



Agricultural mechanization as a tool to alleviate poverty in Ghana: The role of belt and road initiative

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Abstract

This study discusses the steps and initiatives the government of Ghana is adopting to incorporate mechanization systems in agriculture to alleviate poverty. The relevance of mechanization and its adoption for farming systems has been the priority of the Ghanaian populace. However, few countries with high technologies are assisting the nation with their modern trend of food production and food security systems. Findings demonstrated that agribusiness accounts for 60% of Ghana's Gross Domestic Product (GDP), 65% of its employment, and 50% of its exports. This study employed content analysis methodology to achieve its goal. Though, without hesitation, agricultural mechanization has immense potential for increased agricultural output and enhanced farmer standard of living. Notwithstanding, there have been a couple of issues affecting farm mechanization in Ghana. First, mechanization is hampered by farm owners' small size and dispersed holdings. Second, most local farm owners are impoverished and unable to afford expensive machinery such as tractors and combined harvesters. Therefore, Ghana counts on BRI and other international organizations to collaborate with Ghana by providing affordable mechanization equipment, alleviating its infrastructural deficit and poverty levels.

Keywords: Agricultural mechanization, Poverty alleviation, Ghana, China, Belt and Road initiative

1. Introduction

Ghana is one of the wealthiest and peaceful countries located in the West of the African continent. Ghana is one of the countries in Africa endowed with many prosperous natural resources such as Gold, Diamond, Timber, Bauxite, Manganese, and Oil, contributing to making Ghana one of the wealthiest nations in the African continent. In terms of agriculture, Ghana is one of the countries whose soil is very fertile for cultivation, and it is well known for its Cocoa production and other essential food crops. Ghana has been regarded as one of the steadier countries in West Africa since it attained independence in 1957 from the reign of the British colony. Based on Ghana's current pace of development and the objective to speed up development processes in the country. The former ten regions have been further divided into sixteen regions and capitals to facilitate the easy distribution of resources. Ghana transitioned into a multi-party democracy country in 1992 and has since been one of the fast-growing economies. However, the government is still facing other economic challenges in its path to attaining sustainable development plans. Ghana is one of the countries whose primary occupation is Agriculture.

2. The development of Agricultural Mechanization in Ghana

Although the country has the mindset and passion for agriculture, most of such activities are done in smaller quantities, which does not yield enormous benefits to the farmers and those entities who support its activities.

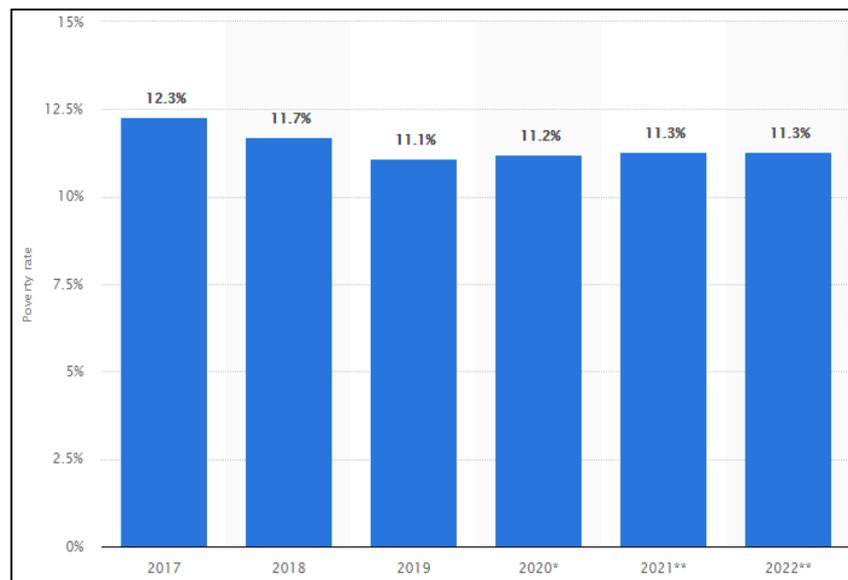
The small size of farming and basic tools employed such as hoes, cutlass, and axe, which the indigenous farmers previously used, has necessitated a great need for mechanizing agricultural activities in the country and some specific rural districts Adansi North District in Fomena, in particular.

These tools, although helpful but can only be used for small farming. In alleviating poverty in the region, the region prioritizes agriculture as the backbone of the country's development. Hence, it is recommended the government prioritize mechanization in the agricultural sector to promote bulk production and exportation. Most crops such as maize, plantain, yam, and others are grown in the region, but cocoa is an essential cash crop assisting the country and the Adansi North District. Cocoa is a crucial product used for many purposes, such as Milo, Pomade, Chocolate, and other medicinal use. Thus, cocoa mechanization and production in large quantities may yield a tremendous amount of foreign exchange for development and assist in alleviating poverty in the country.

This article highlights the need for mechanization in Ghana because of the enormous international and domestic benefits of cocoa and other agricultural products to help alleviate

poverty and enhance international cooperation and trading. Recent statistics have indicated that the poverty standards of the country are rising amidst the various measures the government has instituted (Sasu, 2021) ^[42]. In 2021 Ghana's poverty rate is projected to be 11.3 percent which is further anticipated to maintain at the same rate in 2022 (Sasu, 2021) ^[42]. Although the trends from 2017 to 2020 seem to decline, it is very minimal, indicating that most citizens live in abject poverty that needs interventional measures. Figure 1 shows the trend of international poverty standards in the country, which requires a pragmatic solution.

Further, this article highlights the urgency of Belt and Road Initiatives policymakers to focus more on Agriculture in West Africa and help developing and rural inhabitants in most countries like Ghana to adopt the advanced mechanization systems in China. The author of this article is confident that the Belt and Road Initiatives (BRI) project can help developing countries in infrastructure development, technology, and agricultural mechanization. Much of the author's confidence is based on his experience witnessing the mechanization systems in China at Jurong Farms in the Jiangsu Province of China, Zhenjiang.



Source: (Sasu, 2021) ^[42]

Fig 1: Ghana's international poverty level and projections from 2017 - 2022

Recently, technology has been gaining prominence in the agricultural sector of Ghana (Nyarko & Kozári, 2021) ^[33]. Internationally, an investigation conducted by (Lin & Huang, 2008) ^[29] demonstrates that individuals accept technology that accomplishes their chosen needs and the other way round. Thus, the willingness to embrace technology has shaped modern farming techniques, increasing the production of high-quality and high-quantity agricultural commodities while decreasing losses and workforce responsibilities (Verma, 2006) ^[47]. The growing world population is challenged by fluctuating agricultural products and services, food insecurity, price exacerbation, poverty, hunger, and other potential issues (Li *et al.*, 2020). Mechanization or technology in agriculture tends to be one of the plausible ways to combat this blight (Kwakye *et al.*, 2021) ^[27]. (Tang *et al.*, 2021) ^[43] posited that agricultural technology would take an essential role in agriculture within the 21st

century, and farm owners will become more informed and productive through smart farming with mechanized systems. In Ghana, most farmers are currently trying to rely on agricultural technology and mobile connectivity for agricultural purposes (Kabbiri *et al.*, 2018) ^[26]. Technology is a decisive point within the Ghanaian community, especially within the Northern Region, where low income per capita and enormous poverty standards are recorded (Damba *et al.*, 2020) ^[11]. It is believed that agricultural mechanization is a sure way of aiding Ghana to alleviate poverty.

The spirit of fighting poverty or poverty alleviation would be highly achieved when people work together, being precise and pragmatic in policy implementation, pioneering innovative mechanisms, overcoming difficulties of the citizens, and living up to the expectations of the inhabitants through technological innovation international cooperation, and talent training. With the uprising of China as an engine

for economic growth through the BRI, it is anticipated that investment in various industries such as agriculture, exchange of products, banking, logistics, and technological advancement will increase and be extended to different territories (Tsikata *et al.*, 2008) ^[44]. The BRI is an excellent opportunity to bring different countries and China under one umbrella to facilitate economic development (Johnston, 2019) ^[25].

The BRI is regarded as the most significant initiative in the 21st century. It was launched following the establishment of Chinese President Xi Jinping in 2013. It is considered an advancement of the ancient Silk Road, with the assembling of this open invite reaching 126 nations from the European, African, Asian, and American territories (Tsikata *et al.*, 2008) ^[44].

2.1 Education and collaboration to improve mechanization and alleviate poverty

As Ghanaian students abroad and home continue to study agricultural mechanization systems in the national universities and international levels, it is hoped that the knowledge gained will help support the foreign initiatives and policies that would be inaugurated in the country. Although, the status of Ghanaian universities concentrating on agricultural studies is limited compared to other countries. The interest and pattern of agricultural development in many countries have made many students plan for international collaboration between their country and other nations. It is believed that establishing cooperation with the other domestic and international universities to uplift the standard of the agricultural universities and agricultural mechanization in Ghana is an avenue to strengthen cooperation and agricultural knowledge exchange. The intense education and international collaboration will help to enhance the mechanization systems, improve productivity, and invariably help reduce poverty in the region.

The main goals of BRI are to improve economic relations, improve interconnections among countries through transportation and logistics, promote agricultural technologies to alleviate poverty, encourage bilateral trade, facilitate currency exchange, support the integration of shared culture between individuals, promote global maritime interconnection, and promote scientific and environmental investigations (ESCAP, 2017). It was established that by 2020, China would significantly increase the number of scholarships to developing nations, particularly within the least developed like Africa, for student enrollment in vocational education, information and communication technologies, agricultural engineering, technical, and scientific programs (ESCAP, 2017). All these initiatives through BRI will help enlighten the youth and farmers in various countries who have the zeal to implement technology and mechanization processes in agriculture to alleviate poverty in many countries such as Ghana.

3. Agricultural mechanization advancement in Ghana

Mechanization refers to the improvement and modernization of agricultural operations through improved equipment or machines. It also includes manufacturing, distributing, and operating all kinds of tools, equipment, implement, and apparatus for agricultural expansion. If sustainable agricultural development is on the proposed agenda for growth, agricultural mechanization is required for land development, crop production, harvesting, storing, and on-

farm processing (Amponsah *et al.*, 2012) ^[2]. Agriculture mechanization utilizes three primary forms of power: mechanical, animal, and human. Hand tool technology is the simplest form of mechanization as it involves the use of simple tools and implements powered mainly by human muscle power. The primary power source for this technology is the human muscle, which limits the work rate since regular rest periods are necessary. As a result, most farmers cultivate just one hectare of land (Boahen *et al.*, 2007) ^[8].

In achieving sustainable economic growth, modernizing agriculture has been one of the government's efforts projected to achieve the United Nation's Millennium Development goal of ending hunger and poverty by 2015 (Amponsah *et al.*, 2012) ^[2]. However, this plan has not been fully achieved, and different strategies are required to reach the set target. Previous studies have demonstrated that agribusiness accounts for 60% of Ghana's Gross Domestic Product (GDP), 65% of its employment, and 50% of its exports (Boahen *et al.*, 2007) ^[8]. The statistics demonstrate that if Ghanaian implement and adopt mechanization in farming, enormous benefits would be attained to boost economic progress and alleviate poverty in some rural areas like the Adansi North District, Fomena. Africa is still the only region where agricultural productivity is stagnant, although agriculture brings considerable benefits to the continent (Amponsah *et al.*, 2012; Boahen *et al.*, 2007) ^[2, 8]. As of 2010, yields of maize and other staple cereals have generally remained around 1,000 kg/ha, which is about a third of the average yields recorded for the 1990s compared to the Asia and Latin American countries (Amponsah *et al.*, 2012) ^[2]. Ghana's natural conditions for agriculture are beneficial, but its dependence on food imports is high.

Most agricultural produce is lost due to poor post-harvest handling, storage, and processing methods. The focus of mechanized agriculture is gradually shifting to Sub-Saharan Africa and Ghana as they strive to achieve food security in response to the global agenda of attaining a maximum threshold of food security (Amponsah *et al.*, 2012) ^[2]. Ghana's food and agricultural production would suffer without effective mechanization. Agro-industry might not contribute as much to the economy as expected without mechanization (Amponsah *et al.*, 2012) ^[2].

The concept of agricultural mechanization and support was introduced in Ghana in 2003 to provide relevant and reasonably priced mechanized assistance to farmers who could not afford agricultural machinery on their own (Diao *et al.*, 2014; Houssou *et al.*, 2013) ^[13, 23]. The vision of transferring expertise and trained Ghanaian scholars and agricultural professionals in China to keep pace with technological progress in agriculture and other sectors is an important priority in this current period (Tsikata *et al.*, 2008) ^[44]. Insufficient knowledge in agricultural mechanization and technological cooperation in Ghana, among other factors threatened by land and agricultural issues due to inadequate environmental control measures, contributes to the increased poverty status of citizens. Government and institutions willing to specialize in modern agriculture by signing agreements with Chinese agricultural universities, empowering teams from Ghanaian universities, and practicing them in reality, either through direct agriculture from the state or through the transfer of mechanization technology to farmers, will aid development to alleviate poverty in Ghana. Agriculture is critical in Ghana, it generates enormous benefits such as employment, foreign

exchange, and economic growth (Obafemi *et al.*, 2021) [34], so it is worth creating a great interest in its upliftment. Encouraging and empowering the role of cocoa production and other agricultural products in Ghana generates greater chances of exporting Ghanaian farm products and other cash crops to different countries to attract foreign investment. Figure 2 indicates some of the current mechanized agricultural tools small farmers employ to assist productivity in countries like Zimbabwe in Africa, South Asia, and Mexico. Governments and non-governmental organizations may patronize these farm implements to assist small-scale farmers who do not have the resources to patronize all developing countries like Ghana to boost agricultural production and help combat poverty in the region. The following are the description of the current agricultural

machinery deemed "suitable" to be used in smallholder agriculture as observed in Figure 2 (Van Loon *et al.*, 2020):

- A. two-wheeled tractor with detachable power tiller;
- B. two-wheeled tractor driven direct seed and fertilizer drill;
- C. two-wheeled tractor single row planter;
- D. self-propelled rice and wheat reaper;
- E. two-wheeled tractor propelled stationary maize sheller;
- F. axial flow pump powered by a two-wheeled tractor;
- G. two-wheeled tractor-trailer used to haul agricultural produce to the market;
- H. A "Happy Seeder" is a machine that drills seed into rice residue without tillage; and
- I. A small-scale sprayer cart.



Source: (Van Loon *et al.*, 2020)

Fig 2: Current mechanized agricultural equipment

By proffering an article of the level of mechanization of agriculture and the availability of modern equipment as indicated in Figure 2, cocoa production and other farm products in Ghana, the Adansi North District, Fomena of the Ashanti region, are currently playing a significant role in the use of modern equipment. This article further highlights the state of agricultural mechanization in the district, which is targeted to alleviate poverty in Ghana, particularly among the small-scale farming community (Asare-Nuamah *et al.*, 2019) [3]. This article looked at a survey conducted in 9 areas of active operations within the district's three zones where commercial quantities of cocoa are produced to observe the readily accessible mechanization input information and their usage by cocoa-producing farmers and other farm products (Asare-Nuamah *et al.*, 2019) [3].

Article from the Adansi North Ministry of Food and Agriculture (ANMOFA) employees on the types of machinery, tools, and equipment available and their implementation rates by cocoa farmers in the nine areas of operations were assessed. The available machinery, tools, and equipment were classified as conventional hand-tool, enhanced hand-tools, and mechanical motorized-powered equipment. Their usage was mainly evaluated and represented in percentage growth by the district MoFA

(Asare-Nuamah *et al.*, 2019) [3]. The article demonstrates that several farmers lost connections in the district's mechanized farming chain of the cocoa production line, relying heavily on human labor (Asare-Nuamah *et al.*, 2019) [3].

A few key practice area tasks, such as seeding (germinating seeds), cultivation, application of fertilizers, crop management (spraying), harvesting, and drying, are still carried out entirely by hand. Given the existence of tractors in meaningful numbers, just a few processes, such as soil preparation, transportation, and cocoa bean shelling, are partly mechanized. The article highlighted several challenges confronting the mechanization of cocoa production within the district, including a lower agricultural gate value, a lack of credit, and an absence of adequate cocoa production guidelines, a complete absence of mechanization inputs, poor land ownership, and tenure structure, and a lack of mechanical development programs. Consequently, the average yield of cocoa within the region is only 2.9 metric tons per hectare, compared to the average yield of 5-6 metric tons/hectare obtained by cocoa-producing farmers in the district. This problem is also evident in the majority of the world's developed countries. This article recommends that quality, durable, efficient, and ample supplies of mechanization inputs be provided for the country's cocoa-

producing farmers, corroborated by similar development programs, without destroying the environment. To guarantee the long-term availability of production among these, a cocoa production policy must be implemented since that is the only way to ensure agricultural production and other farm products and an undisrupted availability of raw materials to industrial sectors.

As the core component of the country's attempt to meet the United Nations Millennium Development Objective of reducing hunger and abject poverty by 2020, which was not achieved because of the COVID-19 pandemic, agriculture must be modernized in achieving sustainable economic expansion. In some parts of Africa, and Ghana, the emphasis on agriculture is steadily moving to mechanized agriculture, which is required if food production in our region is to be accomplished. Unless efficacious mechanized farming is implemented, Ghana's agricultural industry and food production will not have the anticipated economic effect.

In Ghana, the main barriers to mechanization are a shortage of expertise labor to utilize such machines and equipment, farm size, adverse policy decisions, and the exorbitant cost of agricultural machinery. This article recognizes the immense significance of technology and mechanization to the country's agricultural production. Thus, the state needs appropriate policies such as land-ownership, empowering cooperative management, and specially designed hiring of machinery, providing farmers with mentoring on such investments and stimulating general service inputs.

3.1 Provision of farming inputs in Adansi North District, Fomena

The Ministry of Food and Agriculture (MOFA) provides agricultural inputs to farm owners through the Government of Ghana's planting for food and jobs program, which is a program to alleviate poverty through the planting of cocoa and other crops such as maize, rice, and cassava, among many others. The goal is also to lessen the hardships of farm owners, especially those living in rural areas such as the Adansi North District. Some farmers in the district reported that receiving subsidized agricultural inputs from MOFA, such as enhanced seeds and fertilizers, is an important initiative to boost agriculture and alleviate poverty (Asare-Nuamah *et al.*, 2019) ^[3]. Their article suggested that the strength of MOFA in supplying the needs of farmers is weak. Hence, an extension of mechanized farming initiatives from China through BRI to Ghana and, particularly, Adansi North District could be geared toward the plausible path of alleviating poverty in the region while ensuring economic prosperity in Ghana.

3.2 Transferring mechanized farming tools and assistance to the Ghanaian populace (Adansi North District)

The agriculture ministry also encourages improved technologies and innovations to boost crop productivity within the district. Innovations within the district aside from boosting cocoa production include plantain sucker multiplier, conservation no-tillage agriculture (Derpsch, 2008) ^[12], and bund construction are presently among the inventions used in the area. Farm owners can maximize plantain suckers with just one sucker through the plantain sucker multiplication technology (Asare-Nuamah *et al.*, 2019) ^[3]. According to the Ministry, "plantain sucker multiplication is very important for farmers whose farms are located on hilly lands." The farmers cannot carry a lot of suckers uphill. As a result, the

plantain sucker multiplier has arrived to alleviate their suffering. The farmers can now get a lot of suckers with just one sucker. Even though most farmers have not fully adopted the innovation in the district, others have adopted it, while a section of them have knowledge but have yet to implement it.

Also, the Rice Project of the Japan International Cooperation Agency (JICA) assists farmers in creating bunds on farms to boost productivity even on small lands (Asare-Nuamah *et al.*, 2019) ^[3]. These technologies could be broadened if BRI expands its territory in the agricultural sector by assisting Ghana with Chinese experts in food production and mechanization processes to boost agricultural yields while alleviating poverty.

Technological progress or mechanization, especially access to tractor services, is critical for broadening and enhancing agricultural output. Regrettably, small-scale farmers in Ghana continue to use mechanization or tractor services at a low rate. One of the reasons for this is a lack of those services in several agricultural communities. Further, the associated cost of mechanized equipment such as tractors has been a constraint in other areas where they prevail. According to the Ministry of food and agriculture, just 2.4 million hectares, approximately 30% of the prospective merchandisable farmland at around 8 million acres of farmland, are mechanized in the district (Robert Darko Osei *et al.*, 2020) ^[40].

3.3 Adoption of Tractor Mechanization as a tool for agricultural expansion

Ghana has been implementing several interventional strategies costing vast amounts of money to address the agricultural sector's obstacles, but with very little progress. The agriculture sector is a complicated structure needing efficient and effective measures. Considering investigations and factual substantiation from within and many other emerging regions in Africa, the impact of relevant agricultural technology cannot be marginalized (Force, 2008; Gatzweiler & von Braun, 2016; Pritchard, 2013) ^[15, 18, 38]. As a result, suitable agricultural technology is anticipated to boost remote Ghana's transitions and contribute to the state becoming a high-income nation.

Almost all government in the world aspires to achieve growth and prosperity by exploiting its resources available to the greatest extent possible without harming the environment. Agriculture is the most critical sector throughout Ghana, and government initiatives always have expected to boost agricultural production to achieve food security and create more foreign currency exchange resources to improve the living standard of the farming community, in particular, and even the whole country in general.

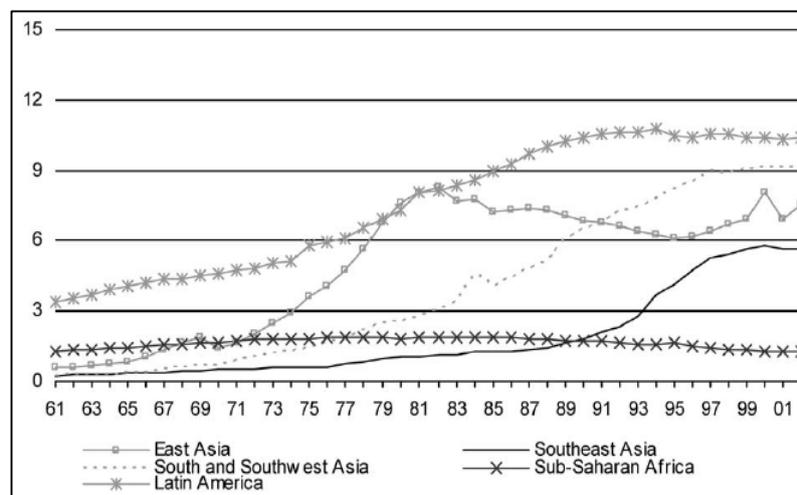
Further, the importance of mechanization in increasing crop production is widely acknowledged. This article suggests that prioritizing tractor mechanization as a tool for agricultural expansion in Ghana is a plausible path to enhance agricultural productivity and poverty alleviation (Robert Darko Osei *et al.*, 2020) ^[40]. By acquiring additional tractors and other implements, it is anticipated that this intervention will increase the region's economy under mechanization by 13% over the next ten years. Studies have shown that the improvements in soil quality, including soil moisture, water retention, air circulation, to mention but a few, resulted in increased growth and development of plants and thus continued to increase yields (Robert Darko Osei *et al.*, 2020)

^[40]. The mechanization of tractor services has seen an increase in the yields of many agricultural products (Benin, 2015) ^[5]. Through tractor mechanization, it is projected yields of agricultural products in Ghana may increase by 11 percent in the subsequent years (Robert Darko Osei *et al.*, 2020) ^[40]. Over the next ten years, it is anticipated that a 13% increase in agricultural mechanization in Ghana will be achieved (Robert Darko Osei *et al.*, 2020) ^[40]. The initiative will add to what the government is planning to undertake through the Agricultural Mechanization Services Centre to ensure that all gains are captured over the useful life of the tractors. (Robert Darko Osei *et al.*, 2020) ^[40] Estimated a model for the costs and benefits stream of tractors from 2020 to 2039. It is projected that the final tractors bought in 2030 will only cease operating in 2039 (Robert Darko Osei *et al.*, 2020) ^[40]. This suggests that the life span is long enough to produce the benefit for the farmers. One of several significant risks associated with agricultural mechanization is the intervention's effectiveness in supplying tractors to the appropriate segments of the private organization to enable overall effectiveness of use. Due to the absence of servicing amenities of the tractors purchased, they may not be used for their original purpose (Robert Darko Osei *et al.*, 2020) ^[40].

However, suppose the associated maintenance factors are considered and appropriately managed. In that case, it is projected that farmers will increase production by 0.2 percent per hectare, estimated in Ghanaian cedis as 822 million over 2030 through 2039 (Robert Darko Osei *et al.*, 2020) ^[40]. The African continent has lower use of mechanization tools to improve farming yields compared to different regions. Figure 3 demonstrates the number of tractors used in East Asia, South and Southwest Asia, Latin America, Southeast Asia, and Sub-Saharan Africa.

and Sub-Saharan Africa. Based on the continent's mechanization standards, information gathered from the Food and Agriculture Organization of the United Nations from 1960 through 2001 indicated that tractor technology acceptance patterns across the continents differ from each region. Thus, Asia and Latin American countries have high levels of mechanization acceptance in farming, whereas mechanization adoption in Africa, particularly Sub-Saharan Africa, is relatively low. In reality, some African nations assumed to be trendsetters have reversed their tractor user acceptance. In 2002, the average tractor use within Sub-Saharan Africa was about 1.3 per 1000 acres of cultivated area.

In contrast, it was around 9.1 in South Asia and 10.4 in Latin America for the same time frame. Tractor utilization reached its peak in Sub-Saharan Africa in 1986 at 1.9 for every 1000 acres and since then has decreased gradually. Stable agricultural production systems for grain crops, such as rice, wheat, and maize, appear to be more mechanized than lower intensively cultivated structures for root and tuber crops. However, recent investigations are indicating higher technology and mechanization acceptance in agriculture within the African continent that would increase agricultural yields and help to reduce the poverty status (Baudron *et al.*, 2015; Fuglie & Rada, 2013; Hillocks, 2002; Houmy *et al.*, 2013; Phillips, 1999; Van Rooyen *et al.*, 1987) ^[4, 16, 21, 22, 36, 46]. The trend of mechanization development in the African continent is evidenced in signing an agricultural mechanization agreement with the Indian government to boost agriculture in thirteen African countries, including Ghana, Mozambique, Zambia, and Togo (Patterson, 2017) ^[35].



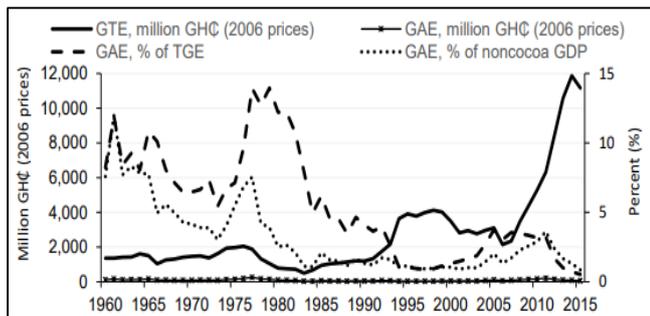
Source: (Pingali, 2007) ^[37]

Fig 3: Quantity of tractors per hectare of 1000 cropland-by region

3.4 Government expenditure in Agriculture in Ghana

Considering the immense contribution of agricultural products to Ghana, the government has made a series of expenditures to aid the mechanization of cocoa and non-cocoa products that help the country's development (Benin, 2019) ^[6]. Figure 4 shows Ghanaian governments' commitments from 1960 to 2015 to improve cocoa and non-cocoa farm products. The figure demonstrates a general decline in the non-cocoa subsector's share of Government Agricultural Expenditure (GAE) in Government Total Expenditure (GTE) from 1960 to 2015, reaching 14 percent

in 1977 and 1979. The share averaged about 8% per year until the 1990s when it dropped to about 2% per year and then rose marginally to about 2.5 percent per year during the Comprehensive Africa Agricultural Development Program era after 2003. The lower GAE shares in GTE since the 1990s are the result of much faster GTE real growth than GAE real growth, particularly since 2007, when GTE grew at an average rate of 22.5 percent per year while GAE declined 5.1 percent per year. Except for cocoa, noncocoa agriculture includes all crops, livestock, forestry, and fishing.



Source: (Benin, 2019) [6]

Fig 4: the expenditure of Ghanaian governments on agriculture from 1960-2015

3.5 Benefits of Agricultural Mechanization

The agricultural sector greatly influences every nation's economy. Mechanization trends across the globe clearly show that economic growth and mechanization are closely related (Pingali, 2007) [37]. Globally, rapid economic growth and solutions to food security problems have been achieved by those countries that have advanced to a higher level of mechanization in their agriculture during the past three decades. Notwithstanding, countries with a stagnant economy and high levels of abject poverty have also lagged in their agricultural mechanization efforts (Hazell, 2005) [19]. With the rapid trend of mechanization over the past decades and the global aspect of agriculture, there is a question whether African countries, especially Ghana, where humans and hand tools are heavily used in agriculture, could have a notable turnaround in development and growth in the subsequent years. Contrarily, many countries have achieved a significant increase in agricultural productivity due to farm mechanization (Fuglie & Rada, 2013; Hazell, 2005; Mehta *et al.*, 2014; Verma, 2006) [16, 47, 19, 31]. Hence, mechanizing agricultural operations is therefore needed in Ghana. Farm mechanization in the country needs to be strengthened for several reasons:

To begin with, due to the advent of mechanization, the time-sensitive nature of operations has become more critical in obtaining optimal yields from different crops. For example, before and after sowing a crop, the farmer needs to perform certain functions at the right time; otherwise, the yield and farm income will be affected. A mechanized system is the best choice for large areas of land, which is essential to ensuring that farm operations are completed as quickly as possible.

In addition, high yields can be achieved by improving the quality and precision of operations. As part of various agricultural activities, such as leveling land, irrigation, sowing, and planting, supplying fertilizer, protecting plants, harvesting, and threshing, accuracy is essential to maximize efficiency and minimize losses. A mechanical device is required to perform specific tasks, such as sowing at the correct seed rate and spacing and applying fertilizer uniformly. These operations are inefficient when indigenous methods carry them out.

Further, another factor that justifies agricultural mechanization is higher land and labor productivity. The labor requirement also decreases with the increase in output per hour. By increasing automation, job opportunities such as manufacturing, repairs, and service shops should be created, which may be absorbed by the displaced labor. In this way, labor is only shifted from one occupation to another. With the

mechanization of the farm operations, agriculture can be commercialized to a greater extent as production increases.

Also, mechanizing farm operations can reduce production costs by saving workers' time. The increasing cost of upkeep of draught animals in the absence of mechanization and the rapidly rising wage rate for human labor are curtailed. Moreover, mechanized large-scale farming results in lower production costs per unit. Furthermore, it minimizes the danger of climate disruption and labor shortages, reducing waste. Swift mechanical mobility, cleaning, and handling also allow for prompt and effective marketing.

Finally, mechanization expands employment opportunities in agriculture and non-agriculture industries by increasing the area under tillage, multiple cropping systems, the advancement of agribusiness, and related services. Conversely, human labor is displaced, and demand for semi-skilled labor is increasing in the position of unskilled labor. In addition, the struggle for human workers is diminished, and unsanitary activities, including managing farmyard manure, can also be performed with machines and equipment.

3.6 Challenges of agricultural mechanization

Mechanization advancement has stalled in much of Sub-Saharan African countries over the past decades, resulting in low profiles in nationwide sustainable agriculture approaches and mainly falling off the plan of global development institutions and donor agencies. The impediments of agricultural mechanization are also a source of worry to farmers. Thus, unsettling patterns of mechanization adoption demonstrate that agricultural production in Sub-Saharan Africa has declined in several ways (Asare-Nuamah *et al.*, 2019) [3]; including a decrease in food production per capita, reduced agricultural value addition, and agronomic imported goods compared to exported goods, and an increment in malnourished populaces (Asare-Nuamah *et al.*, 2019; Block, 2016; Clover, 2003; McIntire *et al.*, 1992) [3, 7, 10, 30]. Though, without hesitation, agricultural mechanization has immense potential for increased agricultural output and enhanced farmer standard of living. Notwithstanding, a couple of issues have been raised in protest to farm mechanization.

First, mechanization is hampered by farm owners' small size and dispersed holdings. As a consequence, farm equipment is usually underexploited.

Second, most local farm owners are impoverished and unable to afford expensive machinery such as tractors, combined harvesters, to mention but a few (Amponsah *et al.*, 2012; Baudron *et al.*, 2015; Roy & Singh, 2008) [2, 4, 41]. To maintain and operate machinery, skilled labor is required. Many tractors mechanization programs have failed in the past due to a severe lack of skilled labor to maintain and run them efficiently, resulting in tractors and equipment having a shorter life. A further impediment to efficient small farm mechanization is an absence of replacement and repair amenities, particularly in rural areas.

Further, unorganized mechanization can result in job loss due to labor displacement. However, increased structured farm mechanization creates jobs in the secondary and tertiary sectors, displacing workers in primary farm operations. Furthermore, machine reliance on fossil fuels sometimes raises operating costs as the cost of fossil fuels rises globally and becomes scarce at times.

Subject to the seasonal nature of agriculture development, farm equipment may be idle most of the time. Thus, idle

machinery leads to unnecessarily high costs unless suitable alternate use of such machines and equipment are made off-season. Furthermore, equipment is sometimes unsuitable for the operation condition (i.e., the soil, weather, and agribusiness conditions), causing it to degrade rapidly.

4 The Role of Belt and Road Initiative (BRI) in Agriculture

BRI is expected to increase China's external agricultural business investment opportunities and benchmark spending on infrastructure to encourage improved agriculture transactions (Qian *et al.*, 2019) ^[39]. Through BRI, more emphasis has been placed on international trade activities' environmental impact, which leads to the growth of an eco-friendly collaboration (Qian *et al.*, 2019) ^[39]. BRI has been an avenue for the global transformation of agricultural production (Huanchi & Xinhua, 2019) ^[24]. It is said that distance matters because time is of the essence. Besides, time is essential because the quicker products can be manufactured and traded, the higher the earnings for existing enterprises (Hildyard, 2017) ^[20]. For instance, JD.com, one of the world's largest e-commerce conglomerates based in China, asserts that it will soon be capable of delivering fruit and other products anywhere in the country to Chinese consumers' doorsteps within two days. An extremely integrated world infrastructure in connecting farmlands to warehouses to transportation to the consumer is required to accomplish this purpose.

The BRI, China's growing mega-infrastructure strategy, would therefore contribute to making JD.com's project a success. This innovation will massively increase food processing and marketing concentration, opportunity to reach local farmers, fish farmers, and rural areas further toward the margins (Huanchi & Xinhua, 2019) ^[24]. The BRI anticipates a land-based "belt" designed to connect China and Europe, as well as a sea-based "road" passing the Indian Ocean to Africa, up through to the Mediterranean, and across the Pacific to Oceania and Latin America (Huanchi & Xinhua, 2019) ^[24]. Thus, BRI envisions extending its territory to diverse jurisdictions to promote economic growth, agricultural mechanization, and infrastructural development (Huanchi & Xinhua, 2019) ^[24]. This valuable innovation through the Chinese president's initiative is targeted not to remain in China alone but also to be extended to the member countries.

4.1 The impact of BRI on Agriculture

The Chinese government has often prioritized food security. Previously, the responsibility of achieving food sustainability was focused on China's small-scale farmers; until recently, BRI has attempted to improve and sustain national self-reliance. The government is now changing its strategy, substituting peasant farms with large-scale commercial agricultural business operational processes, making investments in agriculture production internationally, and allowing other imported products (China-Government-Network & Keqiang, 2015) ^[9]. The private sector has constantly been driving Chinese international agricultural investment. According to (Gale *et al.*, 2018) ^[17], Chinese firms have invested US\$43 billion in agricultural production outside of China over the last ten years. (American-Enterprise-Institute, 2015) declared that individuals have taken on mega shopping sprees, patronizing products in worldwide production chain systems such as pork in the United States and soybeans in Brazil, and garnering better

control of the global seed industry by acquiring the majority shareholding of the Swiss-based seed giant Syngenta. China also imports a lot of soybeans, dairy, oilseeds, sugar, and cereals. The imports of meat and dairy products are increasing due to trade agreements with Australia and New Zealand. BRI is projected to increase China's external agricultural business investment opportunities and standard spending on infrastructure to enable effective agricultural exchanges (Huanchi & Xinhua, 2019) ^[24].

4.2 Belt and Road Initiative in the African continent

East Africa is the very first connection in the BRI's African link. China is constructing ports and sea infrastructure to improve the path from South Asia to Kenya and Tanzania and then to the Mediterranean through Djibouti. Inland railways are also being built to facilitate connectivity. China aims to incorporate BRI with the long-standing relation on China-Africa cooperation to boost African agricultural productivity and improve its agricultural imports from Africa (Huanchi & Xinhua, 2019) ^[24]. (Michael & Omoruyi, 2018) ^[32] revealed that China has already had agribusiness parks in Mozambique, Uganda, Zambia, and other countries. It is now expanding its agribusiness investment opportunities under the Belt and Road Initiative banner. In respect of West Africa, President Xi Jinping visited the area for the first time in July 2018 to connect the region to the Belt and Road Initiative. It is noted that Senegal has founded itself as a steppingstone for Chinese industry across the African continent. The Diannadio International Industrial Platform, a novel Chinese-funded special economic zone in Senegal, has been established. Because Senegal is a signatory to the African Growth and Opportunity Act, China can use Senegal's quota and duty-free privileges to produce and export goods from the special economic zone to the US economy. The same is valid for the EU market, where Senegalese products can be imported under a similar agreement (Huanchi & Xinhua, 2019) ^[24]. It is expected that more of such platforms would be extended to most African countries and especially Ghana through the BRI initiatives.

5. Recommendation and Future Perspectives

This article's main contribution emphasized the level of mechanization in Ghana, the need for external support from BRI, and how the support of BRI will be of great help to the general populace in Ghana in alleviating poverty while increasing economic development. This article further highlights the state of agricultural mechanization in Ghana in the context of adoption, benefits, and challenges tailor-made for agricultural expansion. In broadening the scope of the study, the state of agricultural mechanization development and cooperation of BRI in different regions were also highlighted. This article emphasized key points reiterating the need for a helping hand in mechanization in Ghana from recognized sources such as BRI to assist the country's plan to alleviate poverty, particularly among the small-scale farming community in the Adansi North District, Fomena.

Also, this study emphasized that BRI can continue to be a catalyst for development for the African community and especially Ghana to alleviate poverty in some rural areas like the Adansi North District, Fomena, where the majority of the inhabitants are farmers. This article further stressed that the country is poised for action based on the government initiatives to collaborate with internal partners and the local citizens' zeal to get out of the current increasing status of

poverty. This article put forward that in ensuring probity and accountability, where monetary transactions are involved, appropriate policy and monitoring strategies should be formulated to effectively and efficiently avoid mismanagement.

Though no institution and program instituted at its elementary stage could be devoid of challenges, this article suggests that, in overcoming the associated challenges in the collaboration between the Ghanaian government and China, the BRI policymakers may enshrine categorically in their terms and conditions why and how they need to ensure: fair deal, transparency, accountability, and frequent auditing in either, monthly or quarterly basis within the year or stipulated period to eliminate embezzlement of resources and mismanagement to ensure the goals set are attained on time. When the terms and conditions are specified and implemented at the program's inception, it is believed to assist in yielding the desired purposes of initiating the agricultural mechanization program in the country.

6. Conclusion

This article discusses the steps and initiatives the Ghanaian populace (Adansi North District) are adopting to incorporate mechanization systems in agriculture. It is clear that not much has been done to adopt technologies for farming systems in Ghana. However, few countries with high technologies are assisting the nation with their modern trend of food production and food security systems. This article calls for the contribution of BRI in its plan in building sustainable nations and alleviating poverty in the participating regions to fully extend their technological mechanization systems to most developing countries, especially to help address the deficit of agricultural mechanization systems in the area. Through BRI, it has been established that China has provided debt cancellation and humanitarian financial support to assist other participating developing countries to the best of its capability and with no political strings attached. Therefore, Ghana counts on China's technology to alleviate its infrastructural deficit and reduce poverty.

China and ASEAN countries have jointly launched the Rural Poverty Reduction Advancement Plan to alleviate poverty in Asia. In most countries in Asia, it has been established that there is a launch of a rural poverty reduction advancement plan to alleviate poverty; this article also solicits support from BRI to develop such initiatives in Ghana. Thus, Ghana appreciates the African region support provided by China in building water infrastructure and creating demonstration zones for agricultural cooperation.

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8. References

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