



COORDINATING AND ADVOCATING FOR CONSERVATION AGRICULTURE POLICIES IN SOUTHERN AFRICA

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EXECUTIVE SUMMARY

Conservation Agriculture, as a concept for natural resource-saving, strives to achieve acceptable profits with high and sustained production levels while concurrently conserving the environment. In Southern Africa, the introduction of CA technology into the smallholder farming sector has been primarily through relief programs aimed at improving the livelihoods and food security status of vulnerable households. This report is based on a detailed review of existing documents and aims to identify the key policies influencing CA in the region.

In many countries CA national taskforces have been formed to spearhead the adoption of the technology by smallholder farmers. The key constraints affecting the up scaling of CA include poor access to markets, resource constrained extension systems and inadequate training on CA in the region. The Conservation Agriculture Regional Working Group (CARWG) has identified lack of awareness and information about CA amongst different stakeholders in the region (including donors, private sector, development agencies, and farmers' organizations) as one of the factors identified in limiting CA uptake. FANRPAN has been involved in research studies to review regional policy support to CA with the aim of sensitizing high level policy personnel and lobbying for CA support through FAO, NEPAD, COMESA, and SADC and to respective ministries of agriculture in Eastern and Southern African countries. Although there is evidence of CA success stories in the region, policy stances to promote CA are weak and ineffective. Evidently there are no clear regional policies supporting CA up scaling. This report acknowledges the role of different stakeholders in driving policies that influencing CA up scaling. In the private sector, business organizations in the region are already involved in agricultural adaptation activities through the supply of equipment, technologies, inputs and marketing structures that enhance CA activities by small-scale farmers. A number of international organizations act as the main implementing agents for continental and regional CA programs. The international organizations offer a wide range of input specializations that range from farmer input support, biodiversity conservation and developing sustainable approaches to ecosystems services, that are all linked to the promotion and up scaling of CA technology.

In order to move CA forward there is need for develop and foster new institutional arrangements and strategies at the regional level. Promoting sustainable technologies that include soil fertility and conservation technologies and promotion of high yielding varieties to increase food production and productivity. Improve agricultural extension in order to increasing availability of services to the farmers and this is a critical exit strategy when donor driven CA ends. Strengthening institutional capacity at regional level within partner institutions and across networks for the purpose of human capital development and training stakeholders on CA. New approaches are being recommended for CA, and there is need for constant promotion of science, technology and innovation for example herbicides, bio-safety and mechanization. As such this requires funding for CA research and development. Promoting commodity based value chains which involve the provision of critical inputs, value addition, marketing and trade to develop reliable input and output markets post relief era. Increased public and private sector financing of agriculture as well as developing new and long term financing mechanisms that are friendly to CA will need to be promoted. The regional research collaboration can generate significant technology spillovers as well as economies of scale in raising agricultural productivity through CA initiatives.

1. INTRODUCTION

Agriculture plays a dominant role in the economic development of countries in Sub-Saharan Africa. Despite problems associated with productivity growth, agriculture is a key for spurring growth, getting large numbers of people out of poverty, and is a principal route to meeting the Millennium Development Goals (MDG) (World Bank, 2009). Agriculture is to be considered more than simply an economic activity – it is a key for food security and thus for survival, a means of livelihood and culture, and a provider of environmental services but also a major source of environmental degradation if unsustainable practices are used. Agriculture currently accounts for about 30 percent of Sub-Saharan Africa's (SSA) gross domestic product (GDP), at least 40 percent of export value, and approximately 70-80 percent of employment (FAO, 2006; IMF 2006; World Bank, 2006; World Bank, 2007b). More than 75 percent of the total population in Southern Africa live in rural areas and the majority of them are smallholder households involved in agricultural activities (FAO, 2006; ILO, 2007). Their employment in the agricultural sector gives them an opportunity to earn their livelihood mostly by a combination of subsistence and market production. In a number of resource-poor countries such as Malawi, Mozambique and Madagascar, agriculture plays an even more dominant role, representing 80 percent or more of export earnings (World Bank, 2007b). There are, however, also some African countries, for example Angola, Namibia and South Africa, where the role of agriculture has greatly declined and its importance is camouflaged by the dominance of mineral based industries.

Probably the biggest and most basic challenge for Africa is how to feed its growing population. While it is generally acknowledged that food security is more a problem of access to food (and, thus, of poverty) than of food production, it is important to realise that under the special conditions of many parts of Southern Africa this may be an over-simplification and neglects the importance of national agricultural production. Future sources of agricultural productivity growth are proving to be more complex and harder to find where competition for water resources, especially surface and groundwater, will be more severe as domestic and industrial needs will compete for it. Also climatic models suggest that Southern Africa region will be strongly affected by future climatic changes, with predicted increases in frequency and severity of drought, which will prejudice crop production if there is no adaptation or change of existing cropping systems (Dinar et al, 2008; Boko et al, 2007). This predicted lower rainfall increases the need for more water efficient cropping systems to mitigate the effects of climate change. Researchers, extension, policy makers, farmers and development actors have a growing interest in conservation agriculture (CA), a farming technology that is proving to help meet some of the farming challenges. With its ability to increase efficient use of rainfall, promote higher infiltration, reduce runoff and evaporation, CA will help to extend soil water availability to support crop growth (FAO, 2011; Erenstein, 2003).

The transition from conventional agriculture to CA has been difficult and this is despite all the benefits of production and productivity and cost savings that have been documented and analysed. CA demands a combination of technological innovations and institutional

innovations or new/modified ways of working. This report analyses some of these new or modified ways of working or institutional arrangements that have enabled CA. It uses this understanding to explore broader policy contexts and institutional arrangements that can facilitate the promotion of CA more widely in varying contexts of southern African countries. The report analyzes agricultural policies and institutional arrangements related to CA uptake in Southern African countries; Angola, Madagascar, Malawi, Zambia, Mozambique, Namibia and South Africa. A brief comparison of selected national studies will be done to present different policy approaches to promote CA technology transfer and adoption.

2. METHODOLOGY

The study methodology will be guided by the given terms of references that will be implemented under the supervision of the FANRPAN Secretariat. The study based primarily on review of existing documents will aim to:

- Define and explain key concepts related to CA;
- Present the evolution of CA policy in the region;
- Identify key regional programs that advocate or address CA practices;
- Identify policy instruments and institutional arrangements that promote or deter CA; including likely challenges to expanding CA policies in the region;
- Give practical examples, cases, or success stories of CA programs/practices in the region;
- Present ways forward for CA policy development in the region.

To implement this study, a detailed literature review was undertaken, primarily on documents from regional institutions involved in agricultural development. Documents reviewed included, reports from the Conservation Agriculture Regional Working Group (CARWG), COMESA report on Climate Adaptation, NEPAD's CAADP report, SADC Regional Agricultural Policy (RAP) report, and national CA reports from Malawi, Mozambique and South Africa.

3. EVOLUTION OF CA IN SOUTHERN AFRICA

Interest in applying the principles of CA to the conditions of Southern Africa goes back several decades. But the issues and problems that sparked this interest and the ways in which CA innovation systems have evolved have varied across different countries. Even within a country, variability in production environments leads to the need for a corresponding diversity of CA practices. Smallholder agro-ecosystems in Southern Africa are affected by a multitude of problems. Soils are often sandy, thin and of low fertility. When these soils are farmed under the conditions of low and variable rainfall that is typical of the region, a common outcome is drought stress in crops and seasonal shortages of fodder for livestock. Many feel that CA can help overcome these problems, despite complications that arise in implementing CA in areas where livestock are important components of agro-ecosystems. In Africa, spurred by the American experience and fresh from the memory of the South African

drought of the 1920's, British colonial authorities imposed a set of mechanical soil conservation interventions – soil bunds, ridging, contour plowing – across much of British Africa, through the 1950's (Reij et al, 2001). Successive oil price shocks during the 1970's significantly boosted farmer interest in minimum tillage techniques globally. In addition to diminished compaction, soil erosion and improved water infiltration, the minimum tillage techniques succeeded in cutting fuel costs by 50% to 80% (Witmuss et al, 1975; Epplin et al, 1982; Baker and Rouppet, 1996). In Southern Africa, commercial farmers and associated national and international agricultural research institutions caught the second wave of global interest in conservation agriculture during the 1970's, spurred by advances in the USA and the breathtaking increase in world oil prices. During the 1970's and 1980's South African commercial farmers visited the USA and also launched research programs on minimum tillage (Ellwell, 1995). Considerable research and development of conservation tillage techniques has been conducted in South Africa, especially in the past 25 years. In both Zambia and Zimbabwe, the introduction of CA technology into the smallholder farming sector has been primarily through programs aimed at improving the livelihoods and food security status of vulnerable households (FAO, 2011). As such, targeting has included a significant proportion of resource-limited households which have no draft animals for land preparation and have also been affected by the HIV and AIDS pandemic, among other factors.

3.1 Cases of CA Success

There is an increase in the number of success stories on CA evolution in the region, and agricultural policy support that is increasing its up-scaling in various countries. This section will highlight in detail the evolution of CA in Zambia, and the necessary role of government support programs to smallholder farmers adopting the technology. Also cases from Malawi, Zambia and Zimbabwe are illustrated.

3.1.1 CA in Malawi

The CA practice adopted for smallholder farmers in Malawi entails managing crop residue on the soil surface with no tillage, change to high maize plant density, fertilizer use, and herbicide use amongst other inputs. The Chichewa translation of CA which has been adopted by the National Conservation Agriculture Task Force is “*ulimi wa mlera nthaka*”. This literally means “farming that aim at nursing the land” drawing clear distinction between CA and other resource conserving technologies. There are other local names for CA such as “*ulimi wa mbwezera*” which still serves to explain the understanding and interpretation that the technology is intended to revert back soil quality (Mloza-Banda, 2011). The distinction between CA and other soil and water conservation technologies is therefore that CA emphasizes on the synergies of the various components of the system that provide conditions for minimum soil disturbance, maximum soil cover, effective weed and pest management and crop mixes both in space and time. The technologies that are practiced in isolation or in combination but are not compliant to CA principles, important as they may be, are not CA. Box 1 list a number of CA initiatives in Malawi, that are mostly donor funded, but with the participation of government departments.

Box 1. CA Initiatives in Malawi

1. The ADP-SP/Agriculture Sector Wide Approach (ASWAp)

The ADP-SP/Agriculture Sector Wide Approach (ASWAp) project represents one of the most serious intentions of Government to embrace CA under the component of its Sustainable Growth Initiative. The Sustainable Productivity Growth Initiative will support initiatives aimed at sustainable improvement of national and household food security. Under the sub-component, the project has three activities which include Sustainable Land and Rainwater Management. The initiative targets increased smallholder adoption of environmentally sustainable maize-based cropping practices by adapting and up-scaling innovative CA technologies, including minimum tillage and mulching with crop residues; complementary technologies include permanent pit / basin planting, intercropping and rotation with legume crops and trees (agroforestry).

2. Total Land Care (TLC)

A key focus of TLC programs is to improve rural livelihoods with emphasis in a number of areas including soil and water conservation, CA, contour and box ridging, vetiver grass hedgerows and gully reclamation. TLC has a CA demonstration program in partnership with the CIMMYT where farmers get to observe the method and results of CA. Farmers interested in CA do register with the TLC field coordinators in their respective areas where they pay a deposit of MK1000 each with a commitment to pay the balance in 9 months. Farmers must be those who have registered under the Government's input subsidy program and will receive fertilizer under that program or those who have own means of procuring fertilizer. CA under TLC entails planting on old ridges, use of crop residues and weed control using herbicides.

3. Farm Income Diversification Project (FIDP)

FIDP follows a group approach in CA implementation where farmers are organized in groups for demonstrations. After sensitization and training of field staff and farmers, the target farmers are given start up inputs in the first year on a revolving fund basis. By the third year of the FIDP project in 2009, up to 92% of farmers had been weaned from direct support and were able to buy their own seed, herbicides and fertilizers respectively, using the revolving fund mechanism. FIDP produced the only available CA Field Manual in the country.

4. Concern Universal

Concern Universal applied CA as a response to improving efficient soil moisture in a rain shadow zone in Balaka District, Southern Malawi in 2009/2010. One of the six thematic/output areas of the project is increased agricultural diversification and productivity for 3000 households. The project targeted small scale farmers using the practices of minimum tillage in two ecological zones. These were: (1) drought prone areas where minimum tillage (basins method) was applied with 100% ground cover and more than 30% legume rotation system and; (2) in normal rainfall areas where minimum tillage (dibble stick method) was employed with 100% ground cover and more than 30% legume rotation system.

5. FAO - Malawi

The FAO project promotes CA with the aim of retaining moisture in the face of the recurring dry spells and droughts, replenish nutrients through stover, save labour in terms of both cost and time and finally to control soil erosion through use of cover practices. FAO approach targets villages that are contiguous to one another in a given catchment – catchment approach. Farmers are then organized in groups to access CA inputs provided by the project through a village revolving fund administered by the village local leaders following locally agreed by-laws. The inputs include fertilizers (Urea and 23:21:0 +4S), herbicides (Round-up and Bullet); a sprayer and maize seed. The inputs are for 0.1 ha. The money from the revolving fund is used for other purposes besides CA such as livestock and other income generating activities. The FAO is also supporting implementation of two other short term projects on CA. The first is the setting up of Conservation Agriculture Demonstrations in four different ecological zones in Balaka and Chikhwawa in the south, Lilongwe and Nkhosha in the Centre, and Rumpi in the north. FAO provided support for strengthening of the National Conservation Agriculture Task Force which covered national CA coordination meetings, developing Malawi specific CA guidelines, CA sensitization meetings, field days, participation in regional CA activities and holding national symposium. 10

6. National Smallholder Farmers Association of Malawi (NASFAM)

The National Smallholder Farmers Association of Malawi started promoting CA in 2008 to promote principles and practice of CA in the context of climate change. NASFAM uses lead farmers to demonstrate the technologies and conduct field days. They use government extension front line staff to provide hands on training and assist capacity building of farmer trainers. They make extensive use of print and electronic media for increased outreach and currently they are producing a documentary on CA with their farmers.

7. Department of Agricultural Research Services (DARS)

DARS project entitled "CA in maize based systems for improving food security and adaptation to climate change." Project started in 2006/07 aimed at developing, evaluating and disseminating improved and sustainable agricultural technologies which are compatible with smallholder farmers' conditions. On-farm trials and demonstration plots were implemented under on-farm conditions. Income from crop sales increased from 28% in 2007/08 season to 38% for project participants during the 2008/09 season. Proportion of households with enough food throughout the year increased from 12.5% in 2006/07 season to 71% during the 2008/09 season.

Because of limited land holdings most farmers in Malawi practicing CA, mono-crop maize each year. To some extent, extension advices on CA do not seem to emphasize on rotation. Previously, information on the extent and practice of CA in Malawi has for some stakeholders, been described by degree of tillage (minimum and zero tillage) or the use or non-use of herbicides. Often data was disaggregated according to the components of the CA system or is not in sufficient detail to determine whether the work described fulfils all the CA principles. Currently, the National Task Force on Conservation Agriculture has provided guidelines for reporting on CA practices across Malawi (Mloza-Banda, 2011).

3.1.2 CA in Zambia

High fuel costs of the early 1990s spurred interest in low tillage systems in Zambia and farmers discovered that low-till cultivation could enable them to reduce fuel consumption from 120 to 30 litres per hectare, dramatically improving profitability of mechanized maize production. Parallel benefits of reduced soil compaction and improved soil structure became apparent to early CA adopters (Hudson, 1995; The Farmer, 1995). The Zambia National Farmers Union (ZNFU) created two institutions to spearhead development and extension of minimum tillage technologies for smallholder farmers -- the Conservation Farming Unit (CFU) of the ZNFU and the Golden Valley Agricultural Research Trust (GART). A consultant from Zimbabwe was hired by ZNFU to help set up low-tillage farm trials at the newly established GART and first introduced the hand hoe analogue of minimum tillage systems to Zambia in 1995.

The ZNFU initiated the formation of the CFU to lobby government and donor support for CA in the country. Meetings are held periodically with all stakeholders including traditional and local leadership to influence policies favourable to the up scaling of CA in Zambia (ZNFU, 2000). The ZNFU is also involved in funding or facilitating credit access for farmers to acquire inputs from markets. For example, two projects, the first one Lima Credit Scheme provides for 1-5 ha of CA inputs through credit guarantee for 50% of the cost of inputs. The second one, the Emergent Farmers Support Program works with middle level farmers, for example, tractor farmers with adequate collateral, and are recommended to the banks for input purchases. A product market intelligence is also used to source for best commodity markets, including use of cell phone text messages.

For CA to be sustainable in Zambia, the ZNFU is working on incorporating the lead farmers in other leadership training programs, but discourages the concept of paying these farmers as an incentive. The union is aware of the fact that the majority of people working on the land, and CA practitioners are women. Hence ZNFU is advocating for gender sensitive approaches to CA technology transfers. ZNFU is also sensitive to some cultural implications associated with some CA practices. For example promotion of animal drawn rippers can be a problem for some regions of Zambia where, culturally, women are not supposed to handle a plow or ripper. To help address some of these gender related cultural beliefs, the ZNFU has included gender issues in their CA training programs. The ZNFU also engages the government in lobbying for appropriate gender policies and the discussions include issues related to CA technology practices.

Following the adoption of CA by the Ministry of Agriculture and Cooperatives (MACO) as the strategy for increasing farm productivity and production in 1999, two major projects are now being implemented in partnership with the Food and Agriculture Organisation of the United Nations (FAO) and the Conservation Farming Unit (CFU), with support from the Royal Norwegian Government and the EU. The Conservation Agriculture Scaling up Projects (CASPP) and the Farmer Input Support Response Initiative (FISRI) of 2 years duration each are being implemented in 12 districts by the MACO's Department of Agriculture. The CASPP will expand CA to 140 agricultural camps in 12 districts of Zambia. The aim of the project is to build capacity of the staff of the MACO in the Department of Agriculture and of 3,920 lead farmers to enable the successful expansion of CA in Zambia. The project involves 140 Camp Extension Officers and 3920 Lead Farmers receiving inputs and CA tools as an incentive. FISRI was to complement existing efforts of up scaling CA among smallholder farmers in Zambia, such as those of the CASPP and CAP. The project will build the capacity of MACO's Department of Agriculture and Own Farmer Facilitators (OFF) – lead farmers in the CAP model – in anticipation of longer term investment in CA expansion throughout the country. FISRI aimed at training 45 district staff on CA concepts, and training of 3,920 OFFs on CA topics. The project was to benefit 58,800 farmers.

3.1.3 Promotion of CA through Humanitarian Relief Programs in Zimbabwe

In Zimbabwe, the decision to start CA practices was not, in most cases, voluntary. Smallholder farmers who first participated in CA promotion were selected by NGOs as vulnerable households facing production constraints. Vulnerable households are defined as families that face difficulties in meeting their basic livelihood needs. This definition has been extended by relief agencies in Zimbabwe to include households affected by the HIV/AIDS epidemic. These households were provided with agricultural inputs and appropriate extension support as incentives to adopt the CA technology. After a period of learning the new CA technology, vulnerable households, including some spontaneous adopters, will experience variations in the level of use of the new farming practice. The most common CA package being promoted is a hand hoe-based system that focuses on the creation of planting basins in the dry season, locally referred to as 'Conservation Farming' (CF) (PRP, 2005; Hove and Twomlow, 2007). There has been some spontaneous adoption, mostly from farmers learning the technology from their neighbors. At the same time there has also been some dis-adoption by farmers who originally participated in the CA promotions, but subsequently opted out due to various reasons.

Among the farmers who continue to practice CA, many have modified the package and generally adopted some components of the technology like digging planting basins while leaving out other recommended practices (Giller et al, 2009). Crop rotation, mulching and winter weeding are some principles that have hardly been adopted. The choice of staple cereals to legumes has limited crop rotations and the input package provided more cereal than legume seed thus making it difficult for farmer to achieve a full rotation. The multiple uses of crop residues have also limited their use for mulching. Winter weeding has been considered to be labor intensive and coincides with other off season activities. The findings in Zimbabwe

are in agreement with reports on adoption in Africa that despite nearly two decades of development and promotion of CA by the national extension program and numerous other projects, adoption has been extremely low in the smallholder sector, compared to other continents such as South and North America and Australia due to various constraints (Hobbs, 2007, Derpsch, 2008, Gowing and Palmer, 2008). These constraints include: a low degree of mechanization within the smallholder system; a lack of appropriate implements; a lack of appropriate soil fertility management options; problems of weed control under no-till systems; access to credit; a lack of appropriate technical information for change agents and farmers; blanket recommendations that ignore the resource status of rural households; competition for crop residues in mixed crop-livestock systems and the availability of labor.

A meeting was hosted in 2010 with a primary objective to review the current status of CA in Zimbabwe and come up with a national framework for implementation in the country in order to improve the impact of the technologies. The major output of the meeting was an agreement to come up with a comprehensive National CA Implementation Framework for Zimbabwe which will guide implementation by the various stakeholders in the country. A target of at least 500, 000 farmers practicing CA on at least 250 000 ha by the year 2015, with a targeted average yield of 1.5t/ha on maize crop was set.

The following strategies will be carried out by the Zimbabwe National CA Task Force:

- *Harmonized CA promotion* within the Ministry of Agriculture Mechanization and Irrigation Development (AMID) to including a wide spectrum of stakeholders involved in CA promotion.
- *Promotion of different options of practicing CA.* For the CA up-scaling across all agricultural sectors in Zimbabwe, additional implementation plans and strategies that incorporate the use of animal and tractor drawn implements, will be prepared for CA up-scaling.
- *Resource mobilization.* The CA strategy is conceived first as a process (analysis, priority setting and decision making), then as an actionable plan (for proactive resource mobilization and allocation) and third as a framework for implementation, monitoring and evaluation.
- *Train all extension staff in CA.* The approach of the strategy is to ensure critical mass of trained extension personnel in CA at all levels.

Include CA in the curricula of learning institutions (schools, universities, agricultural colleges). CA should become an integral part of the agricultural practice.

4. CHALLENGES IN CA UPSCALING AND NEED FOR POLICY SUPPORT

The promotion of CA technology has thus far been characterized by a mix of positive experiences and some apparent challenges. It therefore becomes critical to strategize on the best ways to address the challenges and sustain efforts of enhancing the potential benefits that have been realized this far. The following section is a discussion of some issues that have arisen in the transfer of CA to both smallholder and large scale farmers in Southern Africa,

and possible areas of policy support. The issues raised maybe specific to different CA initiatives in some countries, but may need a general policy support for the region.

4.1 The Role of National Extension Services

Extension provides an important link between the technology and farmers and ultimately sustains CA adoption. In a number of countries there are appropriate structures for the implementation of CA, but still some have not been manned by extension staff for an extended period. In addition, resource constraints have greatly undermined efforts to provide effective and regular extension services to the farmers. Transport for staff and availability of operational funds are the basic inputs required to kick-start the dissemination process of CA extensively. The national extension service is better placed to monitor the performances of CA practices. NGO promotions of CA are not permanent; therefore, this practice can only be sustained through involvement of the national extension service. Institutionalization of the technology promotions through extension departments will significantly contribute to sustained CA adoption in Southern Africa. The extension services can help alleviate the policy challenges highlighted by Sibanda (2010) such as inadequate knowledge and training on CA and lack of information flow to farmers.

4.2 Research and Development

Farmers can derive considerable yield benefits from increased weeding frequency. Off-season CA activities such as winter weeding have been implemented with some difficulty. There has also been limited emphasis in training on the appropriate time to start winter weeding and farmers often do so just before digging the basins in August/September. Winter weeding is also a challenge because of conflicting demands for off-season labor. Farmers tend to concentrate on their gardens and other off-farm activities and are less willing to continue to weed their CA plots. It is also socially uncommon and perceived strange to continue tending to the rain-fed fields during the off-season; hence, farmers are reluctant to do so as a way of avoiding embarrassment, so there is need for cultural transformation or a change in mindset by individual households and at community level.

Future CA scaling out initiatives emphasize on the introduction of herbicides where appropriate to reduce labor requirements associated with weeding. Encouraging the use of cover crops and other mulch sources can also assist in weed suppression. More information needs to be provided to farmers on the actual benefits of winter weeding and long-term benefits of maintaining the CA plots weed free. In cases where herbicide use is not possible due to cost, farmers should be encouraged to weed early, when the weeds have not developed seed to reduce weed seed bank.

Inorganic fertilizer has consistently proved to be an important factor in yield improvement, even in low rainfall areas. With the exception of South Africa, availability and accessibility of fertilizer remains a challenge in the region and farmers largely depend on NGO input packs and government subsidies. Farmers usually substitute basal fertilizer with organic fertilizers such as manure and compost when fertilizer is unavailable. Top dressing is still critical because of lack of substitute organic soil amendments. Farmers' perceptions on

fertilizer use are shifting and many farmers now appreciate the benefits of using fertilizer. Alternative soil amendments such as *termitaria*, compost and manure should also be promoted. Farmers should be trained on treatment and preparation of these alternative soil fertility amendments to ensure they obtain maximum benefits from their use.

Labor demand has been a limiting factor in the expansion for CA area. This labor constraint becomes even more adverse if targeted households have limited labor due to HIV/AIDS, chronic illness, and is female or child headed. NGO targeting criteria has often focused on such households for CA promotions, leading to overwhelming labor demands. Some labor demanding components such as weeding can be reduced through introduction of herbicides. In assessing labor requirements in CA, care should be taken to consider not only the labor requirements but, in addition, labor productivity since increased labor input also translates to increased production.

4.3 Agricultural Input and Output Market

Poor access to input and output markets discourage farmers to make meaningful investments in CA practices. Farmers will only adopt CA if the benefits become apparent. In Zambia the limited supply of No-Till planters, Jap planters, Zamwipe sprayers, Chaka hoes and Rippers, has resulted in a reduced number of potential CA adopters. Some of these equipments have to be imported from Zimbabwe. The recommendation is to have local wholesalers and agro-dealers stock these equipments in the CA project sites through contact farmers or On Farmer Facilitators (OFFs) for easier access to the communities. Also industries need to be encouraged to manufacture CA farm implements, including rippers for mechanized practices. In some of the countries such as Zimbabwe, the economic development efforts to open up markets will likely lead to improvements in the function of the commercial sector, including rural agro-dealers. This will include the use of vouchers in some subsidized agricultural input programs to purchase seed and fertilizers that can be distributed freely to vulnerable farmers, such as in Malawi. Also there is need to improve fertilizer access through markets and credit facilities to ensure continued use of fertilizer among smallholder farmers. The instability in the supply and demand of legume has hampered rotation practices in CA. In some countries there has been effort to promote local legume seed multiplication, but still farmers place priority in the production of staple cereal whose seed is generally available in the formal markets. There is still scope for developing alternative product markets for legumes in order to sustain rotation practices.

4.4 Agricultural Mechanization

There is need for mechanizing some of the CA operations such as basin preparation and weed control as innovative ways to address the high labor requirements associated with the technology (Giller et al, 2009). The use of jab planters that are also labor saving can be alternatives for vulnerable farmers. On the other hand, for resource endowed farmers, the use of rippers and direct seeding equipment could be good options particularly if the linkages to both input and output markets are secured. Lack of draft power was observed to be challenge that would take time to gain resolve. However, some initiatives such as cattle restocking program and other projects involved in passing on the livestock to farmers could be tailored

to focus on farmers with interest in animal drawn CA systems. There is greater need for documented evidence on the viability of mechanized CA within both the small-scale and large-scale commercial sector.

4.5 Relief targeting and CA promotion

In some Southern African countries the promotion of CA has primarily targeted vulnerable households as a way of mitigating the effects of food insecurity and chronic poverty although training was open to all categories of farmers willing to participate. There is some concern however, about the extent to which these vulnerable groups can maximize input and technology support. In some instances, vulnerable farmers face severe labor constraints and chronic illnesses, such as women farmers and those affected by HIV/AIDS. This limits productivity particularly due to high labor demands associated with digging basins and timely weeding. The practice of planting basins requires that farmers dig basins soon after harvest to spread labor but most farmers are not doing this due to other commitments and lack of fencing in their CA plots. In sandy soils farmers have had to re-dig basins at the onset of the season as they get destroyed by wind and livestock thereby increasing labor demands. Input provision has often excluded better resource endowed farmers, who could be better positioned to maximize on CA practices. Such exclusion has limited the technology transfer to diverse resource groups within the communities. It is therefore important to include both resource endowed and vulnerable households in the promotion of CA for increased impacts at the household and community level.

4.6 Respect for social and cultural issues

Farmers' attitudes towards CA are not yet positive; probably because this is a concept that discourages farmers from conducting farming business as usual. Farmer would generally resist change until the benefits are fully confirmed. Although change in mindset is a gradual process, progress is more likely to improve in future with education and generation interface. Some farmers who are not practicing CA are of view that it is a farming practice for the poor. Such social and cultural undertones have also undermined uptake and adherence to CA practices. The preference of staple foods to legumes which is a sign of food insecurity has hampered adoption of crop rotation in CA. Creating input and output markets for legumes could be a step forward and training farmers on the importance of diversification is essential. Lack of legal title to land, lack of effective by-laws to protect and regulate communal resources and resource constraint among farmers have made it difficult to practice CA effectively. Communal by-laws of grazing make it difficult for CA farmers who want to maintain permanent soil cover as neighbors livestock will feed on the crop residues. Unless if this cultural behavior changes and amend local by-laws to protect CA farmers, it will be difficult for smallholder farmers in Southern Africa to effectively implement this new farming practice. Incorporating agro-forestry systems into CA could be long term strategy towards addressing the problem.

4.7 Harmonized Approached in CA Promotion

Lack of harmonized approaches to the promotion of CA has been identified as a problem that has hindered the technology transfer process (Sibanda, 2010). The argument is that the

promoters do not have a common platform for addressing CA. Firstly, it was noted that the technical recommendations for some technologies are not uniform, for example the planting basin dimension in Zimbabwe differs with different promoting agencies. Secondly, each CA promoter has a different way of enticing farmers to practice CA. This development has undermined the efforts of national extension services to promote CA through offer of technical advice. Where CA is promoted through the relief programs, farmers have developed a dependency attitude to the extent that they will pay limited attention to any promoter who does not offer them inputs. In some situation CA promoters tend to work with the same specific farmers year after year thereby denying others an opportunity to participate. It is being suggested that the national extension services should regulate CA promotion strategies and aim to harmonize these approaches.

5. REGIONAL PROGRAMS ADVOCATING CA PRACTICES

There are growing regional initiatives in promoting CA up scaling in Southern Africa. The regional programs are drawing policy strategies necessary to overcome the constraints associated with farmer implementation of CA technology. This section will summarize different regional programs focusing on agricultural development, and illustrate policy issues being addressed with implications on CA development. The COMESA-EAC-SADC region covers 26 member states of the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Southern African Development Community (SADC). The member states of the three regional economic communities (RECs) will have important roles in developing long-term investment frameworks for climate change adaptation and mitigation. At the continental level key stakeholders are being targeted through the eight African Union (AU) - New Partnership for Africa (NEPAD) priority areas, particularly Agriculture and Food Security, and Environment and Climate Change, Culture and Tourism. Within NEPAD the Comprehensive Africa Agricultural Development Program (CAADP) Pillar 1 that focuses on Land and Water Management provides the specific focus for many African agriculture programs. The three regional economic communities (COMESA, EAC and SADC) are key stakeholders as they coordinate or support several programs, particularly the implementation of CAADP and derivative programs such as the Alliance for Commodity Trading in Eastern and Southern Africa (ACTESA). ACTESA has a particular concentration in linking food production and regional marketing for small-scale farmers to achieve improved crop efficiencies and more sustained food security.

Farmers in the COMESA-EAC-SADC region are represented by two organizations, the Eastern African Farmers Federation (EAFF) and the Southern African Confederation of Agricultural Unions (SACAU). Each of these organizations comprises subsidiary farmers' associations at the national level that among other things provide conduits for information and technology transfer to their members. Farmers' associations will provide a fundamental entry route to farmer groups.

Three other organizations: the African Conservation Tillage Network (ACT), the Alliance for a Green Revolution in Africa (AGRA), and the Food, Agriculture and Natural Resources

Policy Analysis Network (FANRPAN), have programs across much of Africa ranging from agro forestry, CA, seed production, soil health, agro forestry, advocacy, networking and information dissemination and support to post-graduate and technical education students. At the national level there is further another level of stakeholders involved in CA initiatives. Principal among these are the key government departments and agencies implementing CAADP and national agricultural and environmental initiatives. Other public/private or private sector organizations, such as the Golden Valley Agricultural Research Trust (GART) and the Zambia National Farmers' Union (ZNFU) Conservation Farming Unit (CFU), Foundations for Farming in Zimbabwe, act more at the national or local levels to transfer and disseminate adaptive research findings on CA technologies and integrated pest management practices.

In the private sector, business organizations in the region are already involved in agricultural adaptation activities through the supply of equipment, technologies, inputs and marketing structures that enhance CA activities by small-scale farmers. They are important stakeholders and play a crucial part in achieving the CA scale out initiatives.

A number of international organizations act as the main implementing agents for continental and regional programs. The United Nations Food and Agriculture Organization (FAO) and World Food Program (WFP) have representation in most countries in the region. The former is already involved in support for CA. Other international agricultural research institutions, such as the Centre for International Forestry Research (CIFOR), the World Agro Forestry Centre (formerly known as ICRAF), International Crops Research Institute for the Semi-Arid tropics (ICRISAT), the International Livestock Research Institute (ILRI) and the World Wide Fund for Nature (WWF), also work across the region. The international organizations offer a wide range of input specializations that range from farmer input support, biodiversity conservation and developing sustainable approaches to ecosystems services, that are all linked to the promotion and up scaling of CA technology.

5.1 FAO Conservation Agriculture Working Group (CARWG)

Following regional meetings in 2007 to discuss the status of CA initiatives and activities in various countries at regional level, CA Working Groups were established at national level [National CA Taskforces (NCATFs)] and regional level [CA Regional Working Group (CARWG)] to coordinate and promote CA activities. CARWG and NCATF are convened by FAO who were elected as the CARWG secretariat.

CARWG comprises FAO as convener; National CA Focal Persons; Regional organizations, Africa organizations namely NEPAD and the African Conservation Tillage Network (ACT); NGOs and the international agricultural research centers. The mandate of CARWG include mobilization of resources for CA; facilitating and supporting NCATFs; coordinating CA work at regional level through harmonization, monitoring and evaluation; promoting CA in regional policies/strategies; facilitating CA-related studies; and providing a forum for CA information and knowledge dissemination.

In February 2011, CARWG hosted a Regional Symposium that was attended by CA practitioners representing governments, NGOs, universities and research and development organizations from 14 countries in ESA. The following were the key outcomes of the symposium

1. A critical need for action to up-scale CA in the region as a way to contribute to food security, poverty alleviation, income generation and environmental sustainability.
2. The up-scaling of CA should be led by farmers based on farmers' needs.
3. The holistic systems nature of CA needs broader consideration and acceptance in both the design of research activities and in development programs that promote CA.
4. The research that supports the promotion of CA should be participatory action research that takes a broader integrated systems approach.
5. That there must be an increased emphasis on capacity building through accredited CA education and training at all levels, with a particular focus on farmers, extension and other change agents necessary for effective up-scaling.
6. That public-private partnerships and efficient value chains are necessary to achieve CA up-scaling.
7. Effective coordination of CA promotion efforts at national and regional level is critical for success.
8. CA practitioners and stakeholders must engage in coordination and information sharing platforms and networks to ensure effective support to CA up-scaling.
9. Governments should be encouraged to develop and implement policies that support the up-scaling of CA

CARWG members work in different countries in Southern Africa and tasked to lead in the above outcomes, and assist in formulating policy initiatives to support CA. In Zimbabwe, the NCATFs are drawing a CA strategy to advise the government on the inclusion of CA in the agricultural policy. Research organizations in CARWG have been leading in CA technology development and transfer and work across the region to improve access to appropriate CA tools.

With funds from FAO, FANRPAN was commissioned to review CA related policies in Angola, Madagascar, Malawi, Mozambique, South Africa and Namibia and this report is part of the initiative. CARWG has identified lack of awareness and information about CA amongst different stakeholders in the region (including donors, private sector, development agencies, and farmers' organizations) as one of the factors identified in limiting CA uptake. Sensitizing high level policy personnel and lobbying for CA support by CARWG is being done through FAO, NEPAD, COMESA, and FANRPAN and to respective ministries of agriculture in Eastern and Southern African countries.

5.2 Program on Climate Change Adaptation and Mitigation in the ESA (COMESA-EAC-SADC) Region

The Program for Climate Change Adaptation and Mitigation in the COMESA-ECA-SADC intends to initiate a process that will generate incremental benefits to the region through climate change adaptation and mitigation. The Program will also support the construction and

roll-out of Africa's position on climate change within global climate change agreements and the establishment of capacities to access climate change resources and off-set credits. The Program is founded on the principles that Africa's Climate Change Solution should be driven by African issues, developed, championed, led and implemented by African institutions.

Principle beneficiaries of the Program will be the farmers and farmer organizations that will have their capacity to practice climate-resilient CA, strengthened in time then developing improved and more stable crop yields. In turn the member states will then benefit from enhanced food security and livelihoods for their populations, reducing budgetary demands to provide relief support. The business communities in the region will draw benefits from the flow of resources that will be catalyzed by the Program; benefits that will have strong feedback components in expanded retail, infrastructure and marketing capabilities, including that of CA equipment.

Other beneficiaries will be academic institutions, civil society organizations (CSOs), NGOs, business entities and others working in the climate change arena, where additional resources, improved network structures and structured investment frameworks will enhance their productivities and access to supplementary carbon trading opportunities. In addition, the COMESA, EAC and SADC Secretariats will also benefit in that they will be strengthened in their capacity to implement their respective and collective mandates on regional integration and specifically on Climate Change.

The Program will leverage on on-going climate adaptation initiatives already being implemented under the COMESA Climate Change and CAADP banners through CA farming systems. However, the Program ultimately will have a much wider vision that incorporates stronger emphasis on climate change mitigation and adaptation mechanisms under the National Appropriate Mitigation Action (NAMA) approach, including natural disaster mitigation and avoidance. The rapid scaling-up of on-going CA activities will run through the Program, offering a strong implementation base and a wide and immediate outreach to many beneficiaries.

Several aspects of small-scale agriculture have relevance to the Program in the context of achieving food security and of contributing to poverty reduction through livelihood securing and cash generating actions. The roles of technology, renewable, clean energy, service infrastructure, small-scale irrigation, crop storage and post-harvest loss reduction and crop marketing, and crop and livestock diversification from maize mono-cropping are all anticipated to have application under the general umbrella of developing climate-resilient CA farming systems.

To achieve a lasting impact on rural lifestyles, the COMESA-EAC-SADC region will require substantially strengthened capacities to plan, propose and access the resources needed to do so. Activities required to achieve this will include technical consultancies to select appropriate centers at the regional level and nationally and encourage national selection and funding. Support will also be given to developing standardized curricula and workable

models for sustainable funding to CA Technical Centers. Applying CA and other adaptation and mitigation solutions cannot be achieved in isolation and the program recognizes that support to a range of support services will be essential to strengthen CA buy-in and adoption. Important issues will include the identification and realization of mechanisms for crop and agro forestry seed production, building the academic and technical skills base in the region, realizing an effective, accessible meteorological early-warning system for small-scale farmers, similar technology transfers and ensuring that an integrated mapping and monitoring system exists in the region.

Realisation of investments is central and this result can be measured through the number and effectiveness of technical partnerships and cooperation agreements with implementing partners, reflected in the overall area increment under CA, the number of farmers actively applying CA methodologies, and the increase in crop production (COMESA, 2010; FANRPAN, 2010). The strength of farmer-to-farmer and other CA training statistics in member states, the number of member states where standardised CA guidelines and messages are being applied and the gender balance in CA systems and the level of outreach to disadvantaged groups. Member states are expected to develop comprehensive CA Investment Frameworks. The achievement of solid Investment Frameworks will require success with the establishment and functioning of regional and national CA Task Forces, and the development and approval of regional Investment Frameworks and those in participating member states. The establishment of Task Forces will begin with a limited number of member states where activities and structures favour an early scaling-up of CA activities.

The national Task Forces will develop the focal areas for support in each member state through specific Investment Frameworks. Governments are responsible for providing the policy guidance and development integration of the program at the national level and for hosting the national CA Task Forces, designating ministry focal points that will support day-to-day program implementation and for coordinating and integrating program activities with national planning objectives. Membership of the Task Forces will comprise appropriate sector ministries, farmers' organizations, the private sector, and relevant CSOs. The regional and local partner institutions will be responsible for direct provision of CA and other knowledge bases, experience and tools. The regional Task Force will be a tripartite organisation with representation from the COMESA, EAC and SADC Secretariats. This tripartite arrangement currently operates under an agreement on harmonisation, joint formulation and implementation of projects and programmes, and ultimately merger of the three into one organisation.

5.3 Comprehensive Africa Agricultural Development Program (CAADP)

In order to resolve the binding constraints and realize agricultural potentials within the COMESA region, a number of regional level strategies are planned and will be pursued under the NEPAD Comprehensive Africa Agriculture Development Program (CAADP) framework. The proposed initiatives as currently formulated focus on investment in three "pillars" that can make the earliest difference to Africa's agricultural crisis (FANRPAN, 2010). These pillars are:

1. Land and water management;
2. Infrastructure and trade-related capacities for improved market access; and
3. Support to productivity-increasing activity among small farmers in the context of food security program.
4. Agricultural research, technology dissemination and adoption

The long-term capacity to maintain competitiveness by ensuring high productivity is to be ensured by research and development, allied with technology dissemination for widespread and effective adoption. This initiative will fit in well with the different research institutions involved in CA technology development. CA is one technology that can raise crop productivity, water management (especially when combined with adequate soil husbandry) and helps to ensure better production both for direct consumption and for commercial disposal, thereby enhancing the generation of economic surpluses necessary for uplifting rural economies.

The CAADP pillar that deals with investments in rural infrastructure and market facilities is required to support the anticipated growth in agricultural production and improve the competitiveness of agricultural production, processing and trade. For stakeholders involved in CA promotion, they require adequate infrastructure to enable them to access farmers, particularly poorer farmers in remote locations of southern Africa. Input access as well as the need to deliver produce to the market is critical in improving the livelihood of these farmers and enable them to sustain CA technology adoption.

Pillar 3 presents approaches to making an immediate impact on farmers' livelihoods. It covers two approaches to meet the need to deal with food security in the short-term perspective of disaster induced food and agricultural emergencies: (a) provision of safety nets; and (b) food security through enhancement of production. CA promotion in the region has been achieved primarily through different partnerships all with the aim of improving crop productivity and food security. Therefore, in looking at Africa's immediate needs for agricultural renewal, it is absolutely essential that the emergencies be kept in mind and hence the justification for donor investment in CA as one agricultural technology to be employed to sustain food production in emergence situations. In Zimbabwe, CA has primarily been promoted as a relief program targeting households vulnerable to drought and other livelihood factors.

The fourth pillar reviews the difficult situation of agriculture: falling productivity, low spending on research and development; inefficiency of ongoing research in reaching the farmer; the need for reform towards sustainable research and its funding at national, sub-regional and regional levels; integrating technology adoption; and strengthening institutions. To avert food insecurity and reduce poverty, African leaders have set a target to increase agricultural output by 6 percent a year for the next 20 years. At present, many countries barely achieve 1 percent annual growth in output and some are regressing. To do this requires several lines of action, with a goal to double the current annual spending on agricultural research in Africa within 10 years. The proposed NEPAD research program will be guided by

one central hypothesis: "that conservation and efficiency of use of soil and other natural resources will be optimized under conditions of market and/or policy and institution-driven productivity". This has strong emphasis on CA technology development and transfer.

5.4 SADC Regional Agricultural Policy (RAP)

In the year 2008, the SADC FANR Multi Country Agricultural Productivity Program (MAPP) was crafted. It was aimed at supporting agricultural technology generation and dissemination within the SADC region. The goal of SADC MAPP is to sustainably reduce the food insecurity and poverty in the SADC region, while the objective is to increase smallholder productivity through adoption of improved agricultural technologies and improved husbandry and marketing practices. The Program will achieve this through development of market-oriented technologies, promotion of information dissemination and training mechanisms and production practices. In the year 2010, the Centre for Agricultural Research and Development for Southern Africa (CARDESA) started implementing the MAPP program. Studies are also underway in collaboration with Regional Strategic Analysis and Knowledge Support System for Southern Africa (ReSAKSS) and International Food Policy Research Institute (IFPRI) to define and prioritize the region's agricultural research and development agenda. Though the SADC Regional Agricultural Policy (RAP) is not yet implemented, the following suggested policy areas on seeds and fertilizer are envisaged;

5.4.1 Priority number 1: Agricultural inputs usage

Access to affordable agricultural inputs has the highest potential in enhancing agricultural production and productivity in the SADC region. The existence of acute poverty and hunger, exacerbated by unstable and sometimes very high seed and fertilizer prices requires an immediate response at the SADC level. Seed sector development can assist in increasing the production and distribution of seeds, and if coupled with increased farmer productivity through innovative crop management interventions such as CA, improved seed sales and agricultural productivity will increase.

5.4.2 Priority number 2: Agricultural technology use and adoption

SADC have suggested RAP to focus on the following areas on technology use and adoption;

- Protection of intellectual and property rights for researchers (including indigenous) ;
- Increased investment flows into the region's research and development;
- Strengthen institutional and human resource capacity in research and development;
- Improved rate of technology transfer and adoption by ensuring that research and development is end-use demand driven, readily adaptable and sustainable.

5.4.3 Priority number 3: Water use and management

Possible RAP interventions for addressing water use and management issues include:

- Support/fund/promote technologies and approaches to improve water management for rain-fed farming systems;
- Support/fund programs for improved water harvesting systems and providing guidelines on efficient and effective water use systems including usage rights.

6. INSTITUTIONAL ARRANGEMENTS INFLUENCING CA TECHNOLOGY TRANSFER

This report has tried to understand and emphasize the need to understand the ways of working that CA espouses. In doing this, it has highlighted some important institutional changes that can enable these ways of working among other organizations and individuals. The innovation systems approach offers analytical insights into the mechanisms/processes of CA. The way ahead for CA is not clear yet; but it is clear that institutional changes are crucial to facilitate this way ahead. New institutional arrangements are evident in CA systems compared to conventional agricultural practices. Observations on the institutions of CA reveal that there is a non-linear innovation system in place instead of the conventional compartmentalized and hierarchical arrangements of research that generates technologies, extension that delivers it and farmers who passively adopt it. Transition to CA is possible only if and when the agricultural knowledge community, including all its stakeholders in agriculture and allied sectors acknowledge, adapt, enable and adopt these institutions, processes or ways of working. Some of the important institutional changes that can be introduced in conventional agricultural research and development to enable their transition to CA are highlighted below:

6.1 Learning in coalitions

One of the key principles that make an innovation system is the focus on innovation than on research. Innovation is enabled by the continuous learning and the processes of change that result from this learning (Sulaiman and Hall, 2002; Hall et al., 2004a). This learning takes place without any hierarchy, and in non-linear formats, with farmers, scientists, department officials, extensionists, and others learning together and from each other. Farmers who have adopted CA vouch for the close collaboration and hands on learning in the field with scientists and other stakeholders (NGOs, input dealers, seed suppliers, and implement manufacturers). The research organizations involved in these coalitions have made changes in rules i.e., developed new institutional arrangements by enabling modifications in re-designing data collection formats (to make them user friendly and reflect the flexibility of farm level operations), new learning practices and platforms (the travelling seminar, local discussion groups), and devising new ways to understand the adaptability of the three principles of CA. *Mainstream agricultural research organizations must find ways of enabling such learning processes and new institutions or rules that enable learning. This is a better way to promote such non-linear innovation systems in collaboration with other stakeholders.*

6.2 Appropriate partnerships: respecting different interests/stakes

While the overall purpose of a partnership is to accomplish a complex task that cuts across disciplinary, organizational and sectoral mandates, it is important to recognize that all the partners may not have the same stakes or interests in the partnership outcomes. Table 3 in Appendix, shows the actors, interests and policy spaces around CA in Southern Africa. CA is being adopted for multiple benefits that cut across bio-physical and socio-economic systems and varying scales (micro-household level, meso-farming systems/village levels, and macro-regional level). *Now soil scientists and agronomists should work with other social scientists*

to identify what these benefits are and on fine-tuning the system to maximize the range of benefits including benefits to the soil. For this it is important to identify and build relationships with appropriate stakeholders keeping in view the interests and agenda that each stakeholder brings to the CA innovations. It is often seen that innovations are best triggered by one partner - a catalyst organization. Identifying this catalyst to facilitate broad based partnerships is a crucial part of capacity building for CA.

Evolution is another principle of partnerships; genuine partnerships evolve over time. Partnerships last only as long as there is a task to be accomplished - they are not permanent relationships. While a clear definition of tasks and roles of partners is important, the roles of partners will change during the innovation process, with partners acquiring new skills or capabilities, assuming greater or different responsibilities in the task, or branching off on tangents/complementary roads. Good partnerships are not fettered by the hierarchy of expert opinion or professional blinkers; and they allow more effective linkages among the organizations and individuals involved.

6.3 Non-conventional - out of the box- partners

Examples from successful resource conserving technologies reveal that partnerships with private and voluntary sector organizations led to the uptake, increased adaptation, and adoption of technologies (Biggs and Matsuert, 2004; Raina et al., 2004). Like a partnership among organizations, the collaborative effort of diverse disciplines leads to resource management innovations. In order to deliver the resource improvement benefits to farmers and ecosystems, *CA coalitions now need to decide how it will encourage other useful disciplines/actors to contribute.* It is the responsibility of CA coalitions to explain to conventional agricultural research organizations how different skills, perceptions, social capital, and sources of funding were brought together, and how these conventional organizations can scout for these out of the box partners.

6.4 Capacity development

Partnership skills and learning processes are not available with all organizations and individuals. It takes special effort to develop the capacities for these institutions or ways of working to exist and evolve in different partner organizations. The institutional changes may come incrementally or with some radical changes in the policy framework or context. One of the lessons from analyses of rural innovation systems is that institutional changes can be achieved by encouraging a spirit of experimentation and learning in the agricultural development establishment. *CA demands initiation of several new (especially small experimental) projects aimed at multiple benefits (instead of an exclusive focus on soil fertility/resource management/crop productivity) in various locations. This will force organizations in research and policy-making, farmers, resource conservation, rural inputs or finance, agricultural markets and post-harvest sectors to form need based partnerships to address the key rural livelihoods issues through CA.* Given that there is no single given set of technologies or one prescribed way of making CA work, these partners can then identify the ideal entry point and set of tasks to be taken up in each context. It is important that linear – training- programmes for CA are not the only source or main tool for building capacities. We

need small projects which will facilitate hands on learning within organizations and different coalitions of partners in each context.

These will then enable all the partners to reflect on the processes, results and outcomes of CA projects identify the institutions and rules that have changed during the course of the project, address those that have to change, and help learning and evaluation within project coalitions. Capacity development in this manner, through small locally relevant projects, will ensure that the technological and institutional changes are acknowledged and the new rules and norms of working are not lost.

6.5 An evaluation culture

Viewing, learning and critical internal assessment of learning processes and capacities are important within dynamic innovation systems. These internal learning and assessment processes, which are the core of an evaluation culture, are essential for the actors themselves, their sponsors (whether government, national or international institutions/donors, or private or voluntary sectors), and for future coalitions. While hands on learning is important to enable actual institutional change in organizations, documenting and analysing the research processes and products will ensure that others will have access to these lessons - the principles and practices that are helpful, and not waste precious time and material resources in learning by doing. *CA demands an evaluation culture - that evaluates the technological components and institutional processes that go into the making and conduct of a research programme and not conventional impact assessment that takes place at the end of the research process.*

When institutions are seen as rules or norms or ways of working and not as organizations, the perspective helps us analyze how existing institutions enable science to observe, interact with, analyze and recommend solutions for natural resource problems that hamper agricultural development. Institutions often impede the capacity of science to address these problems within their own research organizations, and to convince farmers, their societies, and policy makers to change agricultural research policies and agricultural policies. It is useful, as part of this introspection to enquire about the extent to which CA has informed or changed the institutions/ways of working of conventional agricultural research and development. An evaluation culture demands an active role of the social sciences within the innovation system - it is doubtful if the social sciences within the agricultural research and development establishment have reached out to partner with natural sciences in order to understand decision-making and other innovation processes.

7. REGIONAL POLICY STRATEGIES TO PROMOTE CA INITIATIVES

Policy is an important determinant in explaining CA adoption and or mis-adoption. Policy stances have sometimes been weak and ineffective in promoting CA. Much of the successful diffusion and adoption of CA in Africa has occurred because of support from private corporations, the formation and operation of farmers' groups and other non-governmental

pathways (FAO, 2001). Substantial, long-term funding not only from donors but from national budgets, appropriate policies, extension and partnerships are needed for up scaling CA. Below are the policy strategies that are crucial for the up scaling CA in the region:

- 1) *Promoting sustainable agricultural practices through technologies such as soil conservation measures and the optimum use of fertilizers.* This is necessary to address the challenge of declining soil fertility and reversing the low levels of productivity. In addition, use of high yielding varieties (HYVs) that are drought resistant and able to survive in harsh conditions will be prioritized. This strategy will include CA practice, particularly on soil conservation and associated use of improved production technologies, such as fertilizer and HYVs. COMESA member States have placed a high priority on accelerating food production and food system productivity through adoption of existing and newly generated technologies in order to reverse the declining trends in food production and productivity in the region. Important underlying factors which will need to be addressed as part of this focus include limited access to inputs (mainly seed and fertilizer), drought/floods (climate change), poor extension systems, low irrigation development, poor crop and livestock diversification, poor infrastructure and market access, unsustainable farming systems and poor land tenure systems if in place.
- 2) *Reviewing and harmonize agriculture extension services to ensure effective delivery.* This will address both the supply and demand sides. The demand side interventions will primarily aim at empowering farming communities to demand for agricultural advisory services while the supply side will primarily aim at increasing availability of relevant services. CA promotion can only be sustainable with an efficient extension services, as most of the current initiatives are donor driven, and are likely to lapse at the end of the funded project.
- 3) *Strengthening institutional capacity at regional level, within partner institutions and across the networks.* The priority will be paid to improving human resource capacities, re-tooling human capacity with requisite skills for a modernized agricultural economy and putting in place requisite service delivery systems for agricultural development. Training of all stakeholders involved in CA promotion is critical. CA is a complex farming technology and its uptake will also depend on the capacity of the researchers, national extension services, NGO staff, and farmers' ability to learn, understand and put in practice different components of CA.
- 4) *Promoting Science, Technology and Innovation (STI).* The priority will be focused to increasing funding of research and development in priority areas such as biosafety and disease control; commercialization of research findings and promoting uptake of modern technologies. There are new approaches being recommended for CA, such as use of herbicides to deal with labor constraints, and all stakeholders, including farmers need to deal with issues of bio-safety requirements.

- 5) *Promoting commodity-based value-chains.* A cluster system will be emphasized to ensure production oriented support and concentrated marketing. The focus will be on elimination of supply side constraints to production including provision of critical inputs; processing and value-addition; commodity distribution; marketing and trade. In most countries of southern Africa, CA is being promoted by relief agencies that provide free seed and fertilizer as incentives. As these relief programs come to an end, farmers practicing CA will need to have access to reliable supply on inputs and a market for their farm commodities.
- 6) *Advocating for provision of requisite infrastructure to enhance regional inter-connectivity, reduce barriers to doing business in the region and accelerate value addition.* The focus will be on transport, energy, water for production and storage infrastructure. There is an increasing advocacy for mechanization of CA components, with most of the equipment being imported either from within the region or outside. This strategy will work in favor of acquisition of different CA tools. While individual regional countries implement their national agricultural development programs, including national CAADP Compacts, the regional programs require a focus that complements these national efforts. Because the region's many small countries often straddle common agro-ecological zones, regional research collaboration can generate significant technology spillovers as well as economies of scale in raising agricultural productivity. Estimates from the ASARECA members of the COMESA region suggest that these spillovers potentially account for 70% to 80% of total regional benefits from agricultural research. To capture these important spillover benefits, the regional programs will promote effective regional agricultural research networks focused on key regional food crops. Likewise, the development of trans-boundary programs and public infrastructure and investments will aim to support national efforts in increasing food production and productivity.
- 7) *Advocating for increased agricultural financing.* This will entail increasing government budgetary allocation to agriculture targeting non-rivalry and non-exclusion goods such as public infrastructure, market regulation, science and technology and extension; as well as increased private sector financing. New and long term financing mechanisms that are friendly to CA will be promoted.
- 8) *Harmonizing the policy, legal and regulatory framework within the region.* In addition, a framework for streamlining the public and private sector engagement in agriculture including promotion of CA as one technology with potential to increase productivity growth and address challenges associated with climate change. COMESA member States will facilitate establishment of harmonized set of enabling policies and regulatory systems for increased agricultural production and productivity and marketing of agricultural products. The region is characterized by haphazard policies that do not stimulate production and marketing of food staples resulting in food insecurity. Of high priority for member states are policies that respond to rising food prices, removing tariff and non-tariff barriers and food trade bans imposed

arbitrarily in the region. The culmination of a series of policy dialogues within the region has identified two major priorities that form the core foundation of the regional compact: First, to open up the region to freer flow of agricultural trade by removing all barriers to trade to ensure that as needed, commodities move from surplus to deficit areas in the region driven primarily by demand and market forces.

This policy shift is enshrined in the Declaration of the Second Meeting of the Ministers of Agriculture, made in Nairobi, Kenya on 15-16 October on, “Expanding Opportunities for Agricultural Production, Enhanced Regional Food Security, Increased Regional Trade and Expanded Agro exports through Research, Value Addition and Trade Facilitation”. Second, is to put in place policies, systems, regulations and procedures which are harmonized across the region so as to create a conducive, transparent and facilitative environment for conducting regional agricultural trade with forward and backward linkages across the region from the farmer to the market. Further, the COMESA agricultural approach aims to position the region as a reliable supplier of primary and processed agricultural goods to global markets and whose producers effectively and competitively respond to opportunities that arise in all external markets.

8. CONCLUSION

Conservation Agriculture is gaining momentum in many countries of Southern Africa. The main regional programmes advocating for CA include CARWG, COMESA-EAC-SADC and NEPAP-CAADP. The FANRPAN, CA policy reviews and dialogues are crucial as they provide the CA policy spaces to share and acquire knowledge. Although there is evidence of CA success stories in the region, policy stances to promote CA are weak and ineffective. Evidently there are no clear regional policies supporting CA up scaling. In order to move CA forward there is need for develop and foster new institutional arrangements and strategies at the regional level. These include learning in coalitions, appropriate partnerships which also include the private sector and capacity development, human capital development and training on Conservation Agriculture, linking research, extension and policy making. The CAADP Compact process aims at developing effective policies and increasing investment levels in agriculture especially in COMESA member states. It is therefore important for these member states to capture this process in order to promote CA effectively

Table 3: Actors, Interests and Policy Space around Conservation Agriculture in Southern Africa

Actors	Interest	Policy Space
Regional bodies and their affiliates: AU, COMESA, SADC, EAC, AGRA, FANRPAN. Ministry of Agriculture	Regional food security Protect the soil Increase water use efficiency Food security Resilience of agriculture to climate change Profession, career Appropriate technology Agricultural research and development	Meetings of Ministers of Agriculture NEPAD, CAADP Agricultural shows Mechanization fairs and expo International Trade Fair (e.g ZITF in Zimbabwe) Demonstration plots and trials Master farmer training scheme Extension training meetings including T&V
Regional and National Farmer Organizations: EAFB, SACAU, Zambia (CFU, ZNFU, GART), Malawi (NASFAM), Zimbabwe (ZFU, ZCFU)	Agricultural research and development Food security and poverty reduction Livelihood diversification Mechanized conservation agriculture Resilience of dryland agriculture to climate change Partnerships and Capacity building	Conferences Demonstration plots and trials Farmer training meetings Lead farmer approach Field days
Donor and NGOs— eg DFID, EU and FAO , World Vision, CARE, Oxfam, Concern, CRS, Africare.	Food security and poverty alleviation Resilience of vulnerable and HIV/AIDS affected households to climate change Profession/career	National CA taskforce meeting Protracted Relief Programme fairs Demonstration plots and trials Farmer training meetings Lead farmer approach Field days
Local communities (farmers, traditional leaders, lead farmers and religious leaders)	Food security Resilience of agriculture to climate change Livelihood diversification	Field days Area (Ward/Village) meetings Lead farmer approach Church meetings: e.g. River of Life in Zimbabwe
Researcher (Academia, CGIAR centres: e.g. ICRISAT, CIMMYT)	Agricultural research and development Food security and poverty reduction Livelihood diversification Mechanized conservation agriculture Resilience of dryland agriculture to climate change Partnerships and Capacity building	Demonstration plots and trials Field days National CA taskforce meeting Protracted Relief Programme fairs Conferences Publications- reports, policy briefs Review meetings, Lectures

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