REPUBLIC OF SOUTH SUDAN

MINISTRY OF AGRICULTURE AND FORESTRY

AGRICULTURAL MECHANIZATION POLICY

(2012 – 2017)

July, 2012

PREFACE

One of the major development strategies in the Republic of South Sudan is to transform subsistence farming into commercial agriculture within the next five to ten years. This strategy auger well with the overarching national objective of "Food for All by 2015". Poverty, food insecurity and unsustainable growth and development in the country is associated with low agricultural productivity due to inefficient and ineffective agricultural operations, which are predominantly dependent on manual labour and hand tools and implements. In comparison with China, Brazil and Turkey, the rapid expansion in farm machinery has stimulated the growth of local machinery manufacture to the point where these countries are now major producers and world leaders in farm machinery exports. The Government is fully aware of such developments and hence in 2007**,** it purchased over 403 tractors of various models for distribution to the ten states for use in mechanizing smallholder land tillage and other field operations. However, low institutional capacity, inadequate knowledge and skills, poor linkages between the private and public sector, and financial constraints, limited the successful implementation of this initiative.

South Sudan as an independent country has the vision to transform the country, socially and economically is the major prerogative of the Government. In this context, reinvigorating agricultural mechanization is a new development paradigm to ensure poverty reduction, food security and sustainable growth and development. Promoting and reinforcing the use of diverse agricultural machinery and implements among various food and cash crops will contribute to efficiency and effectiveness in agricultural operations and value addition. However, this initiative requires guidance and direction through policy development, legislation and regulations to manage and regulate agricultural mechanization. In addition, financial and technical contributions of the donors, development partners and the private sector constitute a pillar for success in implementing the policy and the strategic plan.

Hon. Dr. Betty Achan Ogwaro
Minister of Agriculture, Forestry, Cooperatives & Rural Development

EXECUTIVE SUMMARY

One of the major factors contributing to food insecurity and low economic growth and development in the agricultural sector is the inefficiency and ineffectiveness in agricultural operations due to a high degree of dependency on manual labour tasks in subsistence farming, which has created drudgery, increased cost of production and limited agricultural productivity and profitability in South Sudan. Major constraints limiting efficiency and productivity among farmers include intensity of subsistence farming which is less profitable; low knowledge and skills in mechanization; poor access to agricultural machinery and implements due to high cost structure and lack of availability; and inadequate technical support services, for example maintenance and servicing of machinery and equipment. Low human capacity and weak institutional capacity also contribute to poor access, management and implementation of mechanized farming.

Challenges and opportunities in agricultural mechanization exist in the country. South Sudan has potential to establish large scale mechanized agriculture since it has abundant land. However, mechanized farming is costly in terms of investment and also substitutes capital for labour. Large scale mechanization can result in land degradation through deforestation, soil and nutrient mining. Additionally, as output from high-technology, large scale mechanized production enters the national market at prices competitive with imported products, traditional smallholders will find it even more difficult to market their surplus production. Appropriate mechanization by smallholders can help them to improve competitiveness.

Climate change, for example floods and drought, is another challenge limiting the capability of agricultural mechanization. In South Sudan, there seems to be a general trend over the last decades that extreme climatic events become more frequent and stronger. Flooding disrupts road transportation networks and prevents land preparation using farm machinery and implements.

On the other hand, summer rainfall decreased by 10–20% across parts of Western and Southern Sudan between the mid-1970s and late 2000s, creating drought which affects effectiveness of agricultural machine operations such as ploughing (FEWSNET, 2011). Since 1980, decreasing rainfall has been accompanied by rapid increases in air temperature on the order of more than 1°C across Central and Southern Sudan. Over the past 30 years, these areas have been among the most rapidly warming locations on the globe, with station temperatures increasing as much as 0.4°C per decade. Again, observed changes alone account for 63% of the change magnitudes.

Currently, all imported goods in the country including farm machinery and equipment are charged valued added tax (VAT) of 15% while duties vary between zero to 50%[1]. Frequently, there are inconsistencies with taxes and duties which need to be addressed during the strategy formulation. For example, duty on imported tractors, agricultural machinery and equipment is 1% while spare parts are 8%. This has an adverse effect on the maintenance and repair of machinery and the sustained utilization of the capital investment.

Another challenge to mechanized farming include limited access to capital to enable farmers acquire improved agricultural equipment and spare parts. In addition, high cost of equipment and machinery is a hindrance to adopting mechanised agriculture in the country. In 2011 there were 9 commercial banks and one agricultural bank to provide credit and loans.

Despite many constraints and challenges, South Sudan has opportunities to address some of these bottlenecks. For example, Government commitment to agricultural mechanization, coupled with financial support from foreign investors, especially donors and development partners provides an opportunity to transform subsistence agriculture into commercial farming as well as add value to raw materials to stimulate demand at local and international levels. Furthermore, a broad partnership with public-sector and private-sector agencies and actors at local, regional and international levels will play a catalytic role in expediting implementation of agricultural mechanization in the country.

The Country has abundant land and a suitable agro-ecological environment that are amenable to small, medium and large scale mechanization. In addition, itis rich in bio-diversity comprising natural resources including natural forest and woodlands with an estimated total area of 191,667 km^2 from which various sources of high value commodities such as timber (teak and mahogany), sheanut (locally known as lulu), gum acacia and honey are produced. Based on these opportunities, there is potential for industrialization through plantations of sugar, tea, coffee, timber, and naturally growing gum acacia.This will create employment and contribute to household income, food security and the country's sustainable growth and development.

Although there is a general consensus that agriculture in South Sudan must be mechanize, caution must be exercised as to the type of mechanization to be promoted and facilitated. World-wide experience and lessons from donor assistance to increase mechanization in developing countries provide a number of lessons that should be taken into account when making mechanization policy choices. Experiences in the developing countries, especially Asia and Latin America, show that agriculture has been transformed into progressive commercial and industrial enterprises. Investment in agricultural mechanization has enabled

[1]Customs (2011). Ministry of Finance and Economic Planning (RSS).

farmers to intensify production and improve the quality of life as well as contributing to national and local prosperity.

The major objective of the Mechanization Policy is to improve efficiency and effectiveness of agricultural production and related operations to sustainably increase crop production and productivity, household incomes, food security and rural economic development. In the context of this overarching objective, MAF/RSS will be implementing the following policy statements to ensure increased efficiency in agricultural operations and value addition through a vibrant agricultural mechanization sector:

Policy Statement No1: **P**romote transformation of smallholder agriculture from subsistence to market-oriented production through mechanization.

Policy Statement No 2: **I**mprove and promote appropriate technologies in agricultural mechanization.

Policy Statement No 3: **P**romote sustainable use of soil based mechanization on proper management of farm machinery, while enhancing natural resources biological processes above and below the ground.

Policy Statement No 4: **E**nsure that agricultural land is free from land mines and unexploded ordinance (UXO).

Policy Statement No 5: **B**uild capacity of personnel and operators' knowledge/ skills in agricultural machinery and other related fields.

Policy Statement No 6: **C**reate conducive environment for small, medium and large scale farmers to adopt improved mechanization technologies.

Policy Statement No7: **E**nsure the development of service enterprises by entrepreneurial farmers who are ready to invest in agricultural machinery and implements for use on their farms as well as for providing mechanization services to the small-scale farmers.

Policy Statement No 8: **I**mprove functional, management and organizational structure of agricultural mechanization.


CHANGCHAI

LIST OF ABBREVIATION

MAF	-	Ministry of Agricultural and Forestry
MCPS	-	Mechanized Crop Production Scheme
MFC	-	Mechanization Farming Corporation
R& D	-	Research and Development
VAT	-	Value Added Tax
MFI	-	Micro-Finance Institution
MTD	-	Mechanical Transport Department
CBO	-	Community-Based Organization
FBO	-	Farmers Based Organization
UNIRDO	-	Upper Nile Rural Development Organization
NICODO	-	Nile Community Development Organization
ACCOMPLISH	-	Action Committee to Promote Local Initiative Self-Help
EU	-	European Union
JICA	-	Japan International Cooperation Agency
AGRA	-	Alliance for Green Revolution in Africa
USAID	-	United States Agency for International Development
AMS	-	Agricultural Mechanization Strategies
IFAD	-	International Fund for Agricultural Development
FAO	-	Food Agricultural Organization
UNIDO	-	United Nations Industrial Development Organization
SSDA	-	South Sudan Demining Authority
NCAM	-	National Centre for Agricultural Mechanization

AGRICULTURAL MECHANIZATION: BACKGROUND

1.0 BACKGROUND

South Sudan covers about 640,000 square kilometres between latitude 3.5º and 12º North and longitude 25º to 36º East. Mean annual temperatures vary between 26º C and 32º C across and rainfall, which supports the nation's agricultural activity, is erratic and significantly variable (Lupai, 2009). South Sudan borders Ethiopia in the East, Kenya, Uganda and the Democratic Republic of Congo in the South and Central African Republic in the West and North Sudan in the North. It has potential of arable land (30%), grazing land (40%), heavy forests (23%) and swamps and surface water (7%) (Wongo,1984). Currently, less than two per cent (1.3 million hectares) of the total area is utilized for production (CFSAM, 2010). Ecologically, it is divided into the Greenbelt, the Ironstone Plateau, the Central and South-eastern Hills and Mountains, the Flood Plains, the Nile and Sobat Rivers Zone, the Arid and Pastoral Zoneand the Central Rain Lands (SSLHP July, 2006). The Blue Nile and its tributaries flow down from the highlands of Ethiopia, while the White Nile and its tributaries flows from Uganda and Central African Republic into the low clay basin to form the world's largest contiguous swamp on their way to Sudan and Egypt. In addition, altitude belts can be defined as low belt less than 2000 ft a.s.l, middle belt 2000-4000 ft a.s.l and high belt 4000-6000 ft a.s.l.

The annual rainfall pattern is zone dependant ranging from 500-2000 mm, which provides 130-300 days growing season. Likewise, agricultural performance varies in accordance with zone and year. Furthermore, the temperatures are too variable and typically above 25°C, and above 35°C, during the dry months; January to April. The dry hot, conditions trigger human and livestock migrations to more permanent water sources, which serve as dry season grazing and fishing areas. The nation is blessed with ample natural resources that include vast fertile lands, extensive hardwood forests, large amounts of fresh water and minerals, and variety of livestock. These endowments provide opportunities for different kinds of agricultural and economic activities.

Administratively, South Sudan is sub-divided into 10 States; namely, Central Equatorial, Eastern Equatorial, Jonglei, Unity, Upper Nile, Western Equatorial, Lakes, Northern Bahr El Ghazal, Warrap, and Western Bahr El Ghazal States.

1.1 Rationale for Appropriate Mechanization

South Sudan agriculture is typified by smallholder families that practice low-technology hand-labour agriculture. Because of severely limited employment opportunities compared to available workforce, 80% of South Sudan households are directly dependent on subsistence

farming for their livelihoods. Most of these households are quite poor and their economic conditions are not improving. They are trapped in a seemingly unbreakable "cycle of poverty" from which they are unable to escape.

Giles (1975) as cited by Arnon (1981), concluded that for mechanization to be effective, the average aggregate yield of major crops should be at least 2.5 tonnes/ha and determined that the available power to the farmer should be at least 0.5 hp/ha. Man as a power unit produces only about 0.01 horsepower of continuous output and is therefore not worth much as a primary source of power (Barger *et al*., 1963). With only a hand hoe, Boshoff and Minto (1975) concluded that across the African continent, only about 0.5 ha could be prepared for planting. Based on the above, for man to earn a living from agriculture as an economic activity, he cannot count on hand tool technologies alone. Therefore, the importance of mechanization policy is indispensable to guide investors and farmers in appropriate decision making.

There is a general consensus mechanization is necessary for effective transformation of the agriculture sector in South Sudan. Nevertheless, caution must be exercised as to the type of mechanization to be promoted and facilitated. World-wide experience and lessons learned from donor assisted interventions to increase mechanization in developing countries provide a number of lessons that should be taken into account when making mechanization policy choices. Experiences in Asia and Latin America show that agricultural transformation has led to progressive commercial and industrial enterprises and enabled farmers to intensify production and improve the quality of life as well as contributing to national and local prosperity. In countries like India, China, Brazil and Turkey, the rapid expansion in use of farm machinery has stimulated the growth of local machinery manufacture to the point where these countries are now world leaders in farm machinery exports. Such machinery are researched for appropriate use of farmers like those in South Sudan and its technology could easily be adopted for or local manufacturing industry.

1.2 Mechanization in South Sudan

Agricultural mechanization in Sudan was first established in Gadaref District / Kassala province in the early 40s, in the rain–fed areas of the central clays ecological zone for sorghum (dura) farms.. Mechanized Dura Schemes were first initiated in Goz Famu and Undelwis in 1953. The famous Undelwis Prisons farm was established in 1956. After the establishment of Mechanized Agricultural Authority in 1970, an estimated 320,000 feddans were surveyed comprising 268 private schemes in Undelwis, Goz Rom. The importance of sorghum (dura) production was realised during the Second World War (1942) when this crop became the only main source of food for troops in the eastern front. After the war, the commercial production of dura under Mechanized Crop Production Schemes (MCPS) was extended to other areas like Dali, Mazmuom and Sennar in Blue Nile province and to some

extent, Goz fami and Undewis in Upper Nile province. Until 1950, the areas under MCPS were about 1.0 million feddans. In the late sixties, it was felt necessary that more land could be put under agricultural mechanization with introduction of oil crops like sesame, sunflower and safflower plus pearl millet or bulrush millet. A semi-autonomous body known as Agricultural Mechanization Authority was formed in 1970. In 1974 the Authority became a public corporation called Mechanization Farming Corporation (MFC). From 1975 to 1982 a total of 123,800 feddans of landwas surveyed in Upper Nile as mechanized schemes spread in Akoka/Malakal, Kaka/Dudok, Fama/Kodok, Adulang (Bentu) and Mohamed Ajak (Malaka).

By 2011, Renk had now expanded to an area of 1,558,833 schemes ranging from 500 to 2,000 feddans, while Wadakon has about 685,000 feddans, bringing the total area surveyed for agricultural mechanization in Upper Nile to 2,367,633 feddans. Most of these schemes ceased to operate during the conflict. Currently, only the Renk and Aweil rice schemes continue to function. Some mechanized large commercial farmers in Upper Nile State are producing sorghum, millet, maize, rice, sunflower, sesame and groundnuts. Based on a ten year (1972/73 – 1982/83) Southern Region plan, some areas were proposed for agricultural mechanization and pilot projects were initiated in the following areas:

- Amadhol Dura Scheme in Northern Bahr El Ghazal
- Aliab Dura Scheme in Lakes State
- Jebel Lado Dura Scheme in Central Equatoria State
- Kapoeta Dura Scheme in Eastern Equatoria State
- Lafon Dura Scheme in Eastern Equatoria State

In the past, hardly any attention was given to appropriate mechanization of small-farm rain-fed agriculture. Although the Northern Upper Nile was expected to have 1,000 tractors or more, beginning in 2007**,** the government purchased over 403 tractors of various models for distribution to the ten states for use in mechanizing smallholder land tillage and other field operations (Faguir, 2011). There about 1,538 machinery in Renk including those distributed by the Government.

The tractors and equipment were available for hire to farmers, farmers associations and cooperatives, primarily for land preparation at a cost ranging from SPP50-240 per feddan. A tractor potentially cultivates 1,000 feddans / season and therefore 1,538 would cultivate a total area of 1,538,000 feddans with a production of 559,090 mt[2] (Faguir). However, some of this equipment was never used as intended because of logistical problems.

Today, a large part of this pool of tractors and equipment is missing, or in disuse because of lack of spare parts, fuel and lubricants, along with inadequate (or non-existent) maintenance and repairs. It has also been reported that much of the tillage equipment procured was

[2]1,538,000 x 4 sacks/feddan = 559,090 mt.

inappropriate for prevailing local soil conditions. Although this effort at smallholder mechanization failed, there are numerous worldwide examples of successful "appropriate" mechanization of smallholder farming systems (when combined with other productivity enhancing inputs and cultural practices) that increase factor (especially labour) productivity sufficient for smallholder families to be food secure and economically viable.

The lesson learnt from worldwide experience in developing countries shows that provision of public sector "machinery pools" has not been successful in introducing mechanization into smallholder farming systems. Machinery has little chance of success under the prevailing conditions in South Sudan. Creating adequate infrastructure and skilled human resource base required by the "machinery pool" model, would be a long-term undertaking. The fact that public schemes require heavily subsidized capital inputs, suggests that mechanization would inevitably fail without a strong private sector engagement in the sector.

2.0 PRINCIPLES FOR MECHANIZATION POLICY

Agricultural mechanization is defined as the process of improving the use of agricultural tools, implements and machinery for agricultural land development, crop production, harvesting, preparation for storage, on-farm processing and value addition to maximise efficiency and effectiveness of farm operations. Hand tool technologyis the simplest and most basic level of agricultural mechanization which uses human muscle as the main power source. In addition, draught animal technology refers to implements and machines utilizing animal muscle as the main power source. However, mechanical power technologyis the highest technology level in agricultural mechanization. It embraces all agricultural machinery which obtains its main power from other sources other than muscular power. Within each of these three levels of mechanization technology, degrees of sophistication must be distinguished. For example, a simple locally made single-axle tractor without differential gears and gear box, a single axle tractor with gearbox and power-take-off, and a 70 kW tractor, are all mechanical power technology, but with a large difference in sophistication and capability.

The objectives of agricultural mechanization includes, to:

- improve agricultural productivity and food security;
- release labour for other operations;
- enable or increase efficiency of farm operations including value addition;
- generate off-farm employment opportunities in the manufacture, supply and servicing of machinery; and
- improve the quality of life by reducing drudgery involved in farming operations.

In recent years, the international marketplace has been offering a wide range of machinery and equipment that is scaled to smallholder-sized farming operations. Making appropriate choices requires considerable expertise, and effective utilization requires considerable supporting private sector infrastructure, including skills training, tools and equipment for operation, maintenance and repair. Introduction and effective utilization of scale-appropriate agricultural machinery must be a gradual process that does not exceed the service capacity of the support system. Large manufacturers of smallholder-scaled machinery often will invest financial and human resources in promotional activities to test and introduce their equipment. Policies must assure that any such introductions include long-term commitments to assist in building the necessary support system and that environmental compliance is ensured and adhered to.

3.0 CONSTRAINTS, CHALLENGES AND OPPORTUNITIES

Among the main contributing factors for prevailing low productivities in the agricultural sector is the inefficiency and ineffectiveness of farm operations, including land preparation, cultivation, weeding, harvesting, storage and value addition. A high degree of dependency on manual labour in subsistence farming and value addition has created drudgery, increased cost of production and limited agricultural productivity and profitability in South Sudan. For example, the cost for hiring a tractor for ploughing, in 2010 was SSP265.5/ha, while use of labour power for digging by hand cost SSP403/ha which is 35% higher than the former. Most farm operations, post-harvest and processing activities are done using a small range of rudimentary tools and implements with limited application of tractors or ox-ploughs. This constraint is manifested in extremely low labour productivity, yields and profitability. For example, smallholder maize yields in this country average 0.5-0.7mt/ha, whereas in neighbouring Kenya, the average is 2mt/ha (Makokha, 2001), which is still low by world-wide standards.

Similarly, typical value-added for smallholder family labour in South Sudan is estimated at less than SSP3.1 (US$1) per person per day. This low level of family in-kind income generation barely covers family subsistence needs. It does not allow capital accumulation for investing in improved inputs and cultural practices that increase productivity sufficiently to generate financial surpluses beyond subsistence needs. Furthermore, there is no “surplus” family labour to improve labour performance in many cultural practices that achieve improved yields and land productivity. According to the Joint Baseline Survey Report on the Agriculture and Animal Resources in Southern Sudan, the average household size in seven (with four males and three females), while active labour force in agriculture is 80% among women[3].

Factors contributing to labour inefficiency include predominance of subsistence agriculture, inappropriate technology, inadequate support services, low knowledge and skills and poor access to improved equipment and implements (machinery). Major challenges limiting efficiency in agriculture and value addition include mechanization of large scale farms (which can exacerbate rural poverty), poor health, climate change, taxes and duties, poor access to financial resources, land mines, poor infrastructure (access to feeder roads and markets) and low human and institutional capacity to manage and implement agricultural mechanization. Opportunities in agricultural mechanization exist in South Sudan. These include Government commitment to agricultural development, abundance of land resource, suitable agro-ecological conditions and bio-diversity, support by the donor community and local, regional and international demand for food and agricultural crops.

[3] FAO (1995). Women, Agriculture and Rural Development: A Synthesis Report of the Africa Region.

The Agricultural Mechanization Policy aims at addressing these constraints and challenges to improve the performance of the subsector and enhance its contribution to economic growth and development.

3.1 Constraints

3.1.1 Subsistence Agriculture

Approximately 95% of South Sudan rural population depends on subsistence agriculture of which 80-90% earns less than SSP3.1/day. Studies on maize production cost and agricultural labour show that despite relatively high yields in Western and Central Equatoria, net returns were negative when accounting for family labour and meals for labourers. These costs were substantial and affected producer decisions to expand production, hire additional labour and invest in new technology. For the producers surveyed, an average loss of about SSP139.50 per hectare was incurred under current conditions. Producers lost about SSP74.4/metric ton when all costs were accounted for. For subsistence farmers, the absolute value of losses are lower due to smaller plot sizes and less total labour requirements, but total losses would be greater when converted per hectare level because of lack of economies of scale.

Over 95% of agricultural production is rain-fed and weather variability is a major factor in determining crop performance in low and high land areas. The majority of farmers in the country use traditional knowledge and inputs which result in low agricultural output. Cultivated area at household level ranges from 0.5 – 5 feddans, despite the abundance of land and natural resources. Approximately 4% of arable land is presently utilized. Since all family members are fully occupied in low-productivity subsistence production tasks, there is no family labour available to apply improved cultural practices that can achieve increased yields and land productivity. Therefore, mechanized farming under subsistence agriculture is not cost effective.

The absence of farmers' organizations coupled with attitude, traditions and gender differentiation, limit the land size for cultivation among some communities in the country. In some traditions, farming in carried out exclusively by women.Agriculture is not considered a business among the majority of farmers in South Sudan. Furthermore, migration of most energetic youth to urban areas leaving behind elderly people constitutes additional challenge in terms of labour availability and cost. Small and fragmented nature of land holdings are often a limiting factor to mechanization due to diseconomies of scale.

3.1.2 Inappropriate Levelof Technology

Agricultural mechanization in South Sudan has been associated with application of inappropriate levels of technologies. Availability of appropriate technology is constrained by inadequate knowledge and information due to weak extension capacity. However, appropriate technology is advanced through research and extensions services. Currently, research

development is minimal due to low human capacity and inadequate funding. As a result, farmers are not able to access appropriate technology. Furthermore, farmers' attitude limits their ability to adopt technology.

Currently, agriculture is typified by smallholder families that practice low-technology and hand-labour agriculture. Because of severely limited rural off-farm and urban employment opportunities compared to the available workforce, 80% of the country's households find themselves directly dependent on subsistence farming for their survival[4]. Most of these households are quite poor, and their impoverished socio-economic condition limits their access to improved appropriate technologies. They are trapped in a continuing "cycle of poverty" from which there has been no escape.

3.1.3 Poor Access to Mechanization Technologies

Improved technology, especially for small-scale farmers, hastens poverty reduction through increased crop yields and higher incomes. However, poor farmer access to technology has been hampered by gaps in infrastructure, seed and input markets, extension systems, and very often their ability to afford these inputs[5]. Market, institutional and policy failures have exacerbated the problem. A great deal needs to be done to alleviate small farmers' constraints to technology access and profitable use. Technologies that build on and complement local knowledge tend to be particularly effective in meeting the needs of poor farmers in marginal environments.

In South Sudan, stakeholders have concluded that agricultural equipment is not easy to acquire. A major constraint to increased mechanization for farmers is poor access to full mechanization. This is the result of the high cost of mechanization inputs, low purchasing power of the majority of farmers to acquire them and poor access to loans. Lack of skilled tractor operators is considered to be one of the reasons why Government supported mechanization schemes failed in the past. Other constraints in the country include little commercialization of agricultural products, poor availability of spare parts and the inappropriate land tenure system. In addition, the absence of commercial mechanized services limits famers' access to farm machinery and accessories.

3.1.4 Inadequate Support Services

Success in agricultural mechanisation requires supporting institutions and services such as research and development (R&D), education, training and extension, infrastructure development, land consolidation, etc. Other services include provision of farm inputs including farm machinery and the associated technical support services (supply, repair and

[4] CFSAM, MAF/FAO/WFP Report 2010.

[5] ASARECA (2006). Newsletter - Volume 9 Number 18.

maintenance of equipment). Currently, supporting institutions and services in the country are nascent or emerging.

It is frequently assumed that, in developing countries, the government must undertake these support services because the private sector is not yet developed enough. However, government institutions are usually weak and largely ineffective and/ or inefficient, making it impossible to attract and retain competent staff and to implement substantive programmes.

3.1.5 Low Human Capacity

South Sudan has inadequate functional agricultural mechanization training centres to facilitate improvement of agricultural productivity and efficiency, and in turn this has led to undeveloped agricultural mechanization, food insecurity, and extreme poverty. One of the major constraints in building agricultural mechanization capacity is lack of critical mass of qualified, motivated and committed professionals to national development agenda. Some engineers and technicians were displaced during the war and others migrated abroad. The quality of science-based outputs and outcomes is dependent on the skills and competences of professional and technical staff in agricultural mechanization. There is limited harmonized long-term human resource development strategy and plan for building a critical mass of professionals trained and equipped to handle local and contemporary problems at national level. Inadequate training centres to train tractors operators and extension staff in appropriate and efficient use and management of crop production equipment, makes it difficult to harness the best from the existing human resource capital.

3.1.6 Post-Harvest Losses

Generally, huge losses occur in crop production due to lack of post-harvest machinery and equipment for harvesting, handling, packaging, processing, storage, cooling and transportation facilities. Losses range between 30% - 40% which was a negative impact on the national economy.Traditional grain storage structures, systems and practices in the country have not changed. Very few farmers' cooperatives and grain traders have permanent grain storage structures and few storage structures belonging to cooperatives and traders are often small and in very poor condition (leaking roofs, cracked walls, etc.). In addition, labor demand for storage construction, drying, shelling and cleaning of grain is very high and often competes with other agriculture production activities.

Farmers' understanding of the science behind local grain storage practices such as grain drying and use of rat guards is limited. Improved grain storage technology, called *grainpro,* was introduced to some farmers in Yambio. While they appreciated and believed that *grainpro* is superior to the traditional stores, they also regarded it as expensive and difficult to access. Both Maridi and Yambio farmers (and farmers in the Country in general) lack mechanisms for introducing and promoting improved agriculture production and processing technology and production inputs, including technical services.

3.2 Challenges

3.2.1 Mechanization of Large Scale Farming

About85% of all smallholder African farms including South Sudan are less than 2ha per household, which could be combined to create large blocks of farms for mechanisation using tractors. Large-scale mechanized farming is advocated so as to improve land and labour productivity. It can be expected to reduce unit costs of production and most likely can compete effectively with foreign production, both in internal markets and in export markets. Thus, national food security would be enhanced and foreign exchange sources diversified.

Large scale mechanization, however, is costly in terms of investment. In addition, farming concessions necessarily rely on large scale mechanization and substituting capital for labour. Under this model, demand for semi-skilled and skilled labour (e.g., tractor drivers, service and maintenance personnel, and mechanics) increases, and there is little demand for unskilled manual labour. Therefore, large scale mechanized agricultural production will absorb only minor amounts of labour and most of whom will be skilled, creating huge unemployment status. Currently, there are very limited urban employment opportunities in the country and this will not change significantly for many years. Additionally, a considerable number of unskilled under-employed and disguised-unemployed labourers live in rural areas, both on subsistence farms and in rural communities. These rural labourers are almost wholly dependent on subsistence agriculture and their work is related to informal value chains for their livelihoods.

Large scale mechanization can result in land degradation through deforestation, soil and nutrient mining. Additionally, as output from high-technology large scale mechanized production enters the national market at prices competitive with imported products, traditional smallholders will find it even more difficult to market their surplus production. Appropriate mechanization by smallholders can help them to improve competitiveness.

3.2.2 Climatic Factors

Shifting weather patterns, for example climate change, can limit the capability of mechanized agriculture through increased unpredictability of precipitation, risk of catastrophic flooding and drought. Agricultural mechanization systems are highly vulnerable to such changes. Climate change is defined as any change in global temperatures and precipitation over a period of time due to natural variability or as a result of human activity**.** There seems to be a general trend over the last decades that extreme climatic events become more frequent and stronger.

In South Sudan, there seems to be a general trend over the last decades that extreme climatic events become more frequent and stronger. For example, in 2009 more than 40,000 people were displaced by severe floods in South Sudan. The flooding was concentrated in the

country's south eastern Jonglei State, where the heavy rains caused the Nile River to spill its banks and drenched the rural province. Flooding disrupts road transportation networks and prevents land preparation using farm machinery and implements.

On the other hand, summer rainfall decreased by 10–20% across parts of Western and South Sudan between the mid-1970s and late 2000s, creating drought which affects effectiveness of agricultural mechanized operations such as ploughing (FEWSNET, 2011). Smoothed time series of 1900–2009 rainfall, extracted for the extended the Darfur region (10 to 16 degrees north, 22 to 29 degrees east) and South Sudan (3 to 7 degrees north, 27 to 35 degrees east), show that the 1990–2009 rainfall had been, on average, about 20% lower (-1 standard deviation) than rainfall between 1900 and 1989. Since 1980, decreasing rainfall has been accompanied by rapid increases in air temperature on the order of more than 1°C across Central and South Sudan. Over the past 30 years, these areas have been among the most rapidly warming locations on the globe, with station temperatures increasing as much as 0.4°C per decade. Again, observed changes alone account for 63% of the change magnitudes (FEWSNET, 2011).

A Southern Sudan Environmental Threats and Opportunities report by USAID (2007) observes that there is clear evidence of desertification advancing southward. in the location of the Aweil rice scheme (Northern Bar el Ghazal), one of the two environmental problems noted in the rice scheme was the lower levels of rainfall and flooding compared to the past, whereby it is increasingly difficult to maintain the rice fields under water for the three to four months as required to produce a good rice crop.

3.2.3 Taxes and Duties

Taxes and duties on farm machinery and accessories can be considered as a negative subsidy and their purpose may be similar, but in addition they generate revenue for the government. Currently, all imported goods in the country including farm machinery and equipment are charged valued added tax (VAT) of 15% while duties vary between zero to 50%[6]. Frequently there are inconsistencies with taxes and duties which need to be addressed during the strategy formulation. For example, there are low or no import duties on agricultural machinery, but high duties on spare parts. Duty on imported tractors, agricultural machinery and equipment is one per cent while spare parts are eight per cent. This has an adverse effect on the maintenance and repair of machinery and the utilization of the capital investment.

A principal argument against taxes and duties on imported tools and machinery is that, if food imports are free of taxes and duties, the inputs to produce that food within the country should also be free of taxes and duties. If the Government wants to increase food production or

[6]Customs (2011). Ministry of Finance and Economic Planning (RSS).

produce it more efficiently then the use of modern inputs should be encouraged rather than punished.

3.2.4 Poor Access to Capital

One of the major challenges to subsistence agriculture is limited access to capital to enable farmers acquire agricultural improved equipment and machinery to improve efficiency in farm and value adding operations. In addition, high cost of equipment and machinery is a hindrance to adopting mechanised agriculture in the country. Limited access to capital also prevents operators of agricultural equipment and machinery to acquire spares and this compromises sustainability of mechanised farming.

Sources of credit and loans can be accessed through commercial banks and microfinance institutions. In South Sudan, there are nine commercial banks with one agricultural bank. This bank provides credit and loan to individuals depending on risk assessment of the applicant. Most if not all the banks consider agriculture as high risk enterprise and they have not shown interest investing in the sector. Atil (2009) observes that out of the country's population of 8,260,490, only about 6,000 have bank accounts and about 212,973 can access microfinance services, from non-banking financial institutions. The MFI's estimate of coverage is only 5% of the available clients in the greater Juba region and less than 1% of the potential market in the entire country. Whilst the majority of clients are still focused in urban hubs and have a very low rural penetration, the MFI's address mainly women (67%) and 7 of the 10 states of South Sudan already benefit from the nascent microfinance services.

3.2.5 Low Institutional Capacity

South Sudan has very low institutional capacity to implement and manage agricultural mechanization. Institutional capacity embraces a combination of policies and guidelines, legislation and regulations, administrative structures, economic and financial arrangements, political processes and key participation of stakeholders in the organization. The policy framework exists, but it is currently under review because it was not comprehensive and aligned with national and regional current economic and social conditions. In this framework, there are approaches and strategies emphasizing provision of inputs for increasing agricultural productivity using private sector intermediaries and regional agricultural institutions. Some of these inputs include labour saving technologies and cost effective implements (such as mechanical diggers, ploughs, planters, etc).

In spite of this policy framework, legislation and regulations to manage and regulate agricultural mechanization have not been developed. As a result, Government's effort to enhance mechanization has not been effective. In the absence of policy, there is no law and regulations governing land clearing to facilitate agricultural mechanization.

One of the major constraints limiting the success of the Government agricultural mechanization scheme is the organization structure of the implementing unit. Currently,

there is a Department of Agricultural Mechanization in the Directorate of Agriculture Production. Within this Department, there are three units, mechanization, soil conservation and irrigation. Although this structure exists at MAF/RSS, in some of the States, there is only a mechanization unit. In addition, low human capacity in terms of skills and knowledge to manage and coordinate the mechanization scheme is another challenge. Although the Mechanical Transport Department (MTD) to repair and maintain machinery and equipment exists, it has inadequate trained staff. Overall, budgetary allocation to the scheme has been inadequate and also not linked to the strategic plan. The initiative to mechanize farming has been compromised by inability of farmers to utilise an opportunity of existing farmers' groups. This has maintained fragmented fields, making it difficult and expensive to utilise machinery for land preparation and other field activities.

3.3 Opportunities

3.3.1 Government Commitment to Agricultural Development

Mechanized agriculture can produce food relatively quickly due to the speed and efficiency in land preparation, harvesting, post-harvest and value adding operations. As long as food and agricultural products are being sold on local and international markets, mechanized production may be an incentive to improve productivity, production and household income.

A number of other constraints in smallholder farming systems can be mitigated through appropriate mechanization. Mechanization improves timeliness and quality of agricultural operations as compared to hand methods. Reduced drudgery in manual labour tasks and improved income prospects can induce more youth to remain on the farm. Appropriate mechanization on smallholdings can increase labour productivity and reduce the drudgery of many manual labour tasks required in traditional subsistence farming systems.

3.3.2 Abundant Land

The purpose of mechanization is to produce more from the existing land. Where land is abundant but labour is a limiting production factor, mechanization can increase production per worker and the area under cultivation. South Sudan is endowed with abundant natural resources with considerable potential for agriculture, fisheries, livestock and forestry. Currently, only about 4% of arable land (1.3 million hectares) is utilized, 90% of which is rain-fed. An estimated 80% of cereal production is from traditional subsistence farms that do not use improved seed or soil fertility management practices.

An opportunity exists to use agricultural machinery as a complementary input, required to achieve higher land productivity, for example, through the introduction of tractors, ox-ploughs, irrigation equipment, or faster turn-around machinery to achieve higher cropping intensity. Investments in land development, land consolidation, and rural infrastructure can facilitate advanced degrees of agricultural mechanization in the country.

3.3.4 Suitable Agro-Ecological Conditions and Rich Bio-Diversity.

South Sudan is well endowed with suitable agro-ecological conditions and a diversity of natural resources including natural forest and woodlands with an estimated total area of 191,667 km^2 from which various sources of high value commodities such as timber (teak and mahogany), Sheanut (locally known as Lulu), Gum Acacia and honey are produced. However, enhancement of mechanized technologies for processing and value adding of raw natural resources products, would increase the quality and quantity to meet local and international demand and significantly contribute to growth and development of the country.

3.3.5 Farmer-Based Organizations and Farmers Groups

Introduction of mechanization among subsistence farmers, for example ploughing with a tractor, requires consolidation of small pieces of land to achieve economies of scale. South Sudan has an opportunity to adopt efficient mechanized farming since Community-based Organizations (CBOs), Farmer-based Organizations (FBOs) and cooperatives already exist. According to the Sudan Vision Daily News Paper (July, 2011)[7], private organizations and community-based organizations (CBOs) formed on self-help basis are important and useful because they help their members to become more economically independent and active by satisfying their own demands and interests. Some of the private registered organizations include: Upper Nile Rural Development Organization (UNIRDO) in Malakal, formed in the year 2001; Nile Community Development Organization (NICODO), a private community-based organization like UNIRDO in Upper Nile in Malakal; and Action Committee to Promote Local Initiatives and Self-Help ACCOMPLISH which is a private community-based organization based in Juba formed in March 1979 by Mundari intellectuals to help to develop the Mundari tribe. In the Green Belt, there are currently, 209 Farmer-based Organizations (FBOs) with an average of 23 members involved in farming and marketing of produce.

3.3.6 Support of Donors and Development Partners

Foreign investors and development partners are focusing on agricultural mechanization to improve the country's food security status and support sustainable economic growth and development. Some of these foreign partners include the United States Agency for International Development (USAID), the World Bank, the European Union (EU), the Kingdom of the Netherlands, Japan International Cooperation Agency (JICA) and GIZ: Other development partners include IFDC and the Alliance for Green Revolution in Africa (AGRA). Investment in farm machinery requires large amounts of capital that is amortized over several years. Support of these organizations will accelerate agricultural mechanization and enhance agro-industries in the country. In agricultural mechanization with the collaboration of the private sector, investment opportunities include:

- manufacturing and assembling of machineries and implements;

[7]http://www.sudanvisiondaily.com/modules.php?name=News&file=print&sid=2219

- manufacturing of post-harvest processing machines and storage facilities;
- importation and distribution of machinery, equipment and spare parts; and
- establishment of private service centres and hiring of machinery and oxen.

Creation of conducive policy environment by Government would encourage donors and development partners to significantly contribute to agricultural mechanization through public and private investment.

3.3.6 Local, Regional and International Cooperation

A broad partnership in agricultural mechanization is required between the public-sector and private-sector agencies and actors at local, regional and international levels. Specialized institutions are needed to support and facilitate farm mechanization through training, research and investment. Therefore, the Government of South Sudan should endeavor to develop linkages and membership with local, regional and international institutions to support agricultural mechanization.

Farmers need assistance to expand their farms, intensify their cropping and productivity by investing in inputs such as seeds, fertilizer, irrigation and farm equipment, with a view to fully participating in the cash economy and bringing its benefits to their families and communities. A report on Agricultural Mechanization in Africa by FAO (2008) observes that international technical institutions such as UNIDO and FAO have a role to play in bringing their expertise to bear on the problems and challenges described above. In particular, UNIDO and FAO can offer a holistic approach developed over many years in a wide range of situations.

FAO can assist in producing Agricultural Mechanization Strategies (AMSs) for specific countries or regions. UNIDO has developed analytical tools to put the whole Agricultural Machinery Industry System (AMIS) in perspective for development purposes. International financial institutions such as the World Bank (WB), the African Development Bank (ADB) and the International Fund for Agricultural Development (IFAD), as well as foreign government sources, may be invoked in tackling the funding needs of agricultural mechanization.

4.0 AGRICULTURAL MECHANIZATION POLICY

The strategic plan of Agricultural Mechanization sector in the Ministry of Agriculture and Forestry focuses on improving the use of agricultural tools, implements and machinery in agricultural production and crop processing, value addition, so as to maximize the efficiency and effectiveness of the implementation of these operations. The purpose of this policy statement is to provide the framework for introducing mechanization into the national agricultural production system in a manner that transforms traditional farming systems into market-oriented productive enterprises that are sustainable (i.e., that generate surpluses for improving standards of living and for enterprise capitalization).The vision, mission, goal, guiding principles and objectives of mechanization policy are:

4.1 Vision, Mission and Goal

Increase efficiency in agricultural operations and value addition through a vibrant agricultural mechanization sector.

4.1.1 Mission

Enhance and facilitate active participation of farmers, public and private sector and other key stakeholders in sustainable agricultural mechanization processes to increase productivity, production, value addition and competitiveness.

4.1.2 Goal

To contribute to sustainable increases in agricultural production and value added, and to supply marketable surplus to local, regional and international markets.

4.2 Guiding Principles

Transparency, integrity, accountability and inclusiveness create and promote opportunities and a conducive environment for all interested stakeholders to participate in agriculture production. Development of this policy takes into account the following areas of concern:

i. Capacity building and human resources development;
ii. Gender equity and mainstreaming;
iii. Ensure peace and security;
iv. Building partnership;
v. Compliance with national, regional and international environmental conventions, protocols;
vi. Global and regional context and marketing; and
vii. HIV/AIDS and other diseases.

4.3 Major Objectives

The major objective is to improve efficiency and effectiveness of agricultural production and related operations to sustainably increase crop production and productivity, household incomes, food security and rural economic development.

4.3.1 Policy Statement on Smallholder Mechanization

Problem Statement No. 1   **Lack ofmechanization to promote transformation of smallholder agriculture subsistence to market oriented production.**
Policy Statement No. 1   **Promote transformation of smallholder agriculture from subsistence to market-oriented production through mechanization**

Implementation Strategies for Policy No. 1   i. Facilitate establishment of farmers' organizations that operate sustainable mechanized farming business enterprises   ii. Promote the use of small-motorized farm machines, ox-drawn equipment (animal traction) and processing equipment;   iii. Provide subsidies to disadvantaged farmers in order to facilitate land clearing, cultivation, weeding, harvest and post-harvest handling; and   **iv.** Build capacity of farmers in agricultural business entrepreneurship in collaboration with NGOs, CBOs, Civil Society Organizations, private sector and development partners.

Flagship project for Policy No.1   **Agriculture mechanization policy and its strategy**

4.3.2 Policy Statement on Promotion of Appropriate Technologies

Problem Statement No. 2   **Inadequate mechanization promotion of appropriate agricultural technologies**
Policy Statement No. 2   **Improve and promote appropriate technologies in agricultural mechanization.**

Implementation Strategies for Policy no. 2

i. Conduct reviews to assess appropriate mechanized technology to be promoted;
ii. Promote improved crop production, irrigation, harvesting, storage and processing facilities;
iii. Encourage manufacture/fabrication of agricultural tools, implements, equipment and machines by agriculture-led industries including fabrication of tillage, cultivation, planting and harvesting tools, implements and equipment; manufacture or assembly of production agricultural machinery (engine powered); manufacture/fabrication of animal-drawn implements and equipment; manufacture/fabrication of spare parts for the above mentioned tools and equipment; manufacture of spraying equipment; manufacture of transport equipment; manufacture of crop processing equipment (shellers, threshers, oil expellers, etc.); and manufacture of fruits and vegetable processing and packaging equipment (fruit juice, vegetable purees, etc.); and
iv. Introduce a National Centre for Agricultural Mechanization (NCAM) for adaptive and innovative research and development (R&D), standardization, testing and certification for the commercialization of agriculture.

Flagship project for Policy No. 2

National Centre for Agriculture Mechanization

4.3.3 Policy Statement on Use of Appropriate Soil Conservation Tillage Techniques

Problem Statement No. 3

Lack of effective promotion and proper mis-management of mechanization on sustainable use of soil based farm machinery

Policy Statement No. 3

Promote sustainable use of soil based mechanization on proper management of farm machinery

Implementation Strategies for Policy no. 3

i. Identify different soil types and structure to facilitate effectiveness of agricultural machinery in collaboration with SSARO;
ii. Conduct field evaluation for farm machinery appropriateness; and
iii. Develop best practices to promote mechanization at different levels through general extension work and media.

4.3.4 Policy Statement on Land-Mines-Free Farmland

Problem Statement No. 4

Existence of agricultural land from land mines and unexploded ordinance

Policy Statement No. 4

Ensure that agricultural land is free from land mines and unexploded ordinance (UXO).

Implementation Strategies Policy No. 4

i. Engage and collaborate with South Sudan Demining Authority (SSDA) and UNMAO to expedite removal of land mines on agricultural land;
ii. State and local authorities should cooperate in identifying dangerous areas of land mines and UXOs; and
iii. Creating awareness among farmers on areas with land mines and UXOs.

Flagship project for Policy No. 4

Support to SSDA and UNMAO to clear land mines

4.3.5 Policy Statement on Human Resources Capacity Building

Problem Statement No. 5

Lack of capacity building for personnel and operators in agricultural machinery and other related fields.

Policy Statement No. 5

Build capacity of personnel and operators' knowledge and skills in agricultural machinery and other related fields.

Implementation for policy No. 5

i. Establish Agricultural Mechanics and Machinery Operators Training Centres;
ii. Establish Blacksmith Artisan Training Support Unit for the training in blacksmithing, welding and metalworking craft skills for the manufacture and repair of tools;
iii. Organize up-grading training of personnel, custom operators and farmers to acquire knowledge and skills related to maintenance, operation and repair of agricultural machinery and in other related fields;
iv. Formulate standardized courses for instructors in draft animals and tractor operators in collaboration with training institutions;
v. Establish linkages with neighbouring countries for training collaboration;
vi. Develop demonstration plots on smallholder farms in all states for demonstrating benefits of appropriate mechanization; and
vii. Arrange with Conservation Agriculture (CA) specialist organizations in neighbouring countries to train Farmer Field school facilitators in the Management and use of CA procedures, machinery and equipment.

Flagship project for policy No. 5

Agricultural Mechanics and Machinery Operators Training Centres.

4.3.6 Policy Statement on Promotion of Different Modes of Farm Machinery

Problem Statement No. 6

In adequate mechanization technology to create conducive environment for small, medium and large farmers

Policy Statement No. 6

Create conducive environment for small, medium and large scale farmers to adopt improved

mechanization technologies.

Implementation Strategies for Policy no. 6

i. Promote draught animal powered technology involving the use of oxen and donkeys to pull specially designed implements for light tillage operations;
ii. Facilitate access to credit to enable entrepreneurs, the farming community and other end-users to enhance economic feasibility and profitability of the various mechanization options;
iii. Promote engine-powered technology and modern level of agricultural mechanization including the use of a wide range of tractor sizes as mobile power for field operations, mills, irrigation pumps, grinders and self-propelled machines for production, and harvesting and handling of a wide variety of crops;
iv. Ensure that 10% to 25% of agricultural land is reserved for forest plantation to secure forest resources for household use and future generations;and
v. Reduce import taxes and duties on agricultural machinery and spare parts.

4.3.7 Policy Statement on Investment in Farm Machinery Service Centres

Problem Statement No. 7

Un developed service enterprises and mechanization for the small scale and entrepreneurial farmers.

Policy Statement No. 7

Ensure the development of service enterprises by entrepreneurial farmers who are ready to invest in agricultural machinery and implements for use on their farms as well as for providing mechanization services to the small-scale farmers.

Implementation Strategies for Policy no. 7

i. Provide services to farmers and agro-based industries including privately owned contract/hire services for tractors and draught animal powered equipment to promote adoption of mechanized farming;
ii. Establish private sector mechanization services and hiring centre of agricultural machinery, equipment and services in collaboration with financial institutions;
iii. Promote privatization of tractor hiring units and service centres to support entrepreneurship and enable linkages with financial institutions enhance agricultural mechanization; and
iv. Provide advice and information on proper agricultural mechanization in collaboration NGOs, public and private sectors.
v. Promote privatization of tractor hiring units and service centres to support entrepreneurship and enable linkages with financial institutions enhance agricultural mechanization; and
vi. Provide advice and information on proper agricultural mechanization in collaboration NGOs, public and private sectors.

4.3.8 Policy Statement on Institutional Structure for Promoting Mechanization

Problem Statement No. 8

Insufficient organization structure and agricultural mechanization to improve functional management.

Policy Statement No. 8

To improve functional, management and organizational structure of agricultural mechanization.

Implementation Strategies for Policy no. 8

i. Establish South Sudan Agricultural Mechanization Corporation (SSAMC) to encourage and support the public and private sector, farmers organizations and NGOs to effectively develop, invest and manage agricultural mechanization;
ii. Promote Industrial liaison and supply of technology-oriented hardware, inputs and services including importation and distribution of farm machinery, agro-industrial equipment and spare parts through the private sector;
iii. Encourage institutions of higher learning and Research Centres to accelerate the development and local fabrication of suitable equipment for use by intermediate and small-scale farmers;
iv. Promote the participation of the private sector in the commercialization of prototypes to enhance productivity, production and value addition;
v. Establish agro-based industries for processing, canning, packaging, cold storage, animal feed and apicultural production;
vi. Establish linkages between donors, research institutions and the industry at local, regional and international levels to ensure harmonization and collaboration in agricultural mechanization.

Flagship project for Policy No. 8

South Sudan Agricultural Mechanization Corporation (SSAMC)

5.0 INSTITUTIONAL AND IMPLEMENTATION FRAMEWORK

Government's effort to mechanize agriculture through introduction of tractors, machinery, implements and other equipment started many years ago, but one of the major challenges has been inadequate capacity to implement the agenda. Implementation of the South Sudan Agricultural Mechanization has been hampered by inadequate institutional capacity, non-existence of a strategic plan and poor coordination between the public and private institutions, including the farming community. Limited knowledge and skills among farmers and personnel in the public sector, as well as insufficient financial support from donors and development partners have also limited the capability to implement mechanization. The implementation framework is therefore creating a conducive and an enabling environment to ensure that agricultural mechanization strategies stipulated in the policy statements are effectively implemented through multi-sectoral and participatory approaches.

5.1 Institutional Arrangement

Implementation of the Agricultural Mechanization Policy requires smooth and progressive, but decisive action, including establishment of a South Sudan Agricultural Mechanization Corporation (SSAMC) within the MAF/RSS. A three phased process is proposed for activating this policy and governance structure.

5.2 Phase I constitute two steps

i. **Immediate step (2012):**

- Establish a semiautonomous institution herein designated as the South Sudan Agricultural Mechanization Corporation (SSAMC) with responsibility to oversee implementation of this policy;
- Build consensus to support and participate in implementation of this policy;
- Facilitate political and legal confirmation of this policy; and
- Initiate a series of enabling activities to facilitate and promote orderly implementation of this South Sudan Agricultural Mechanization Policy.

ii. Establishment of a Technical Management Team

A Technical Management Team (TMT) consisting of eleven persons (one from each State Government and one from MAF/SS) will be seconded on a volunteer part-time basis, initially for two years and renewable once. The team will be provided with secretarial support by the MAF/RSS Directorate of Agriculture Production. The terms of reference for the TMT shall be prepared by the SSAMC in consultation with MAF-RSS. The team shall include individuals with proven financial and administrative experience, with a scientific background, and with knowledge about agricultural mechanization. The team also should have experience in dealing with public and private sector agricultural stakeholders. Some of their

responsibilities will include engaging broad consultations with stakeholders and development partners to raise awareness, enhance buy-ins, and to build consensus on the implementation pathway. The consultation process shall target, among others:

- All stakeholder institutions;
- Senior civil servants and members of parliament with an expressed interest in or direct involvement in Agricultural mechanization initiatives, fact-finding or related pursuits; and,
- Representatives of key stakeholders and partners related to agricultural mechanization;

iii. Drafting of Relevant Legal Instruments (2012)

Implementation of this policy will require:

- Approval of a legal disposition establishing SSAMC as a semi-autonomous coordinating body;
- Establishing the internal organization of SSAMC, and designation of its management team;
- Initiation of a broad-based planning and programming process to develop an implementable agricultural mechanization action plan;
- Consideration of establishing an agricultural mechanization Competitive Trust Fund;
- Development of an organizational structure to permit all states to participate in agricultural mechanization dialogue and implementation actions; and,
- Development of a process for engaging development partners in designing means and programs for implementing this agricultural mechanization policy and strategies for identifying and achieving expected results.

5.3 Phase II

The main objective of this Medium-Term Strategy is to ensure that the SSAMC will have the responsibility of engaging and integrating relevant institutions into the dialogue, decision-making and implementation process. This will take place between 2013 and 2014.

5.4 Phase III

The objective of this Long-Term Strategy is to realize the active participation of a progressive mechanization process to double foodstuffs production within five years, primarily through increased yields and productivity. This will begin from 2015 up to 2020.

5.5 Agriculture Mechanization Development Consultative Forum

Disparities in terms of agricultural mechanization knowledge, skills and information among civil servants, members of the private sector, academicians, scientists, States, Payams, Bomas exist. The disparity originates from differences in education and professional development background of the beneficiaries and private service providers of agricultural mechanization within the public and private sectors. A forum to exchange and share these attributes is an effective strategy to enhance multi-sectoral capacity in mechanization, promote agricultural industrialization, lift farmers out of poverty and contribute to sustainable growth and development of South Sudan. As part of the policy implementation framework, the SSAMC under the jurisdiction of the Directorate of Agriculture, will establish an Agriculture Mechanization Development Consultative Forum (AMDCF) to engender modern technologies and encourage sharing of ideas on development strategies of agricultural equipment and mechanization; exchange visions for future development and technological innovation; and to analyse and explore opportunities in the mechanisation value chain across the country and the world.

The Forum will be convened annually and will be managed and supervised by the SSAMC with the support of MAF/RSS. Participation of this event will constitute representatives of all beneficiaries and services providers at MAF/RSS and State levels, civil society, the private sector, NGOs, donors and development partners, scientists and academicians at local and international levels.

5.6 National, Regional and International Collaboration

The art and skill of agricultural mechanization require effective support from experts in policy, legislation, technology and engineering at national, regional and international levels. As stated earlier in Section 2.3.5, South Sudan has an opportunity to link up withinternational technical institutions such as UNIDO and FAO which have a role to play in bringing their expertise to bear on the problems and challenges described above and offer a holistic approach in producing Agricultural Mechanization Strategies (AMSs) for this country. Furthermore, existing major political economic regional groups, such as Economic Community of West African States (ECOWAS), Common Market for Eastern and Southern Africa (COMESA), Southern African Development Community (SADC), West African Economic and Monetary Union (UEMOA), and the Arab Maghreb Union (UMA), can support harmonization and rationalization of agricultural mechanization policies, legislation and regulations across the region to ensure stability and prosperity in sub-sector.

6.0 STRATEGIC PLAN

Effective implementation of any policy requires formulation of a Results-based Strategic Plan which follows immediately after the policy has been approved. The Strategic Plan stipulates the major outcome, outputs and activities and is directly linked to the budget of the relevant Directorate, in this case Agriculture Production. The process of developing the Strategic Plan is participatory in nature, involving key stakeholders such as farmers, civil society, private sector, donors and development partners and the representatives at MAF/RSS and State levels. In principle, the SSAMC in collaboration with the Directorate will be responsible for developing the plan.

6.1 Implementation Framework

Policy implementation process requires a systematic schedule of activities based on thematic areas. The following table proposes an outline of activities and timeframe to implement the Mechanization Policy.

Immediate Actions for 2012

Actions	Responsible	Timing
1. Formulation of Mechanization Legislation and Regulations	MAF Senior Executive	March 2012
2. Establishment of the SSAMC & subsidiaries (AMDCF and AMDTF)	MAF Senior Executive	June 2012
3. Appointment of a Technical Management Team (TMT)	SSAMC	
4. Strategic Plan	SSAMC	March 2012
5. Mechanization Development Consultative Forum	SSAMC	Oct 2012
6. National, Regional and International Collaboration	Minister	June 2012
7. Resource Mobilisation	MAF/RSS and SSFC	June 2012
8. Monitoring the Implementation Schedule	Minister	Continuous

The plan for 2012 – 2017 will be indicated in a strategic plan to be prepared separately.

6.2.1 Effective Date

This Mechanization Policy shall be applicable when approved by the Council of Ministers, and shall apply until modified by appropriate legal dispositions. The tenets of the policy shall have long-term application, and shall continue in force indefinitely, until specifically modified by law. Any such modifications shall not change the intent or philosophy of this Mechanization Policy.

6.2.2 Applicability

All public and private stakeholders in the Agricultural sector shall respect the content and spirit of this Mechanization Policy. A legislative proposal and regulations shall be introduced in due course to establish the South Sudan Mechanization Policy.

To keep South Sudan Mechanization Policy current and applicable to changing conditions, MAF/RSS will from time to time make recommendations to the Government on relevant issues of importance to ensure achievement of vibrant and sustainable horticulture value chain system. The responsible Ministers shall consider such recommendations; discuss them with State Ministers responsible for the Agricultural Sector, consult with other stakeholders, and, in accordance with applicable laws, issue modifications to South Sudan Mechanization Policy and regulations, in order to improve suitability and applicability to current conditions without changing the long-term intent or legitimacy.

6.3 Resource Mobilisation

Agricultural mechanization is one of the most expensive strategies in the operations of the agricultural sector due to high costs of machinery and equipment. During the 2009 Round Table meeting organized by FAO in Tanzania to discuss alternatives to investment in agricultural mechanization, experts observed that lack of finance is an overwhelming reason why farmers cannot purchase machinery and equipment for land preparation, cultivation, harvesting, storage and value addition (Ashburner and Kienzle, 2009). One of the constraints to access financing is that commercial banks are generally not interested in lending to farmers, and their interest rates are far too high for farmers to use loans effectively. Other problems to access financial resources relate to landownership and registration for which farmers often lack sufficient collateral to qualify for loans; lack skills and sufficient investment funds for local manufacturers; high tariffs on imported steel and components, and the cost of doing business which is frequently quite high; and the perception that mechanization issues are a concern of the Agriculture Ministry alone, and not the Ministries of Industry, Finance, Education and others.

Several options for resource mobilisation to finance agricultural mechanization were proposed during the meeting. Some of these include the possibility of central banks providing direct support to commercial banks for on-lending to farmers/entrepreneurs and to prescribe a minimum percentage allocation of bank lending to the agriculture sector; facilitation of long-term financing needed for agricultural mechanization; establishing or strengthening rural banking facilities to provide financial services to the agriculture sector; and ensuring that financial service providers to the agriculture sector are consistently made aware of current best practices in the technical and economic use of agricultural mechanization technologies.

The experts also considered creation of an Agricultural Machinery Development Trust Fund (AMDTF) where the board of trustees should comprise representatives of Government and the private sector, both partners contributing to the fund. In order to raise funds, levies/tariffs should be imposed on all food imports, a percentage of the national budget should be transferred into the fund, contribution made from commercial banks, commodity boards, equipment suppliers, development banks and donors; guaranteeing schemes whereby donors, central banks and development partners support commercial and local banks and other financial institutions to lend to farmers and entrepreneurs. In addition establishment of Warehouse Receipt System (WRS) was proposed to provide short- to medium-term facilities of bridging seasonal finance for farmers and entrepreneurs as well as guaranteeing fair prices.

A properly developed Strategic Plan provides guidance on budgetary allocation and sources of funding in a specific sector. Therefore, SSAMC will have the responsibility to ensure that some of these proposals will be incorporated in the strategic plan to ensure effectiveness in the implementation of the mechanization Policy.

6.4 Monitoring And Evaluation

Plans of action shall be prepared and updated from time to time to serve as guides to both public and private actors and stakeholders in the implementation of actionable components of this policy. The plans of action shall be based on the goals, objectives and strategies outlined in this policy and shall specify (1) outputs and activities expected from the recommended interventions, (2) implementation time frames, (3) responsible and/or implementing institutions, and costs, budgets and other resource requirements. The MAF/RSS shall oversee preparation of plans of action but all participating institutions will be invited to propose specifics relating to components for which they are responsible.

Appendix 1- Timeframe and Budget for the Strategy

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
1. Output 1: Promote transformation of smallholder agriculture from subsistence to market oriented															
1.1 Establishment of farmer's organization that operate sustainable mechanized farming business enterprises. **Activities:**															
1.1.1															
1.1.2															
1.1.3															
1.1.4															
1.2 Promote the use of small-motorized farm machines, ox-drawn equipment etc. **Activities**:															
1.2.1															
1.2.2															
1.2.3															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
1.2.4															
1.3 Provide subsidies o disadvantages farmers. **Activities:**															
1.3.1															
1.3.2															
1.3.3															
1.3.4															
1.4 Build capacity of farmers in agriculture business in collaboration with NGOs, CBOs Civil Societies, Private Sectors etc. **Activities:**															
1.4.1															
1.4.2															
1.4.3															
1.4.4															
2. Output 2: Promote and improve technologies in agriculture mechanization															
2.1 Conduct review to assess appropriate mechanized technology.															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
Activities:															
2.1.1															
2.1.2															
2.1.3															
2.1.4															
2.2 Improved crop production, irrigation, storage and processing facilities. **Activities:**															
2.2.1															
2.2.2															
2.2.3															
2.2.4															
2.3 Encourage manufacture of agriculture tools, implements, equipment and machines by agriculture led industries. **Activities:**															
2.3.1															
2.3.2															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
2.3.3															
2.3.4															
2.4 Introduced a National Centre for Agriculture Mechanization (NCAM development. **Activities:**															
2.4.1															
2.4.2															
2.4.3															
2.4.4															
3. Output 3: Promote sustainable use of Soil and proper management of farm machinery															
3.1 Identify different soil types and structure. **Activities:**															
3.1.1															
3.1.2															
3.1.3															
3.1.4															
3.2 Conduct field evaluation for farm machinery.															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
Activities:															
3.2.1.															
3.2.2															
3.2.3															
3.2.4															
3.3 Develop best practise to promote mechanization at different level through general extension work and media. **Activities:**															
3.3.1															
3.3.2															
3.3.3															
3.3.4															
4. Output 4: Land is free from land mines and unexploded ordinance (UXO).															
4.1 Collaborate with South Sudan Demining Authority and UNMAO to expedite removal of land mines on agricultural land. **Activities:**															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
4.1.1															
4.1.2															
4.1.3															
4.1.4															
4.2 Cooperation between State and Local authorities in identifying dangerous areas of land mines and UXO. **Activities:**															
4.2.1															
4.2.2															
4.2.3															
4.2.4															
4.3 Create awareness among farmers and areas with land mines and UXO. **Activities:**															
4.3.1															
4.3.2															
4.3.3															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
4.3.4															
5. Output 5: Build capacity of personnel and operators															
5.1 Establish training on Agricultural Mechanics and Machinery operators. **Activities:**															
5.1.1															
5.1.2															
5.1.3															
5.1.4															
5.2 Establish Blacksmith artisan training support unit. **Activities:**															
5.2.1															
5.2.2															
5.2.3															
5.2.4															
5.3 Organize up-grading training of personnel, customer operators and farmers.															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
Activities:															
5.3.1															
5.3.2															
5.3.3															
5.3.4															
5.4 Formulate standardize courses for instructors at each field. **Activities:**															
5.4.1															
5.4.2															
5.4.3															
5.4.4															
5.5 Establish linkage with neighbouring countries for training collaboration. **Activities:**															
5.5.1															
5.5.2															
5.5.3															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
5.5.4															
5.6 Develop demonstration plots on smallholder farms in all states. **Activities:**															
5.6.1															
5.6.2															
5.6.3															
5.6.4															
5.7 Arrange with Conservation Agriculture specialist organization in neighbouring countries to train farmers. **Activities:**															
5.7.1															
5.7.2															
5.7.3															
5.7.4															
6. Output 6: Create a Conducive environment for small, medium and large scale farmers.															
6.1 Promote draught animal powered technology															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
involving the use of oxen and donkeys. **Activities:**															
6.1.1															
6.1.2															
6.1.3															
6.1.4															
6.2 Facilitate access to credit **Activities:**															
6.2.1															
6.2.2															
6.2.3															
6.2.4															
6.3 Promote engine-powered technology and modern level of agricultural mechanization. **Activities:**															
6.3.1															
6.3.2															
6.3.3															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
6.3.4															
6.4 Reserve 10% - 25% of agricultural land for forest plantation and future generation use. **Activities:**															
6.4.1															
6.4.2															
6.4.3															
6.4.4															
6.5 Reduce import taxes and duties on agricultural machinery and spare parts. **Activities:**															
6.5.1															
6.5.2															
6.5.3															
6.5.4															
7. **Output 7: Development of services enterprises by entrepreneurial framers**.															
7.1 Provide services to farmers and agro-based industries.															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
Activities:															
7.1.1															
7.1.2															
7.1.3															
7.1.3															
7.2 Establish private sector mechanization services and hiring centre of agricultural machinery, equipment in collaboration with financial institutions. **Activities:**															
7.2.1															
7.2.2															
7.2.3															
7.2.4															
7.3 Promote privatization of tractor hiring services. **Activities:**															
7.3.1															
7.3.2															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
7.3.3															
7.3.4															
7.4 Provide advice and information. **Activities:**															
7.4.1															
7.4.2															
7.4.3															
7.4.4															
7.5 Provide advice and information on proper agricultural mechanization in collaboration with NGOs, public and private sectors. **Activities:**															
7.5.1															
7.5.2															
7.5.3															
7.5.4															
8. Output 8: Improve functional, management and organization structure															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
8.1 Establish (SSAMC) to encourage and support the public and private sector. **Activities:**															
8.1.1															
8.1.2															
8.1.3															
8.1.4															
8.2 Promote industrial liaison and supply of technology. **Activities:**															
8.2.1															
8.2.2															
8.2.3															
8.2.4															
8.3 Encourage institutions of higher learning and Research Centres. **Activities:**															
8.3.1															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
8.3.2															
8.3.3															
8.3.4															
8.4 Promote participation of the private sector in the commercialization of prototype to enhance productivity, production andvalue addition. **Activities:**															
8.4.1															
8.4.2															
8.4.3															
8.4.4															
8.5 Establish agro-based industries for processing, canning, packaging, cold storage etc. **Activities:**															
8.5.1															
8.5.2															
8.5.3															
8.5.4															

Output and Activities	Budget	PHASE I						PHASE II							
	US$	2012		2013				2014		2015		2016		2017	
		Q1	Q2	Q1	Q2	Q3	Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4	Q1-Q2	Q3-Q4
8.6 Establish linkage between donors, research institutions and the industry at local, regional and international levels. **Activities:**															
8.6.1															
8.6.2															
8.6.3															
8.6.4															