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The Most Important Agricultural Products that Sudan Exports and the Mechanisms to Develop

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Authors' contributions

This work was carried out in collaboration among all authors. Author AHI prepared, designed and analysed the study whereas author EPP analysed the data, supervised and directed the research. Author ADM helped to write and proof reading this manuscript. All authors read and approved the final manuscript.

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ABSTRACT

This study is dealing with the most essential agricultural products that Sudan exports them abroad and looks for the mechanisms of developing and improving for those products. The purpose of this paper is to find out the agricultural products that Sudan should depend on them as alternative export goods (instead of petrol which has gone with South Sudan after the separation), also this research aims to discover the mechanisms that used in increasing and expanding the production of those products. This paper is depending on the literature review and uses descriptive approach in order to describe the most substantial agricultural products that Sudan exports as alternative goods. The paper selected this method, because it is suitable. Data and information of this work have been gathered from different sources such as books, journals, newspapers, websites, government reports and other documents that are relevant to the title. The findings of this study are: the results indicates that, more than 65% of the population of Sudan depend on the cultivation, also, it shows that oil seed such as sesame seed, Cotton and Gum Arabic are the most substantial

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farming products that supply Sudan with hard currency, after the secession of South Sudan which was very rich part of Sudan with petrol. In addition to that, the paper has come out with the mechanisms that will be used in improving and increasing those products, these tools are; implementation of genetic engineering system in the areas of agriculture in Sudan, application of cultivation without tillage system and choosing the suitable time of agriculture. Cultivation development is one of the sustainable development goals, which targeting the increasing of productivity in rural areas, countryside is suffering from the lack of fresh water and the negative effects of climate change. Agriculture in Sudan, particularly Darfur and Kordofan regions is seasonable system that depend on the rain in autumn specifically the growing of millets, sorghum, oil crops for instance sesame seeds and water-melon. In Sudan, 80 percent of nonpatrol exports are from the agriculture and its derivations, therefore it contributes in narrowing the gap of unemployment.

Keywords: Agriculture; exportations; cotton; sesame; Gum Arabic; mechanisms.

1. INTRODUCTION

Agriculture is one of the most paramount factors in economy, because it is the main source of food, fibre and income. Sudan, as well as other third world countries which - despite progress in science and technology- has a low productivity, depends on agriculture [1]. Agriculture and livestock are considered as two of the most reliable sources of livelihood for the people of Sudan, as more than sixty-one percent of the total number works in two sectors. Sudan occupies the third rank in African continent in terms of area, it also has vast areas of arable land, in addition to water [2]. The key source of revenue and living income for 60-80% of the population and the driver of development is agriculture in Sudan, which is the driver for many economic sectors, including manufacturing, industry and transportation. More jobs opportunities will be generated by the projected effects of agricultural production. This will boost habitability in rural areas and rising domestic migration to larger cities, contributing to adequate food stability and poverty reduction [3]. The agricultural sector in Sudan has witnessed a significant deterioration during the past three decades, due to what was attached to the systematic destruction of many major projects, especially Al-Jazeera project, which was considered the largest irrigation system scheme in the world.

Experts estimate the cost required to rehabilitate the infrastructure of the project, which was ruined by the policy of the Muslim Brotherhood regime that was toppled last April 2019, at about \$ 60 billion [4]. Agriculture in Sudan faces major challenges, including poor extension and use of traditional methods and delayed rehabilitation of

irrigation canals in irrigated areas. Agricultural experts have made new suggestions out of the traditional tunnel, by applying mechanization, modern technologies and heat-resistant seeds, fertilizer production and agricultural land levelling. However, the Minister of Agriculture and Forestry in charge, Babiker Othman, said, in an interview with Al-Arabi Al-Jadeed, that the challenges that hinder the development of the agricultural sector are summarized in the lack of interest in scientific research, despite the great effort made by the Sudanese agricultural researcher [5]. The purpose of this work is to find out the agricultural alternative goods which replace the petrol that has gone with South Sudan during the separation in 2011. The questions that raised are: What are the agricultural products that consider as the alternative of petrol for Sudan after the secession of South Sudan? How those products can be developed?

2. LITERATURE REVIEW

2.1 Concept of Agriculture

The word agriculture come from Latin two words Agri + cultura, Agri means soil and cultura means cultivation. agriculture is application science, that encompasses all concepts of crop production involving horticulture, rearing of livestock, forestry and fisheries [6]. Agriculture is defined as sciences, as art and as business. As sciences: To optimize yield and benefit, uses all technologies built based on science principles such as crop growing, processing techniques, crop safety, economics. For starters, hybridized new crops and plants, pest resistant Transgenic crop strains, hybrids on each seed, reacting plants with high fertilizers, management with soil,

weed control herbicides, the use of biocontrol agents in the battle against pests and diseases. As an art, it requires knowledge of how to conduct farm operations in a professional manner but does not generally include the values behind farming practices. Although agriculture is essentially a consumption-bound way of life for the rural community growth. However, agriculture as a sector seeks to increase its net return through land labor, water and resource management utilizing the expertise of various sciences in grain, feed, fiber and fuel development. Agriculture has been sold as a company by mechanization in recent years [7]. Cultivation also, is an practice in which people engage directly in the life cycle and management of certain plants. In nature, dirt, water and other elements of the plant's ecosystem are controlled. It requires seeding seeds in soil that has been stripped from other plants at its most important. In processes of low pressure, these may result in plant burning (slash and burn), or the usage of fresh deposits of silt by flux. The preparing of the soil by looping is normally involved. The tools and equipment utilized in the workflow range from basic manual equipment (sticks, spades, hoes) to team-based instruments [8].

2.2 Significance of Agriculture

Over decades the development of important food crops has been synonymous with agriculture. Forestry, animal goods, crop production, livestock, beekeep, fungus, random, etc. are actually found in agriculture above and outside farming. Existing farming activities are also understood in terms of production, selling and sale of crops and animal products. Therefore, farming may be referred to as agricultural products growth, manufacturing, promotion and distribution. In the entire life of a given nation, agriculture plays a vital position. Agriculture is the foundation of a given country's economic structure. As well as fuel and raw material, agriculture works to reduce unemployment in the country [1].

As well as it is an essential material for many companies and factories. Also, agriculture provides opportunities of employment to a very big percentage of the population A food health nation is assured by a healthy agriculture sector. Each country's key necessity is food health. Food protection avoids hunger, which is generally perceived to be one of developed countries' main issues. Most countries depend on their key source of income from agricultural

products and related industries [9]. Agriculture reduces desertification and supply advantages to humans and animals of all kinds. Agriculture helps build some housing. In addition to that, it reduces poverty and its absence due to the availability of production and productivity. Agriculture utilizes its thousands to feed animal production. Beside to the contribution to farmer's vitality and activity [10].

2.3 The Impact of Agriculture on Sustainable Development

One of the objectives of sustainable development is to improve agriculture system and raise the productivity of rural area, This goal calls for all countries to increase cultivation, animal household and fishery production, develop agricultural methods, rural infrastructure, and access to food supplies, increase income for the smallholders, minimize environmental impacts, foster rural development, and ensure resistance to climate change. Local growers encounter a lot of problems. The issues are with the lack of fresh water, the effects of climate change and the need to build new programs focused on science and knowledge to alleviate nutrition for the weakest of such families and maintaining more efficient and robust agricultural systems. Established agricultural practices have contribute to a loss of biodiversity, a degradation of groundwater, excessive nitrogen and phosphorous production, chemical contamination and other destruction. Sustainable Development Goal 6 acknowledges the centrality and viability of sustainable agriculture [11]. Sustainability of environment can be created by the engagement of the institutions and community [12]. Therefore, stability of environment contributes in increasing of agricultural production in rural areas.

Sustainable development lies at the heart of the Food and Agriculture Organization's strategic framework, and the motivation for FAO's work in the area of sustainability is to recognize complex interactions between goals and different interests. The necessary shift towards sustainability necessitates actions that focus on actual changes in practical practices, including strengthening related capabilities and ensuring a policy enabling environment that recognizes these interactions and addresses trade-offs and synergies. Agricultural development efforts, especially crops, livestock, forests, fisheries and aquaculture, have resulted in significant productivity improvements. There is competition between crops and livestock for land and water,

usually expanding their range at the expense of forests, and this causes declining biological diversity and an increase in carbon dioxide emissions. Trade-offs are based on three dimensions of sustainability, which are the economic, social and environmental dimensions. The Food and Agriculture Organization has developed five principles to achieve a balance between the three social, economic and environmental dimensions (1). Improve resource efficiency. (2) Direct measures to conserve, protect and enhance natural resources. (3). Protect rural livelihoods and improve equality and social welfare. (4). Strengthening the capacities of individuals, societies and ecosystems to withstand climate change and market fluctuations. (5). Promote responsible and effective governance mechanisms [13].

Sustainable development is a link between the current generation and the next generation, ensuring continuity Human life, and guarantees for the next generation a decent living and a fair distribution of resources within one country, and even between multiple countries. The importance of sustainable development lies in being a way to reduce the gap between developed countries And developing plays a major role in reducing economic dependency abroad, distributing production and protecting The environment, social justice, improving the standard of living, raising the level of education, reducing the percentage Illiteracy, provision of capital, raising the level of national income, social justice 1. Agricultural production in its two parts (vegetable and animal) constitutes the driving force of the human being. Also, it is the main profession that accommodates a huge number of workers.

2.4 Agriculture as One of the Sustainable Development Goals SDGs

Sustainable agriculture is at the heart of the 2030 Agenda, and the first essential step in ensuring hunger is eliminated. There has been a great debate over the past thirty years on how to define "sustainable agriculture". Since cultivation contributes to advancement - as one of the economic activities, a source of livelihood and a provider and utilizer of environmental services - the 2030 Agenda refers that all sectors, including agriculture, should be seen through three dimensions of sustainability: Economic, social and environmental. Indicator 2-4-1, defined as "the proportion of the agricultural area devoted to productive and sustainable agriculture", does not differ. In the past, it was defined mainly by

environmental standards. If the soil is bad or if the water is not managed properly, the farm may be considered unsustainable. In recent years, it has been recognized that sustainability is much further than this. It includes economic and social dimensions. And put farmers at the center of things regions [13].

Agriculture investment will address not only malnutrition and undernutrition but other problems such as poorness, water and energy usage, climate changes as well as inefficient production and consumption are discussed in agriculture expenditure. Inextricably related to economic growth benefiting the poor is agriculture production. Indeed, the World Bank reports that the growth of agriculture in incomes among the poorest among all sectors is around two to four times more efficient than development (in sub-Saharan Africa, up to 11 times more successful) Improved production is needed for over three quarters (77 percent) of the additional food we expect to generate by 2030 [14]. If the farm is economically unsound or unable to withstand external shocks, or if the welfare of the farm workers is not taken into account, the farm will not be sustainable. This indicator was developed through a multi-stakeholder process that includes statisticians and technical experts from countries and international organizations, national statistical offices, civil society and the private sector. It combines issues related to productivity, profitability, resilience, land, water, decent work and well-being in order to accommodate the multidimensional nature of sustainable agriculture. It is being pilot tested in selected countries from different regions [13].

2.5 Agriculture in Sudan

The climate in Sudan is characterized by diversity, and it ranges from the tropical climate in the south to the semi-arid climate in the middle, and the arid desert climate in the north. Forests and natural pastures are important economic and environmental resources, this importance is reflected in the conditions of agricultural productions and food security. The agricultural sector is considered as one of the pioneering sectors in the Sudanese economy, it consists of the irrigated sector, the automatic rain sector and the traditional rain sector. Agriculture contributes to an estimated percentage of the gross domestic product, as most people depend on it to provide food and employment opportunities [15].

In 2011 there was the separation of South Sudan, due to that, the total area of Sudan has reduced becoming 1.8 million km. In Sudan there is diversity which represent in the diversity of ecology, diversity of topography and diversity of people. According to the report of UN in 2017, by the 2050 the population of Sudan will double, now the enumeration of population of Sudan is estimated by 40 million inhabitants. The demand for the food in Sudan is growing due to the growth of population, staple demand of food in Sudan is consisting of roots and cereals is expected to increase from 6.5 million tons to 10.1 million tons by 2030. In Sudan agriculture is practiced by two main way (1) rainfed (2) traditional and mechanized, it occupies over than 90% of farming land, 10% of cultivation in Sudan is done by irrigation. Agriculture sector is divided into three main subsectors involving (1) cropping it contributes by 36% (2) livestock, it contributes 60% (3) forestry and fisheries, contributes by 1%. Their contribution is to the gross domestic product (GDP). In Sudan farming provides livelihood to 65% of the inhabitants, specifically to the population whom live in rural areas and poor families. Cultivation in Sudan is operating under its productive potentials, it can be watched in the major crops of Sudan, that represent in wheat, cotton, groundnut, millet, sesame and sorghum. In addition to other agricultural products such as; gum Arab, sugar cane, and livestock that includes camels and live sheep.

The key rainfed food produced in West Sudan (Darfur and Kordofan) is Millet, with a low yield of average productivity of less than 240 kg / hectares a year in the traditional Darfur and Kordofan rainfed region. The low productivity is usually because of low inputs, no inputs like fertilizers are being bought for millets. In addition, the rainfall quantity and stability affect and eventually decide output. The conventional rainfed market, which is generally characterized by low crop productivity, low utilization levels of inorganic fertilizer and improved seed, is mainly produced for sorghum, sesame, millet and pasture species [16].

Sorghum is a major cereal crop in Sudan, with more than 34% of total staple crops growing in the region. Sorghum cultivation is important in the eastern region of Sudan, and its growing area and production account for over 5% of the region's main total grain crops. Accordingly, it is important for plant management issues as well as food supply and requirement nationally to

obtain early and accurate information on sorghum yields and plant in this area. Gedarif is considered to be the largest mechanized region for rain-feeding sorghum in the country where the rain-fed agriculture grew to approximately 2.3 million ha in 2006 from 500 hectares in the early 1940s and later to more than 4 million hectares in recent years. In this area, almost 50 percent of the total Sudanese sorghum is cultivated. The mechanized rainfed sorghum area covers approximately 4 million ha and provides some 50% of Sudan's total sorghum production [17].

2.6 Impact of Agriculture on Sudan's Economic

Sustainable economic aims to raise agricultural productivity and production for regional security and export food. Social sustainability aims to Improve productivity and agricultural profits Small and ensure food security Domestic. Environmental sustainability aims to ensure sustainable use and land conservation Forests, water, wildlife, fish and water resources [18]. Agriculture plays an important role in the development of Sudan in terms of exports and industrialization, it considers as one of the essential resources of Sudan, agriculture contributes in the total out puts of manufacturing in Sudan at 60% in the form of raw materials, 80% of nonpatrol exports are products of agriculture. It contributes in economic recovery [3].

Agriculture is the mainstay of the Sudanese economy, as Sudanese farmers relied on traditional agriculture in Sudan in ancient times for strength. This is for themselves and forage for their animals, the culture of Sudanese society is based on life agricultural and many problems occurred in seasons before and after planting and harvesting for reasons of land ownership or traditional clash between livestock owners with farmers. Until recently, Sudan's main exports were production Agricultural and livestock are represented by crops of cotton, maize, wheat and peanuts It was exported to foreign countries, such as cotton, on which factories relied Europe generates hard currencies that contribute to the movement of the public treasury The economy, despite the deterioration in agriculture in Sudan in the past decades However, it represents the main pillar of the Sudanese economy, due to the significant contribution In exports and GDP, and because most of Sudan's cash exports The food suitable for agriculture is about 200 million

acres of automatic rain irrigation Traditional rain [19].

2.7 Sudanese Exports of Agricultural Products

Sudan has suffered from a protracted social conflict and a civil war. In July 2011, it lost three quarters of its oil production due to the secession of South Sudan. The oil sector has been the main driver of Sudan's GDP growth since 1999. For almost a decade, the economy has boomed against the backdrop of high oil production, high oil prices and large inflows of foreign direct investment. Since the economic shock experienced by Sudan as a result of the secession of South Sudan, Sudan has struggled to stabilize its economy and compensate for the loss of foreign exchange earnings. The interruption of oil production in South Sudan in 2012 for more than a year and the subsequent loss of oil transit fees further exacerbated the fragile state of the Sudanese economy. The ongoing conflicts in Southern Kordofan, Darfur, and Blue Nile states, the lack of basic infrastructure in large areas, and the reliance of many residents on subsistence agriculture have left half of the population at below the poverty line, according to the CIA's World Factbook. Sudan is trying to develop non-oil sources of revenue, such as gold mining and agriculture, while implementing austerity program to cut costs. Sudan produces the world's largest exporter of gum arabic, 75-80% of total world production. Agriculture continues to employ 80% of the workforce [20].

2.7.1 Sesame seed



Source: [21,22]

Agriculture and livestock are the main sources of Sudan's income after the separation of South

Sudan in 2011. About 80% of Sudanese population depend on agriculture and livestock, both of them shape as third of economic sector. Sesame is cultivated in the area of Savanna of Sub-Sahara Africa, eastern part of Sudan is considered as the original land of farming sesame, it is the erect yearly plant, up to one meter it is grow, it is appropriate for sandy soil, loamy soil and clay soil. It favors soil that is well-drained. Sesame seed is susceptible to salt, but resistant to the drought, it is ideal for rain-fed cultivation (300-1000 mm) in Central-Eastern Sudan. In certain cultivable fields, sesame seeds can be used in several colors. Sesame seed is most widely traded and colored off white. Buff, tan, gold, brown, red, gray, and black are also common colors. Sudan has the largest cultivated field of sesame in 2014, with 2,53 million hectares, led by India, which harvests 1,86 million hectares, Myanmar 2,14 million hectares and Tanzania, which harvests 6,52 million hectares.

The fourth highest in overall export amount is Sudan, however, while the fifth highest is Tanzania. This figure indicates that in African states like Sudan and Tanzania output gain per ha is not as successful as in Asian countries such as China and Myanmar in terms of production yield per ha. The most critical aspect of farm operations and main cash crops in Sudan is sesame seed cultivation. Sudan accounts for 45.8% of the land, which in 2014 was planted with sesame seeds and around 2.53 million hectares were sprayed. Much of its development facilities include sesame seed, boarding with South Sudan and Ethiopia in the South-east of Sudan. It has 1050 ha of land cultivating sesame seed, or 52 per cent of the global output of sesame seed. Kordofan is the main development location. The State of Kassala is preceded by an area of 231 hectares. The development of sesame-seeds in Sudan takes into account two kinds of agriculture, semi-mechanized rainfed agriculture and conventional rainfed agriculture. Semi-mechanized rainfed agriculture is performed by major farmers and by significant federal or commercial bank deposits. Access to land by advantageous expenditure allows horizontal extension and large-scale cultivation. The semi-mechanized rainfed production in Sudan, including sesame and other crops, is 5.9 million acres of agriculture, with semi-mechanized cultivation accounting for 62% of the country's developed sesame.

Instead, family households cultivate profits and livelihoods conventional rainfed agriculture. Traditional sesame and other products rainfed cultivation occupies approximately 7.56 million ha of Sudanese land, and traditional rainfed farmers account for 38 percent of country's output of sesame seed. Following Burma, India and China, Sudan is the fourth-largest manufacturer of sesame seeds. In 2013, 562,000 tones, which represents approximately 10.3 percent of global total seed output, were generated by this region. Small subsistence farming and small farmers who depend upon rain-fed crops are the main part of the sesame development in Sudan, and irrigation does not come in addition to this. The production is therefore volatile in 2013, whereas in 2012 there were 562,000 tones, while in 2012 there was only 187,000 of the 562,000 tons of sonamic seed produced in Sudan in 2013, approximately 239,000 tons were exported to the world, according to Sudan Central Bank. Chinese seeds (22% of overall exports), Saudi Arabia (15%), Egypt (15%), Syria (1% of the total exports), Lebanon (6% of all seeds) and Jordan (15%) are the main importers of the Sudanese sesame seeds [22,23].

2.7.2 Gum Arabic



Source: [23,24]

Gum Arabic (GA) is a pure, edible gum, its unique properties derive from a complex mix of glycoproteins and polysaccharides. The usage of GA is common in numerous fields and global demand is increasing steadily; for this purpose, GA origin evaluation is important to counter market fraud and guarantee food health [24]. Gum is mainly produced in the belt region of Africa, especially Sudan, Chad and Nigeria. In the food industry, it is used in the confectionery industry, in the pharmaceutical industry, it is used as an emulsion, film coating and others. Gum

has traditionally been used to treat chronic kidney failure, dyspepsia, and others. Although gum Arabic is considered an inactive substance, it is not Recent information has demonstrated multiple pharmacological and medical effects, such as weight reduction, pressure, hypoglycaemics, anticoagulant, antibacterial, Anti-diabetes, anti-inflammatory and other medical effects [25].

Acacia plants, Acacia Senegal and Acacia Seyal of South Africa, are the nontimber forest component of Gum Arabic, with various applications. The Acacia group of natural gum occurs over 500 species. Gum from A. Senegal tree and. Seyal tree is recognized as of strong commercial significance. A Senegal tree is commonly referred to the Hashab tree in Sudan, either on natural sites or on farms. Gum from Seyal, known locally as Talhah in Sudan, is harvested without tapping. The fruit is grown directly on trees. Seyal's general usage theme is firewood and energy production. However, the tree contains a large amount of gum. Seyal favours desert soils and is present in mere stands alone and in combination with others. The species develops natural gum, which is known to be weaker than the gum of Hashab, but it has a range of local uses and commercial applications. Farming systems of the Sudanese rubber belt are primarily Acacia-based cultivation, in which, in addition to livestock development, A Senegal is intercropped with farm crops. It constitutes about 12% of Sudan's GDP and is a productive agriculture program that guarantees a healthy, safer climate and provides social and economic benefits to the gum belt community in Sudan. Gum Arabic generates over 80% of the world's Gum Arabic. In the country's economy, gum arabic plays an significant function. Stable income source for rural people, especially in crop failure seasons.

As the key component of conventional rainfed cultivation, the contribution of Senegal to the household income and foreign exchange revenues is recognized as important. The farm is split in four sections in the perfect sense of the hashab farming system: just mature A. Senegalese field, premature field, young stand interspersed with crops and freshly felled sole trees. At farm stage, the economic and environmental importance of a development dependent on Acacia is a dynamic system; efforts are also required to understand it [26]. As, strong evidence, that Gum is a foreign exchange

source in Sudan [27], and it derives the hard currency from the exportation of Gum Arabic [28] that Sudan is the largest producer of Gum Arabic, but due to the wars in South Kordovan and Darfur the amount has decreased around 25%. Also U.S.A. economic sanctions that imposed against Sudan in 1997 played a role in declining the rate of production of Gum Arabic because of closing of international markets in front of Sudanese products.

2.7.3 Cotton



Source: [29]

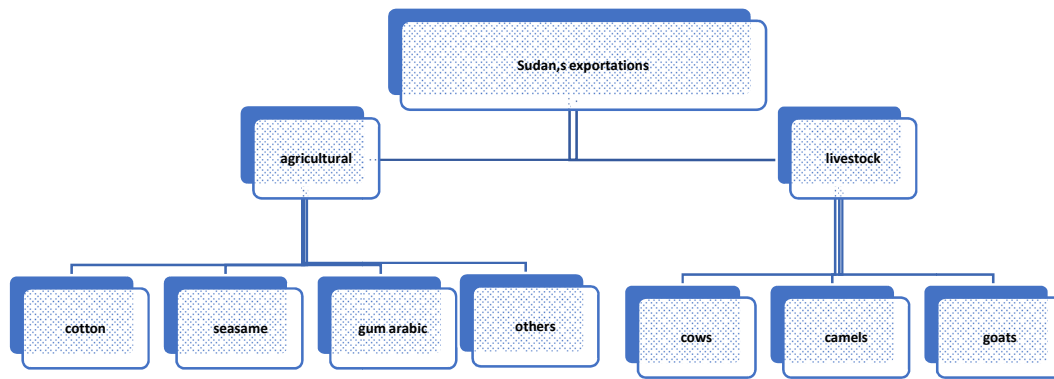
Cotton is considered as one of the most important sources of natural fibres in the world, as it is produced in about 70 countries of the world. The rest of the countries are either manufactured or consuming the products. The world's cotton production is about twenty million metric tons, China and the United States produce (Equally approximately) 40% of the total of the world production, followed by India, Pakistan and Uzbekistan, respectively 14%, 10%, 6%, then the rest of the world. And this global production has nearly tripled in the last fifty years. For Sudan, cotton is the first crop in terms of the contribution of the agricultural sector to GDP, and effects on wide sectors in society, where about two hundred thousand families work directly in addition to direct and indirect agricultural employment. Besides its impact on other economic sectors

such as the industrial sector, the commercial sector and the services sector.

Cotton is important in the multiplicity and diversity of its uses, as cotton is the main source of the textile industry, as it is used from a seed in Producing industrial oils, fodder and detergents, in addition to its various marginal uses such as the use of fluff in an industry IEDs, carpets, paper [30]. Cotton is a cash crop in Sudan and is grown on a commercial scale. Cotton was the first export crop before the production and export of petroleum products. Sudan relied on cotton for hard currencies. Cottonseed contains vegetable oil at 20% of the seed's weight and is used in cooking and making soap. There are constraints of cotton production they are: (1) An increase in the cost of production, resulting in a decrease in productivity and growth. (2). Low average productivity per acre due to lack of rain, poor farm yields, and decreased profit. (3) Commercial classes of cotton are limited in addition to the problems of preparation and environmental pollution. Sudanese cotton is externally demanded, Asian countries constitute the largest mass consumer of Sudanese cotton, with Sudan's cotton exports reaching 53% in 1987 and increasing to 63% in 1992. The most important countries importing black cotton are: Thailand, Japan and China [31].

3. RESEARCH METHODOLOGY

This study depends on literature review and it uses descriptive approach, beside to that, it follows qualitative method, because this method is very appropriate to describe the Sudan's most significant agricultural exports and the mechanisms that will be used to increase the rate of exports of different agricultural products such as cotton, sesame seed and gum Arab. Thus, to collect data and information about the agricultural exports of Sudan and the strategies to raise up the percentage of them, the paper used secondary data sources such as books, articles, newspapers, government of Sudan reports and other documents that is related the title. The researcher chose the case study of Sudan, because it lost the main source of its revenues which was petrol in South Sudan, it took place after the separation of South Sudan in 2011. Therefore, Sudan has to look for alternative sources of revenues which represent in agriculture products such as cotton, sesame seeds, gum Arab and other products.



Source: Researcher

4. RESULTS AND DISCUSSION

In 2017, Sudan exports of cotton were US\$138.27 million, according to the database of UN COMTRADE on the international trade.



Fig. 1. Sudan exports of Cotton
Source: Trading economic (2020)

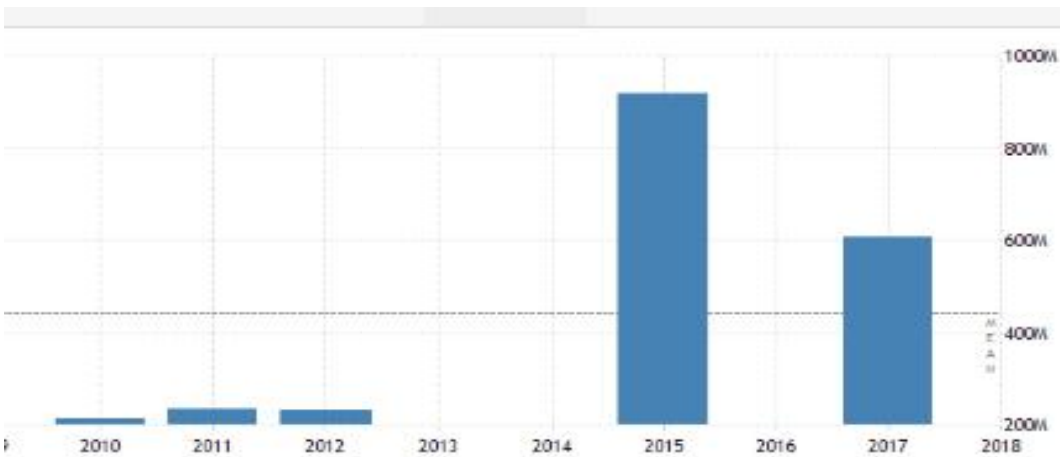


Fig. 2. Sudan exports of oil seed, oleagic, fruits, grain and seed
Source: trading economics (2020)

According to the COMTRADE database of united nations on international trade, Sudan exports of oilseed, fruits, oleagic and grain was US\$607.45 million in 2017.



Fig. 3. Sudan exports of Gum, lac and resins

Source: Trading economics (2020)

Above, illustrates the exports of Sudan of gum, resins and lac, according to the COMTRADE database which belongs to United nations, it clarifies that in 2017, Sudan exports was US\$114.69 million.

According to the figures above, Sudan exports of oil and gum was high in 2017, while the exports of oilseeds was high in 2015, therefore, in order to develop the traditional system of agriculture, especially sesame, cotton and others, some new applications and tools should be followed such as:

1. The cultivation system without tillage: Cultivation without tillage is the direct seeding of crops without mechanically stirring the land with chemical treatment of weeds before and during sowing and also during the stages of crop growth. The cultivation system without tillage is characterized by a number of characteristics, namely: Increased soil susceptibility to moisture retention due to leaving plant residues on the surface of the earth that work to retain moisture and reduce surface runoff of water, as well as reduce water loss through evaporation. Improving soil building properties due to keeping plant wastes that increase the organic matter and increase the activity of living organisms. Also, one of the characteristics of cultivation without tillage is achieving effective control of weeds by improving the performance of pesticides and reducing their density with repeated system [32].

2. In case of cotton cultivation genetic engineering techniques should be used: genetic resistance to pests is very important for the

cotton plant as it affects cotton Pests led to a deterioration in the quality of the fibre and seed in addition to the lack of production as it increases Production costs. The goal of genetic engineering was to produce varieties with the ability to resist One or more pests, although the first goal is to fight against plant diseases but there is interest With insect resistance, the bacterial cell of the first hybrid was sensitive to most insects while it was done Obtaining average levels of resistance in the germ cells of the second and fourth hybrids. The important point is that the MAR varieties are modified varieties genetically (develops genetic or genetic variations derived from cotton adapted to the environment. The same system is based on the creation and definition of genetic or genetic mergers in order to obtain On plant resistance to diseases, insects and environmental stresses obtained results show that MAR varieties have a high throughput, whether or not adverse conditions exist The germ cell has a distinct advantage in early flowering and fruiting as well as early ripening. In Texas all MAR varieties produced higher production in the first year and the results are evident in Increased genetic gains in production and early generation from the first to the fourth hybrid and this increase in Production is accompanied by an increase in the characteristics of resistance to diseases, insects and adverse conditions [33].

3. In order to increase the productivity of sesame, its cultivation should be on the suitable time, the results of various researches confirmed that the optimum date in general for clay mechanized lands is cultivation after about 100

mm precipitation or sufficient amount of rain to fill cracks and this occurs in Sudan, early July in most areas or mid-June in the southern ends of the automatic cultivation belt or after On the northern outskirts, fifteen days. Early planting means that the planting takes place first, then the weeds are built after the crop has grown, i.e. cultivation without tillage or sand blasting, and this results in an increase in the costs of weeding, but it compensates for a doubling in productivity. As for the delay, the young plants will be exposed to torrential rains during August, leading to the death of many plants, as well as the exposure of the crop to pests and thirst at the end of the season. Add to that early planting increases productivity and this is done by first growing the crop, then weeds are removed, i.e. cultivation without tillage or sand blasting. Late planting until August affects the establishment of the crop [34]. Also the results show that, the promotion of the oil industry in the country needs to issue orders and directions from the Central Bank of Sudan to provide the necessary and appropriate financing for production processes to purchase major inputs and other production equipment. it urged the departments of the various factories working in the oil and soap industry to keep abreast of global technical developments, to overcome the effects of the relative underdevelopment of the technologies used in production processes [35].

4. The results show that, the production of gum Arabic in Sudan would increase by expanding the area of cultivation of Hashab. Hashab tree is the tree that produces gum Arabic in addition to the Talh tree and some other trees Such as Sunt. Also, it shows that, under normal circumstances, Sudan could produce at least 85% of the world's production of gum Arabic. At the same time, 100% of gum Arabic production in Sudan is grade 1. Gum of Nigerian, Chadian, and the rest of West Africa are considered to be Grade 2 gum. Since Nigerians have the ability to forge, they call their gum Grade A, but, knowing that there is no gum called Grade A [36]. The results indicate that the removal of the restrictions and the control of the foreign trade of Al-Arabi would increase the export revenues of gum Arabic in Sudan Also, an increase in the returns of small-scale farmers who produce Gum Arabic. It also refers that The problems of the Arab gum sector are represented in the size of the huge belt, and the short harvest season, which does not exceed two months, during which labour is mobilized and funding is provided [37].

5. CONCLUSION

This paper was written because, Sudan has lost around 75% of petrol revenues due to the secession of South Sudan in 2011, which was very rich with petrol. Sudan must look for alternative goods which fills the vacuum of petrol in order to export them, therefore, the agriculture was the possible alternative for Sudan's economy, it gives strong evidence that Sudan's export products are represent in two sectors namely; agriculture and livestock. Here in this paper the writer interests in sector of agriculture, the paper found that sesame, cotton and gum Arabic are the most agricultural products which are the pillars of the exports of Sudan to the abroad. Data and information have been collected from different sources such as books, journals, newspapers, websites, government reports and other documents that are relevant to the topic. In order to develop tools and mechanisms of increasing the production of those agricultural products in Sudan the paper propose various technics such as; cultivation system without tillage, genetic engineering in plants, suitable time for cultivation and expanding the area of farming those products, particularly Hashab tree, Telh tree and Sunt tree which grown in Sudan, specifically in Western Sudan-Kordofan and Darfur- regions.

The researcher recommends that, the state should encourage investment in agriculture and animal production. Graduates of the Faculties of Agriculture and Animal Production must have long-term funding for the implementation of agricultural and animal science projects that contribute little by little to replacing traditional agriculture and traditional animal production with a modern one. The development process does not mean that the old is harmful rather, it means that the new is more competitive globally, and more able to generate profits for the country in hard currency. Therefore, more attention, planning, and tireless work in this field will move the States from the slave countries to the mobile and emerging countries, which makes us stand strongly behind the statements of the Minister of Agriculture to establish an investment fund for food security and agricultural development soon, open to Arab and local banks and investment funds and absorb many Of production vessels in the agricultural and animal fields.

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Authors have declared that no competing interests exist.

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