Policies and Institutional Arrangements Relevant to Conservation Agriculture with Trees in Zambia

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June 2012

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EXECUTIVE SUMMARY

In the past fifteen years, agricultural policy in Zambia has been transformed. The regime of comprehensive government controls that existed in the early 1980s has been almost completely dismantled, and commercial investment in farming and agro-services is increasing. Zambia is relatively well endowed with natural resources, and prospects for sustained agricultural growth within the new policy environment appear to be good.

The main purpose of this report among others is to review existing institutional / policy factors and how they impede or facilitate scaling up of conservation agriculture with trees (agro forestry based conservation agriculture) in Zambia and suggest policy direction and strategies for ACT and other partners in Zambia on how best Conservation Agriculture with Trees Programmes can be implemented.

Section 1 (**Introduction**) starts by describing how this report came to be written and its specific objective are outlined and elaborated. The main point to emphasise is that the study will provide support and assistance in various aspects to project/programmes being managed by ACT Secretariat. The output will also provide a viable resource for the formulation of an investment plan.

Section 2 (**Country Profile**) starts with an overview of agricultural policy and performance over the last few years and also provides essential background on the Zambian agricultural sector. It discusses Agriculture and highlights that it is the main source of income and employment for more than 60 % of the population, and especially for women, who constitute 65 % of the rural population. Further that smallholder farming systems vary according to the agro-ecological conditions across the country and the overall, agricultural production system is dominated by maize, which is grown by 80 % of farming households. In 1999, the Government of Zambia, through the Ministry of Agriculture and Cooperatives (MACO) then, declared Conservation Farming (CF) and related technologies a priority for promotion by both MACO and the various partner Institutions, such as the Conservation Farming Unit (CFU), Golden Valley Agricultural Research Trust (GART), Land Management and Conservation Farming Programme (LM&CF) and its successor programme the Agriculture Support Programme (ASP) and the World Agroforestry Centre (ICRAF) in order to address the issue of low farm productivity and sustainable production.

The vision for Ministry of Agriculture and Livestock (MAL) is to scale up CA among small scale farmers as a sustainable approach to increase farm productivity and sustainable production. However, up-scaling of CF/CA has been limited due to the need for constant intense extension support, limited access to inputs to support the learning process by small scale farmers, low involvement of MAL in CF/CA implementation and lack of a platform for sharing evidence based results.

This section then summarises the some key CA/projects and programmes highlighting their scope and coverage. 11 projects have been summarized and discussed.

Section 4 (**Existing Institutional Arrangements)** discusses the mandate and capacity of the Ministry of Agriculture and Livestock to formulate CA/CAWT policies, implement and coordinate the implementation of projects and programmes and undertake research. Changes in this institutional landscape will in turn have an important influence over how CA/CAWT policies and programmes are formulated and implemented.

The section also looks at the sector, national and international level policy frameworks. Notable is that the Zambian Government emphasises and supports the need to conserve the natural resources of land, soil, water and forests through sector, national and international level policy frameworks. At a national level, the Sixth National Development Plan contains an overall Agriculture Policy which aims to facilitate and support the development of a sustainable and competitive agricultural sector that assures food security at national and household levels and

maximizes the sector's contribution to Gross Domestic Product (GDP). While at international level, Zambia is a signatory to the African Union's New Partnership for Africa's Development's (NEPAD's) Comprehensive African Agriculture Development Program (CAADP). The CAADP is based on two major principles: the pursuit of a 6% average annual growth rate at the national level in the agricultural sector, and the allocation of 10% of national budgets to agriculture. Zambia signed its CADDP compact in 2011.

The transformation of the Agricultural sector is a critical component of the poverty alleviation strategy in Zambia, through providing farmers with the necessary services and conditions for them to increase their incomes. This will involve expanding and strengthening access to agricultural inputs; improving research and extension services, introducing smallholder friendly technologies, improving access to local and international markets; reducing barriers to land acquisition, enhancing use of sustainable land management technologies; increasing investment in irrigation.

Section 5 (Raising the profile of CA/CAWT in Zambia: – the way forward)

This section discusses and recommends that the principles and policy on Conservation Agriculture/Conservation Agriculture with Trees in sustainable agricultural development in Zambia should be developed and internalized (mainstreamed) in appropriate policies, regulations and guidelines. Appropriate indicators for the social, economic and environmental aspects relating to conservation agriculture/conservation agriculture with trees in sustainable development need to be identified through an appropriate consultative process or forum.

A five-year implementation plan needs to be developed, in consultation with stakeholders. This should be harmonized, within the Ministry of Agriculture and Livestock and other government structures, taking into consideration national, regional, and international commitments. Thus nine (9) policy & strategic options for scaling-up CA/CAWT have been proposed. Ranging from interventions in formulating specific legislation to address agriculture land use and management to the internalisation of CAWT in sector policies and development plans

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1.0 Introduction

1.1 Purpose of the study

Conservation Agriculture (CA) is a farming innovation centred on three basic principles: i) minimizing soil disturbance, ii) maintaining a permanent soil cover, and iii) practicing crop rotations. CA is being promoted as a promising solution to the problem of low agricultural productivity in southern Africa. When combined with good agronomic practices such as timely planting and effective weed, pest and disease management and planting of trees, CA has sustainably increased crop yields, helped mitigate the impacts of drought and provided a sustainable and productive eco system. However, uptake of the CA technologies by farmers in Zambia remains low due to among others policy constraints, for which solutions are urgently needed. The study was conducted by the two institutions namely African Conservation Tillage Network (ACT) and World Agroforestry Centre (ICRAF)

The African Conservation Tillage Network (ACT) is a pan-African membership organization bringing together stakeholders and players interested and committed to enhancing the development and adoption of conservation agriculture in Africa through sharing knowledge and information.

ACT's mandate is driven by the conviction that widespread adoption of conservation agriculture will contribute significantly to the attainment of both agricultural and environmental objectives-empowering farmers and rural communities to manage their resources, sustaining the resilience at the same time achieving viable production systems. In this way, ACT aims to contribute to placing at the disposal of development partners and governments farming practices that will not only bring agriculture back in the driving seat for economic and rural development, but also address the immediate concerns of food insecurity and poverty and climate change adaptation and mitigation.

The World Agroforestry Centre (ICRAF) is a CGIAR Consortium Research Center. ICRAF's headquarters are in Nairobi, Kenya, with five regional offices located in India, Indonesia, Kenya, Malawi and Cameroon.

The Centre's **vision** is a rural transformation in the developing world as smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability.

The Centre's **mission** is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes, and use its research to advance policies and practices that benefit the poor and the environment.

The World Agroforestry Centre is guided by the broad development challenges pursued by the CGIAR. These include poverty alleviation that entails enhanced food security and health, improved productivity with lower environmental and social costs, and resilience in the face of climate change and other external shocks.

1.2 Scope of the study

The main objective of the study is to provide support and assistance in various aspects of project/programmes managed by ACT and ICRAF Secretariats; hence the policy study is expected to carryout in areas of conservation with trees (CAWT) in Zambia.

More specifically, the scope of the study will address the following:

1. Review of the existing institutional / policy factors and how they impede or facilitate scaling up of conservation agriculture with trees (agro forestry based conservation agriculture) in Zambia
2. Identification of the major existing national and regional agricultural development initiatives that could integrate Conservation Agriculture with trees (agro forestry CA focused intervention) in Zambia
3. Identification of successful or promising institutional and policy mechanisms that exist to facilitate wide spread adoption of conservation agriculture with trees in Zambia
4. Prepare policy direction and strategies for ACT and other partners in Zambia on how best Conservation Agriculture with Trees Programmes can be implemented.
5. Pursue opportunities to work with government officials and other organizations to refine, mainstream and improve Conservation Agriculture policy related issues
6. Present findings to the country Conservation Agriculture Task Force before final report is widely shared

1.3 Methodology

The methodology employed by the study is to obtain data and information included office visits, consultations and discussions to solicit relevant documentation followed by a desk study of relevant literature. The starting point was the identification of key and relevant policy focal points that generally fell into one broad category of Government Ministries and Departments. Given the limited time and budget available for the exercise, there was no recourse to visit and discuss with stake holders outside Lusaka. The preliminary report was presented to the National Conservation Agriculture Task Force for review before circulation to the wider audience as part of the baseline survey activities. Other means to gather information included consultations with key informants and review of literature reports from the Conservation Agriculture with Tree task force

2.0 COUNTRY PROFILE

2.1 Physiography

Zambia is a large landlocked country which covers an area of 752,000 km^2. The population grew at 2.8 per cent during the 2000s and totaled only 13 million in 2010, giving it a population density of only 17 persons/km^2.

At independence in 1964, Zambia inherited an economy which was heavily dependent on the copper mining sector (accounting more than 90% of export earnings), and a population that was close to 50 per cent urban, one of the highest rates in sub-Saharan Africa. After 30 years of relatively poor economic performance, Zambia's macroeconomic situation has improved in the last 10 years: driven by the macroeconomic and public sector reforms initiated in the 1990s and propelled by rising copper prices, annual economic growth averaged 4.8 % over the period 2002-2005 and increased to 6.1 % over 2006-2009. Average annual inflation over 2006-2009 fell to 11 % as compared to 20 % during 2002-2005 (IFAD, 2011). Good progress has been made in seven out of the eleven MDG indicators, in particular for child malnutrition, primary education, infant mortality and the incidence of malaria. Targets on hunger, education, gender equality and HIV&AIDS are likely to be achieved by 2015.

National poverty levels have reduced somewhat since 1998, but remain high with 64 % of the population ranked as poor and 51 % as extremely poor in 2006. Poverty in rural areas is significantly higher than in urban areas and female headed households are more likely to be poor than those headed by men (IFAD, 2011). Agriculture is the main source of income and employment for more than 60 % of the population, and especially for women, who constitute 65 % of the rural population. Accelerated growth in the agriculture sector is thus key to reducing both poverty and the dependency on the mining sector. However, the sector has only grown marginally since 2000 – on average 2 % per year, though there were strong performances in 2003/2004, 2009/2010 and 2010/11, mainly linked to record-breaking maize harvests the last two seasons (Copestake J.G, 1997),. Moreover, while between 1987 and 2010 food production increased at an average 4.3-4.4 % per year, increases in the area cropped accounted for 4 % of this growth, while the annual productivity (yields per ha) increased at only 0.3-0.4 % per annum.

2.2 Extent of agricultural production, smallholder and large scale

In Zambia, agriculture, defined as food production, livestock, and fish, is a small and declining proportion of national GDP. Close to 85% of the population participates in agriculture but the sector only contributes 20% to GDP (MTENR, 2011). There is low productivity of labour and land; and maize yields are on average about 900 kg/ha. The use of inorganic fertilizer is also low and not increasing despite strong government intervention.

Agriculture and food security in Zambia are highly vulnerable to changing climatic conditions due to the sensitivity of crops to timing, amount, and intensity of rainfall and temperature fluctuations. However agricultural production has wide ranging impact on other sectors such as health as sufficient nutrition determines worker productivity to a certain extent. Most importantly agriculture is intimately linked with the state of food security. Critical to determining agricultural yield and food security is rainfall distribution and soil types amongst other factors.

The smallholder farming sector numbers approximately 1.1 million households, over 20 % of which are women headed. These households cultivate on average 1.5 ha of land, generally using low-input, hand hoe technology and relying primarily on family labour. They produce principally for household consumption, although about one-third sell some of their production, while at the other extreme, about one quarter suffer chronic food insecurity and require long-term social protection. These are often female, elderly or child-headed households, the chronically sick and/or disabled. In

addition, there are some 50,000 emergent farmers, who cultivate between 5 and 20 ha, typically with draught power, greater use of purchased inputs, and hired labour; and their production is predominantly for sale. The vast majority of such farmers operate along the line-of-rail that traverses the country from south-west to north-east. There are some 1,500 large-scale commercial farmers, including a sizeable number of Zimbabweans who have relocated to Zambia, who generally cultivate upwards of 50 ha, have extensive mechanization and use both permanent and casual staff. There is also a limited number of large corporate operations, farming thousands of hectares of crops and/or with a thousand or more head of livestock, that are managed by hired professionals and vertical integrated to agro-processing.

Smallholder farming systems vary according to the agro-ecological conditions across the country. In the northern half of the country, cassava is the main staple and the basis for the production system. In the southern half of the country, maize is the main food crop; while in the centre, there are mixed maize/cassava systems. The overall, agricultural production system is dominated by maize, which is grown by 80 % of farming households (Thurlow et al, 2008), and in 2010 this covered over half the total crop area planted. Maize production is strongly promoted by the Government of Zambia (GRZ) through: (a) a targeted subsidized Farm Input Supply Programme (FISP); and (b) a guaranteed maize purchase programme by the Food Reserve Agency (FRA), which in recent years has offered above market farm gate prices. Other important smallholder crops include beans, groundnuts, rice, cotton, tobacco, sugar cane and vegetables. Some 20 % of smallholders own cattle, mainly in the drier southern part of the country, where draft power is a key element of the cropping systems and permit larger areas to be cultivated than in the north, where lack of labour is the principal constraint to increased production. Poultry are much more widespread, owned by over 90 per cent of households.

Conservation farming practices have been widely promoted in Zambia and around 180,000 small-scale farmers have adopted some elements of conservation farming. However, the techniques used are those that have been developed specifically for the maize-based farming systems in the dryer parts of the country, while the main cassava based farming systems are mostly located in more humid regions with acidic soils, for which appropriate CF techniques still need to be developed. Promotion of CA in Zambia is highly attributed to favorable policy frameworks and support from donors who have worked closely with the private sector, NGOs, research and government institutions. The promotion efforts are coupled with a dedicated extension unit, supported by donor funds, spread the message. Here, small-scale farmers found that conservation agriculture worked on their farms too. Currently more than 100,000 small-scale farmers in Zambia have converted to conservation agriculture (www.act-africa.org).

An estimated 300,000, or one quarter of all, smallholders are currently linked to agribusiness through more or less vertically integrated value chains, for crops such as cotton, tobacco, sugarcane and horticultural crops. Outside these value chains, low population densities mean that for many farmers agricultural markets are distant, uncompetitive and unremunerative, all of which creates little incentive for increased production. This is one of the factors behind the low productivity of the smallholder sector. Another is the plentiful availability of arable land, which means that expanding the area under cultivation, rather than intensifying the production system, remains a possibility for a majority of smallholder farmers. Lack of education – over 70 per cent of smallholder farmers have only primary education – and entrepreneurial skills; high dependency rates and seasonal labour constraints, combined with high levels of disease and hunger during the growing season; plus the devastating effects of HIV/AIDS, all undermine farmers' productive capacity and so too, do farmers' lack of financial assets.

Zambia has a well-defined unimodal distribution of rain, falling between November and April. Precipitation and the length of the growing season generally decrease from north to south and is normally divided into three agro-ecological regions (Figure 1). Region III in the northern part of the country is the largest region geographically (46% of total area) and has the highest average annual rainfall (1228mm) with the lowest inter-annual variation; it is also the hottest region with the poorest soils overall. Region I in the south accounts for 14% of Zambia's total land area and has the lowest average rainfall (786mm) with a high coefficient of variation; it is the poorest and least dynamic

agriculturally (Jain, 2007). Region I also has the highest evapo-transpiration rate. Zone II, the location of most of the country's nature reserves, is divided by Thurlow et al (2009, 2010) into three sub-regions. Region IIa1 (in the south-central part of the country) has the lowest rainfall in Zone II, but is the location of Zambia's capital, Lusaka, and much of the country's economic activity and commercial agriculture. It too has a high coefficient of variation.
Zones I and IIa1 with the lowest average rainfall and highest coefficients of variation are therefore the most vulnerable to weather risk and extreme weather events. Zones IIa2 to the east and IIb to the west have higher annual rainfalls at 930 and 941mm respectively. Zone IIa (1&2) comprises 28% and Zone IIb comprises 12% of Zambia's land area.

Figure 1: Agro-ecological map of Zambia (showing meteorological stations and Thiessen polygons) *Source: Thurlow et al 2009*

- Cassava is the main staple food crop grown and consumed in Zone III, while maize is the main staple grown and consumed in the dry Zone I. Much of Zone II is mixed, with both cassava and maize grown (but with variation by sub-zone) and about equally consumed (Haggeblade et al, 2009, 2010); sorghum and millet are also important in Zone IIb. Maize is consumed by many more people than is cassava; and unfortunately is also more vulnerable to both seasonal and intra-seasonal drought and therefore its productivity is far more variable than cassava.

The Sixth National Development Plan (SNDP) for 2011-2015 rightly states that "agriculture remains the priority sector in achieving sustainable economic growth and reducing poverty in Zambia." However climate change and variability over the next ten years may limit the potential for growth in these sectors. Current development projections in the SNDP and the 2011-2013 Mid-Term Expenditure Framework assume favorable climatic conditions in forecasting agricultural growth which may not be the case.

The primary objective of agricultural policies during 1999–2001 was to promote more efficient smallholder agricultural production, with a view to increasing agricultural output and non-traditional exports. The government's strategy emphasizes the diversification of output and the reduction of susceptibility to drought by (i) improving smallholder access to inputs and financial markets through the promotion of private sector activity in input distribution and agricultural marketing; (ii) providing

effective technical and advisory services through the decentralization of adaptive research and extension services; and (iii) improving infrastructure. An important vehicle for the coordination of agricultural policies is the Agricultural Sector Investment Program (ASIP), which combines donor support into one program.

The key elements of the government's agricultural reform policy have been liberalization and decentralization. The agricultural sector has been largely liberalized, as input supply and crop marketing have been privatized, prices are set in free and open markets, and restrictions on domestic and international trade have been removed. (Zambia Framework Paper, 1999-2001

2.3 Brief overview of current status of CAWT in Zambia

The challenges of agriculture among small scale farmers include low farm productivity and continuing yield decline as a result of soil degradation associated with inappropriate farming practices. HIV/AIDS, together with high costs of external inputs and the vagaries of climate change continue to negatively impact on the agriculture landscape for small scale farmers. Land degradation as a result of inappropriate farming practices, climate variability and rising input costs have all contributed to declining crop production and productivity among small scale farmers (SSFs) in Zambia.

In 1999, the Government of Zambia, through the Ministry of Agriculture and Cooperatives (MACO), declared Conservation Farming (CF) and related technologies a priority for promotion by both MACO and the various partner Institutions, such as the Conservation Farming Unit (CFU), Golden Valley Agricultural Research Trust (GART), Land Management and Conservation Farming Programme (LM&CF) and it successor programme the Agriculture Support Programme (ASP) and the World Agroforestry Centre (ICRAF) in order to address the issue of low farm productivity and sustainable production.

The vision for MAL is to scale up CA among SSFs as a sustainable approach to increase farm productivity and sustainable production. However, up-scaling of CF/CA has been limited due to the need for constant intense extension to support, limited access to inputs support the learning process by small scale farmers, low involvement of MACO in CF/CA implementation and lack of a platform for sharing evidence based results.

CA and CAWT

Conservation agriculture (CA) is a combination of tested technologies and/or principles in agricultural production. CA is a toolkit of agricultural practices that combines, in a locally adapted sequence, the simultaneous principles of reduced tillage or no-till; soil surface cover and crop rotations and/or associations, where farmers choose what is best for them. CA as a concept for natural resource-saving, strives to achieve acceptable profits with high and sustained production levels while concurrently conserving the environment (FAO 2009; Bayala J, 2011).

The integration of trees in the farming system offers multiple livelihood benefits to farmers, including diversifying the sources of green fertilizer to build healthier soils and enhance crop production, and providing fruits, medicines, livestock fodder, timber and fuel wood. There are environmental benefits too, in the form of shelter, erosion control, more effective water cycles and watershed protection, increased biodiversity, greater resilience to climate change, and carbon storage and accumulation. In fact, one tropical tree can sequester at least 22.6 kg of carbon from the atmosphere each year.

In Zambia, more than 160,000 farmers have extended their conservation farming practices to include the cultivation of food crops within agro forests of *Faidherbia* trees over an area of 300,000

hectares. The Conservation Farming Unit (CFU) has observed that unfertilized maize yields in the vicinity of *Faidherbia* trees averaged 4.1 t/ha, compared to 1.3 t/ha nearby but beyond the tree.

2.4 Summary of CA stakeholders: key actors in CA/CAWT, roles and responsibilities

Table 1: Summary of CA/CAWT stakeholders in Zambia

Actor	Organizational mandate	Conservation agriculture		
		Roles	Responsibilities	Target areas
Technical Services Branch(TSB), Ministry of Agriculture and Livestock (MAL)	Planning, coordination, implementation, monitoring and evaluation of land resources conservation policy, legislation, programs and projects in the country	Secretariat of the National Conservation Agriculture Task Force	Farmer training, outreach, implementation of CAWT	Nation-wide
Agricultural Advisory Services (AAS), Ministry of Agriculture and Livestock (MACO)	Planning, coordination, implementation, monitoring and evaluation of agricultural extension programs and projects in the country	Secretariat of the National Conservation Agriculture Task Force	Farmer training, outreach together with TSB personnel at District Agricultural Offices	Nation-wide
Zambia Agricultural Research Institute	Planning, coordination, implementation, monitoring and evaluation of agricultural research programs and projects in the country	Member, National Conservation Agriculture Task Force	Agricultural Research and Development Programmes	Nation -wide
Conservation Farming Unit (CFU)	to increase production and income levels of small scale farmers through improved agricultural practices with sustained conservation and management of the natural resources base	Member, National Conservation Agriculture Task Force	Farmer training, outreach, research	Localised: 10 Districts
Zambia National Peasant and Small Scale Farmers Association (ZNPSFA)	an umbrella association of all farmer associations	Member, National Conservation Agriculture Task Force	Farmer training, outreach, CA demonstrations and Brokerage	Nation-wide
University of Zambia,	Teaching undergraduate and postgraduate programmes, research and outreach	Member, National Conservation Agriculture Task Force	Training, research, outreach	Localised
Natural Resources Development College (NRDC),	Teaching Diploma graduates and outreach	-	Training, research, outreach	Localised
Zambia National Farmers' Union	an umbrella body of all farmer organizations, cooperatives, associations	National Conservation Agriculture Task Force	Brokerage	Nation-wide
Care International	Facilitates aid to partner organizations	-	Farmer training, outreach	Localised
World Vision	Implementation	-	Farmer training,	Localised

Actor	Organizational mandate	Conservation agriculture		
		Roles	Responsibilities	Target areas
Zambia			outreach	

2.5 Programs and projects promoting CA/CAWT in Zambia

2.5.1 Conservation agriculture scaling up for increased productivity and production (CASPP) inception project (2009 – 2010)

The CASPP aims at up scaling conservation agricultural for increased Productivity and Production among small scale farmers in Zambia. This programme shall run for two years to be implemented jointly by MACO, FAO and other stakeholders and will seek to lay the ground for building capacity of MACO's Department of Agriculture and Own Farmer Facilitators ((lead farmers)) in anticipation of a longer term investment into CA expansion countrywide. The anticipated long term CA intervention would increase adoption of environmentally friendly farming systems leading to improved food supply, reduce hunger, counter rising food prices, and improve responses to food emergency crisis by extending the area of land under conservation agricultural practices. Specific problems to be addressed partly by the CASPP project but in more detail by the anticipated longer term programme are:

- Lack of consistent application of best practices in land and crop husbandry;
- Declining soil fertility and erosion due to unsustainable agricultural practices;
- Increased vulnerability of farming households to natural disasters and the effects of climate change;
- Increased costs of farming inputs.

Both the CASPP and longer term programme will promote MACO's leading role in scaling up Conservation Agriculture in Zambia by working through their structures to implement the program. The CASPP project is harmonized with the CAP in terms of approach with the following exceptions: i) CAP uses it own extension network while this project will use the government DoA extension services ii) CAP is working through cotton associations at the farmer level with the current project will work through the government organized camp/zone associations. In this respect, the CAP has more of a commercial focus through out-grower schemes and cash cropping due to its association level structures. However, the current project would also seek to establish market linkages for interested farmers by working closely with the CFU commercialisation programme and to take advantage of their expertise in this area.

Similar to the CAP, the main stakeholders in the project are the Ministry of Agriculture and Cooperatives, including the Conservation farming Unit (CFU) of the Zambia National Farmers Union, the Golden Valley Agricultural Research Trust (GART), and Palabana Farm Power Training Centre, the Zambia Agricultural Research Institute (ZARI), FAO and the selected communities.

This CASPP project will focus on selected Own Farm Facilitators (OFFs), (or Lead Farmers in the CAP- model) as the direct beneficiaries who will be trained by the Department of Agriculture (DoA) Camp Extension Officers/Block Extension Officers through the Farmer Field Schools (FFS) approach

The outcome of the project is to increase the capacity of MACO and Own Farmer Facilitators to provide future extension support to CA beneficiaries in the country. Tentatively the programme will focus on the following district; Chipata, Katete, Petauke, Chongwe, Chibombo, Kapiri, Mumbwa, Mazabuka, Monze, Choma and Kalomo. The programme will work in MACO camps not covered by the CFU programme, but in the same districts (to be decided through a joint selection process). The input supplied throughout the programme will as far possible be based on local purchase through agro-dealers based on competitive pricing. This will ensure availability of inputs after the programme period through local agro-dealers and community agro-agents.

2.5.2 Food security pack programme (FSP)

The FSP Programme has been implemented by the NGO Programme Against Malnutrition (PAM). Since its inception in 2002, the FSP Programme has targeted vulnerable but viable small-scale farming households who are selected by a community committee. The programme promotes crop diversification and CF methods to optimise agricultural output, and provides training in market entrepreneurship to enhance farmers' sustainability. The FSP provides selected candidates with a range of inputs, including fertilizer, lime and seeds (of cereals, legumes and roots or tubers) appropriate to the target AER. Furthermore, the programme builds capacity for developing seed/grain banks to improve seed availability and therefore food security. Candidates pay back 50% of their harvest in kind to the programme, part of which is stored (the amount is decided by the community and supported by facilitators) whilst the remainder is sold and the proceeds put towards providing FSPs to additional farmers. In this way, the programme seeks to build community capacity nation-wide (including instilling a sense of self-worth in productive farmers), encourage sustainable farming techniques and eradicate the existing "dependency" syndrome. Furthermore, the programme encourages participation in the Food-for-Work programme which is involved in developing public infrastructure.

2.5.3 Conservation agriculture programme (CAP) 2007 -2011

In 2006, Norway began funding a five year Conservation Agriculture programme (CAP) through the Conservation Farming Unit (CFU) of the Zambia National Farmers Union. The program was designed to increase the number of smallholder farmers that practice conservation farming and conservation agriculture in 12 districts of Zambia. The objectives of the CAP are to increase food security, enable appropriate responses to emerging economic opportunities and encourage environmental regeneration and reforestation. Under its current programme of work, CFU worked with over 120,000 farmers (approximately 15 percent of the small-scale farming population in Zambia) in five of the nine Zambian provinces (www.cfu.zm Website May, 2010). Farmers participated in four different training sessions per year, as well as attending field days, demonstrations and exchange visits. They also received technical support and extension services from CFU field staff.

2.5.4 Conservation agriculture programme (CAP II)

CAP II intervention will be the final major investment in the promotion of CF/CA through the CFU. The CAP II investment profile is therefore structured to take into account this eventuality with a substantial reduction in extension and training activities commencing from 2013. This will be achieved by shrinking the CFU's presence CAP Regions based on the following criteria:

- Where the CFU has had a constant presence for at least 8 seasons.
- Where CF/CA adoption by numbers of farmer's within training groups is approaching a plateau.
- Where an adequate and robust network of active agro-dealerships exists.
- Where all MACO staff have been trained and have a thorough knowledge of basic CF/CA practices.

The premise is that since CF/CA farming systems offer substantial and proven social and economic benefits to a wide spectrum of farmers, they should after 8 or more years of promotion be firmly embedded as the preferred farming system and should be robust enough to withstand a much lower level of technical extension.

2.5.5. Farmer Input Support Response Initiative (FISRI) Project (2009 -2010)

In its quest to respond further to the challenges of low crop productivity which small scale farmers face in the agricultural sector, the Government of the Republic of Zambia (GRZ), again, initiated another conservation agriculture focused project called Farmer Input Support Response Initiative in 2009, shortly after the CASPP project had been launched. All projects related to CA/CF fall within

the framework of the Government's Conservation Agriculture for sustainable Agricultural Development CASAD.

The FISRI project was funded by the European Commission (EC) to function within the umbrella of the CAP model and thus use the same approaches and methodologies to ensure consistency and coherence among all major on-going initiatives related to CA/CF in Zambia. However, the rationale for the FISRI project was to address the issue of rising input and commodity prices in Zambia by way of supporting farmers with CA/CF inputs and extension services. Specific problems addressed by the project included increased costs of farming inputs, lack of consistent application of best practices in land and crop husbandry, declining soil fertility and erosion due to unsustainable agricultural practices and increased vulnerability of farming households to natural disasters and the effects of climate change.

The project is being implemented jointly by MACO's Department of Agriculture (DoA), FAO and other stakeholders such as the United States Agency for International Development (USAID), Production, Finance and Improved Technologies (PROFIT), GART, Zambia Agriculture Research Institute (ZARI) and private sector agricultural service providers for the overall purpose of increasing synergies with other existing CA promotional efforts. The role of the DoA in the project is to supervise the overall implementation while FAO facilitates. ZARI and GART on the other hand will conduct adaptive research during the period and review. The role of PROFIT is to provide partial support to the marketing linkages. Similar to the CASPP project, the CA/CF technologies to be promoted under the FISRI include planting basins, Animal draft power ripping using the Magoye ripper, crop residue management, improved crop rotations and associations as well as promotion of agro forestry species such *as faidherbia albida.* Given the target of up-scaling CA to 58,000 small scale farmers in two years, the approach remains to train (216 MACO) extension personnel (i.e. 45 provincial/district staff and 171 field staff) who in turn will train 3,920 OFFs on CA topics and Best Agricultural Practices (BAPs) per year. Since each OFF trained will train 4 farmers per year, the project hopes to achieve the 58, 000 farmer beneficiaries target. The project is equally using the input voucher system to enable farmer's access inputs easily and timely.

2.5.6 UN collaborative programme on reducing emissions from Deforestation and Forest Degradation (UN-REDD)

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a new environmental finance concept with the primary objective of providing financial incentives to reduce greenhouse gas emissions (predominantly CO_2) from forest lands in developing countries. REDD+ frameworks will have a positive effect on the conservation of associated biological diversity and ecosystem services, and the livelihoods of forest-dependent communities through a better management of forests. The objective of UN-REDD Programme is to prepare Zambian institutions and stakeholders for effective nationwide implementation of the REDD+ mechanism.

To prepare Zambian stakeholders and institutions for effective future nationwide implementation of REDD+:
- Build institutional and stakeholder capacity to implement REDD+;
- Develop an enabling policy environment for REDD+;
- Develop REDD+ benefit-sharing models; and
- Develop Monitoring, Reporting and Verification (MRV) systems for REDD+.

2.5.7 Zambia Agricultural Research Institute (ZARI)

Has two ongoing activities related to climate change. The first one being the resilience of Social Ecological Systems Program. This is a pilot program being undertaken in Sinazongwe and Petauke areas through setting up of automated weather stations whose objective is to build farmer adaptive capacity. The second one is Conservation Farming Methods Program and it focuses on good tillage practices and development of different seed varieties with the objective of increasing food production.

2.5.8 Adaptation to the effects of drought and climate change in agro-ecological regions I and II in Zambia

The strong dependence of Zambian communities on rain-fed agriculture renders them particularly vulnerable to climate change (including variability) and it was clear from the study that indeed application of conservation with trees technologies contributes in mitigation and adaptation to the effects of drought and climate change. The effects of climate change are likely to manifest in Zambia as higher temperatures, increased variation in rainfall, a concomitant shortening of the growing season and an increase in the frequency and intensity of drought and flooding episodes, all of which will have adverse consequences on food security in Agro-ecological Regions I and II. This LDCF project "Adaptation to the Effect of Drought and Climate Change in Agro-ecological Region I and II in Zambia" will bolster current agricultural policies and development support programmes by integrating climate-induced risk management of agricultural resources into policy.

To reduce the vulnerability of communities in AER I and II to climate change impacts, the project will use a four-pronged approach. Firstly, capacity and systems to anticipate, assess and prepare for climate change risks will be developed at community, regional and national levels. This will enable farmers in Zambia to increase their resilience to the effects of climatic hazards. Secondly, community-based adaptation measures will increase water availability and improve soil quality for agricultural users in the pilot areas in order to improve crop yields and incomes. Thirdly, knowledge gained from the pilot projects will be used to guide national fiscal, regulatory and development policy to ensure that it supports adaptive practices. Fourthly, knowledge gained and lessons learned throughout the duration of the project will be shared via the UNDP Adaptation Learning Mechanism and WikiADAPT with other areas and countries sharing similar climate change threats.

2.5.9 Ministry Of Agriculture and Cooperatives

With regard to climate change, the Ministry of Agriculture and livestock implemented a pilot project in miombo ecosystem of Mkushi and Serenje districts. The project had two components. The first component of the project was Conservation Farming (**CF**) which is considered to create an environment to enhance carbon sequestration and discourage the use of the chitemene system of cultivation. CF enables the regeneration of the natural environment-sink and promotes intensification of agriculture production.

The second component was ecosystem management which involved planting of agro forestry tree species to enhance soil fertility and increase woody biomass, controlled fire burning and biodiversity management to reduce pressure upon fauna and flora (certain wildlife species and protected forests). An alternative livelihood sub-component was also incorporated where some farmers were supported to diversify economic enterprises such as engage in rearing local chickens, bee-keeping and establish trading centres for inputs and crops. This component is being up-scaled in Northern, Luapula and North -Western Provinces.

2.5.10 Fertiliser Support Programme (FSP)

In 2001, MACO estimated that only 30% of smallholder households had access to improved maize seed and just 20% of farmers had access to fertilizer. After nearly a decade of market reforms, Government therefore saw that small-scale farmers were too weak economically to provide adequate demand for private inputs and that this was leading to problems with the erosion of Zambia's resources, low farmer productivity, and increased cases of food insecurity and poverty at the household and national levels. Previous input programs since liberalization had suffered from poor credit recovery and were unsustainable.

To improve this record, the FSP sought to disengage Government from credit provision by selling inputs on a direct cost-sharing basis. In addition to the benefits to farmers, it was anticipated that the program would create additional demand for inputs and open new market opportunities for private dealers to supply the rural areas. The FSP was thus conceptualized as a program that

would build both smallholder farmer and private sector capacities as part of a well-managed transition to full market liberalization.

To achieve these aims, the FSP was designed to supply standardized input packs for maize. Each input pack was meant to consist of 20kg of hybrid maize seed plus four 50kg bags of Compound D (basal) fertilizer and four 50kg bags of Urea (top dressing) fertilizer (i.e. 20kg seed + 4x4 fertilizer), which is the amount MACO recommends to plant 1ha of maize. FSP inputs were to be accessed only through approved farmer cooperatives or other registered farmer groups who would apply through their local District Agricultural Committee (DAC) for members to receive support. Farmer payments were to be collected by the sponsoring organization and deposited in a designated local bank account as a condition for the inputs being released. Originally, the subsidy level was set at 50% but was increased to 60% from the 2006/07 season.

With regard to the program's second objective of building private sector capacities, MACO intended that FSP inputs would be supplied as far as the district level by private seed and fertilizer companies selected through a national tender. Thereafter, onward distribution of inputs to participating farmer groups was to be managed by local transporters selected by the DACs. In the first seven years of the FSP to 2008/09, MACO's working estimate is to have reached an accumulated 1,055,000 households with 422,000 tons of fertilizer and 21,100 tons of seed for a total cost of ZMK 1,361.1billion (USD 316.2 million). With these inputs, MACO estimates that the program produced a total of 3,165,000 tons of maize, based on the assumption of 3 tons of new production for every 1ha input pack it budgeted for.

The FSP was aimed at improving household and national food security, incomes, accessibility to agricultural inputs by small scale farmers through a subsidy, and building the capacity of the private sector to participate in the supply of agricultural inputs. Through the FSP, GRZ also aimed at rebuilding the resource base of the smallholder farmers.

2.5.11 World Food Program with COMACO-based market incentives

Initial support to CA was provided by World Food Program (WFP) in 1995 through a relief program that involved maize incentives to encourage adoption of conservation farming following a severe drought. Planting basins and use of compost were the main RCTs promoted. The support was characterised by the Conservation Market in Community (COMACO) approach as well as testing of the viability of CA. COMACO evolved from the idea that the aid-dependent rural poor in Zambia could partner with a company to sustain their livelihood. In exchange for agreeing to use conservation farming techniques, farmers receive help in the areas of access to farming inputs, education to improve their farming skills, and a high market value for the goods they produce.

Therefore, continued compliance with conservation farming by replacing maize incentives from World Food Program with COMACO-based market incentives was a major challenge for the COMACO approach. The sharp reduction of WFP maize supplementation as an inducement for initial training in 2006 offered an important opportunity for testing farmers' support for joining and maintaining membership in this model. However, it became apparent that in (Lundazi and Chama) areas where WFP maize support had been completely removed for the 2006 planting season and where COMACO markets were most developed, conservation farming compliance had remained consistent with the previous years. All in total, about 49, 407 farmers benefited from this program between 2001 and 2006 with compliance to CA recorded in the range of 56 – 78 %.

3.0 EXISTING INSTITUTIONAL ARRANGEMENTS

3.1 Current CA/CAWT institutional arrangements, responsible agencies

3.1.1 The Ministry of Agriculture & Livestock

The mandate of the Ministry of Agriculture & Livestock (MAL) is to:

- attain and sustain household food self-sufficiency and to improve the nutritional status of the population;
- expand and diversify agricultural production and exports;
- increase farm incomes;
- conserve the natural resource base;
- formulate agricultural policies, legislation and regulations with stakeholder participation;
- generate and disseminate agricultural information and technologies;
- regulate and ensure quality control of agricultural produce and services; and
- monitor and manage the food security situation.

To fulfil this mandate and perform the necessary activities, the Ministry of Agriculture & Livestock (MAL) is organised into 10 departments, which report directly to the Permanent Secretary for Agriculture & Livestock. The departments are: Human Resources; Department of Agriculture; Department of Animal Health; The Department of Livestock Development; The Department of Fisheries, The Department of Marketing; Department of Cooperatives and The Policy and Planning Department, Zambia Agriculture Research Institute (ZARI) and The Seed Certification and Control Unit (SCCI).

The Ministry has been further divided, administratively and technically, into 10 Provincial Agricultural Offices, headed by Programme Agriculture Coordinators (PACOs). Each PACO has specialists representing crop production, animal health and veterinary services, agricultural extension support services, research and technical services.

The Provincial Agriculture Offices are subdivided into district offices, replicating the professional structure of the PACO. These are further sub divided into Agriculture Extension Blocks, which were further divided into Agriculture Camps. Under the Decentralisation Programme, the Ministry links to the Area Development Committees as the lower level local government planning structures coordinating development.

The Zambia Agriculture Research Institute (ZARI) has the responsibility to develop agricultural technologies for use by farmers in Zambia. ZARI is at the national level and operates three regional Research stations located in the main geographical regions: Mt Makulu in the Centre, Mochipapa in the South, and Kasama in the North. There are further four so called Experiment stations spread over the different regions: Muskera in Chipata, Mansa, Solwezi and Namushakendi in Mongu. There are also smaller sub-stations in each region where research activities are taking place on a more limited scale for a specific commodity and within a specific agro-ecological zone.

The Ministry headquarters in principle concentrates on functions of policy formulation and regulation, coordination of training, and collaboration with other stakeholders. The key stakeholders in relation to the Ministry are: other government ministries and departments, public sector institutions, NGOs, donors, small and large-scale farmers, farmers' associations, input suppliers, agro-processors, international agriculture research centres, and produce buyers.

The role of the PACO's within the present hierarchical structure is to interpret and implement policies formulated at the central level, coordinate technical specialists, supervise programmes,

and develop “technical messages” and further training of technical specialists and extensionists. At the District level, the functions of the District Agricultural Coordinator’s Office (DACOs), now include dissemination of messages, training of Block and Camp Extension staff and farmers, providing technical advice and supervision of extension staff. At camp level, activities involve imparting technical messages to farmers, formation of farmer groups, conducting farmer demonstrations, and linking farmers to credit institutions.

The training of professional for the agricultural sector is carried out at the University of Zambia. A considerable number of Masters and PhDs have also been completed locally and abroad, while the training of technical staff who have the primary responsibility as frontline staff is done at the Natural Resources Development College (NRDC) and; Zambia Colleges of Agriculture (ZCA) at Monze and Mpika

3.1.2 Current CA institutional arrangements

The National Conservation Task Force (NCATF) has been in existence for past 6 years. Its mandate is to promote the uptake of conservation agriculture in the country. In line with the regional efforts to establish CA task forces in each country to promote conservation agriculture, the National Conservation Agriculture Task Force (NCATF) in Zambia was launched in 2007.

The task force aims to advocate and influence agriculture policies and other policies related to conservation agriculture, facilitate capacity building amongst stakeholders and develop strategies for the roll out and adoption of conservation agriculture. Specifically the NCATF is expected to undertake the following activities;

i) facilitate networking of conservation agriculture implementers,
ii) advocate and influence agriculture and other policies related to conservation agriculture,
iii) facilitate the development, packaging and dissemination of conservation agriculture through stakeholder consultation, iv) facilitate capacity building among stakeholders,
iv) participate in regional and global conservation agriculture related fora,
v) monitor and evaluate conservation agriculture activities in the country and,
vi) solicit funding to support expansion of conservation agriculture activities in Zambia.

Although resource limitation remains a challenge to NCATF since its inception, the task force has managed to implement a number of activities such as field visits and review meetings in order to iron out some issues affecting the scaling out of conservation agriculture in the country.

The Ministry of Agriculture and Livestock currently holds the Chairmanship of NCATF. The Department of Agriculture is the Secretariat to NCATF. NCATF is made up of voluntary members on invitation by the NCATF Secretariat.

3.2. Policies relevant to CAWT

3.2.1 Sectoral, national and regional policies

The Zambian Government emphasises and supports the need to conserve the natural resources of land, soil, water and forests through sector, national and international level policy frameworks (SNDP, 2011). At a national level, the Sixth National Development Plan contains an overall Agriculture Policy which aims to facilitate and support the development of a sustainable and competitive agricultural sector that assures food security at national and household levels and maximizes the sector’s contribution to Gross Domestic Product (GDP). The Policy is to be realised through the following specific objectives:

- To ensure national and household food security through dependable annual production of adequate supplies of basic foodstuffs at competitive costs;

- To ensure that the existing agricultural resource base (and environment) is maintained and improved upon;
- To generate income and employment through increased agriculture production and productivity
- To contribute to sustainable industrial development by providing locally produced agro-based raw materials; and
- To increase agricultural exports thereby enhancing the sector's contribution to the balance of payments.

At sector level, since independence government has provided agricultural subsidy in form of improved seed and fertiliser which has enabled many small holder farmers to access farm inputs. In addition, there has long-term commitment towards cash-for-work, asset-for-work or input-for-work programs (World Bank Report No. 54864-ZM, 2010). These policies have been intended to improve productivity, reduce soil nutrient depletion, soil erosion and encroachment of agriculture into marginal lands. This implies improvement in natural resource availability in the form of sinks for climate change mitigation and adaptation as well as improved resilience of the agro-ecosystem to climate variability.

In 1992-1997, the Agricultural Sector Investment Programme (ASIP) was formulated to harmonise investment and support programs in agriculture based on their highest potential for contributing to food security and agricultural growth for the next five years. The ASIP was a prioritised results-oriented framework that focused on food security and risk management; agri-business and market development; and sustainable land and water management.

At international level, Zambia is a signatory to the African Union's New Partnership for Africa's Development's (NEPAD's) Comprehensive African Agriculture Development Program (CAADP). The CAADP is based on two major principles: the pursuit of a 6% average annual growth rate at the national level in the agricultural sector, and the allocation of 10% of national budgets to agriculture. The CAADP initiative was endorsed by the African Union Heads of State in 2003 in Maputo, Mozambique. CAADP's agenda reflects a fundamental shift in the way Africa's leadership looks at agriculture and its potential contribution to ending poverty, hunger, and malnutrition. The program-fully owned and led by African governments-drives the efforts to achieve growth and national development in line with the Millennium Development Goals (MDGs). Zambia signed its CADDP compact in 2011.

3.2.2 The National Agricultural Policy

The overall Agriculture Policy is to facilitate and support the development of a sustainable and competitive agricultural sector that assures food security at national and household levels and maximizes the sector's contribution to Gross Domestic Product (GDP).

The policy will be realized through the following specific objectives:

- To ensure national and household food security through dependable annual production of adequate supplies of basic foodstuffs at competitive costs;
- To ensure that the existing agricultural resource base is maintained and improved upon;
- To generate income and employment through increased agriculture production and productivity;
- To contribute to sustainable industrial development by providing locally produced agro-based raw materials; and
- To increase agricultural exports thereby enhancing the sector's contribution to the national balance of payments.

Amplification of Objectives:

a. Food Security

Food security, broadly defined, means access by all Zambians at all times to enough of the right food for an active and healthy life on a sustainable basis. This policy objective has a role to play in ensuring;

the dependable and efficient annual production of adequate supplies of cereals, legumes, root and tubers, tree and plantation crops and animal products; (ii) that the hunger periods in rural areas are bridged by either storage, building long term strategic food reserves or off-season production of food crops; (iii) that markets and marketing incentives exist to channel food commodities from surplus to deficit areas; and (iv) that farmers have a steady and reasonable income from their production.

b. Sustaining the Resource Base

The important resource base for increased agricultural production and productivity are soils, water and air. Current environmental problems of major concern to the agricultural sector include: -

- rapid deforestation
- loss of agro-biodiversity and;
- Land degradation

To ensure a sustainable agricultural sector, these problems must be addressed before serious damage is done. Special attention will be given to promoting sustainable farming practices.

c. Incomes and Employment

Over half of the population of Zambia lives in rural areas where incomes are consistently lower than those of their urban counterparts. The country has large areas of under-utilized arable land, while the productivity from existing land by many farmers is still very low. Thus, expanded farm output for domestic and export markets offers the means whereby the productivity and incomes of a large component of Zambian society can be significantly raised through increased production.

d. Contribution to Industrial Development

Increased production of agricultural products (raw materials) through processing of farm products (e.g. grains, sugar, cotton, oilseeds, livestock, and milk) provides an important share of Zambia's industrial and commercial sectors. There is need to ensure that there is value adding in agricultural products. As the economy improves, domestic demand for processed farm products should expand and the export of processed products should enhance the value-added component in the industrial sector.

e. Increasing Agricultural Exports

In the past, the contribution of the agricultural sector towards the balance of payments has been low despite its high potential. While Zambia is remote from world markets, it is situated close to good regional markets for many products. It is, therefore, possible for Zambia to supply selected export markets with high value products such as paprika, marigold, cat flower, essential oils, spices, mush rooms, castor oil, specific varieties of groundnuts and beans, and vegetables.

3.2.3 The National Policy On The Environment (NPE)

The National Policy on the Environment serves to rationalise the various priorities and define a comprehensive policy for managing environmental and natural resources in harmony with the national development policy. The NPE is envisaged as an all-encompassing approach to environmental management. The overall goal of the environmental policy is to promote sustainable social and economic development through the sound management of the environment. Its goals are expected to be achieved through the FNDP and SNDP programmes on natural resources management and the environment.The policy seeks to promote efficient utilization and management of natural resources, facilitate the rehabilitation and management of essential ecosystems and ecological processes. In addition, the policy will enhance public awareness on the importance of sound environmental management; and promote cooperation between Government, local communities, women groups, NGOs and the private sector in the management and sustainable utilization of natural resources and the environment.

The outstanding feature of this document is its effort to link its principles and objectives to those of other sectors. For instance, one of its sectoral policy objectives is to promote environmentally sound agricultural development by ensuring sustainable crop and livestock production through ecologically appropriate production and management techniques, and appropriate legal and institutional framework for sustainable environmental management. The guiding principles of the aforementioned objectives include ensuring agricultural policy and planning involves local community and NGO participation at all levels and is closely coordinated with land use, water and natural resource policy and planning.

3.2.4 National Forestry Policy

Forests are one of the most important natural resources of Zambia, covering sixty six percent of the total land area of the country though most of it is being degraded. The forests play vital roles in people's livelihoods as major sources of timber, traditional medicine, wood fuel, food and building materials. Furthermore, forests play major roles in both carbon and hydrological cycles, are key factors in watershed and soil conservation, and are important for other landscape factors (e.g. soil erosion). However, forest resources are under pressure from the effects of several factors including deforestation, encroachment, uncontrolled bush fires, agricultural expansion and degradation. Forest degradation is primarily as a result of inappropriate management regimes and policies, and unsustainable harvesting systems. Against this background it has therefore become necessary that Zambia adopts a National Forestry Policy which aims at enhancing sustainable management of the country's forest resources and simultaneously meets the growing local needs for fuel wood, fodder, timber and non-wood forest products (NWFPs).

The National Forestry Policy encourages participatory forest management which is anchored on the active participation of local communities, traditional institutions and other stakeholders in the management and utilization of forest resources at all levels of decision making, implementation, monitoring and evaluation. The policy also encourages the definition of stakeholder roles, resource tenure, costs and benefit sharing mechanism related to forest resources management, investments and forest industries development. The policy therefore, is aligned within the framework of decentralization, stipulations of the Vision 2030 and the Fifth National Development Plan (FNDP) and recognizes regional and international opportunities and obligations or frameworks such as the SADC protocols on forestry and other natural resources, CITES, MDGs, and forest related international conventions.

The National Forestry Policy is based on the following guiding principles:

i. To ensure sustainable forest resources management
ii. To enhance the role of forests in the abatement of climate change
iii. To develop the capacity of all stakeholders in sustainable forest resources management and utilization

iv. To facilitate private sector investments and public private partnerships in forestry development
v. To promote the establishment of local level forest development related institutions and public private partnerships to enhance the contribution of the forestry sector to livelihoods and the national economy
vi. To promote an equity in participatory approaches to forest management and development by establishing close partnerships amongst all stakeholders; and adopt an integrated approach, through intra and inter-sectoral co-ordination in forestry sector development
vii. To take advantage of opportunities provided by international conventions and bilateral agreements related to forestry, and meet Zambia's international obligations.

3.2.5 The National Gender Policy

The National Gender Policy (NGP) was drafted in 1997 through a consultative process spearheaded by GIDD and adopted by Cabinet in 2000. The NGP emphasizes issues of poverty, noting that women and children are differentially affected compared to men. Female headed households are singled out as experiencing more poverty than any other social group in the country, while the HIV and AIDS pandemic and violence against women are exacerbating the situation. The policy outlines priority areas of concern, such as:

a) the unbalanced power relations between women and men in the domestic, community, and public domains which are impediments to the advancement of women;
b) the feminisation of poverty as reflected in women's limited access to and control over reproductive resources, social services, remunerative employment opportunities, and minimal participation in political and managerial decision-making positions;
c) statutory and customary laws and practices which hamper women and men's full participation in national development;
d) the prevalence of gender violence;
e) the lack of access by women to credit, improved technology, land and extension services, which constrain agricultural productivity; and
f) cultural and traditional practices that systematically subject women to male subordination.

The NGP was accompanied by the Strategic Plan for the Advancement of Women (SPAW), aimed at ensuring the effective implementation of the NGP. The SPAW was developed as one of the post Beijing Activities for a period of five years from 1996 to 2001. It provided all principle stakeholders with a workable plan of action for the effective implementation of the Beijing Platform for Action (BPFA).

The following were identified as the five priority areas and arranged in order of priority:

- The persistent and growing burden of poverty on women and their unequal access to resources,
- Women's participation in economic structure and policy design,
- Gender inequalities in access to and opportunities in education, skills development and training.
- Women's unequal access to health and related services.
- Inequality between women and men in sharing of power and decision-making.

3.2.6 National HIV and AIDS Policy

In order to demonstrate its highest political commitment to the fight against HIV, AIDS, STIs, TB and other opportunistic infections and to militate against the harmful socio-economic impact that communities have been subjected to, the Government in 1999 established the National HIV/AIDS/STD/ TB Council (NAC) through an Act of Parliament. The chief mandate of the Council is to coordinate national responses to the HIV/AIDS/STI/TB pandemic. Policy interventions against HIV/AIDS/STI/TB have, however, been undertaken in an environment devoid of policy direction

and guidance. As might be expected, the lack of a national policy has resulted in undue duplication of effort and waste of scarce health resources.

An effective response to the HIV/AIDS epidemic requires the adoption of strategic partnerships involving Government Ministries, local and international NGOs, CBOs, FBOs, the private sector, Members of Parliament, traditional leaders, the United Nations (UN) System and international bilateral and multilateral development partners. This approach requires effective coordination of policies and activities by all partners with a view to ensuring synergies and maximising the utilisation of limited health resources.

The aim of the National HIV/AIDS/STI/TB Policy is to attain a society in which the prevalence and impact of HIV/AIDS/STI/TB are significantly reduced to levels where they become manageable socio-economic and public health problems and in which people infected and affected by HIV/AIDS/STI/TB live positively without stigma and discrimination. The policy, therefore, is expected to provide the requisite framework for informing and guiding various stakeholders in the quest to contribute to the fight against HIV, AIDS, STI, TB and other opportunistic infections.

3.3 Implications of current policy environment for expanding CA/CAWT development

The transformation of the Agricultural sector is a critical component of the poverty alleviation strategy in Zambia, through providing farmers with the necessary services and conditions for them to increase their incomes. This will involve expanding and strengthening access to agricultural inputs; improving research and extension services, introducing smallholder friendly technologies, improving access to local and international markets; reducing barriers to land acquisition, enhancing use of sustainable land management technologies; increasing investment in irrigation. But the generation of technology is not sufficient in itself. The technologies have to reach and be adopted by large numbers of those who have been bypassed by previous efforts. They have to be appropriate for an environment in which human disease, especially HIV/AIDS, is a major cause of poverty. And they need to address the very real problems that vulnerable populations such as child-headed households and women face in breaking out of the poverty trap. Fundamental to the success of this strategy are agricultural research and outreach institutions that are able to work with farmers across gender, age and wealth barriers to increase the productivity, profitability, and sustainability of agriculture in Zambia.

Achieving better profitability and sustainability in agriculture requires the improved management of agricultural resources, combined with increased efficiencies in managing inputs and outputs at all stages of the production chain, the adoption of new technologies, and the extension of the use of existing technologies, such as reduced tillage, mechanization, water harvesting and irrigation, range management, crop protection and animal health, and crop storage. The essence of the strategy recommended here is to enable, through appropriate policy and strategic interventions, the speedy and efficient implementation of conservation agriculture with trees as an integrated strategy that achieves better profitability and sustainability in sustainable agriculture production systems.

3.3.1 Institutional frameworks

Lack of capacity, weak institutions, a weak civil society, and repeated donor bail-outs have permitted even the best policies and programs to be ignored, subverted or delayed to the point of being ineffective. Presently, CA/CAWT is enjoying coordinated collaboration between development partners, local NGOs, training and research institutions and other agencies under the guise of the National Task Force on Conservation Agriculture. This strategy needs to be further developed and reinforced to inform legislation and policy development for CA/CAWT. It is further suggested that NTFCA should focus on supporting mechanisms that recognize effective decentralization (District Agriculture Offices) as an essential component to inculcate CAWT in rural agriculture.

In order to influence more buy in for CA/CAWT from decision makers/ policy makers, it is proposed that NTFCA be strengthened to act as a Technical Committee (to appraise CA/CAWT activities) for a higher decision makers/ policy makers at the Ministerial level.

3.3.2 Leveraging improved income from markets strategies

In order to produce sufficient food small scale farmers need to increase productivity through efficiently using fertiliser and improved seeds. To pay for these inputs they will have to produce a surplus that they can sell. This requires that they have access to the required inputs at optimal cost and access to markets for their produce. Markets are thin and poorly integrated and marketing margins have been high. In many areas a trader may have a virtual monopoly and thus be able to offer farmers very low prices. Several organisations, NGOs and other organizations (eg. PROFIT, ZNFU and MUSIKA) have thus stepped in to develop more efficient and competitive markets for inputs and produce. This has been achieved through establishing market information systems for collecting and publicising information about prices and quantities of inputs and produce at various locations in the country. This information is conveyed to the public through radio programmes, printed media and SMS services. The development of a network of agro-dealers in the country who have been provided with training in input and products marketing provides for important market intermediaries. Thus CA/CAWT scale up needs to recognize and utilize these market networks and systems.

Conservation Agriculture with Trees should not only be seen an avenue for improving maize productivity at the local scale. It should also be contextualized as a link to open up new income streams that poor small scale farmers can link into at macro-scale. It should provide the staple requirement for the household while allowing enterprise diversification in the production system. An important role of CAWT in its new research and extension domain will be to prioritize and internalise backward and forward linkages of agricultural products as they relate to important constraints of market development.

3.3.4 Gender, health and nutrition

The HIV/AIDS pandemic is adversely impacting agricultural productivity because most of the affected people are the productive group. In addition to being more at risk of HIV infection, women are also disproportionately affected by HIV. The task of caring for people with HIV and AIDS orphans falls more on women than on men. Girls tend to be the first to be withdrawn from school as AIDS exacerbates poverty at the household and community level. Increasing numbers of households are headed by women, children or the elderly. The pandemic has increased the vulnerability of women, the elderly, orphans and the sick, as they cannot access productive resources such as labour, fertiliser and seed. Improved home nutrition can slow the onset of disease and is essential for the successful use of antiviral agents needed to keep the disease in check.

Conservation Agriculture/Conservation Agriculture With Trees has the potential to improve food security needed to mitigate many of the negative impacts of HIV and AIDS. However, much greater attention needs to be paid to how implementation of CA/CAWT actually affects gender needs, how gender roles are changed and enhanced, and where the key intervention points exist to modify important gender relationships. Zambia being a multi cultural country has many conflicting views on gender issues, which has contributed to various limitations when it comes to effective service delivery. At community and village levels, perceptions on gender have been vast due to the different traditions and beliefs. For example, studies consistently show that women, compared to men, have much poorer access to extension services such as demonstrations, meetings, training and research activities (Charles, E and Chiyanika P., 2001, LM&CF, 2002). The choice for married women to participate in the extension programme activities has been shown to depend on their spouses, suggesting that participation in extension activities is a major family decision and the extension staff should treat it as such.

However, the choice of technologies promoted affects the level of participation between men and women. There is need to provide evidence for CA/CAWT and the gender divide based on its knowledge intensiveness and practices of reduced tillage complemented by herbicide application (knowledge of chemicals, safety, application), permanent soil cover often from maize stalks (livestock stover), and possible rotation crops.

3.3.5 Climate Change

Climate change is widely acknowledged as one of the greatest environmental and developmental challenges of our time. It has the potential to impact negatively on almost all sectors of the economy, particularly in developing countries, thereby hampering economic growth and development.

Climate change is a significant development challenge for Zambia. It is likely that the negative effects of climate variability, manifested by floods and droughts, will be experienced for decades to come. The exact extent of climate change impacts on Zambia is uncertain. What is certain is that Zambia will continue to face tremendous development challenges in the next decades as a result of "natural" climate variability (MTENR, 2007, 2011). These challenges will further be exacerbated by a volatile global economy, and a decline in the natural resource base, including arable land, as population growth exerts pressure on available resources. Climate change will therefore put additional pressure on development efforts especially if measures to reduce the underlying vulnerabilities are not introduced in time. In the worst-case scenario, climate change may reverse development gains made over the past decades (MTENR, 2010, MOFNP, 2011). Its based on such observation that, the promotion of Conservation agriculture with trees technologies could play a key role in alleviating effects associated to climatic changing condition, and for the CAWT related technologies to contribute towards mitigation and adaptation to climate change, the country needs to develop policies which will create conducive and supportive environment to promote such technologies.

Like the rest of Sub-Saharan Africa, Zambia's agricultural sector is largely dependent on rainfall, making it highly vulnerable to climate change and climate variability. The Second National Communication to the UNFCCC states that "climate change is expected to have a direct impact on agriculture and livestock activities, which underpin the livelihoods of most of the rural poor. Crop yields may be affected adversely by the vagaries of climate change, and the control of pests may become increasingly destabilised. Crop failure due to droughts, dry spells and flooding contribute significantly to food insecurity especially in rural Zambia." Flood events, especially those related to the La Niña phenomenon, affect agricultural activities as heavy waters inundate farming fields and submerge crops, sweep away assets including livestock, and keep farmers away from their farms.

Economically, these impacts have major implications, as concludes a study by the International Food Policy Research Institute (IFPRI), which estimates that climate variability costs the country USD 4.3 billion over a 10-year period (Thurlow et al., 2009), the losses peaking at USD 7.1 billion under Zambia's worst rainfall scenario. Most of the negative impacts of climate variability occur in the southern and central regions of the country, where food security is most vulnerable to climate shocks. Overall, climate variability is projected to keep 300,000 farming households, most of whom are dependent on subsistence agriculture, below the national poverty line by 2016 (Thurlow et al., 2009).

3.3.6 Land degradation

Depletion of soil fertility is well documented as a major cause of low per capita food production in Zambia. Low crop production per unit area requires that large parts of the landscape must be cultivated to provide a minimum of food for the people. Expansion of agriculture into marginal and unsuitable land is a major threat to the sustainable utlisation of land and water resources. Cultivation of sloping lands followed by soil erosion has led to rapid sedimentation in water bodies.

Destruction of spawning areas as a result of sedimentation is believed to be a partial reason for the rapid reduction in fish catches in the major lakes and rivers, and consequently, loss of protein in people's diet. Agricultural planning should envisage a future situation where arable agriculture is practiced using sustainable land management systems and technologies. By improving the productivity of agriculture and improving the livelihood options of small scale farmers the destruction of ecosystems and landscapes can be halted and reversed.

3.3.7 Agricultural Research And Extension

Agricultural research and extension programmes inform farmers about new technologies and opportunities (including market access and other needs) that can help them attain better returns from their agricultural activities. A number of research areas are being pursued on a long-term basis, looking at tillage, beneficial/monetary-value cover crops and crop rotations, liming in response to acidified soils, varying fertilizer rate effects, and weed science in CF systems of pests and diseases. Based on Agro-ecological Regions (AERs), problems peculiar to a particular AER are addressed appropriately, e.g. moisture deficits in AER I, soil acidity and leaching in AER III, or monocropping/plough pans in AER II. Experiments have been set up in different places to explore the different aspects. Though current CA strides are CFU-based, ZARI is picking up research matters and now assessing what systems work where and why are they are working by looking at the science. ZARI has 10 stations located in different parts of the country where this work is being undertaken.

3.4 Analysis of CA policy environment

To achieve a system of sustainable agriculture, such as that promulgated by Conservation Agriculture With Trees, it may be necessary to develop regulatory and incentive-based tools that require or promote the practices. The challenge faced is how to revise current policies to meet the goal of ensuring and affording a healthful food production system while moving toward an agricultural system that is environmentally, economically, and socially sustainable. This study proposes two avenues for integrating conservation agriculture in a sustainable agricultural development paradigm for Zambia.

3.4.1 Support for development and enactment of 'agriculture land use and management

This study proposes that proponents of CA in Zambia should place CA as part of response to inappropriate land use and management of agricultural lands in Zambia. In this regard, it is proposed herein, that CA, be integral to amendments to existing legislation or new legislation to mitigate current problems facing land use and management, rather than deploying efforts at developing a stand-alone CA policy framework. Such a framework will not have requisite provisions for compliance, in a similar manner to current state of conventional ridge tillage-based farming system where there is no mechanism for compelling farmers who do not comply with good land husbandry practices that are a perquisite to engendering food security, reducing land degradation and enhancing resilience of the agro-ecosystem in the face of climate change.

Land use and management problems in Zambia with special emphasis on customary land, with a view to determining amendments to existing legislation or new legislation to address current problems facing land use and management would need to be studied and . This study is in support of including Conservation Agriculture/ Conservation Agriculture with Trees, as a land use system, under the proposed Act. This Act should be the responsibility of MAL with some powers of monitoring and policing being given, in the spirit of decentralization, to district councils and communities. The premises for development of the new legislation are summarized below:

- A number of government departments are involved in land use and management. The Departments of Lands, Town and County Planning, Agriculture, Mining, Forestry, Environment and Water are some of them. A number of statutes deal with use and

management of land. These include the Lands Act no 27 of 1995, the Draft Town and Country Planning Act, 2011, the Water Act, 2011, the Forestry Act, 1999 and the Mines and Minerals Act. A selective review of these statutes has been carried out in the recent past. Of the various departments it is only MAL which does not have a statute on the activities for which it is responsible, relating to land use and management. Yet, use of agriculture land is the single most important as it is not only the backbone of the economy but it is the only source of food.

- The biggest problem of non-regulation concerns use and management agricultural land under customary tenure. This problem requires a sectoral statute, and the development and enactment of an Agriculture Land Use and Management Act is been proposed. The proposed Act would regulate not only customary land, but notably customary land which of late continues to be leased, fragile lands that have no specific regulations, and public land to ensure holistic environmental protection.

- There are inadequate regulations concerning the use and management of customary land, and this is coupled with unclear policy frameworks to support such land management. This type of land forms the bulk of all land in Zambia and is the main source of food supply. It is small scale farmers who grow the bulk of the maize supply. They are, however, constrained in their efforts due to poor land use and management practices which exacerbate declining soil fertility due to soil erosion and mining.

- Land is allocated by the chief or village headmen to family lineages who in turn, allocate to individual members of the family. At that point the chief's authority almost comes to an end. The chief cannot order the farmer on how to use his land, which trees not to cut or which parts of the land not to cultivate or how to cultivate them. Customary land, even when allocated, still belongs to the community with the traditional leaders acting as trustees. In case of violation of customary norms, the chief has power to expel the convict and thereby forfeit the land he occupied, in practice this power is only exercised in very few cases.

- Most small scale farmers lack the knowledge, expertise and facilities to carry out soil and water conservation measures. They rely on agricultural extension workers for advice and even for necessary facilities, for example, for construction of soil erosion control measures such as the A-frame or line level. These farmers will continue to rely on such services for a long time. On the other hand extension services do not reach every farmer, for several reasons. Lack of adequate resources from the government, laziness on the part of extension personnel, and lack of interest on the part of some small scale farmers contribute to the problem.

3.4.2 Mainstreaming conservation agriculture with trees existing policies

The benefits of Conservation Farming/Conservation Agriculture have been well documented both with specific reference to the LM&CF programme, and to the Zambia National Farmers' Union's Conservation Farming Unit. Langmead (2002), concludes that conservation farming practices can increase maize yields by 153 percent, to around 4 tonnes per hectare, when compared with conventional farming practices. Similarly AF systems have been known to increase crop yields, improve soil fertility and provide a diverse array of forest products. Thus a combination of the two systems will undoubtedly provide benefits provide a resilient, sustainable and vibrant production system.

This will entail providing an adequate evidence base and a period of at least 8 years was suggested in order to attain potential convergence between socioeconomic desirability of CA/CAWT and its potential attractiveness. The present study remains consistent with this view. However, two added perspectives are: (a) supporting development of a legal instrument for agricultural land use and management where conservation agriculture is pivotal as discussed above, while (b) CA is firmly mainstreamed into existing sectoral policies.

CA/CAWT may be considered as just one of many options available to farmers responding to perceived changes in their production environment once made aware of CA/CAWT. The choices of individual farmers are cumulative and can have eventual impacts well beyond the individual farm. This is where we see further complementarities and synergies between agricultural policies that favour CA/CAWT and other sectoral policies that depend on agriculture to provide production systems and ultimately products that sustain livelihoods and ecosystems upon which livelihoods depend on. It may be argued that investments in agriculture will only reach their full potential if progress is also made in sectors determining the socio-economic environment for farmers; health, education, energy, infrastructure and resource conservation.

In Zambia agriculture has been subject to considerable state interest and intervention over the since independence, perhaps more than any other economic sector (SNDP, 2011). A number of studies have examined the influence of policies in farmer decision making and have concluded that the provision of public support in the form of guaranteed output prices, input subsidies, group credit, or disaster relief has encouraged and facilitated massive investment by farmers in production capacity expansion (FASZ, 2010). For example, the success in promoting CA practices in Zambia among small scale farmers has been influenced to large degree by certain policy support approaches singularly by government but often in collaboration with development partners/NGOs (Table 2) below. This represents the second illustration that informs the proposal for mainstreaming CAWT in sectoral policies.

Table 2: A Summary of some policy approaches used to promote conservation agriculture in Zambia

Category	Approach	Proponent
Financial incentives	Free inputs	Programme Against Malnutrition (PAM), CLUSA, CARE, CRS
	Input subsidy	FISP, FRA
	Revolving fund	FAO
Voluntary compliance	Training and extension services	Department of Agriculture, LM&CF – SCAFE, ASP, CFU
		Zambia Agricultural Research Institute, Golden Valley Agriculture Research Trust.
Cross-compliance	Support for CA/CAWT intervention in exchange for undertaking related projects/ programs	Programme Against Malnutrition (PAM), CLUSA, CARE, CRS

Policy in support of financial assistance is considered most suitable to help overcome significant initial investments and transition costs, or to reduce the risk faced by small scale farmers in adopting an `unknown technology' and thereby reduces their need for detailed information prior to adoption. There is however no equivocal evidence for or against incentives in cases where adoption is unprofitable from the individual farm perspective or results in positive net returns for farmers. It may be argued that CA/CAWT would provide for 'national and global good' intended to reduce the declining natural resource quality and farmers should therefore be compensated and this arrangement should be supported by clear policy framework to facilitate the compensation.

It is implicit that a uniform policy prescription to fit many locations and households would not be realistic, whether it consists of direct incentives or more indirect interventions or some mix of both. Designing successful policies to promote CA/CAWT is likely to start with a thorough understanding of farm-level conditions which MACO and development partners/NGOs have so far attempted to enunciate at different socio-ecological locations, albeit, with varying levels of success. It is thus suggested that design of location-sensitive CA programs should draw upon a range of policy tools.

Where policies of a more uniform nature might be useful is in the development of social capital and the promotion of the precursor conditions for collective action. For example, the social capital benefits of group extension approaches probably are under-appreciated. Given the demonstrated importance of farmers' groups and information dissemination in the successful diffusion of LM&CF technologies (LM&CF, 2002; ASP, 2008.) efforts to strengthen the enabling conditions that foster these activities can yield very beneficial dividends.

4. Raising the profile of CA/CAWT in Zambia: – the way forward

Preamble

The principles and policy on Conservation Agriculture/Conservation Agriculture with Trees in sustainable agricultural development in Zambia should be developed and internalized (mainstreamed) in appropriate policies, regulations and guidelines. Appropriate indicators for the social, economic and environmental aspects relating to conservation agriculture/conservation agriculture with trees in sustainable development need to be identified through an appropriate consultative process or forum. A five-year implementation plan needs to be developed, in consultation with stakeholders. This should be harmonized, within the Ministry of Agriculture and Livestock and other government structures, taking into consideration national, regional, and international commitments.

4.1 Policy & strategic options for scaling-up CA/CAWT

4.1.1 Nutrition and Food Security

Policy options

Increasing agricultural productivity through CA/CAWT as an effective option to combat poverty and mal nutrition

Strategies for policy development:

- Ensure that agricultural objectives based on CA/CAWT as a productivity enhancement and resiliency strategy are integrated into broader national food security and nutritional policies and plans;
- Enhance food security, agricultural productivity, and income generation through CA/CAWT as a productivity enhancement and strategy;
- Improving access to CA/CAWT-based production resources like finance, agricultural inputs, and information to a broader section of the population;

4.1.2 Poverty Reduction

Policy options

Increasing agricultural productivity through CA/CAWT to significantly contribute to the reduction of rural poverty levels

Strategies for policy development:

- Develop CA/CAWT policies that are geared towards contributing to stabilizing food production and food prices;
- Develop CA/CAWT programmes aimed at facilitating enhanced market access for small scale and emerging farmers;
- Develop CA/CAWT programmes aimed at providing poor small scale farmers with opportunities for diversified income generation

4.2.3 Health

Policy options

Increasing agricultural productivity through CA/CAWT to provide an adequate supply of diverse foods which is a key determinant of adequate nutrition and health

Strategies for policy development:

- Promote programmes which
- Facilitate development of awareness programmes on nutrition arising from productivity enhancement capacity of CA/CAWT;
- Promote good practices with regard to handling and utilization of pesticides, herbicides, fertilisers and other agro-chemicals

4.2.4 Equity

Policy Option

Promote participation of previously disadvantaged groups, including women, youth and the disabled in CA/CAWT thus ensuring sustainability and food security for all

Strategies for policy development:

- Develop programmes and projects aimed at empowering women, youth and the disabled and support their full participation in CA/CAWT programmes and ensure their integration in the agricultural industry;
- Ensure that policies and programmes promote women's equal access, to and full participation in, decision-making at all levels in CA/CAWT production systems;
- Ensure that gender perspectives are mainstreamed in all CA/CAWT policy development and implementation strategies.
- Facilitate equitable access to public information to support decision making related to CA/CAWT development and implementation;
- Empower communities and their local groups to make informed decisions in meeting essential food, water and energy needs while employing CA/CAWT for the conservation of resources and environment.
- Ensure that policy formulation and implementation for CA/CAWT is guided by principles of accountability, transparency and broad-based public participation to promote the empowerment of people living in poverty and their organizations.
- Develop CA/CAWT programmes aimed at the marginalised and enable them to increase access to productive resources and public services and institutions;
- Facilitate equitable access to CA/CAWT technology and its transfer in appropriate language, level of communication, and transfer medium in order to align it with the needs of targeted communities and their level of understanding;

4.2.5 Unemployment

Policy option

CA programmes that focus on improving the wellbeing of rural people and creation of new opportunities and enterprises in agricultural production and service provision that could revolutionalise rural industrialization.

Strategies for policy development:

- Transfer of CA/CAWT as a sustainable technology for agricultural entrepreneurial development to rural communities through strong national agricultural research programmes;
- Improve private and public partnerships in supporting rural agricultural entrepreneurial development, through agro-processing and other value adding initiatives for rural products;
- Promote CA/CAWT programmes that encourage innovative entrepreneurial development for rural agricultural produce, by creation of market opportunities and availability of information;
- Facilitate the creation of new employment opportunities for off-farm employment, through CA/CAWT backward and forward linkages;

4.2.6 Agricultural research systems

Policy Option

Ensure optimization of available resources through involvement of a wide spectrum of role players in engaging research challenges of CA/CAWT

Strategies for policy development

- Improve public and private funding for research in CA/CAWT
- Promote the development of new crop varieties that are capable of higher yields, can adapt to CA/CAWT conditions and are tolerant to adverse conditions, pests, and diseases;
- Integrate and strengthen national research and extension services and farmer organizations to trigger farmer-to-farmer exchange on good CA/CAWT practices
- Develop research policies, which focus on identifying and removing constraints to the development of viable CA/CAWT technology options
- Develop programmes aimed at making agricultural extension, education and communication more responsive to CA/CAWT farmer needs.
- Develop and promote investment in human capital, access to databases of best CA/CAWT practices for technology generation and dissemination
- Develop environmentally friendly technologies within the tenets of CA/CAWT that will use less land, water, supplemental plant nutrients and pesticides;

4.2.7 Management of land resources

Policy options

Develop and promote an integrated approach to land use planning and management which maintains the integrity of arable ecosystems with CA/CAWT as the pillar

Strategies for policy development:

- Encourage implementation of CA/CAWT under land use and management plans based on integrated assessments of socio-economic and environmental potential;
- Promote the principles of ecological agriculture to help conserve ecological processes that support life by recycling essential elements, regenerating soils, etc.;
- Ensure effective and efficient use of soil fertility improvement practices;
- Promote CA/CAWT practices to address the decline in soil organic matter;
- Adopt integrated approaches combining increased use of organic manure, mineral fertilizers, hybrid seeds, and rainwater use for optimal productivity
- Identify and implement the principles of the United Nations Convention to Combat Desertification in order to arrest land degradation, including access to information to improve monitoring and early warning related to desertification and drought;

- Promote CA/CAWT practices by establishing networks and disseminate successful techniques for land conservation and rehabilitation;
- Ensure and enhance farmer household participation and involvement of vulnerable communities, women and youth in CA/CAWT as the pillar for sustainable management of land resources

4.2.8 Water use efficiency

Policy options

Improve measures that promote sustainable rainwater harvesting and use and address rainfall shortages through integrated water resources management and water efficiency plans which embrace the tenets of CA/CAWT under rain-fed conditions

Strategies for policy development:

- Develop and promote appropriate water harvesting technologies within the tenets of CA/CAWT
- Adopt and integrate watershed approach to CA/CAWT practices to improve the efficiency of rainwater harvesting and use;
- Promote scientific understanding of the sustainable use, protection and management of rainwater resources to farmers and encourage knowledge sharing;
- Internalize and integrate indigenous knowledge systems to advance long-term sustainability of rainwater resources management;
- Promote development of drought tolerant crops;

4.2.9 Developing functional markets

Policy Option

Promote farmer organisations and farmers' linkages with input and output markets (agro-dealers)

Strategies for policy development

- Supporting agro-based processing and rural entrepreneurship
- Strengthening local market organizations and institutions.
- Promoting agricultural services through agro-dealership, cooperatives and rural agricultural education.
- Provision of reliable and up-to-date information on marketing opportunities and trends.

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