/GDP	-3.310140	-2.677544	0.0158	1(0)
GCFF	-5.088098	-2.878212	0.0000	1(0)
INFL	-7.917778	-2.909206	0.0000	1(0)

Researcher's computation
IND/GDP= Ratio of industrial contribution to GDP, GCFF= Green climate finance funds and INFL= Inflation rate.
Table one represents the unit table of all the variables used in the study.The variables are IND/GDP, GCFF and INFL. All the variables are stationary at levels since the probability values of ADF statistics are negative than the critical values at 5%.(-3.310140,-5.088098 and 7.917778).The corresponding 5% critical values are (-2.677544,-2.878212 and -2.909206) .The probability values are 0.0158, 0.0000 and 0.0000 respectively. Based on these outcome, the study therefore reject the null and state that series has no unit root.

3.5. Johansson co-integration Test
Statement of Hypothesis:
H_o:Series is not co-integrated
$H_1:$ H_0 is not true
Decision Criteria: Reject the null hypothesis if the trace statistics is greater than the critical value at 5%, otherwise accept the null hypothesis.
Table 2

Unrestricted Cointegration Rank Test (Trace)		
Hypothesized	Trace	0.05

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.391094	39.44311	29.79707	0.0029
At most 1	0.136012	11.66200	15.49471	0.1739
At most 2	0.060167	3.474987	3.841466	0.0623

Table 2 indicated evidence of one co-integration (at None*) since the trace statistic (39.44311)   is greater than 5% critical value(29.79707) and their corresponding probability value is less than 5% level of significance, therefore the alternate hypothesis is not rejected. This implied that short run deviation can be corrected in the long run. The speed at which this adjustment is made can be determined through the error correction model in table 3.

3.6 Error correction model (ECM)
Table 3
Error correction model table

Sample: 1 186				
Included observations: 61				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.237599	0.078884	-3.011995	0.0039

Table 3 revealed the rate (24%) at which the short run deviation can be corrected and at a significant speed (0.0039) .This implied that it takes a significant speed of 24% to converge in the long run, when there is evidence of short run divergence .

3.7 Test of Hypothesis
Statement of Hypothesis
Statement of Hypothesis in null form:
H_0 :   Green climate finance funds   does not have positive impact on industrial development in Africa.
Decision Criteria: Accept the null hypothesis if the coefficient of the explanatory variable is not positively signed, otherwise reject the null hypothesis.

Table 4
ARDL Model Table

Variable	Coefficients	P-Values	R-Squared	DW-Start	Prob(F-statistic)
IND/GDP		0.5712	0.640353	1.98	0.000000
GCFF	6.57E+08	0.3316			
INFL	3.74E+08	0.3316			

We observed that all the variables were associated with positive coefficients, although they are all non-significant since their probability value are not less than 5% of significance. The 64% as shown by R- squared was explained variation caused by the explanatory variables on the explained variable leaving the 36 % unexplained as a result of omitted variables not accounted for during the estimation .Durbin-Watson stat of 1.98 indicated absence of correlation among the variables, since 2 means perfect absence of correlation .The probability value of F-statistic (0.0000) indicates that, the overall regression is statistically significant. There is evidence of positive coefficient and this implied that null hypothesis is not accepted, therefore, green climate finance funds positively impact industrial development in African.

4.1 Findings:
Green climate finance funds positively impact industrial development in Africa from 2017 to 2023.

4.2 Conclusion and recommendation:
This study adds to the current body of literature on the factors impacting industrialization through an analysis of the roles played by climate finance and green innovations in industrial progress. Of particular importance to the African continent, this research emerges at a juncture characterized by ongoing changes in the global financial arena, alongside an increasing acknowledgment of the necessity to customize financial instruments to address Africa's specific requirements, given its heightened susceptibility to the adverse effects of climate change. Consequently, the evaluation of Africa's management of its industrialization process in the midst of a growing emphasis on green financial mechanisms becomes crucial.
In order to optimize the impact of green finance on industrialization in Africa, a comprehensive strategy is essential. A primary emphasis should be placed on enhancing education and building capacities, especially in rural areas, to support grassroots innovations and facilitate the adoption of large-scale renewable energy

technologies. The effective utilization of green finance for industrial growth is fundamental, necessitating strong regulatory structures and specialized management bodies.

The study proposes that both donors and recipient nations should collaborate closely throughout the implementation phase to ensure proper accountability.

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