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RESEARCH ARTICLE

THE THEORETICAL PAN-AFRICAN EMISSIONS TRADING SYSTEM: A POLICY TOOL FOR CLIMATE CHANGE MITIGATION AIDING SUSTAINABLE ECONOMIC GROWTH IN AFRICA.

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Abstract

African economies are developing, and rising emission levels present a global challenge to the continent. It is imperative that a climate change mitigation strategy is adopted which aids sustainable economic growth in the region. This paper explores the feasibility of adopting an Emissions Trading System (ETS) with a hybrid market-based approach as an innovative socio-economic policy tool and structure; in line with the global policy narrative, for implementing a green vision in Africa. The piece examines the international emissions trading framework, analyses regional case-studies of ETS's, highlights key factors stimulating the African potential, and discusses the benefits and challenges of utilising this tool in the continent. The paper then proposes a theoretical model for a hybrid market-based Pan-African Emissions Trading System (Pan-Af ETS) under the impetus of the African Union (AU) and the Regional Economic Communities (REC'S); owing to ever increasing levels of regional integration and cooperation. The paper further develops multiple experimental methods to implementing the Pan-Af ETS in African countries; emphasising scalability and integration. It concludes by emphasising the potential of Africa to be a global leader in developing and fostering an ecosystem of climate change mitigation married to sustainable economic development, and highlighting key prospects and challenges for the ETS approach in Africa in the future.

Introduction:-

Africa currently holds 16% of the world's people, its population will be 25% of earth by 2050, and more than half of the population growth till 2050 is expected from the region. An overall annual average real GDP growth rate of 5.4% p.a. of the continent from 2000-2010, over 3% p.a. 2010 onwards, the growth of the continent is projected to get even higher. This means Africa is soon going to be a larger player in the world economy, and is likely to experience booming economic growth.

Africa is poised to be the next growth engine of the world, which might inadvertently lead to excessive carbon emissions. Most African countries have ratified the Paris Accord and are obliged to limit their carbon emissions by committing to their nationally determined emissions targets. Hence, innovative strategies have to be adopted to ensure climate change mitigation occurs without hampering economic growth.

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As the global policy narrative shifts towards the adoption of green development policies, it is proposed that African countries adopt a strategy executing the vision of successful climate change mitigation coupled with sustainable economic growth, guaranteeing an international standard of life to the African people.

The adoption of a market-based Emissions Trading System (ETS) is one feasible approach in this direction. The establishment of a Pan-African Emissions Trading System (Pan-Af ETS) can help Africa achieve its emission targets, but more importantly graduate to economies which are clean, sustainable and most conducive to economic and social development.

The Paris Agreement created a framework for countries to cooperate on carbon pricing and carbon markets. This framework is enshrined in Article 6 of the Agreement which allows countries to transfer (trade) mitigation outcomes, build a new mechanism for mitigation, and account and report on emissions reductions that cross international borders. It confirms that a new international carbon market is soon going to exist, and the early adapters will have a clear advantage. As the world gradually adopts sustainable policy mechanisms, Africa can benefit from the opportunity of being an **early-mover** in adopting a progressive public policy tool such as the ETS., and become a global leader

Figure 1: Regions of the African Union

Why Africa?-

The next phase of economic growth is likely to be very strong in Africa owing to the existence of the following reasons-

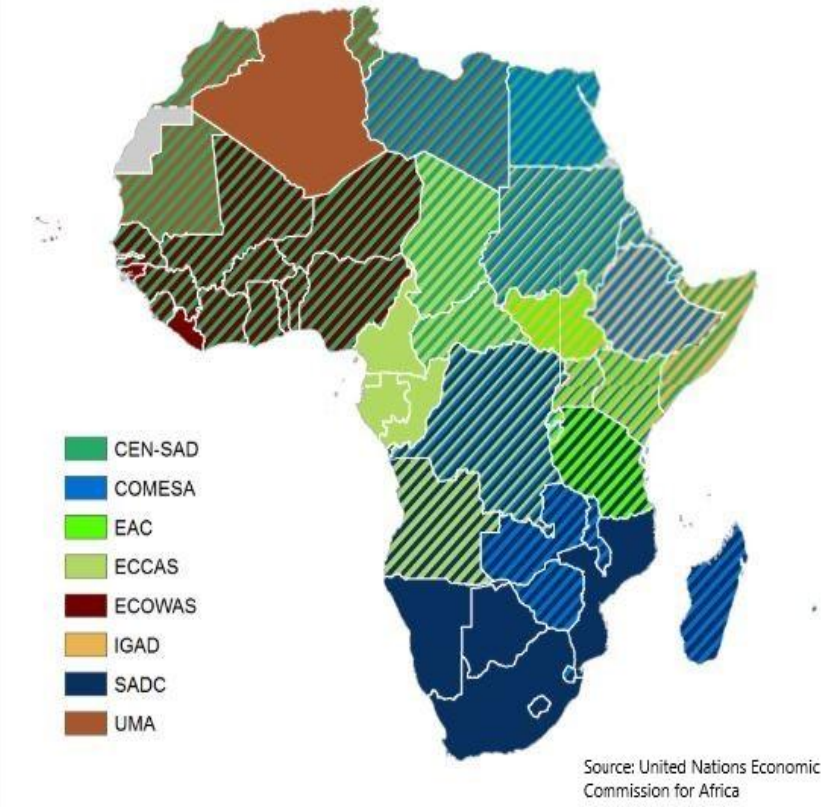
The flourishing Regional Economic Communities (REC's). There are officially 8 REC's recognised by the African Union- 1) The Arab Maghreb Union (AMU/UMA), 2) The Common Market for Eastern and Southern Africa (COMESA), 3) The East African Community (EAC), 4) The Intergovernmental Authority on Development (IGAD), 5) The Community of Sahel-Saharan States (CENSAD), 6) The Economic Community of West African States (ECOWAS) 7) The Economic Community of Central African States (ECCAS), 8) The Southern African Development Community (SADC).

The African Union (AU), REC's and increased collaboration among countries proves that they have a united front. III) Recent creation of the African Continental Free Trade Zone by the members of the AU, and increasing regional

integration. Africa is on the path of streamlined Regional Economic Integration through memberships into the Regional Economic Communities and implementation of an African Continental Free Trade Area (AfCFTA); under the recently enforced African Continental Free Trade Agreement.

The United Nations Economic Commission for Africa has predicted that there will be a 52% increase in intra-African trade compared to 2010 levels by simply streamlining tariffs and the creation of a pan-African Free Trade Zone. Figure 2 depicts the Regional Economic Communities recognised by the African Union.

Figure 2: Regional Economic Communities of Africa



The Economic basis for including developing Africa in emissions reductions mechanisms is that it is theorized that emission cuts are less expensive in developing nations compared to developed nations. An Emissions Trading System (ETS) is one major measure for limiting emissions. Environmental regulation is traditionally weaker in developing countries' which makes it cheaper to adopt new technology. Thus, there could be a large influence on future efforts of Infrastructure decisions made in these countries to limit global emissions.

The recent spurt in investments in Africa, especially by China, European Union, India and other nations confirms the increase in importance of Africa as an emerging strategic geo-political partner, with whom all countries wish to have a strong relationship with. Africa has to utilise this opportunity

Emissions Trading System/Scheme, Carbon Credits and Trading Mechanism explained-

An Emissions trading system (ETS) is a mechanism involving trade in emissions; through which countries help maintain their emission output within internationally liable emission limits, usually agreed upon by an agreement(currently Paris Accord). The Kyoto Protocol serves as the keystone agreement which originally legitimised the concept of an Emissions Trading System.

It utilises a currency; commonly called the carbon credit, which facilitates trade in quantified emissions reductions among participants. This system ensures that countries limit their emissions by holding them accountable to their

internationally binding commitments, such as through enforcing diplomatic measures including sanctions in case of violation.

The Kyoto Protocol of the UN established the concept of carbon markets, Joint Implementation (JI) and Clean Development Mechanism (CDM) as tools for emissions trading. JI and CDM exist till 2020. A Universal Sustainable Development Mechanism is being envisaged as the future governing mechanism under the Paris Accord.

Independent Emissions Trading systems also have been established across numerous countries and groups of countries utilizing various policy instruments and have proven effective in limiting the emissions through the ETS market mechanism such as the European Union ETS (EU ETS).

The Carbon Credit- Past, Present and Future-

Emission Credits (Carbon credits) are the basic units used for trade in the Emissions Trading Systems. It is the currency which has been used for Climate change mitigation. Carbon Credits developed as a concept under the Kyoto Protocol, 1998.

Carbon credit is a credit for greenhouse emissions reduced or removed from the atmosphere from any emissions reduction project, which can be used, by governments, industry or private individuals to compensate for the emissions they are generating. Its mechanism involves one organisation or country which has surplus emission capacity earning carbon credits (1 carbon credit earned= 1 tonne of carbon emissions or equivalent), and being able to trade them with participants wishing to achieve their carbon emission limit targets. They will be able to deduct these carbon credits from overall emissions and hence meet their predetermined emission obligations to the world community.

The Emissions trading systems are supported by this currency, which can denote any emission (Carbon oxides, nitrogen oxides etc.). The denomination of each credit is agreed among participants, an emissions trade market is developed- limits are set, trade occurs and gradually, emissions are cut.

Types of ETS Approaches-

1. There are two main Emissions Trading System approaches (ETS) in practise around the world- Cap and trade system- This is the most common one, also used in the European Union ETS is the largest ETS in the world. In a cap-and-trade system, an upper limit on emissions is fixed, and emission permits are either auctioned out or distributed at no cost according to specific criteria. A central authority (regulator) allocates or sells a limited number of permits to discharge specific quantities of a specific pollutant per time period.
2. Polluters are required to hold permits in amount equal to their emissions. Polluters that want to increase their emissions must buy permits from others willing to sell them. Financial derivatives of permits can also be traded on secondary markets.
3. Baseline and credit system- there is no fixed limit on total emissions, but polluters that reduce their emissions more than they otherwise are obliged to earn ‘credits’ that they sell to others who need them in order to comply with regulations they are subject to.
4. Under this approach emitters are allocated a certain amount of allowed emissions, called the baseline level of emissions. These emitters then must surrender enough emissions credits to account for their emissions above this baseline. Third parties may create the credits through projects implemented and then trade these credits with emitters, or other market participants, hence monetising the green system. Ideally, as the emitter’s baseline is lowered the overall amount of emissions reduces.
5. The important difference with this approach is that emitters are required to purchase offsetting emission credits, and are not under a strict aggregate emissions cap. Credits are created by firms or development projects that either reduce the amount of overall emissions or destroy/absorb existing emissions.
6. Two additional approaches, subsets of the main two exist. These include the Hybrid approach (which is an amalgamation of the main two), and also a Project Based approach (which can be either-cap and trade or on a baseline and credit system).
7. An Emissions Trading System establishes a trading mechanism which works at both-micro and macro levels. It is an innovative policy tool which has multiple applications. Infrastructure decisions made in developing nations could have a very large influence on efforts to limit global emissions. Hence, it is proposed Africa applies this tool.

The Kyoto Mechanisms –Joint Implementation (JI) and Clean Development Mechanism (CDM)-

The Kyoto Protocol was a landmark step in climate change mitigation. It established three cooperative mechanisms designed to help industrialized countries reduce the costs of meeting their emissions targets by achieving emission reductions at lower costs in other countries than they could domestically. It established-

1. International Emission Trading-permits countries to transfer parts of their 'allowed emissions'
2. Joint Implementation (JI) allows countries to claim credit for emission reductions that arise from investment in other industrialized countries, which results in a transfer of equivalent "emission reduction units" between the countries.
3. The Clean Development Mechanism (CDM)- is a mechanism defined in the Kyoto Protocol that provides for emissions reduction projects which generate Certified Emission Reduction units (CERs) for use by the investor. The investor is from a developed country, investing in a developing country country to earn tradable certified emissions reductions. The CDM operates under the economic assumption that emissions cut are thought to be less expensive in developing countries compared to developed countries.

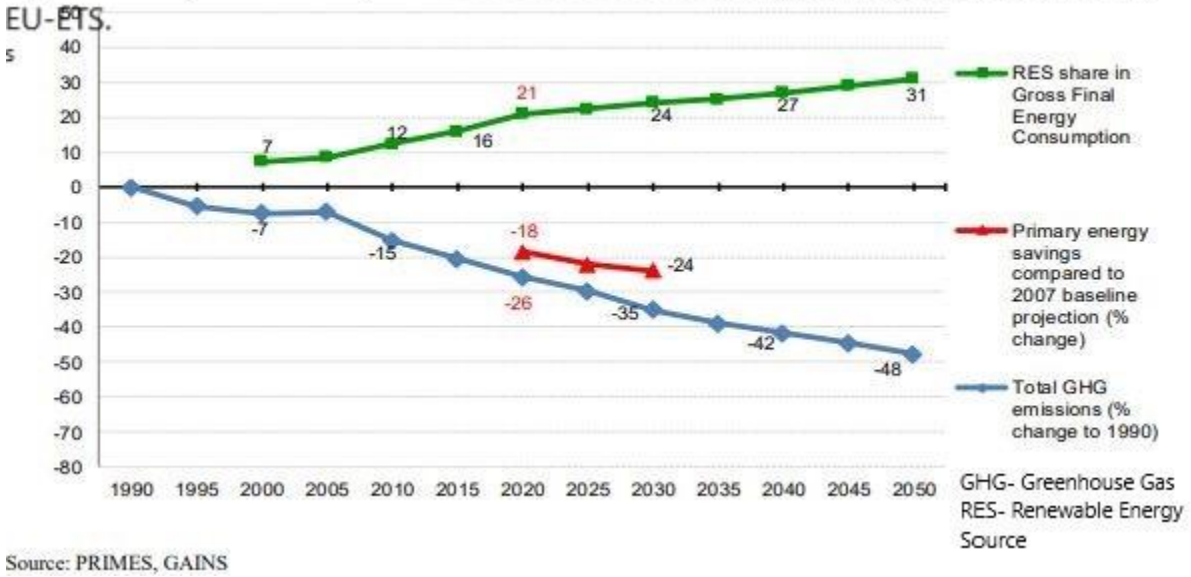
Independent ETS Mechanisms in the world-

The list of pre-existing ETS include

The European Union ETS system- The EU ETS is the cornerstone of the European Union's drive to reduce its emissions of manmade greenhouse gases. It covers over 3 quarters of the international trade in carbon credits at present, and regulates 45% of EU's greenhouse gas emissions. EU has reduced its carbon emissions by 22% from 1990 to 2016 (Figure 3), and is on track for achieving 2020 and 2030 targets well before time.

A limit is put on overall emissions from covered installation's, which is reduced each year. Within this limit, companies can trade (buy or sell) emission allowances as needed. This 'cap-and-trade' approach provides companies the flexibility needed to cut their emissions in the most cost-effective way.

Figure 3 - Projection of Key Indicators in EU due to mitigation strategies, including EU-ETS.



Source: PRIMES, GAINS

As can be observed from Figure 3, the PRIMES prediction model of the EU has depicted a decline in emissions, and increase in utilising renewable resources. It is worth noting economic gains have been lower than estimated possibly due to externalities like- the 2007 financial crisis, subsequent Euro crisis and low prices of carbon credit in the market.

New Zealand- ETS has a functioning New Zealand Unit (NZU) which targets over half of its emissions. The NZ ETS puts a price on greenhouse gas emissions. This price on emissions creates a monetary incentive for businesses emitting greenhouse gases to invest in technologies and practices that reduce emissions.

One key aspect specific to NZ ETS is that it encourages forest planting by allowing eligible foresters to earn New Zealand emission units (NZUs) as their trees grow and absorb carbon dioxide. This national programme is projected to play an essential part in making the country net carbon zero by 2050.

California- ETS in California has led to an annual reduction of carbon emissions by 2% per year while GDP growth has been over 4% annually. New ETSs are operating across 35 countries in 4 continents covering 40% of global GDP.

African Pilot Projects-
A few countries including South Africa, Ghana, Ivory Coast, Senegal among others have at present, and/or have had small scale carbon credit markets in the past as a cornerstone of their emissions management strategy. They have been pilot projects on a micro scale, achieving limited success

South Africa which emits nearly half the carbon di-oxide emissions in entire Africa has been a leader and had 90 registered projects under the Clean Development Mechanism existant under the Kyoto Protocol. Other nations including Uganda, Ethiopia have also experimented with pilot projects in the past.

Businesses also have introduced this into their own framework such as, an electric rental company allows consumers leasing cars in three countries (Ghana, Senegal, Ivory Coast) to offset their carbon emissions with carbon credits earned by green stoves in Ivory Coast.

South Africa, Uganda, Ethiopia all have had a carbon trading mechanism at some point during the Clean Development Mechanism of the past and have existed on an impermanent basis. Progress has been limited, as large scale implementation has not been possible owing to possibly a lack of a coherent carbon trading market structure (ETS). The proposed Pan-African ETS has the potential to solve issues by creating an inclusive market-based framework.

China- Post the United States' backing out of Paris Agreement, China has emerged as a leader along with the EU in exhibiting the importance of a concrete approach to combat climate change by limiting emissions. China had launched in December 2017 its own ETS, which when implemented will cover over a quarter of the world's emissions.

China tested pilot projects in 9 provinces, which conceptualized the development of a nation-wide system. The most effective system from all experiences is being developed, with best practices industry wise. Separate projects across provinces helped experiment with various carbon credit prices whose average per industry helps formulate the most pertinent rules, structure and regulation to be implemented in the long term.

Several other countries have implemented city level projects having the possibility to evolve into large-scale ETS's in the future.

The aforementioned case-studies present successful examples in reducing emissions. The Case studies also provide proof of the willingness of the governments' commitment towards evolving the ETS as a pragmatic approach. It highlights significantly their intent towards adopting a systematic climate change mitigation approach, while positioning their own economies strategically to leverage an opportunity unlocking sustainable economic growth**.**

The Pan-African ETS- a theoretical framework-
A Possible Hybrid Approach-
One potential suitable market structure for an African ETS under the African Union is a **hybrid approach** encompassing the best of other approaches which we now explore**.**
This hybrid approach would include utilising both cap and trade and the baseline and credit based system.

The **main system in the framework** should possibly be a **cap and trade system** which puts a cap on emissions of the respective industry, divides it among businesses, auctions up allowances; hence determining an effective price, while gradually limiting the allowance auctioned at a fixed annual rate. This would finally allow the system to reach its emission target by moving and reaching the limit. This system is likely to stimulate the economy **sector-wise** and **enforce greenhouse emission reductions.**

Complementing this would be a **baseline and credit system** under which businesses emitting under a determined baseline earn carbon credits and **trade** with those who are over-emitting; while **gradually reducing this baseline to move towards this target**. Such a system is likely to provide **additional incentive** to progressive businesses who wish to minimise emissions and maximise efficiency and returns simply because the price of carbon credits will be going higher. This system provides additional incentive to go that extra step to businesses in reducing emissions and implementing best practises and technologies. This hybrid approach would be the ideal scenario.

Such a hybrid approach would **work well for Africa** as it combines the best of the two approaches, and **does not** threaten to **hamstring economic growth** in Africa **due to arbitrary targets** but **rather** a **progressive market-based approach**.

However, it has to be ensured that a system is developed with the most effective rules, structure and mechanism with long-term planning whose benefits in the long-term are going to be extremely tangible and measurable. Such a system also has to be engineered keeping in mind that its **structure is such** that can be seamlessly **integrated into the possibility of a future universal ETS** under the future Sustainable Development Mechanism regime.

This is a system which can be possibly implemented on all scales, both micro and macro with multiple implementation strategies.

It has to be acknowledged that implementation of this idea brings with it a number of challenges, and there are **multiple possible methods for implementing the ETS in Africa affecting its scale-**

1. **Top-Down**
2. **Bottoms Up**
3. **Combination of Top Down, and Bottoms Up**

Top-Down- A top down approach encompasses a trickledown effect where a large scale implementation is led by the institution with the widest ambit of power i.e. African Union in this case. In this approach, a framework is established under the African Union by creation of a legally binding agreement for the establishment of an African-ETS. This ensures public policy among all nations is steered in direction aligned towards the implementation of the pan-African ETS framework.

Further, since domestic policies of each nation will have to ensure laws are passed in order to facilitate carbon finance, investment and trade. This would create a healthy carbon trade environment essential for a successful Pan-African ETS. Domestic Laws of each nation can then further delegate authority to regional, provincial or even district level governments to enact policies aligned with the motive of the ETS.

Further, national and multinational, local level players, even small level businesses have to be enabled to make green decisions and integrated into the ETS. The Private sector is a major stakeholder, and should be made a partner in action. It has to be enabled to launch programmes and products, and all establishments be provided additional economic incentives which endorse and implement these schemes.

As the ETS scheme permeates all levels; including the micro levels, it would ensure accelerated implementation owing to participation being led from the top. It becomes imperative that a systemic inclusion of all levels is essential for a successful Pan-African ETS. What is special to the Top-Down approach is that the process is led from the top when a universal framework is immediately devised, and actors at all levels are enabled. This route is suitable for a large scale pan-African ETS, and promotes collective interest.

Bottoms Up- In this approach, while there is policy declared at the national level, the implementation is initiated through micro level projects at a smaller scale. This approach serves as a litmus test for possible systems structured according to the needs of the country. Countries can launch small pilot projects, or scale up when comfortable.
The utility of this approach is that every country is provided with the freedom of experimenting, evolving and adopting a perfect model for themselves. This can be further be integrated into larger systems progressively. There might exist unilateral or bilateral ETS's, and subsequently multilateral (under REC's) ETS suited to the respective

nations' style might evolve, which would be integrated eventually into the pan-African ETS as envisaged. The Bottoms up route is a more tailor made approach suited to the individual interests of countries.

Combined Top-Down and Bottoms Up- This approach would enable a balanced method of implementing the ETS. This would enable utilising the existing framework of existing Regional Economic Communities (REC's) such as (ECOWAS, COMCAS etc.) and establishing a common ETS within this cluster of nations. The memberships to REC's have been usually based on certain similar characteristics and have a higher level of sustained integration than say the whole of African Union (AU).

This would ensure that clusters are formed among nations of a similar bandwidth, and essentially ensure a higher chance and degree of cooperation between members. In this system, the ETS would grow organically as clusters of nations work together in enforcing universal standards. Benefits include that best standards are going to be established through trial-and-error on the. These best standards would be adopted across Africa and culminate eventually into the envisaged Pan-African ETS.

Note: The Aforementioned section detailed a Theoretical Model for the Pan-African ETS which explores possible alternative ways of implementing such model.

Essential Mechanisms Complementing the ETS-
Here is a list of mechanisms involving possible stakeholders and organisations which are essential towards establishment of a successful pan-African ETS-Carbon ETS Regulator-The Carbon Board of Africa (CBA) will be the central regulatory authority for the African ETS. This regulator oversees all functions related to the carbon credit market. It keeps a check on member states, the carbon credits existing, blockchain technology, enforcement of rules and standards and serves as the central regulator for the ETS. This central regulator will be the authority, and could possibly be placed under the African Union

Centralised Carbon Exchange- The African Carbon Exchange (ACE) will serve as the central African carbon marketplace. A centralised Carbon Exchange market is essential in Africa to ensure that the function of the market is performed. This trading place would serve as an exchange aimed towards facilitating the carbon credit trade, investment and finance.

National Carbon Exchanges- National Carbon Exchanges (NCE's) would help facilitate carbon credit trade within nations and businesses inside them. The more effective and efficient marketplace system that exists, the stronger the ETS functions within the country.

National Carbon Regulators- These regulators would be the central carbon authority within a nation and enforce the best standards.

The aid from all Carbon mechanisms, both-Regulators and Exchanges enforcing stringent measures for the establishment of sustainable capacity development and technology is going to go a long way in realising the African Dream. This would help ensure carbon credits are earned in transparent manner adhering to best standards established by the United Nations and member bodies.

Advantages of an Emissions Trading Scheme for Africa-
Pan African ETS model has multiple advantages for Africa-

Increase in Investments-
It would attract investment in African economies which are the greenest as that would lead to timely mitigation of carbon emissions and meet the respective countries Nationally Determined Contributions (NDC's or carbon emissions reduction goals).

These Foreign Direct Investments or Carbon Investments will be rising in the near future simply because, for example: when a Chinese Manufacturer decides to invest in Africa, he has a dual advantage- Overall income levels in Asian economies are growing. Once high enough, African countries will likely offer **cheapest factors of production-** the trio of land, labour and capital.

Also, the carbon being emitted adds towards the African country's emission, reducing domestic outcomes (for China), and helps reduce emissions on an overall global scale gradually. (Global emissions are an assumed **fixed constant** due to all countries having predetermined total emissions). The ETS allows Africa to trade in its surplus Carbon credits with deficient nations looking to meet their carbon reduction targets.

Now, these investments will in most cases be in Best Available Technologies (BAT's) which are greener, cleaner and more sustainable simply because they are usually relatively cheaper (in terms of real costs) to establish in Africa, than in most other places. There is added incentive of earning carbon credits through greener production and trading the surplus ones for the firms too.

African countries which presently have low carbon emissions (surplus carbon credits), by utilising this market oriented system will be enabled to **successfully monetise the mechanism by trading surplus carbon credits earned, with other countries** (such as India or China who are excessive polluters to meet their emission targets). Surplus African countries trading with others are likely to benefit simply by utilising these carbon credits as an additional source of revenue for the government.

Also, the Firms investing in Africa are likely to **earn carbon credits** (based on pre-existing CDM) when they invest in such technologies while retaining their competitiveness, which would allow them to build brand value and maximise revenues and profits.

Political challenges in Africa-

Africa specific challenges facing the ETS-

1. Political consensus and governance issues- Proper Governance and political stability in countries is essential to move forward with a long-term climate change mitigation plan such as the ETS. Multilateral organisations help in improving the region. Overall, Africa has been committed towards climate change mitigation.
2. Red-Tape and Bureaucratic hurdles- These have plagued many African nations, while situation has been improving in several places on many fronts. Many nations have been successful in improving their World Bank's Doing Business rankings and global investor sentiment has improved. These include a number of inconsistent regulations too.
3. Primitive Infrastructure - Primitive infrastructure has posed a significant constraint in enabling the African nations towards rapid sustainable economic growth. Sustainable state capacity building measures are essential.
4. Disagreement between nations- Nations often disagree with each other, owing to diplomatic goals requiring adherence to foreign policy which often leads to stand-offs. Harmonious resolution of any disputes arising, and understanding that cooperation is better than conflict is essential.
5. High Tariff Rates- These may not directly affect the ETS, but high tariff rates have a huge bearing on intra-African trade. The Africa Continental Free Trade Area should reduce these and bolster cooperation.

Common Hindrances to ETS and Future Possibilities-

At present, the first major hindrances to widespread adoption has been the **low price of the carbon** credit, but eventual creation of emissions trading markets globally offers a solution. The average price in Beijing during pilot had been 10 USD, and in the EU it has been between 10-11 USD.

These prices are likely to go higher as the Paris Agreement gets enforced and widespread adoption of an ETS around the world takes place because of international commitments. Basic market determinants of higher supply and higher demand are likely to lead to a larger market, and a higher price.

The Second issue affecting the ETS was that its currency, the carbon credit faced **certain bottlenecks in the past**. These issues specifically related to the **creation of multiple units, lack of transparency in the issuing process, duplication of the carbon credits** all of which were major challenges. All these issues boiled down to the **lack of technology** enabling a mechanism which tracks carbon credits in real time, mines them and allocates them at a set rate, simultaneously in a pre-defined manner. The **invention of Block-chain technologies** is a huge boon and is a possible solution to ensure carbon credit authenticity and real time tracking without any manipulation.

Such blockchain solutions to manage an emissions trading currency and the ETS will ensure there is a set standard, by utilizing **elements** of the block-chain and other computational technology which **keeps track of the units**

created, stored, transferred and traded and will have wide-ranging implications in the future of emission trade and carbon finance. This enforces the vision that every emission credit is equal to other, and no fraudulent ones can be created sealing the system from possible leakages.

The Third issue has been reluctance in adoption of this **relatively new approach**. A fundamental question exists which questions the existence of such an offset mechanism, and why use it as an alternative to direct enforcement of carbon reduction by banning, taxing etc. The simple answer figured in public-policy is that two complementary measures exist- direct decrease in carbon and greenhouse emissions through tax, and/or carbon emission reduction through a market based approach such as ETS

The first measure is not completely effective, as it does not guarantee decline in emissions. In the second measure, offsets of one project's emission reductions in an industry can be offset with another project, which is usually more cost effective. It leads to an overall reduction in carbon emissions, without disincentivising any specific industry/sector of an economy to move to a more competitive country to set up operations.

Conclusion:-

Africa has developing countries which are soon bound to experience major economic growth. This is going to lead to a significant increase in greenhouse gas emissions. Countries in Asia, while having unlocked economic growth and increase in income levels, are already battling adverse effects of pollution and have also contributed to phenomenon such as global warming leading to irreversible climate-change.

The International Community has highlighted its intent towards adopting innovative tools such as an ETS through the United Nations via the Kyoto Protocol in the past; and the Paris Accord most recently to mitigate climate change.

Hence, it is imperative that an approach is adopted by Africa which mitigates climate change and complements sustainable growth. The Pan-African ETS is a theoretical framework intended towards achieving this goal. It would help streamline the interests of all members of the African Union and align them in a common direction of overall prosperity, through sustainable economic growth.

Having evaluated in this paper, the ETS is now feasible to implement in Africa due to elements including- shift in global narrative, success in reducing emissions, possibility of both micro-macro level independent existence of ETS, newer technology such as Block-chain for transparency, deeper level of integration through AU, REC's and the African Continental Free Trade Area.

Climate Change mitigation strategy in the form of ETS is a strong economic opportunity.ETS has benefits and is being globally adopted. ETS systems already exist in various parts of the world, and have been piloted in others with mostly positive results. Case studies such as the European ETS highlight positive results in emissions reductions and development.

The case for an ETS is strong because it aids and complements economic integration and growth, and could possibly be a strong dual-climate change mitigation and sustainable economic development strategy for Africa. There are several challenges, but also a lot of potential. Africa can be the leader in climate change mitigation and prove that mitigation strategies can also be economically rewarding. With possible benefits extremely high, and very low risk, it is about time the African policymakers develop and launch the Pan-African ETS.

References:-

1. United Nations, Department of Economic and Social Affairs, Population Division. "World Population Prospects: The 2017 Revision."https://population.un.org/wpp/Graphs/DemographicProfiles/ (Accessed August 5 2018)
2. UN Department of Economic and Social Affairs, "World population projected to reach 9.7 billion by 2050", 2015, In un.org, https://www.un.org/en/development/desa/news/population/2015-report.html
3. Acha Leke, Dominic Barton, "3 reasons things are looking up for African economies", In weforum.org https://www.weforum.org/agenda/2016/05/what-s-the-future-of-economic-growth-in-africa/

4. Acha Leke, Dominic Barton, “3 reasons things are looking up for African economies”, In weforum.orghttps://www.weforum.org/agenda/2016/05/what-s-the-future-of-economic-growth-in-africa/).
5. Climate Analytics, “Paris Agreement Ratification Tracker”, 2018, In climateanalytics.org, https://climateanalytics.org/briefings/ratification-tracker/
6. United Nations Secretariat, “The Paris Agreement”, In unfccc.inthttps://unfccc.int/sites/default/files/english_paris_agreement.pdf)
7. Sahel and West Africa Club Secretariat, “The Six Regions of African Union” In west-africa-brief.org, 2017, http://www.west-africa-brief.org/content/en/six-regions-african-union
8. African Union Secretariat, “Regional Economic Communities” In au.int, (https://au.int/en/organs/recs)
9. African Trade Policy Centre of Economic Commission for Africa, African Union Commission, “African Continental Free Trade Area, Questions and Answers”, In au.int, March 2015: P.1,4-6 , (https://au.int/sites/default/files/documents/33984-doc-qa_cfta_en_rev15march.pdf,
10. African Trade Policy Centre of Economic Commission for Africa, African Union Commission, “African Continental Free Trade Area, Questions and Answers”, In au.int, March 2015: P.1 , (https://au.int/sites/default/files/documents/33984-doc-qa_cfta_en_rev15march.pdf)
11. Loes Witschge, “African Continental Free Trade Area: What you need to know”, In Aljazeera.com, 20 March 2018(https://www.aljazeera.com/news/2018/03/african-continental-free-trade-area-afcfta-180317191954318.html)
12. UNECA, “Regional Economic Communities”, In uneca.org, https://www.uneca.org/oria/pages/regional-economic-communities
13. M. Grubb, "The Economics of the Kyoto Protocol", In World Economics, July–September 2003, p. 159
14. José Goldemberg, et al. “Introduction: scope of the assessment”. p.30
15. J Sathaye, et al., "Barriers, Opportunities, and Market Potential of Technologies and Practices”, In Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change 2001,(B. Metz et al. Eds.) (Cambridge University Press, Cambridge, U.K., and New York, N.Y., U.S.A.), p. 387-389
16. Bonnie Fisher; et al, "Development trends and the lock-in effect of infrastructure choices”, In (book chapter): Issues related to mitigation in the long term context. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (B. Metz et al. Eds.)", 2007, https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch3.html
17. United Nations Secretariat, “The Kyoto Protocol”, In unfccc.int, 1998 https://unfccc.int/resource/docs/convkp/kpeng.pdf
18. Lary Gilman, “Carbon Credits”, Climate Change: In Context, In Encyclopedia.com. (https://www.encyclopedia.com/environment/energy-government-and-defense-magazines/carbon-credits)
19. United Nations Secretariat, “The Paris Agreement”, In unfccc.inthttps://unfccc.int/sites/default/files/english_paris_agreement.pdf)
20. European Union, “The EU Emissions Trading System (ETS)”, 2016, In ec.europa.eu https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf
21. United Nations Secretariat, “The Kyoto Protocol”, In unfccc.int, 1998 https://unfccc.int/resource/docs/convkp/kpeng.pdf
22. Lary Gilman, “Carbon Credits”, Climate Change: In Context, In Encyclopedia.com. (https://www.encyclopedia.com/environment/energy-government-and-defense-magazines/carbon-credits)
23. Wikipedia, The Free Encyclopedia, “Carbon Credit”, In wikipedia.org, https://en.wikipedia.org/wiki/Carbon_credit
24. Organisation of Economic Cooperation and Development, “Emissions Trading Systems”, In oecd.org (https://www.oecd.org/env/tools-evaluation/emissiontradingsystems.htm
25. European Commission, “The EU Emissions Trading System (ETS)”, 2016, In ec.europa.eu https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf
26. Australian Parliament, “Emissions Trading”, 19 November 2010, In aph.gov.auhttps://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/ClimateChangeold/responses/economic/emissions/emissionstrade
27. Organisation of Economic Cooperation and Development, “Emissions Trading Systems”, In oecd.org (https://www.oecd.org/env/tools-evaluation/emissiontradingsystems.htm
28. Fisher; et al, "Development trends and the lock-in effect of infrastructure choices” 2007, https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch3.html
29. United Nations Environment Programme, “Introduction to the CDM”, In unfccc.in,https://unfccc.int/files/cooperation_and_support/capacity_building/application/pdf/unepcdmintro.pdf (Accessed 5 September 2018)
30. M. Grubb, "The Economics of the Kyoto Protocol", p. 159
31. José Goldemberg, et al. “Introduction: scope of the assessment”, p.30

32. Eurostat, “Greenhouse gas emissions statistics-emission inventories”, June 2018, In ec.europa.eu,https://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics
33. European Commission, “Progress made in Cutting Emissions”, in ec.europa.eu, https://ec.europa.eu/clima/policies/strategies/progress_en
34. European Commission, “The EU Emissions Trading System (ETS)”, In ec.europa.eu, 2016 https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf
35. European Commission, “Economic Analysis”, In ec.europa.eu, https://ec.europa.eu/clima/policies/strategies/analysis_en
36. Erik Rudenstam, Robert Tadell, “Assessing the EU Emissions Trading System’s Impact on Economic Growth”, In Bachelor Thesis, University of Gothenburg, Spring 2016: p.13-14 https://gupea.ub.gu.se/bitstream/2077/39766/1/gupea_2077_39766_1.pdf
37. European Commission, “EU Reference Scenario 2016, Energy, Transport and GHG Emissions trend till 2050, Main Results”, In ec.europa.eu, 2016: p.14https://ec.europa.eu/clima/sites/clima/files/strategies/analysis/models/docs/20160712_summary_ref_scenario_en.pdf
38. Ministry of Environment, New Zealand, “New Zealand Emissions Trading Scheme”, In mfe.govt.nz, https://www.mfe.govt.nz/climate-change/new-zealand-emissions-trading-scheme/about-nz-ets
39. Sebastian Postic, “Carbon pricing policies around the world : case studies in 2015”, 2015, In 14ce.org,https://www.i4ce.org/go_project/put-a-price-on-carbon-different-models-of-carbon-pricing-around-the-world/
40. Katie Sullivan, et al. “CALIFORNIA: An Emissions Trading Case Study”, January 2018, In ieta.org, https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2018/California-Case-Study-Jan2018.pdf
41. Trusha Reddy, et al. “Carbon Trading in Africa: A Critical Review”, 2011, In Institute of Security Studies, Monograph Number 184, https://issafrica.s3.amazonaws.com/site/uploads/Mono184.pdf
42. Reddy, et al “Carbon Trading in Africa: A Critical Review”, 2011: p:47-50, 63-65
43. UNFCC, “Carbon Trading Within West Africa Marks New Milestone”, 6 August 2015, In unfccc.in, https://unfccc.int/news/carbon-trading-within-west-africa-marks-new-milestone).
44. Jocelyn Timperley, “How will chinas new carbon trading scheme work”, 29 January 2018, In carbonbrief.org, https://www.carbonbrief.org/qa-how-will-chinas-new-carbon-trading-scheme-work.
45. Stefano De Clara, et al. “JAPAN: MARKET-BASED CLIMATE POLICY CASE STUDY”, 2016, In ieta.org, https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2016/Japan_Case_Study_2016.pdf
46. Jeff Swartz, et al. “INDIA: AN EMISSIONS TRADING CASE STUDY”, May 2015, In ieta.org, https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2015/india_case_study_may2015.pdf
47. Climate Analytics, “Paris Agreement Ratification Tracker”, 2018, In climateanalytics.org, https://climateanalytics.org/briefings/ratification-tracker/
48. World Bank Group, “Doing Business Report 2016”, 2016, In doingbusiness.org, http://www.doingbusiness.org/en/reports/global-reports/doing-business-2016
49. Benjamin Storrow, “Carbon prices are too low to reduce emissions”, 20 September 2018 In scientificamerican.com,https://www.scientificamerican.com/article/carbon-prices-are-too-low-to-reduce-emissions/
50. J. Timperley, “How will chinas new carbon trading scheme work”, 29 January 2018, In carbonbrief.org, https://www.carbonbrief.org/qa-how-will-chinas-new-carbon-trading-scheme-work
51. Carbon Tracker Initiative, “EU carbon prices could double by 2021 and quadruple by 2030”, 26 April 2018, In carbontracker.org, https://www.carbontracker.org/eu-carbon-prices-could-double-by-2021-and-quadruple-by-2030/
52. Melanie Swan, “Blockchain- Blueprint for a New Economy”, (Sebastopol, California: O’Reilly Media Inc, February 2015, First Edition),Inhttps://books.google.co.in/books?hl=en&lr=&id=RHJmBgAAQBAJ&oi=fnd&pg=PR3&dq=blockchain+&ots=XQuDA2XOf1&sig=oYarFT1qiNvS1VmodRj6Ms_VFts#v=onepage&q=blockchain&f=false
53. Vimi Grewal-Carr, Stephen Marshall, “Blockchain Enigma. Paradox. Opportunity”, 2016, In deloitte.com, https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte-uk-blockchain-full-report.pdf .