International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

Carbon Intensity Reduction in Trade and Its Implications on Economic Development (A Case Study between China and Ghana International Trade)

Nelly Ataawomba Afuubi[1*] Li Fanglin[2] Emmanuel Owusu[3]

1. School of Finance and Economics, Jiangsu University, 301 Xuefu Road, Jingkou District, Zhenjiang, Jiangsu, China

2. School of Statistics, Jiangsu University, 301 Xuefu Road, Jingkou District, Zhenjiang, Jiangsu, China

3. School of Finance and Economics, Jiangsu University, 301 Xuefu Road, Jingkou District, Zhenjiang, Jiangsu, China

Submitted: 25-06-2021 Revised: 04-07-2021 Accepted: 07-07-2021

ABSTRACT

Economic development has been the priority over centuries and still remains a key reason for trade between countries. According to OECD, increased trade activities between nations can have negative and positive effect on the natural environment. In recent years, environmental quality advocacy has intensified, leading countries to work on making trade less negative for the environment. Environmental issues have become a greater concern currently and countries are under some pressure to reduce their negative impacts such as degradation and pollution on the environment. The abundance of carbon dioxide is perceived to be the biggest negative player in destroying the environment. This research paper seeks to analyze the impact on Ghana's economy due to reduction in China's Carbon intensity in trade. Ghana is a major importer of Chinese manufactured products mainly because of cheap prices and any policy or practices such as China's move away from coal energy, capping of carbon, putting a price on carbon and other green practices is likely to impact the economy of dependent countries such as Ghana economically.

Keywords: Carbon intensity; environmental quality; trade and investment cooperation; Green economy; Ghana; China; pollution haven; capping carbon.

I. CHAPTER ONE: RESEARCH BACKGROUND

1.1 Introduction

Trade and investment cooperation is an influential factor for economic development between countries. Over the past centuries, humans have focused more on their economic gains than their environmental quality of life. The need for resources to feed industrial plants has increase substantially. According to the Kuznets curve various indicators of environmental degradation tends to get worse as modern economic growth occurs until average income reaches a certain point over the course of development (Shafik, 1994). Researchers over the years have modelled the link between environmental pollution and economic growth. (Azam et al. 2016; Baek 2015; Burnett et al. 2013; Chen 2015; Dogan and Seker 2016b; Feng et al. 2015; Lee and Oh 2015; Liu et al. 2016; Lorente and Álvarez-Herranz 2016; Mensah 2014; Michieka et al. 2013; Onafowora and Owoye 2014; Ramakrishnan et al. 2016; Song et al. 2008; Wang et al. 2016; Zou et al. 2016). The byproducts such as carbon dioxide, slurry and industrial waste ejected into the environment has affected the environment substantially. The effects of our past decisions have led to environmental impacts that are being felt in our present days. These effects include climate change which has led to rises in sea level and causing loss of habitats around coastal areas, unpredicted weather conditions leading to natural disasters like floods and wildfires, acid rains that has caused damages to infrastructures such as bridges and buildings. These impacts currently felt has led to world leaders meeting to usher in the historic Paris Agreement within the United Nations Framework Convention on Climate Change which deals with greenhouse gases emissions mitigation, adaptation and finance.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

1.2 Statement of Problem

China has pledge to be a major player in the field of mitigating climate change and has plans to reduce its carbon emission in order to achieve its pledge towards the Paris Agreement. According to the Ministry of Ecology and Environment, China reduced its carbon intensity by 18.8% in the five years through 2020 and continuous to reduce their carbon emission. With such pledge could arise a positive or negative impact on its trade and investment to a country like Ghana who depend heavily on China for trade and investment.

1.3 Justification of research

China over decades have been developing tremenduously, currently the world's second economic powerhouse and gradually taking on international roles in the economic sphere such as the G20 summit which made emphasis on innovation and green financing, has made major trade and investments strides in Africa in the likes of Sudan, Nigeria, South African and other developing country in the west African region like Ghana and there is no doubt a major policy taken by the Chinese will not affect Africa and the world as a whole. According to Wikipedia, The Chinese have been involved in many investment projects such as the construction of the Bui Hydroelectric dam and also an interest free loan to construct The Ofanko Nsawam road which is a major project to the Ghanaian economy. The Chinese have also invested immensely in the Ghanaian fishing industry and The Afife rice project. China has provided substantial technical support to Ghana with more than 700 Ghanaians having attended Chinese-funded training courses in education, trading, communication, energy, auditing, agriculture and fisheries operation.The world is becoming more conscious about environmental protection and as discussed by researchers can lower economic growth in a scenario where countries carbon emissions, an important contributor to environmental pollution are reduced. This research seeks to analyze China's carbon emission reduction impact on the Ghanaian economy.

The research is also a source of information for Chinese and Ghanaian investors to identify prospects that may arise when China makes efforts to reduce its carbon emissions.

This research seeks to examine the trade and investment cooperation between Ghana and China over the period of time, how this cooperation has benefited both countries and what impacts, both negative and positive can be felt in a regime where China sets up a policy to reduce its carbon emissions.

1.4 Research objectives

The objectives of this research is to

- Analyze trade and investment cooperation between Ghana and China.
- China's carbon emission reduction, its negative and positive impacts for the Ghanaian economy.

1.5 Research Questions

- What are the negative and positive impacts of China's carbon emission reduction impacts?

1.6 Research design and framework

1.6.1 Research design

This research seeks to study how partial equilibrium effects of carbon restriction model and other trade theories; The Heckscher-Ohlin theory and world systems theory can be used to explain the impact of China's carbon emission reduction policy on the Ghanaian economy.

1.6.2 The partial equilibrium effects of carbon restriction model

The partial equilibrium effect of carbon restriction is a condition of economic equilibrium which takes into consideration a part of the market (carbon emission) to attain equilibrium. It was also defined by George Stigler as one based on restricted range of data, a standard example is the price of a single product, while the prices of other products are held fixed during analysis. This research will use the ideology of the partial equilibrium effects of carbon restriction to explain how prices of commodities will be affected. Under this model, carbon is seen as a goods and its demand and supply determines the price of Carbon.

1.6.3 World systems theory

This study will use the world systems theory in elaborating the economic and trade cooperation between Ghana and China. The world systems theory viewed the world as a global village that can be easily divided into different social and economic strata. Verma (2006) asserts that the world systems theory recognizes the inter-dependency of Nations; as no one country is self-sufficient and capable of meeting all its needs. The theory explains the need for one nation to focus in areas of comparative advantage and use what it has as bargain with other nations to get what it does not have. The theory also believes that the world is a global village an entity where an event in one would definitely affect the other. This can be related to the situation of the fall in demand of cocoa and the sluggish world economy which affected Ghana. Another clear example is how the South African economy was affected in light of China's policies to tackle overcapacity in the steel

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

industry. The world theory has been defined by Wallerstein (2000), as a social system that has boundaries, structures, group rules of legitimacy and coherence. The systems life is made up of conflicting forces which holds it together by tension and tears it apart as each group seeks eternally to remold it to its advantage. With this brief outline, the world systems theory was introduced because it suits the purpose of this study in analyzing the economic and trade cooperation between Ghana and China under the carbon emission restriction regime.

1.6.4 Heckscher-Ohlin (HOV) theory (Factor Proportions Theory)

Swedish economists, Eli Heckscher and Bertil Ohlin's theory is based on a country's production factors-land, labor, and capital, which provide the funds for investment in plants and equipment. They determined that the cost of any factor or resource was a function of supply and demand.Their theory, also called the factor proportions theory, the Heckscher-Ohlin theory (HOV theory); the classical, country-based international theory states that countries would gain comparative advantage if they produced and exported goods that required resources or factors that they had in great supply and therefore were cheaper production factors. In contrast, countries would import goods that required resources that were in short supply in their country but were in higher demand. The theory of comparative advantage makes us to understand that countries trade with each other in goods and services because of the concept of differentials in the natural resources, human capital, financial capital and technical capabilities endowment of nation. Therefore, Ghana, one resource endowed nation with vast reserves of oil and gas, gold and other mineral resources needs China's financial and technical assistance in the development of its poor infrastructure and China also needs Ghana's natural resources like fuel and gold to fuel and feed its growing industry. This theory is important to this study because it is based on the fact that no country can produce all goods and services which people require for their consumption largely owing to resources differences and constraints. Therefore, the economic cooperation between Ghana and China under a carbon emission restriction policy can affect Ghana positively. The United Nations Conference on Trade and Development (UNCTAD) consistently find that FDI in the region is mainly for natural resources and that countries such as Nigeria, Egypt, Angola and South Africa (that have huge natural resources) usually attract most of the FDI flowing into the region every year. Asiedu [2006] therefore observed that in addition to the natural resource endowment, large markets, and good infrastructure and as efficient legal framework should be used by African countries to promote FDI inflow.

II. CHAPTER TWO: LITERATURE REVIEW

1.7 Overview of international trade in China

China's economy, in recent years, has opened up to huge foreign trade through its 'opening-up strategy'. Major reforms have been undertaken beyond those initial reforms in the early 1980s (Jaggi et al. 1996). In the mid-1990s to the early 2000s, most of the state-owned enterprise firms were privatized and massive trade and tariff reduction were embraced. In 2001, China became the 143rd country to join the WTO. Ever since, China joining the WTO, China has also embarked on transformational reforms such as bilateral trade, agreements with Europe and USA and its participation in the Asia-Pacific Economic Cooperation (APEC). Trade reforms account for China's increasing economic growth (Michieka et al. 2013).

Remarkably, in 2013, the Government of China commenced the New Silk Road Economic Belt. This economic belt is a regional development program that promotes partnership amongst neighbouring countries in quest to promote trade. It is exceptional and distinct in the sense that this economic belt envisions the creation of the world's biggest ever single market spanning across the largest landscape defining the Eurasia (China Briefing 2015). The Silk Road Economic Belt has commissioned both the overland and maritime routes that provide two distinct transportation corridors that connects Xi'an in West China to Duisburg in Germany and Rotterdam in the Netherlands (China Briefing 2015). The marine route connects South China to the North and East Africa by way of Vietnam, Malaysia, Indonesia, Sri Lanka and India. This economic belt is popularly referred to as the One Belt, One Road (OBOR). It has key prospects not only for China but also for the entire world.

1.8 Trade and Investment between Ghana and China

A research conducted by Crentsil Kofi Agyekum, Huang Haifeng, Amma Agyeiwaa of Beijing University of Technology in 2015 came out with the conclusion that One would say China had had a long-standing aid relationship with Ghana dating back to the 1960s. However, Chinese aid is only a small percentage of the total development

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

assistance. In most West African countries, such trade represents a significant share gross domestic product. West Africa's trade integration with China has accelerated over the last 6 years, and Chinese trade currently accounts for an inordinate share of West African trade flows. Trade with China has yielded higher export revenues as well as lowering prices for both consumer and capital goods. West Africa has been registering expanding trade deficit with China, partly because of consumer demands for relatively cheap Chinese products, and partly because of the import-content requirements that are frequently included in Chinese development assistance agreements. On the issue of import, Ghana's imports from China have increased consistently over the past few years, from $96 million in 2000 to $503 million in 2006, mirroring the overall increase in Ghana's total imports. This increase has been largely fueled by a growth in manufactured goods imports and this observation has significant negative implications on the development of Ghana's industrial sector. On the other hand, the availability of cheap manufactured goods may increase overall welfare of Ghanaians, especially low-income consumers. Over the years China has become an important source of Ghana's imports. The rising share of Ghana's imports from China and the more diversified imports relative to falling market share of other countries can be traced partly to the competitiveness of China's imports compared to other traditional sources of Ghana's imports. Part of the causes of Ghana's looking increasingly to China was the Structural Adjustment Program that not only encouraged increased liberalization of imports but created an austerity environment that made importers look towards cheaper sources. In the context of explaining China-Ghana trade, the commodity composition of trade clearly suggests that resource endowment explain much of the trade in primary commodities while competitive advantage explain most of the manufactured goods. In other words, because China has productivity advantage in manufactured goods it exports more of these goods to Ghana, whereas Ghana is endowed with huge primary resources and thus exports more primary goods to China. Apart from this, it was reported that Ghana's businessmen import sub-standard products from China by ordering lower quality product specifications. This was confirmed by firms in China which said Chinese firms do not produce sub-standard goods generally but produce to Ghana importers' specifications. Chinese products are of different grades of quality and are targeted at different types of consumers. Most of the Chinese products in the Ghanaian markets are of low quality and the prices are relatively low. Thus they basically meet the demand of low income groups. To a reasonable extent these groups of consumers benefit from inflow of Chinese products. Although Chinese producers have access to cheap labor and excellent infrastructure, access to large market such as provided by Ghana promoted economies of scale and has salutary effects on the prices on Chinese manufactured goods. Over the past decade, Ghana has benefited significantly from investment inflows from China and India. In 2004, India became the main source of foreign investment, followed by China. Between 1994 and 2006, India registered a total of 256 projects with 37 percent of them being in the manufacturing sector and 16 percent in general trade. China followed with a total of 249 projects registered, 34 percent of these in the manufacturing sector and 19 percent in general trade [GIPC, 2006]. Manufacturing is the most significant activity for Chinese immigrants in Ghana. Results from the study Decai Tangand K.B. Gyasi shows that, about 80% or more of investments from China has been mostly concentrated in the Manufacturing, Building & Construction and General Trade sectors of the economy of Ghana for the past five (5) years.

1.9 The Economy and Environment

Economic growth from our trade activities have been a priority over centuries and will remain a key reason for trade between nations.

Maizels (1963) discussed the positive relationship between international trade and economic development. Kavoussi (1984), after studying 73 middle and low-income developing countries, found out that higher rates of economic growth were strongly correlated with higher rates of export growth. He showed that the positive correlation between exports and growth holds for both middle- and low-income countries, but the effects tend to diminish according to the level of development. Balassa (1986) and Dollar (1992) argued that outward-oriented developing economies achieve indeed much more rapid growth than inward-oriented developing ones. Sachs and Warner (1995) constructed a policy index to analyze economic growth rate, and found that the average growth rate in the period after trade liberalization is significantly higher than that in the period before liberalization. In sum, most empirical studies support the positive effects of openness on economic growth. Will the world be able to sustain economic growth indefinitely without running into resource constraints or despoiling the environment beyond repair? According to (Meadows et.al) Economic growth caused environmental decline

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

and could not be sustained forever. Georgescu-Roegenand Meadows et al.,growing economic activity (production and consumption) requires larger inputs of energy and material, and generates larger quantities of waste by-products. According to Daly (1991) Furthermore, it is argued that degradation of the resource base will eventually put economic activity itself at risk. To save the environment and even economic activity from itself, economic growth must cease and the world must make a transition to a steady-state economy.

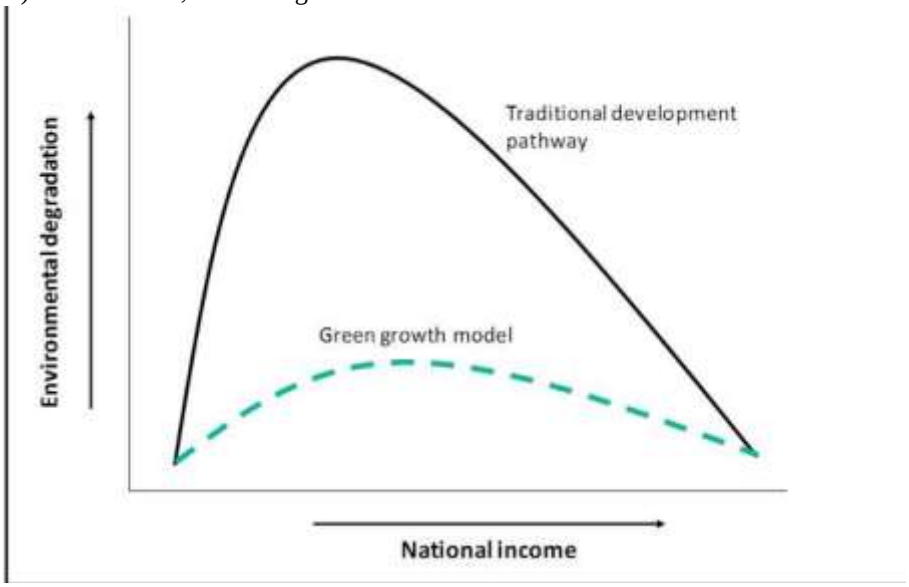

FIG. 1 The graph above explains the extent of environmental degradation in a traditional growth model and in a green growth model.

Trade openness is a great idea but when not managed with effective policies could increase the decline in environmental quality. Currently, the negative impacts of the world's economic activities and other human activities have led to increased Carbon dioxide concentration, fertilization of ecosystems, acidification of the surface of th ocean and greenhouse effect like climate change. These impacts are being felt all over the world including countries that have not had a great economic growth as compared to the world's most developed nations. Negative impacts such as Climate change which causes flooding poses a threat to human existence. According to (Tang et al., 2000), Total precipitation will increase in the future as a result of climate change. Since the beginning of the Industrial Age, the concentration of Carbon dioxide in the atmosphere has increased by about 30% from 280 to 370ppm (Herzog et al., 2000). Climate change mitigation is a world issue and needs to be managed now. The Paris Agreement which is legally binding to countries that have ratified it is obliged to curb pollutions from its economic activities in order for the world to meet its objectives on climate change mitigation.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

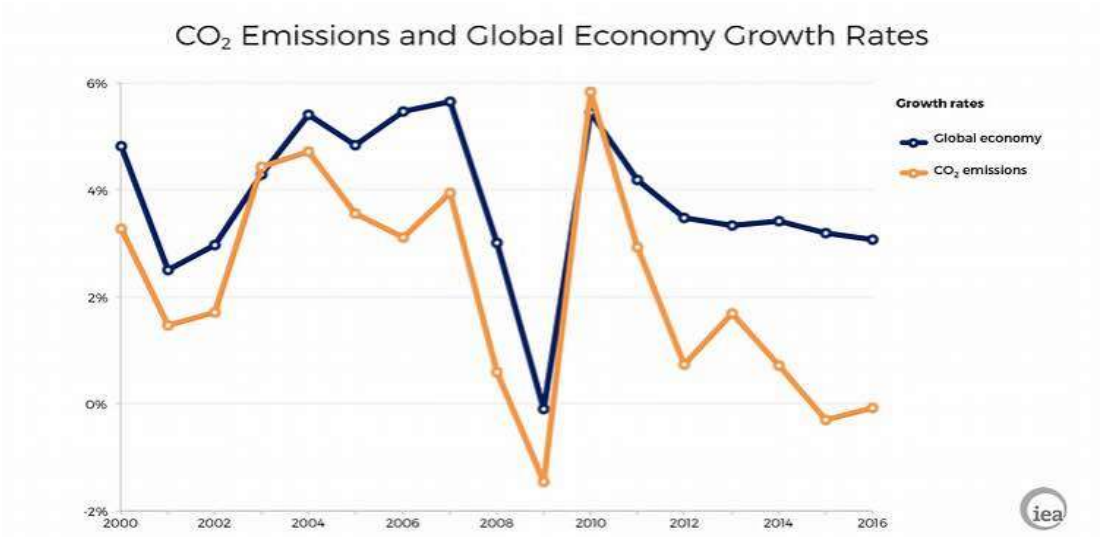

FIG. 2 This graph also shows the relationship between Global economic growth and Carbon emissions. It shows that Carbon emission is directly proportional to economic growth.

1.10 China's Carbon Emissions and Reduction policy

China's role in emitting GHGs can hardly be overstated. From 2000–2008, its emissions doubled from 3.4 gross tons (Gt) to 7 Gt of CO2. By contrast U.S. CO2 emissions remained about 5.7 Gt in 2000 and 2008 (Paltsev et al., 2012). China overwhelmingly relies on coal for electricity generation accounting for about half of the world's annual coal consumption.

For those who lament an increase in global GHG emissions, China's carbon-footprint increase in the past few decades have been a disaster, but the Chinese people have seen a nearly six-fold increase in per capita gross domestic product (GDP) from 1990 to 2011. Hundreds of millions of Chinese have been lifted from poverty thanks to agricultural and free-market reforms that have led to economic development (Huang, 2008).

It is important to remember that environmental policy must ultimately be good for people, any country's most important resource. Moreover, economic growth also creates the wealth necessary for countries to make real environmental improvements in the long run (Lieberman, 2011).

Countries per the Paris Agreement are finding ways to reduce their carbon emissions through policy implementations and market mechanisms such as Carbon taxes and Carbon trading.

An **ETS** – sometimes referred to as a cap-and-trade system – caps the total level of greenhouse gas emissions and allows those industries with low emissions to sell their extra allowances to larger emitters. By creating supply and demand for emissions allowances, an ETS establishes a market price for greenhouse gas emissions. The cap helps ensure that the required emission reductions will take place to keep the emitters (in aggregate) within their pre-allocated carbon budget.

A **carbon tax** directly sets a price on carbon by defining a tax rate on greenhouse gas emissions or – more commonly – on the carbon content of fossil fuels. It is different from an ETS in that the emission reduction outcome of a carbon tax is not pre-defined but the carbon price is.

The choice of the instrument will depend on national and economic circumstances. There are also more indirect ways of more accurately pricing carbon, such as through fuel taxes, the removal of fossil fuel subsidies, and regulations that may incorporate a "social cost of carbon." Greenhouse gas emissions can also be priced through payments for emission reductions. Private entities or sovereigns can purchase emission reductions to compensate for their own emissions (so-called offsets) or to support mitigation activities through results-based finance.

Some 40 countries and more than 20 cities, states and provinces already use carbon pricing mechanisms, with more planning to implement them in the future. Together the carbon pricing schemes now in place cover about half their emissions, which translates to about 13 percent of annual global greenhouse gas emissions. Carbon trading is a model in which a cap is placed on carbon emissions and allowances are allocate to bidders to induce change in behavior by putting a price on pollution (carbon). As part of the Chinese

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

government's policy to reduce carbon emission, a plan to enroll a carbon market has been discussed. In 2013 and 2014, seven pilot carbon markets were launched in 5 Chinese cities (Beijing, Tianjin, Chongqing, Shanghai and Shenzhen) and two provinces (Hubei and Guangdong). In aggregate, the seven pilot emissions trading systems make up the second largest carbon market in the world, covering more than 700 million tonnes of CO2. The experiences gained with these pilots are expected to be useful for rolling-out the nation-wide emissions trading system from 2016 to 2020.

Since markets for GHG emission reductions have been established, their combined value has increased to more than US$100 billion in just a few years (Capoor and Ambrosi 2009).China continues to step up its efforts to address climate change in a bid to achieve the target of reducing CO2 emissions per unit of GDP by 40 to 45 percent by 2020 from the 2005 levels," reiterated Xie Zhenhua, head of the Chinese delegation and vice chairman of the National Development and Reform Commission (NDRC) during the high-level segment of the Warsaw Climate Change Conference.Chinese FDI in Ghana over the period 1994 to 2009has increased and Manufacturing is the most significant activity for Chinese immigrants in Ghana.

China is now the world's second largest oil-consuming country after the United States (Zhao, 2007, p. 399). Realising that energy, climate change mitigation, and economic development are tightly interlinked, the Chinese government developed an ambitious set of energy-security and climate-related policies as a cornerstone of the 11th Five Year Plan (2006–2010). China today accounts for almost a quarter of global greenhouse gas emissions and about half of annual emissions growth (Steckel et al. 2011). China became the world top CO_2 emitter in the last decade and half of the emission increase was due to production of exports (Guan et al., 2009). The International Energy Agency (IEA 2009) has estimated that about half the growth in global energy-related carbon dioxide (CO2) emissions from now until 2030 will come from China. China has made economic growth its top domestic priority, but it faces a serious energy and climate security dilemma (Hallding et al. 2009). It is therefore also an urgent and keen national interest of China to embark on a low-carbon and resource-efficient development pathway (Jiang, Sun, and Liu 2010; Liu and Peter 2010; Zhang 2010). In 2007, China was the first developing country to issue a National Climate Change Program (NDRC 2007); While China came very close to achieving the 20 per cent energy intensity of GDP reduction targetduringthe 11th FYP (2006-2010), this was not without tremendous difficulties. In order to achieve the reduction targets, "black-outs" of industries and certain cities were not uncommon at the end of 2010. A number of provinces were forced to shut down large swathes of industrial capacity as part of last-ditch efforts to meet 2006-2010 energy intensity targets. The Chinese scholar used input-output analysis estimating carbon emissions embodied in China's international trade during 1997—2006, it showed that the share of net exported emissions on domestic emissions accounting for 12%--14%, which increased rapidly since 2002 and it is up to 29.28% in 2007(Q. Hui et al., 2008). As part of the countries policy to peak its Carbon dioxide emissions by 2030 and to make best effort to peak earlier, China has shown leadership in putting a price on Carbon by committing to build a national cap and trade system, which will launch somewhere around 2017-2020 and become the world's largest.

1.11 List of initiatives taken by the Chinese to curb carbon emission

1.11.1 Rolling out of a National Carbon market in 2017

1.11.2 Seven pilot carbon markets already operating in some provinces

1.11.3 Setting up of a south south climate cooperation fund to finance and assist developing countries meet climate change mitigation targets

1.11.4 Adjusting the Industrial Structure

1.11.5 Transforming and upgrading traditional industries.

The National Development and Reform Commission (NDRC), the Ministry of Environment Protection and the Ministry of Land and Resources have raised the entry threshold for industries by enhancing the evaluation and examination for energy saving, and improving the assessment of environmental impact and the pre-examination of land resources for construction, to strictly control the launch of the industries with high energy consumption, high emissions or excess capacity and exports of the products from high energy consumption or high emission industries. In February 2013, NDRC cooperated with relevant administrations to amend the 2011 edition of the Guideline Catalogue for Industrial Restructuring, highlighting the strategic principle of energy saving and emission reduction by improving and upgrading the industrial structure. In March 2013, the National Development and Reform Commission issued the Restructuring Plan on the Old National Industrial Bases (2013-2022), in

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

which it pointed out that China needs to restructure and upgrade its traditionally-advantageous industries, enhance its competitiveness and improve its industrial structures by adopting new technologies. In the 12th Five-Year Plan period, NDRC initiated the National Low Carbon Tech Innovation and Model Industries Projects, among which 34 model projects have been launched in the coal, electric power, and construction and building materials industries in 2012.

1.11.6 Supporting the development of strategic and newly emerging industries.

In July 2012, the State Council issued the Development Plan for National Strategic Emerging Industries during the 12th-Five-Year Plan. It charts the road map for seven strategic emerging industries energy conservation and environmental protection, new-generation information technology, biology, high-end equipment manufacturing, new energy, new materials and new-energy vehicles. It has mapped out a sequence of specific plans for the seven strategic and newly emerging industries and over 20 areas of science and technology, such as modern biological manufacturing. It has also issued several policies and measures, such as the Catalogue of Key Products and Services in Strategic Emerging Industries, the 2012 Strategic Emerging Industries Categories, and Several Opinions on the Work of Enhancing the Intellectual Property Rights of the Strategic Emerging Industries. 26 provinces and cities, such as Beijing and Shanghai, have issued plans or guidelines on the development of the strategic emerging industries. So far, 138 venture capital funds have been set up, managing 38 billion yuan. Among these funds, 38, with a total of 11 billion yuan, are designed to stimulate the development of the energy-saving, environmental protection and new energy sectors.

1.11.7 Speeding up the elimination of backward production capacity.

The State Council issued the Instructive Opinions on Solving the Problem of Overcapacity in October 2013, which proposed the general principle of respecting the law, tailoring policies to industries, multiple-measure approach and addressing both symptom and root cause, and also put forward the opinions on how to implement policies according to the characteristics of industries of steel, cement, electorlytic aluminum, glass and shipbuilding and set eight main tasks to slove the current overcapacity issue. The State Council further implemented the Notice on Issuing the Evaluation Measures on the Work of Eliminating Backward Production Capacity, improved the phasing-out system of the backward production capacity, encouraged local governments to set strict standards on energy consumption and emission standards, and sped up the process of eliminating the backward production capacity. In June 2012, the Ministry of Industry and Information Technology set a goal of eliminating 19 industries with backward production capacity and subsequently announced a name list of the enterprises concerned. It required local governments to break down the tasks and assign them to cities, towns and enterprises. After the evaluation in 2012, China eliminated obsolete production capacity in the following industries: iron smelting, 10.78 million tons; steel production, 9.37 million tons; coke, 24.93 million tons; cement (clinker and mill), 258.29 million tons; plate glass, 59.56 million cases; paper, 10.57 million tons; printing and dyeing, 3.26 billion meters; lead battery, 29.71 million kvah.

1.11.8 Optimizing Energy Structure

In October 2012, NDRC issued the Natural Gas Development Plan During the 12th Five-Year Plan Period, setting out the supply capacity of natural gas will reach 176 billion cubic meters in 2015, among which conventional natural gas will reach 138.5 billion cubic meters, synthetic natural gas 15-18 billion cubic meters, and mining and production of coal bed gas about 16 billion cubic meters. About 18 percent of residents from cities and towns will use natural gas. In 2012, NDRC and the National Energy Administration announced the Development Plan for Shale Gas (2011-2015); The Ministry of Finance and the National Energy Administration issued the Notice on Issuing the Subsidy Policies of Exploring and Utilizing Shale Gas, and arranged special funds to support shale gas projects. In September 2013, the State Council issued the Airborne Pollution Prevention and Control Action Plan, which stipulates the goals and requirements for controlling the consumption cap of coke and increasing the utilization of clean energy. The plan also requires increasing control over fossil fuel consumption and advancing the development of clean energy. By the end of 2012, the rate of thermal power units above 300,000 KWH was 75.6 percent, a year-on-year growth of 1.2 percent; a total of 54 supercritical coal-fired units were in operation, the highest figure in the world; the demonstration power station Tianjin Huaneng

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

IGCC, designed, constructed and operated by China, was put into operation in December 2012. The power station marked a major breakthrough in China's clean coal generator technology.

1.11.9 Increasing Forest Carbon Sinks

The State Council approved the second stage of the plan to curb the source of sandstorms in Beijing and Tianjin. The plan has been expanded to six provinces (autonomous regions, municipalities) and 138 towns. The State Forestry Administration issued the Plan on the Division of Work on Enhancing the Forest's Role in Tackling Climate Change to Implement the Durban Climate Change Conference Agreement, began to draft the fifth stage of the plan on the shelterbelt construction in northeast, northwest and northern China, announced the third stage plan on the shelterbelt construction along the Yangtze River, the Pearl River, as well as the greenery work on plains and Taihang Mountain. China will continue to improve forest management. Forestry subsidies from central fiscal revenue have been expanded from pilot regions to the whole country. China initiated a mid- and long-term plan to manage national forests, decided to build 15 model forests management bases, and issued measures on how to examine and evaluate the cultivation of forests as well as the regulations for their management. It launched a pilot program for sustainable management in 200 towns (forestry farms), taking lumbering as the center of the management. It also issued the Notice on Further Protection and Management of Forest Resources to proactively protect forest resources. The construction of the national monitoring system on forest sinks has made steady progress, as the program expanded from 17 pilot provinces (autonomous regions and municipalities) to the whole country from 2012 to 2013, and a national data base and parameter model base for forestry sink calculation has been built at the initial stage. From 2012 to the first half of 2013, a total area of 10.25 million hectares was greened in afforestation drive, and 4.96 billion trees were planted in volunteer tree-planting drive and 10.68 million hectares of forests were cultivated, further strengthening forest sink capabilities.

1.11.10 Controlling Emissions in Other Areas

In 2012, the central government allocated 700 million yuan in special fund to support 2,463 fertilizer projects. The Ministry of Agriculture initiated and carried out a project categorizing formulas for fertilizers for different types of soil in thousands of villages. The central government earmarked 30 million yuan for special agrarian project funds and 300 million yuan for protective agrarian projects, promoting protective agrarian technologies in 204 towns (cities). The area of protective agrarian land increased to 1.64 million hectares. The central government invested 3 billion yuan to continue standardizing farming areas for pigs and cows. It also put emphasis on the renovation of livestock and poultry farms. The projects will set up several waste treatment facilities, including manure pits and sewage treatment sites. Biological resources and new energies, such as manure, solar and wind will be used for biomass generation, biomass energy projects, methane projects and the replacement of fossil fuels with solid bio-fuels and biomass in heating.

1.11.11 Pushing Forward Carbon Emissions Trading Pilot Programs

Since 2012, pilot programs for carbon emissions trading in Beijing, Tianjin, Shanghai, Chongqing, Hubei Province, Guangdong Province and Shenzhen have witnessed positive progress. In October 2012, Shenzhen implemented management rules. From July to August, 2013, Shanghai, Guangdong Province and Hubei Province sought opinions on carbon emissions trading management. Based on their local situations, the designated areas considered goals for energy saving and emissions reductions, economic development trends and the emission levels of enterprises and industries, then worked out a range to cover how many enterprises which fit carbon emissions trading, and eventually researched and determined the trading range and quota allocation. Based on the industries that the trading covered, each pilot area has researched and set up calculation approaches and standards for carbon emissions, and carried out the calculation and checks on the past data of enterprises' carbon emissions. Shanghai issued carbon emission calculation guidelines for industries like steel and electric power in October 2012, while Shenzhen published quantity reports on greenhouse gas emissions according to local standards, and guidelines to check for emissions and detailed rules for the construction industry in November 2012 and April 2013. Shenzhen launched a carbon emissions trading platform in June 2013. Thus far the total trading volume is over 110,000 tons and the turnover is more than 7 million yuan.

1.12 Investment in low Carbon and South South Climate Fund

China is also motivated by the generally positive experience with the Clean Development Mechanism (CDM). China is the source of 51% of

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

CERs issued globally. The China CDM Fund, the government body that invests the money earned from the sale of CERs generated in China, has almost $1 billion to invest in clean technology projects in China. This amount is expected to increase to $1.5 billion by 2012. It has pledged 20million Renminbi to south south climate cooperation Fund to help developing countries address climate change. According Ghana Investment Promotion Council (GIPC), Ghana has enormous investment potentials in the energy and power sector where green energy such as solar, wind and hydro energy sources can be tapped through the south south climate Fund. As the world's largest developing country, China has been an active advocate and participant of South-South Cooperation. Under the framework of the Cooperation, China has provided assistance to developing nations through the sharing of development experience and professional knowledge, including the assistance on climate issues.

In 2011, China launched a three-year climate change cooperation project to support the least developed countries including the small island countries and some African countries to tackle climate issues. China has also signed a memorandum of understanding with more than 10 countries such as Grenada, Ethiopia, Maldives, Samoa and Uganda and has provided assistance to them by giving them energy-saving and low carbon products and capacity-building trainings.

1.13 Summary

The above chapter has provided information on the overview of China's International trade, Ghana's economy, trade and investment between Ghana and China, relationship between the economy and the environment, China's carbon emission reduction, the specific activities taken by China to reduce its carbon emissions and others.

III. CHAPTER THREE: DISCUSSION ON DEVELOPMENT OF TRADE BETWEEN GHANA AND CHINA

1.14 Introduction

This chapter elaborates on analysis of trade and investment cooperation between Ghana and China, the negative and positive impact on trade and investment when china puts in measures to reduce its carbon emissions.

1.15 The Analysis of the influence of economic and trade cooperation between Ghana and China

Global economic activity remained sluggish. Growth in emerging market and developing economies while still accounting for over 70 percent of global growth declined for the fifth consecutive year, while a modest recovery continued in advanced economies.(IMF, World Economic Outlook Update, January 2016).

Three key transitions continue to influence the global outlook:

(1) The gradual slowdown and rebalancing of economic activity in China away from investment and manufacturing toward consumption and services,

(2) Lower prices for energy and other commodities, and

(3) a gradual tightening in monetary policy in the United States in the context of a resilient U.S. recovery as several other major advanced economy central banks continue to ease monetary policy.(IMF, World Economic Outlook Update, January 2016).

In totality, growth in China is steadily and broadly expanding as perceived, but with a slowdown in imports and exports due to weaker investment and manufacturing activity. Such trends, coupled with the market about the future growth of the Chinese economy, are causing ripple effects on other economies through trade and cheap commodity prices. Globally, manufacturing activity and trade remain sluggish, not only through China's development dynamics, but global demand and investment more broadly. The sharp fall in demand in a number of emerging markets and developing economies has affected global tradetremendously.

Ghana ranks China first in the number of its registered projects in the country compared with other development partners and sixth in the value of registered investments in 2012.China is currently the second largest exporter to Ghana. In 2005 US$433.74 million worth of imports come into Ghana from China with Ghana exporting US$0.1 worth of exports. This reflects a sharp rise in two-way trade between the two countries from $93.13 million in 2000 to $433.74 million in 2005. Most of China's foreign direct investment in Ghana is focused on manufacturing, construction, tourism, trading and services with total investments worth US$75.8 million in 2008. Of 283 projects that Chinese nationals and SOEs have investments in 97 are in manufacturing, 59 in trading, 48 in tourism,44inservicesand15inconstruction. (http://www.worldbank.org/en/country/ghana/overview)

China and Ghana's relationship has reached heights with the largest bank in China,which opened China Africa Desk at Eco

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

bank Ghana ltd to service China's infrastructure projects in Ghana and other sub-Saharan African nations. Africa is by no doubt an important market for China's manufactured and semi manufactured products. As a result of China Ghana relationship; a loan amount of $600 million between the two countries has been appropriated for rural electrification, and another $13 billion, for infrastructure, transport and housing development, the largest loan facility that China ever committed in any African state. (GIPC,2006)

China is substantially increasing its investment in African and precisely Ghana because China has enough money earned through its tremendous growth over the past decades. This can be linked with other developed nations like the British and Americans that have invested tremendously in other countries.Tsikata et. al. argued that the perception of some areas in Africa by western countries as less attractive and occasional risky has led the Chinese to rather step up their demand for, and to take advantage of local resources necessary for producing light industrial products and at the same time, market for Chinese finished goods. The Chinese advancement in trade relations is promoted by the Forum for China Africa Cooperation (FOCAC), a Sino-African relation which was established by Hu Jian Tao.

China's investment in African is more favorable since China sees Africa as an economic partner in development rather than the western nations and institutions that provide loan packages which come with concessions, commitments and conditions attached. Africa has been in the grip of colonialism where it has been dictated to for a longtime and will be attracted to nations such as China who is willing to see it as an economic partner rather than to influence Africa for its own gains.As oppose to the Exim banks of the World Bank and IMF, key factor that prevailed African countries is the fact that national leaders can run their day to day business without any domestic political interference. The Chinese government through the FOCAC, has increased scholarships to African students to study in China. This has increased the human development index in many African countries including Ghana. On foreign aid to Ghana, Tsitkata et. al., argued that aid to Ghana in the last four decades has been in three forms: grants, loans and technical assistance. Over the years China has become an important source of Ghana's imports. (CIA world Fact Book, 2009). The rising share of Ghana's imports from China and the more diversified imports relative to falling market share of other countries can be traced partly to the competitiveness of China's imports compared to other traditional sources of Ghana's imports. Part of the causes of Ghana's looking increasingly to China was the Structural Adjustment Program that not only encouraged increased liberalization of imports but created an austerity environment that made importers look towards cheaper sources. In the context of explaining China-Ghana trade, the commodity composition of trade clearly suggests that resource endowment explain much of the trade in primary commodities while competitive advantage explain most of the manufactured goods. In other words, because China has productivity advantage in manufactured goods it exports more of these goods to Ghana, whereas Ghana is endowed with huge primary resources and thus exports more primary goods to China.

(https://issuu.com/alexanderdecker/docs/research_on_the_chinese_investments). (Frimpong S.K, 2012), it was reported that Ghana's businessmen import sub-standard products from China by ordering lower quality product specifications. This was confirmed by firms in China which said Chinese firms do not produce sub-standard goods generally but produce to Ghana importers' specifications. Chinese products are of different grades of quality and are targeted at different types of consumers. Most of the Chinese products in the Ghanaian markets are of low quality and the prices are relatively low. Thus they basically meet the demand of low income groups. To a reasonable extent these groups of consumers benefit from inflow of Chinese products. Although Chinese producers have access to cheap labor and excellent infrastructure, access to large market such as provided by Ghana promoted economies of scale and has salutary effects on the prices on Chinese manufactured goods. China is an important trade and investment partner for Ghana and cooperation between both countries must be treated mutually. As at 2015, China was the third export nation for Ghana's goods trailing India and Switzerland, also Ghana's number one import partner was China accounting for 32.6% of Ghana's imports.

1.16 Insight into trade and investment cooperation between Ghana and China

According to wikipidea.com the relations between the two countries dates back to 1960 when the countries first established diplomatic relations. Since then, Ghana has provided substantial diplomatic support to the PRC with the PRC reciprocating with material support to aid Ghana's development. In the 1960s President Nkrumah lobbied for the PRC's reinstatement in the United Nations. Nkrumah also supported the PRC during the Sino-Indian War in 1962. After the Nkrumah

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

regime was overthrown, Beijing withdrew about 200 Chinese aid workers and embassy staff. In the early 1990s, China built Ghana's National Theatre as a reward for Ghana's diplomatic support during the Tiananmen Square protests in 1989. Dr. Kwame Nkrumah the then president of Ghana in 1957-1960 had paid several official visits to China enhancing a good relation between the two countries. After Kufuor was elected president of Ghana in 2001, the PRC gave Ghana a US$2.4 million grant to renovate the national theatre. In 2002, the then president of Ghana John Agyekum Kufuor paid an official visit to China, also enhancing the good relation between the two countries. The then president of China, Hu Jintao in 2003 embarked on an official visit to Ghana and China's premiered Wen Jiabao also visited Ghana on his seven-nation tour Africa in 2007. The CPPCC'S Chairman, Jia Qinglin, granted a loan of US$30million to enhance the development of communication projects in order to enhance military and security ties between the two countries. In 2009, there was an estimated 700,000 ethnic Chinese migrants who had settled in Ghana. In the past more than 30 years, China's economy has grown by 9.7% annually, ranking first in gross outputs for the first time. According to the data from World Bank, China's GDP surpassed that of Britain in 2006, becoming the fourth biggest economy in the world and accounting for 20% of global economy. In 2010, because of the difference on economic growth rate for many years, China's economic output surpassed that of Japan, becoming the global second biggest economy. (2011) Moreover, according to the prediction of multi-country's economists and Goldman Sachs, in the coming 20 years, China annual economic growth rate will maintain about 7%. By around 2030, China's economic output will surpass the US, leaping to the world leader. Since the reform and opening to the outside world, the Chinese foreign cargo volume of trade has increased suddenly from 20,640 million US dollars in 1978 to 2,561,630 million US dollars in 2008.Although in 2009, because of the loan crises influence it dropped to 2,207,270 million US dollars, in 2010 China's foreign trade created a historical new high record. On March 5, 2011 Premier Wen Jiabao pointed out in the government work report that in 2010 the total amount of Chinese foreign trade achieved 2,970 billion US dollar, with annual growth of 17.4%, becoming one of the most important factors of rapid economic growth of China. Moreover, in 2009, China surpassed Germany to become the world largest export country. Furthermore, according to Li Gang, a researcher of the research institute of international trade and economic cooperation that on quantitative index, China's gross trade volume, including cargo trade and service trade, will amount to about 5,300 billion US dollars by 2020, with about 4,300 billion US dollars on cargo trade and approximate 1,000 billion US dollars on service trade.(Xiao, 2010) By that time, China's cargo trade export amount will amount to about 2,400 billion US dollars, ranking the first in the world; the import amount will amount to about 1,900 billion US dollars, ranking the second in the world.

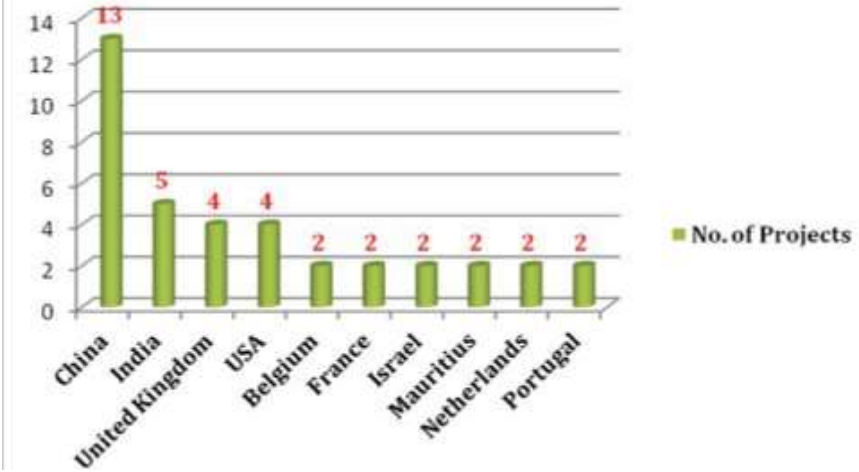

FIG.3 Number of investments by countries in Ghana in Q3 of 2016.

1.17 China's trade with Ghana

As in other parts of Africa, Chinese–Ghanaian trade follows a classic North–South model, with Ghana exporting mainly primary commodities such as cocoa beans; manganese; sawn timber; natural rubber and vegetable products; and metal ores, concentrates and scrap, while importing from China a wide range of

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

manufactured goods, including textiles and clothing, travelling bags, shoes, electronics, machinery and automobiles. China is currently the second largest exporter to Ghana behind Nigeria (which supplies Ghana mainly with crude oil), edging out the US, the UK and South Africa. With the recent discovery of light sweet crude oil in Ghana, China may eventually become Ghana's largest trading partner in terms of both the expected reduction in oil imports from Nigeria and increased exports to China. The volume of trade between Ghana and China reached $7.5 billion at the end of 2019, making the Asian country the single biggest trading partner with the West African country. Ghana's exports to China have also increased significantly, rising to 86.7 per cent, against the backdrop of decrease in total international trade.

Ghana's exports to China hit $1.4 billion, a historical high. All the indicators of China-Ghana cooperation are ranking high in China- Africa cooperation. The achievements of the cooperation have not grown overnight; it is jointly cultivated and nurtured through mutual political trust.

Ghana is facing one of its most serious economic crises in its history, registering a high budget deficit and rising public debt with a stockpile of payment of arrears as well as fast depreciation of the local currency the cedi which has lost more than 30 per cent of its value against the US dollar since January.

The precarious economic situation, amplified by erratic power supply, forced the government to seek an International Monetary Fund bailout of $918.8 million over a three year period.

Despite the country's wobbling economy, Chinese enterprises say they still have confidence in the economy, while the China has also urged its companies to invest more in the West African country.

"In recent years, Ghana's economy encountered some difficulties, while most of the foreign investors are pessimistic about Ghana's economy and decrease investment to Ghana, Chinese enterprises still have confidence in Ghana's market," the Chinese embassy said.

The Chinese government encourages Chinese companies to invest in fields such as energy, aviation, manufacturing and agriculture.

China's non-financial direct investment in Ghana reached $230 million in 2014, ranking second after the Republic of Congo among Chinese investment in the 24 mid-West African countries.

China's investment in Ghana jumped from the 10th in 2013 to 5th in 2014.

"China is willing to keep close policy dialogue, improve cooperation mechanisms, exchange governance experiences and properly solve the existing problems through consultation and cooperation with Ghana," said by China's ambassador to Ghana.

Over the last decade, the increasing share of large emerging economies in international trade and investment revived academic and policy interests in South-South integration and inspired a debate on the growth implications for the less developed recipient countries, particularly in Africa (Kaplinsky & Messner,2008)

1.18 Ghana and China: seizing the opportunities for growth

China and Ghana has had their differences, a clear example is with illegal Chinese miners that have settled in Ghana illegally and exploiting natural resources without any environmental consciousness. This situation has soured relationship between Ghana and China spanning from a Ghanaian satirist making a cartoon depicting Chinese officials which was strongly condemned by the Chinese and in response the Chinese embassy warning the country on its behavior. Such behaviours should not be made to overshadow the blossoming relationship between both countries. There are a number of legitimate Chinese businesses all over and across many sectors. China presents Ghana with an alternative trade and developmental partnership, which, if properly managed, will benefit Ghanaians immensely. Just as Ghana has served as a market for Chinese goods and services, so too can the vast China market present opportunities for Ghana. Ghana needs to empower local businesses to access this market. Ghana has become the host nation for the African Continental Free trade Area (AfCFA) and China can take advantage of this development and conducive business environment offered by the country to access the continental market.

1.19 How China's policy on Carbon emission reduction can impact on Trade and Investment between Ghana and China

Ghana imports most of its manufactured goods from China because goods are cheaper as compared to other trade partners while China needs natural resources to feed its factories. With a carbon emission reduction or restrictions companies in the short run will be affected since there are no immediate plans to reduce their emissions. Secondly, businesses will have increased cost to their production since they need to invest in new technologies, expertise and emission permits. This can lead to a negative cost externality where businesses pass down increase

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

cost of production to consumers in this case domestic consumers and dependent countries like Ghana who need Chinese cheap priced goods.When a firm faces an increase in input costs, threeoptions are open in the short-run: (1) absorb thecost by reducing profit margins; (2) decrease costsby improving the efficiency of their operations; or (3) pass the additional costs to the consumer byincreasing prices. The latter is desirable from theperspective of reducing emissions as it drives demandside mitigation via demand substitution. Earlier studies using static anddynamic bottom-up (engineering economic) models

to simulate the effect of the EU ETS to product prices and windfall profits find, in general, that a significant part of the costs of CO2 emission allowances are passed through to product prices resulting in higher electricity prices for consumers. According to a research conducted by CHEN Wenying, GAO Pengfei, HE Jiankun, The China MARKAL-MACRO model was used to study the impacts of carbon emission reduction on the GDP growth for future carbon emission reduction in China. The results show that the GDP loss rate would be in 0～2.5% for reduction rates of 0～45%. The quantitatively GDP loss predictions for the whole planning horizon for the different reduction scenarios, indicates that the GDP would start to decline at around 10 years before setting the reduction constrains, and the GDP losses would gradually increase and last for several years after setting the reduction constrains. If the start of the emission reductions is the year of 2030, 2020 or 2010 instead of 2040, then the undiscounted total GDP losses in the whole planning horizon would be 0.58～0.74, 1.00～1.32, or 1.10～1.83 times higher.

Energy is considered to be the life line of an economy, the most vital instrument of socio economic development and recognized as one of the most important strategic commodities (Sahir and Qureshi, 2007). Energy is not only essential for the economy but its supply is uncertain (Zaleski, 2001). Chan and Lee (1996) used a vector error correction model (VECM) techniques and co-integration to analyze China's energy consumption behavior, suggesting that energy price, income and the share of heavy industry output in national income are significant factors affecting energy consumption.During the cap-and-trade debate in 2009, the National Association of Manufacturers and the National Black Chamber of Commerce commissioned studies looking at the effect of carbon caps on manufacturing and found that hundreds of thousands of manufacturing jobs would be lost.Proponents of cap-and-trade acknowledged that a price on GHG emissions would negatively affect domestic manufacturing unless the cost was fully and permanently offset. Additionally, to offset the impact on manufacturing fully and permanently would be to negate the desired environmental impact of the policy (make it more expensive to emit GHGs and therefore reduce GHGs).

The GDP of a country indicates the health of the economy, it is also an indication of how firms and businesses will employ workers or retrench them. Firms are unlikely to invest when GDP is low. According to the partial equilibrium effect of carbon restriction carbon is treated as a goods and hence the laws of demand and supply will determine its cost. When the allowable permit for carbon emissions is reduced consumers will have to bear a higher cost since the demand for permits is high and vice versa. This in light will determine how much cost businesses are willing to pass down to consumers in order to meet their profit margins.

People are becoming conscious of their environment and this has made natural resources exploitation an issue. Extraction companies need to pay more money to land owners, the nation in which the resources are extracted and finally ambitious policies are set up to protect the environment such as liabilities and corporate social responsibilities which leads to extra cost incurred to extraction companies. Investment in green technologies and low carbon projects are becoming important topics for companies, governments and investors in general, so in light of this investors will be attracted to low carbon projects.

Green financing which was discussed during the G20 Summit which took place in Zhejiang in September, 2016 threw more light on how investments will be changing in the future. Projects that emitted high carbon emissions will slow down and investments will attract more environmentally friendly projects.

Some evidence has been reported in this literature of impacts on marginal decision-making on investment and innovation patterns, chiefly by helping move the issue of carbon into the realm of key decision-makers at boardroom level or by incentivizing energy or GHG saving measures relating to their manufacturing or core processes. Anecdotal accounts also link the EU ETS to the cancelation of investments in highly carbon-emitting generation plants, increased corporate CCS research, incentives to retrofit coal plants, and inducing small-scale investment decisions with short amortization times. Preliminary econometric

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

analysis on Swedish firms finds no significant effect of the EU ETS on either small or large investment decisions. It is showed that, on average, about 13% of the total carbon dioxide emissions of the six largest OECD countries were embodied in manufactured imports during 1984-1986 (Wyckoff and Roop, 1994). The Chinese scholar used input-output analysis estimating carbon emissions embodied in China's international trade during 1997—2006, it is showed that the share of net exported emissions on domestic emissions accounting for 12%--14%, which increased rapidly since 2002 and it is up to 29.28% in 2007(Q.Hui et al., 2008).

1.20 Prospects of a Chinese Carbon emission reduction for the Ghanaian economy

As China has an abundance of capital stock and is ever ready to take an important role in the mitigation of climate change, China has set up the South south climate cooperation where it has pledge to support developing countries in meeting their emission targets through financing, sharing of technology and capacity building. With this there are chances of Ghana attracting investment from the Chinese government to undertake project in green energy such as solar energy. Such investments will have a positive effect on Ghana's economy by adding jobs. Secondly, Coe and Helpman (1995) studied the international R&D diffusion among 21 OECD countries and Israel over the period of 1971-1990, and found that international trade is an important channel of transferring technology. Officials from the the Chinese and Ghanaian governments consolidated the partnership, according to a report from the United Nations Development Programme (UNDP). Entitled 'China-Ghana-South-South Cooperation on Renewable Energy Technology Transfer', the alliance marks the objective of the Chinese government to transfer renewable energy technologies that will ideally suit the needs of Ghana, such as solar and wind for irrigation, biogas, mini hydro and improved cook stoves.

IV. CHAPTER FOUR: SUGGESTIONS FOR PROMOTING TRADE AND INVESTMENTS

After analysis of trade and investment between Ghana and China, certain suggestions can be offered;

1.21 Setting up industries in Ghana

From the analysis, China is an important trade and investment partner for Ghana. Many Chinese firms and industries have been setting up in Ghana and should be encouraged to set more companies in the sub African region. The trade theory between Ghana and China is such that Ghana is endowed with a lot of natural resources which are needed by a country like China to feed its factories and in return Chinese firms manufacture finished and semi-finished goods for the Ghanaian consumers. The Ghanaian consumers are attracted to the Chinese manufactured goods mainly because its price competitiveness on the world market.

1.22 Chinese commodity prices

Secondly, some policies of bigger nations can affect the economy of small nations like Ghana, e.g. efficiency in the Chinese steel industry increased prices slightly and these affect countries like South Africa, which depends much on Chinese steel. With the setting up a carbon emission reduction policy, the Chinese energy industries which emits most of the carbon in China is likely to be affected and under normal circumstances restricting carbon emissions from this sector will increase cost that will have to be passed through to consumers leading to increased commodity prices but fortunately the Chinese energy sector is a sector regulated by the government and an increased cost of energy production is not likely to affect consumers and even if it does will be mildly depending on the intensity of carbon restrictions or carbon prices. This should encourage Ghanaians to set up businesses in order to protect them from such effects.

1.23 Ghana should attract green investments

The Chinese government has set up a South South Climate Cooperation Fund to help developing countries tackle their climate change mitigation plans and policies. According to the Chinese government the Fund was to provide training, technology and financing of low carbon projects. Ghana has so many challenges that can attract Chinese investments in the field of green financing. Traditionally, Chinese investments are attracted by Ghana mainly because of natural resources and the country can do more to attract green investments. E.g. With the energy and power crisis that has purged Ghana over the periods of time, a Chinese technological firm has invested in solar panels to help the sub Saharan African nation solve some of its energy crisis.

1.24 Technology know how

The Chinese government have made strides in green technologies and Ghana should do its best to get some of these know how by cooperating with the Chinese in this field. International trade is seen as a medium through which technologies can be passed on and bilateral trade cooperation between Ghana and China should

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

be set on new levels to attract such technologies. According to the United Nations Development Program (UNDP) the Chinese have set up an objective to transfer renewable energy technologies that will ideally suit the needs of Ghana, such as solar and wind for irrigation, biogas, mini hydro and improved cook stoves.

1.25 Discovery of oil

Oil production has been an important resource to the development of some nations like Saudi Arabia, as an infant player in this field, the Ghana Government should do its best to develop this industry with technologies that are up to standard and do not lead to pollution of the environment as witnessed with BP oil spill in the Gulf of Mexico where damages were caused to marine ecosystems.

1.26 Safety and Security

Ghana should continue to create a safe and business enabling environment to encourage Chinese and other investors. In recent times Chinese citizens are involved in "Galamsey" which is an illegal gold mining activity taken place in the country, Ghana can work with the Chinese government in solving this problem and also form partnership in this field to undergo this activity in a lawful and safer manner for both parties.

1.27 Good governance and transparency

Ghana should show good governance and be transparent in trade and economic cooperation with China and it must be mutually beneficial and conducted with reciprocated respect and trust and in so doing, the cooperation will continue to pave the way for structural engagements to the greatest extent between the two countries.

1.28 Consistency in the Ghanaian policies and financially discipline

The Ghana government must be up and doing in its responsibilities. And there should be discipline on the part of the officials and consistency in their policies. In this light, the Chinese traders' should not see Ghana as a market for dumping goods, but they should invest heavily in factories in Ghana, and this will reduce capital flight and also create the badly needed jobs in Ghana and reduce unemployment

1.29 Protection of infant industries

Ghana can enjoy sustainable and profitable economic cooperation with China by increasing the value-added of its exported mineral resources to China and it is equally relevant for it to effectively manage the importation of Chinese products to avoid killing growing local infant industries that dominate the small and medium scale sector in the Ghana economy.

1.30 Learning from China

The economic achievements attained by China should make China a model to be followed by African countries who have many similarities with the Chinese before their miraculous leap to economic achievements. From agricultural oriented country to a manufacturing powerhouse of the world to an importance investment player. Trends of reforms taken from the Chinese can help Ghana develop tremendously. Ghana can also take advice from the current state of environmental issues and try to develop in a manner that is harmonious with environmental quality of life.

V. CHAPTER FIVE: SUMMARY AND CONCLUSION

The benefits enjoyed under a blossoming trade and investment between Ghana and China should be advanced in all sectors of life. China with no doubt is an important trade and investment partner and increased dialogue between both countries will bring greater prosperity to the two countries. China being an economic giant has a lot to offer to Ghana and the world as a whole. This paper examined the effect of a carbon emission reduction policy by China will have on Ghana's economy both positively and negatively. The research included the availability of fund; improvement of the country's infrastructural development and transfer of technology from China. According to the research, threating carbon as a goods will determine its price through demand and supply. Depending on how the Chinese government price Carbon will determine the cost externality. These cost externalities are passed on to consumers. The Chinese government regulates its energy sector which is the greatest source of carbon emissions in the country and hence price increment of energy will either be mild or no increment depending on the price of carbon. Ghana also attracts huge sums of Chinese investment which has had a lot of impact on the Ghanaian economy. In the 3RD quarter of 2016, Chinese investments including other investments added over 1,504 jobs both locals and foreigners to the Ghanaian work force. Chinese investments amounted to 9 projects which was the highest number of project among other investors in the country. With the Chinese government pledging through the south south climate cooperation to invest in low carbon projects, Ghana should do more to attract green investments from China.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

Funding Institution
The research work was fully supported by the National Natural Science Foundation of China and the grant number 71503105.

REFERENCE

[1]. "A Free Economy Is a Clean Economy: How Free Markets Improve the Environment," Chapter 4 in Terry Miller and Kim R. Holmes, 2011 Index of Economic Freedom (Washington: The Heritage Foundation and Dow Jones & Company, Inc., 2011), pp. 53–60,
[2]. Sergey Paltsev, Jennifer Morris, Yongxia Cai, Valerie Karplus, and Henry Jacoby, "The Role of China in Mitigating Climate Change," MIT Joint Program on the Science and Policy of Global Change Report No. 215, April 2012, p. 4,
[3]. Agriculture', ACTA Geographica Sinica **55** (2), 129–138.
[4]. Ahmed K et al (2016) Revisiting the emissions-energy-trade nexus: evidence from the newly industrializing countries. Environ Sci Pollut Res 23(8):7676–7691.
[5]. American Council for Capital Formation and National Association of Manufacturers, "An Analysis of the Waxman–Markey Bill 'The American Clean Energy and Security Act of 2009' (H.R. 2454) Using the National Energy Modeling System (NEMS/ACCF-NAM 2)," http://accf.org/wp-content/uploads/2009/10/accf-nam_study.pdf (accessed August 9, 2012), and CRA International, "Impact on the Economy of the American Clean Energy and Security Act of 2009 (H.R.2454)," August 2009,
[6]. Azam M et al (2016) the impact of CO2 emissions on economic growth: evidence from selected higher CO2 emissions economies. Environ Sci Pollut Res 23(7):6376–6389.
[7]. Baek J (2015) Environmental Kuznets's curve for CO2 emissions: the case of Arctic countries. Energy Econ 50:13–17.
[8]. Balassa B. (1986), Policy responses to exogenous shocks in developing countries, Brookings Papers on Economic Activity, 26(1), 1-118.
[9]. Burnett J.W., et al (2013) Carbon dioxide emissions and economic growth in the US. J Policy Model 35(6):1014–1028.
[10]. Capoor, K., P. Ambrosi. State and trends of the carbon market 2009. Washington, DC: World Bank
[11]. China Briefing (2015) Business intelligence from Dezan Shira & Associates (158). Available: http://www.china-briefing.com
[12]. China Embassy Report (2011) China's foreign trade. Available: http://www.china-embassy.org/eng/zt/bps/t943740.htm
[13]. China. 2006. China's African Policy. Ministry of Foreign Affairs of the People's Republic of China. Available at http://www.fmprc.gov.cn/eng/zxxx/t230615.htm
[14]. Climate Strategies, 2011.
[15]. D. Guan, G.P. Peters, C.L. Weber, K. Hubacek Dixit AK, Stiglitz JE. Monopolistic competition and optimum product diversity. Am Econ Rev 1977, 67:297–308.
[16]. Dollar D. (1992), Outward-oriented developing economies really do grow more rapidly:
[17]. Donald D. Kim, Teresa L. Gilmore, and William A. Jolliff, "Annual Industry Accounts: Advance Statistics on GDP by Industry for 2011,"U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, Vol. 92, No. 5 (May 2012), Table E, p. 12, "Value Added by Industry Group as a Percentage of Current-Dollar GDP," www.bea.gov/scb/pdf/2012/05%20May/0512_industry.pdf.
[18]. Dornbusch R. Exchange rates and prices. Am Econ Rev 1987, 77:93–106 Economics, 14(1), 241-250.
[19]. Evidence from 95 LDCs, 1976-1985, Economic Development and Cultural Change, Geophys. Res. Lett., 36 (2009)
[20]. Hallding, K., G. Han, and M. Olsson. 2009. "China's Climate-and Energy-security Dilemma
[21]. Hervé-Mignucci M. Operating and financial investments by European utilities over 2004–2009: what role for European mitigation policies? CDC Climate Research Working Papers 2011–9, 2011.
[22]. Herzog, H. J.; Eliasson, B. & Kaarstad, O. (2000) Capturing greenhouse gases, Scientific American. Hoffman V. EU ETS and investment decisions: the case of the German electricity industry. Eur Manag J 2007, 25:464–474.

[23]. http://blog.heritage.org/2009/08/07/manufacture-this-10-democrats-express-concern-over-cap-and-trade/
[24]. Hui Q. et al. Accounting Embodied Carbon in Import and Export in China [J]. China Population, Resources and Environment. 2008, 18(3):8–13(In Chinese)
[25]. Bloomberg News, October 22, 2010, http://www.bloomberg.com/news/2010-10-22/china-cdm-fund-to-have-1-5-billion-for-clean-energy-projects-by-2012.html
[26]. Institute of Statistical, Social and Economic Research (ISSER). 2005. State of the Ghanaian Economy Jaggi, Gautam, et al. (1996) China's economic reforms—chronology and statistics. Institute for International Economics, Working Paper, 96(5)
[27]. Jiang, B., Z. Sun, and M. Liu. 2010. "China's Energy Development Strategy Under the Low-carbon Economy." Energy 35 (11): 4257–4264.
[28]. Journey to world top emitter: an analysis of the driving forces of China's recent CO_2 emissions
[29]. surge
[30]. Kavoussi R.M. (1984), Export expansion and economic growth, Development
[31]. Liu, J., and H.R. PETER. 2010. "China's Environmental Challenges and Implications for the World." Critical Reviews in Environmental Science and Technology 40 (9-10): 823–851.
[32]. Lorente DB, Álvarez-Herranz A (2016) Economic growth and energy regulation in the environmental Kuznets curve. Environ Sci Pollut Res 23(16):16478–16494.
[33]. Maizels A. (1963), Industrial growth and World Trade, Cambridge University Press.
[34]. Martin, R, Muuls M and Wagner U. Climate change, investment and carbon markets and prices—evidence from manager interviews, Climate Policy Initiative and Climate Strategies, 2011
[35]. Meadows, Donnella H; Meadows, Dennis L; Randers, Jorgen & Behrens, William, W. 111 1972,
[36]. The Limits to Growth, A Report for the Club of Rome's Project on the Predicament of Mankind,
[37]. Pan, London and Sydney.
[38]. Mensah JT (2014) Carbon emissions, energy consumption and output: a threshold analysis on the causal dynamics in emerging African economies. Energy Policy 70:172–182.
[39]. Michieka NM et al (2013) An empirical analysis of the role of China's exports on CO2 emissions. Appl Energy 104:258–267.
[40]. Mike Shannon, Paul Harnick, and Tom Meike, "The Future of the US Chemical Industry," Reaction Magazine, Seventh Edition (June 2012), pp. 8–11, http://www.kpmg.com/global/en/issuesandinsights/articlespublications/reaction/pages/the-future-of-the-us-chemical-industry.aspx (accessed August 9, 2012).
[41]. N. Georgescu-Roegen, The Entropy Law and the Economic
[42]. National Development and Reform Commission (NDRC). 2007. China's National Climate Change Programme.
[43]. Available at http://en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf.
[44]. Neuhoff K. Carbon Pricing for Low-Carbon Investment: Executive Summary, Climate Policy Initiative and Neuhoff K. Tackling Carbon: How to Price Carbon for Climate Policy, Climate Strategies Report, 2008.
[45]. New Path of Economic Growth." Journal of Current Chinese Affairs 38 (3): 119–134.
[46]. Nicolas Loris, "Manufacture This: 10 Democrats Express Concern over Cap and Trade," The Heritage Foundation, The Foundry, August 7, 2009,
[47]. Nicolas Loris, "Waxman–Markey Cap and Trade's Biggest Losers: Manufacturing," The Heritage Foundation, The Foundry, June 25, 2009, http://blog.heritage.org/2009/06/25/waxman-markey-cap-and-trade%E2%80%99s-biggest-losers-manufacturing/.
[48]. Of company case studies in the German Power Sector. Ecol Econ 2010, 70:513–523.
[49]. Onafowora OA, Owoye O (2014) Bounds testing approach to analysis of the environment Kuznets curve hypothesis. Energy Econ 44:47–62.
[50]. Policy, 1994, 22(3): 187–194. Process (Cambridge, Harvard University Press, 1971).Rogge K, Schneider M, Hoffman VH. The innovation impact of the EU emission trading scheme—findings
[51]. Sachs J.D. and A. Warner. (1995), Economic reform and process of global integration,
[52]. Sergey Paltsev, Jennifer Morris, Yongxia Cai, Valerie Karplus, and Henry Jacoby, "The Role of China in Mitigating Climate Change," MIT Joint Program on the Science

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

and Policy of Global Change Report No. 215, April 2012, p. 4,
[53]. Song T et al (2008) An empirical test of the environmental Kuznets curve in China: a panel cointegration approach. China Econ Rev 19(3):381–392.
[54]. Steckel, J.C., M. Jakob, R. Marschinski, and G. Luderer. 2011. "From Carbonization to decarbonization?–Past Trends and Future Scenarios for China's CO2 Emissions." Energy Policy.
[55]. Tang, G., Li, X., Fischer, G., and Prieler, S.: 2000, 'Climate Change and its Impacts on China's
[56]. U.S. Department of Agriculture, Economic Research Service, "The International Macroeconomic Data Set," updated July 5, 2012.
[57]. United Nations, "National Accounts Main Aggregates Database," 2010, http://unstats.un.org/unsd/snaama/selbasicFast.asp (accessed July 17, 2012).
[58]. Wang S et al (2016) spatiotemporal variations of energy-related CO2 emissions in China and its influencing factors: an empirical analysis based on provincial panel data. Renew Sustain Energy Rev 55:505–515.
[59]. Wyckoff A. W., Roop J. M. The Embodiment of Carbon in Imports of Manufactured Products [J]. Energy
[60]. Yasheng Huang, Capitalism with Chinese Characteristics: Entrepreneurship and the State (New York: Cambridge University Press, 2008).
[61]. Zhang, Z.X. 2010. "China in the Transition to a Low-carbon Economy." Energy Policy 38 (11): 6638–6653.
[62]. Zhao, H. (2007, November 8). China's Oil Venture in Africa. East Asia, 399-415
[63]. Zou X et al (2016) Environment and air pollution like gun and bullet for low-income countries: war for better health and wealth. Environ Sci Pollut Res 23(4):3641–3657.

APPENDIX

Sector	Projects	Assistance type (and how China benefits)	Status
Energy	Bui hydro-electric power dam project; continuous support for rural electrification	$562 million mixed credit nuancing from China Exim Bank; 42% concessionary from Exim, the rest supplier's credit; concessionary component repayable over 20 years at 2% interest rate per annum, while commercial component within 17 years with a five-year moratorium; Ghanaian Ministry of Finance to establish escrow account with China Exim Bank to avoid default; China's energy giant Sino-hydro undertaking the project, plus jobs for about 500 Chinese workers	Bui project under way to be completed by 2021; rural electrification on-going
Telecom	Implementation of the 1st phase of the National Communication Backbone and E-Government Project	$30 million interest-free loan approved in 2006; a big new turn-key business for Huawei	completed
Transport	Reconstruction of the 17 km Ofankor–Nsawam road	$28 million interest-free loan; opens new business opportunities for Chinese construction companies	Completed and commissioned in 2006
Agriculture & fishing	(i) Support for irrigation farming, including for Afifi rice project in the Volta region; (ii) construction of landing sites for fishing	(ii) $99 million interest- free loan for construction of landing sites; Chinese fishing companies gain improved access rights	(ii) Construction of landing sites ongoing; 12 started already

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

	communities		
Mining	Supply of labor-saving small-scale mining equipment to Ghana	More business opportunities for Chinese operators in contract mining services provision	Ongoing
Technology transfer	Transfer of bamboo technologies through the development of the bamboo and rattan industry in Ghana; transfer of fish-farming technologies through the establishment of demonstration centers for training and distribution of fingerlings to out-growers; assisted Legon Fisheries to start processing of octopus; assisted Ghana National Fishing Corporation to establish factory with processing capacity of 20,000 metric tonnes of tilapia, 8,000 tonnes of shrimp	Technical assistance and various grants; improved access rights to Chinese fishing companies; China seeking off-shore processing opportunities in Ghana	Ongoing
Education & capacity building	Scholarships and training programmes for Ghanaian students and public officials, especially in public policy management and agricultural extension; the establishment of Chinese- language institutes in the country; construction of three basic-level schools in rural locations in Ghana	Grants; enhanced soft power through positive international image for sharing development experience; the opportunity to share Chinese culture through the establishment of a Centre for Chinese Studies at the University of Ghana in Accra	completed
Health, water & sanitation	(i) The construction of a 100-bed capacity general hospital for malaria treatment at Teshie, a suburb of Tema; supply of anti-malaria drugs to the government of Ghana (ii) Construction of the 60- bed Dangme East District Hospital located in Ada, some 100 km east of Accra (iii) Kpong water supply extension project	Grant	(i) MoU signed (ii) Completed (iii) MoU signed

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

Defence	Construction of an of defence complex for the Ministry of Defence	Estimated cost of $9 million with $7.5 million grant from the Chinese government; growing security cooperation with Ghana's security agencies; triangular aid peacekeeping in third-party countries and regional stability necessary for Chinese business	Completed

1.31 **Ghana Economy Data**

	2015	2016	2017	2018	2019
Population (million)	27.7	28.3	28.9	29.6	30.2
GDP per capita (USD)	1,721	1,926	2,014	2,173	2,164
GDP (USD bn)	47.7	54.6	58.3	64.2	65.3
Economic Growth (GDP, annual variation in %)	2.2	3.4	8.1	6.3	6.5
Consumption (annual variation in %)	1.1	0.2	0.1	8.5	4.3
Investment (annual variation in %)	-2.7	12.2	1.0	13.2	-10.0
Industrial Production (annual variation in %)	1.1	4.3	15.7	10.6	6.4
Unemployment Rate	-	-	-	-	-
Fiscal Balance (% of GDP)	-5.3	-6.9	-5.0	-3.8	-4.5
Public Debt (% of GDP)	55.1	57.3	57.2	59.1	-
Money (annual variation in %)	26.6	24.6	19.8	15.7	16.0
Inflation Rate (CPI, annual variation in %, eop)	17.7	15.4	11.8	9.4	7.9
Inflation Rate (CPI, annual variation in %)	17.2	17.5	12.4	9.8	8.7
Policy Interest Rate (%)	26.00	25.50	20.00	17.00	16.00
Exchange Rate (vs USD)	3.81	4.30	4.54	4.83	5.70
Exchange Rate (vs USD, aop)	3.78	3.94	4.40	4.68	5.35
Current Account (% of GDP)	-5.9	-5.2	-3.4	-3.2	-2.5
Current Account Balance (USD bn)	-2.8	-2.8	-2.0	-2.0	-1.7
Trade Balance (USD billion)	-3.2	-1.8	1.2	1.8	2.3
Exports (USD billion)	10.3	11.1	13.8	14.9	15.7

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 735-756 www.ijaem.net ISSN: 2395-5252

	2015	2016	2017	2018	2019
Imports (USD billion)	13.6	12.9	12.6	13.1	13.3
Exports (annual variation in %)	-21.6	7.9	24.2	8.0	4.9
Imports (annual variation in %)	-6.5	-4.7	-2.0	3.8	1.5
International Reserves (USD)	5.6	5.8	6.9	6.2	7.4
External Debt (% of GDP)	42.2	38.8	38.4	36.3	-