Conservation Agriculture

for

Sustainable Agriculture and Rural Development (SARD) and

Food Security in Southern and Eastern Africa

(CA-SARD)

Monitoring and impact evaluation study report

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October 2010

EXECUTIVE SUMMARY

Background

The African Conservation Tillage Network (ACT) in partnership with Food and Agriculture Organization of the United Nations (FAO), and Ministry of Agriculture Food and Cooperatives (MAFC) of the United Republic of Tanzania through Selian Agricultural Research Institute (SARI) are involved in the implementation of Conservation Agriculture Project (CA-SARD II) in Arusha, Karatu, Babati, Hanang and Moshi districts. The project is being implemented through the Farmer Field School (FFS) approach with each district having an average of 10 FFS comprising of 25-30 farmers. The extension wing of the Ministry of Agriculture Food Security and Cooperatives (MAFC) are the direct implementers of the project on the ground in collaboration with local partners.

This study aimed at carrying out monitoring and evaluation impact study to map out the extent of adoption of CA in the Country and specifically in the project districts. This was according to the terms of reference given for this study (Appendix 1). The specific objectives were to:

i. Determine how many CA - FFS groups established in both phase 1 and 2 and by interacting with group members, district coordinating team and National Project Coordinator establish the adoption extent in every district.
ii. Identify the most preferred CA option adopted by farmers under various AEZ and reasons for success and challenges.
iii. Inventorize at national and local level key institutions/projects involved in promotion of CA as a result of interaction with CA-SARD with specific emphasis on the location, what they do, target group and outcome.
iv. Map out the input supply chain and determine accessibility and affordability of farm input to the target group.
v. Map out the CA implement supply chain with specific emphasis on the key players involved, utilization of the implement by the groups and individual farmers, hire service provision by local entrepreneurs, accessibility and affordability.

Methodology

Field work was carried out in all CA-SARD project districts in northern Tanzania, namely Karatu, Hanang, Babati, Arusha and Moshi. Ten participating villages were selected two from each of the target districts. A random stratified sampling method was used in selecting a total of 200 households for interview. Data collection included review of project documents, key informants interview, physical and direct observation, participatory meetings and in-depth household interview. The interviews were conducted using a structured questionnaire administered by extension staffs that were trained to ensure common understanding of the questions and how to conduct the interview. The data were analyzed using the Special Program for Social Scientists (SPSS) which is appropriate for analyzing social economic data. The effect of project interventions on various indicators of adoption and impacts was determined for beneficiary and non beneficiary households.

Findings

The following were the main finding of the study:

i. The project managed to directly reach a total of 4908 farmers in 228 FFS and 73 villages during the two phases of the project. About 40% of members in the FFS groups were females while 60% were men. The FFS activities included the training of group CA facilitators (71) and extension officers (154) which were then used to facilitate operations in the FFS groups.

ii. A total of 1959 and 660 households (from phases 1 and 2 respectively) were reported to have adopted CA being about 108% of the total reached households in the target FFS groups. The extent of adoption in phase 1 varies with district being highest in Hanang (353.6%) Karatu (77.8%) and Babati 78.5%) districts, and lowest in Arusha district (34.5%). Similarly in phase 2, adoption was highest in Karatu (124.4%) and hanang (167.9%). The reasons given for lack of adoption were such as lack of CA equipment, Insufficient CA equipment and low economic ability to hire CA equipment.

iii. Farmers have not adopted all the three components of CA, but have picked one or two depending of perception and convenience. However majority of farmers have adopted minimum tillage operations such as ripping and direct seeding. There is also higher extent of adoption of CA among beneficiary households than the non beneficiaries. For example the households which participated in the project adopted ripping (80.8%), used direct seeder (56.4%), jab planter (71.8%), Intercropping (95.5%), planting of cover crops (87.2%), crop rotation (69.2%) and crop residue retention (82.7). For the non beneficiaries only 25% ever did ripping, 11.4% used direct seeder, 6.8% used jab planter, 39.4% practiced crop rotation and 59.1% planted cover crops.

iv. Adoption of CA technologies was mainly prompted by perceived advantages such as prevention of soil erosion, conservation of soil moisture, improvement of soil fertility, saving time and labour, improvement of yield, cost effectiveness and easy of use.

v. Several key stakeholders participated in CA-SARD project such as the Research Community and Organizational Development Associates (RECODA) in Arusha (2002 to date), Women Agricultural Development & Environmental Conservation (WADEC) and CPAR (Canadian Physician for Aid and Relief Services) in Karatu District; and Farm Africa in Babati and Hanang Districts. Although there were several institutions involved with CA SARD to promote CA, RECODA and CPAR had outstanding performance and outputs. They have been much more responsive in objective and in delivery of outputs.

vi. CA equipment imports, manufacturing, stocking and retailing in Tanzania is still patchy. The business is as young as the technology adoption which has relatively light footing in the country. The supply of CA implements has been developing in the same pace as promotion dynamics. The initial

influx of CA equipment has been done by projects promoting CA through research and extension activities.

vii. Currently there are no formal importers of CA equipment for which most of the importations are through development projects such as CA SARD and LAMP projects. This import business is not well developed because the volume of equipment demand does not justify threshold order levels, costs of imports, transportation and delivery. Development of CA equipment imports and even manufacturing depends on increases in adoption levels which will definitely increase the demand.

viii. Just like in the case of importing and manufacturing the stocking and retailing of CA implements is still evolving. In the current situation the manufacturers does much of stoking and retailing themselves. This is not very sustainable because the manufacturers are linked directly to farmers by the projects, programmes, NGOs and district councils engaged in promotion of CA.

ix. Majority of farmers have indicated highest ability to purchase rippers (70%) and jab planters (79%), respectively the animal and hand labour based implements, being more affordable and acceptable. This suggests that there is a more potential impact in promoting animal traction based CA implements than other sources of power.

x. Most of the farmers practicing CA in the study areas depend on CA SARD supplies of CA equipment (73.7%) in their farm operations, a few have purchased own equipment (12.2%), a much smaller proprtion have hired (8.8%) and borrowed (6.3%) from friends. Credit and subsidy access for CA equipment was explored by only 0.4% of households.

xi. A high proportion of farmers (66.7%) had shown ability to offer at least one kind of CA service to fellow farmers. However the most frequent service offered was training (89.5%) on various issues in conservation agriculture. Also it was noted that most frequent service requested was ripping and jabbing, the most adopted CA technologies.

xii. Sufficient incentive policy instruments exist potentially to be used to enhance the manufacture, importing, stoking and retailing of CA implements and inputs. However, only some few stakeholders in the equipment supply chain have used the incentives.

xiii. SACCOS institutions are most accessible and reliable sources of credit for most farmers. In the study 83.3% of the farmers accessed credit from SACCOs, and a few from NGOs (12.5%) and Banks (4.2%). There is still a big potential for farmers to access credit using other available facilities to increase demand of farm equipment and foster development of CA equipment supply chain.

xiv. The use of fertilizer by farmers (between 65.1% and 85% of the farmers) in the SA-SARD operations area is on the high side as far as smallholder farmers in Tanzania are concerned.

xv. Both non beneficiaries and beneficiaries attributed improvement to household income, food security and ability to pay for children education to CA-SARD project. The extent was higher with beneficiaries than non beneficiaries. This was due to income from sustainable yields obtained by practicing CA.

Conclusions

i. The impact assessment has found that the interventions of the project have strengthened capacity of institutions involved in implementing various activities at district, community level, farmers groups and NGO institutions.

ii. The number of farmers that project has directly reached (about 4908) over the two phases of the project could be more than achieved if the farmer-farmer trainers were effectively tasked towards reaching a larger section of farmers. There was a higher dependence of Extension officers cum group facilitators who could not make the needed impact.

iii. The most adopted CA technologies were ripping (80.8%), use of direct seeder (56.4%) and jab planter (71.8%) in the same extent in all the agro ecological locations in the study area. The use of CA implements was always going together with planting of cover crops.

iv. Intercropping was found to be the most widely adopted component of CA in all the project districts for food security insurance, sufficient biomass production for soil amelioration, provision of livestock feed and for adequate soil cover needed as a prerequisite condition for conservation agriculture.

v. Participation in CA SARD has increased farmers income, food security and ability to pay for children education. The Project beneficiaries also had more sustained food reserves for relatively longer period in a year than non beneficiaries.

Recommendations

i. For sustainability purposes, the district councils with facilitation of ASDP, should be encouraged to facilitate farmers to engage in private service provision of CA technologies to bridge the gap that is created by inadequate public extension service. The use of Farmer-farmer extension service must be encouraged for efficiency in knowledge transmission as well as for cost effectiveness. The prospective future initiatives need to assist the LGA to put this structure in place.

ii. In connection to above recommendation, while there is commendable extent of adoption there still a need to strategise so as to fasten the adoption rate. One of the strategies would be to promote further, the local CA service providers who should be moulded to become paraprofessionals

benefiting from service provision business but at the same time disseminating knowledge to fellow farmers.

iii. CA-SARD has done well to promote manufacturing but needs in future to involve all key players in the implement supply chain within the CA technology promotion process. Future programmes must be developed together with all stakeholders in the CA equipment supply chain to enhance their participation and input. Involvement of the manufacturers alone has failed to link supply with demand. Also there there is still needed effort to concretise training so as to make farmers understand and be convinced that the CA equipment make the difference in their farming business.

iv. The project must provide in its objectives the strengthening convention of FFS groups into SACCOs institutions for microfinacing of equipment and input supply and to address the question of affordability of CA equipment.

v. Concerted strategy and action is needed for the future project activities to fully benefit from the opportune incentive policies for enhancing development of manufacturing importing, stoking and retailing of CA equipment and inputs.

vi. Collaboration between manufacturers and the engineering research institutes needed backstopping would have provided our farmers with a wider range of appropriate adaptable technologies needed to enhance development of CA in the country.

vii. The participation of NGOs in project implementation was very useful and cost effective. However these institutions were taken on board well after the project inception for which they were not fully committed deliver to project expectations. Despite the successes the going was not as smooth as planned. Such key Institutions need to be involved from the beginning of project planning so as to harness their full enthusiastic participation and make use of their resource endowments to make the project resources more cost responsive.

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1 PROJECT BACKGROUND

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The purpose of CA-SARD project is to contribute to the promotion of growth and improved food security in Tanzania through the scaling up of conservation agriculture (CA) as a sustainable land management (SLM) tool. CA-SARD project has been implemented in the 5 districts since 2004 with phase 1 ending in 2006 and phase 2 starting from 2007 to 2010. In both phases, emphasis has been put in using the farmer field school approach to introduce the technology to the farmers then focus on individual farmer adoption afterwards. The groups targeted in phase 2 are different from those involved in phase one hence there exist a critical mass in every district of farmers exposed to CA technology. The project approach has been holistic in articulating cross cutting issues complimenting adoption of CA technology by smallholder farmers. These include involvement of private sector especially the input supply chain, CA implement supply chain, agro-processing and market access. Since its inception, the project has played a critical role in providing a benchmark and lessons for establishment of new projects by new players in the agricultural sector.

1.1 Objectives of the study

This study aimed at carrying out monitoring and evaluation impact study to map out the extent of adoption of CA in the Country and specifically in the project districts. This was according to the terms of reference given for this study (Appendix 1). The specific objectives were to:

vi. Determine how many CA - FFS groups established in both phase 1 and 2 and by interacting with group members, district coordinating team and National Project Coordinator establish the adoption extent in every district.
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2 METHODOLOGY

2.1 Sampling Frame

Field work was carried out in all CA SARD project districts in northern Tanzania, namely Karatu, Hanang, Babati, Arusha and Moshi (Figure 1). With the assistance of CA SARD national facilitators ten villages were selected two from each of the target districts. In case of Arusha district which was split into two districts after the inception of phase 1 of project into Arumeru and Arusha, one village was selected from each of them for the purpose of data collection. All the villages selected were those involved in CA SARD project during the respective phases.

A random stratified sampling method was used in selecting households for interview. In the first instance the about 15 households were randomly selected from the target Farmer Field Schools in a village. In the later instance about 5 non participating households were selected from a village register which resulted to a total of about 20 households per village and 200 households for the entire study. Table 1 shows the actual proportion of CA SARD beneficiary and non beneficiary households interviewed with respective gender division.

Table 1: Proportion of respondents who participated in CA SARD project by gender

District	Beneficiaries	Non beneficiaries	Males	Females
Karatu	75.0	25.0	32.5	67.5
Hanang	76.3	23.7	63.2	36.8
Babati	81.1	18.9	70.3	29.7
Arumeru	100.0	0.0	45	55
Arusha	68.2	31.8	31.8	68.2
Moshi	74.4	25.6	53.5	45.5
Total	78.0	22.0	51	49

2.2 Data collection

Data from different stakeholders at national, district and household level were collected using a combination of methods. These methods include review of project documents, key informants interview, physical and direct observation, participatory meetings and in-depth household interview. Different documents were reviewed including the project document, mid-term review mission report and some progress reports. Key informant interviews involved influential people

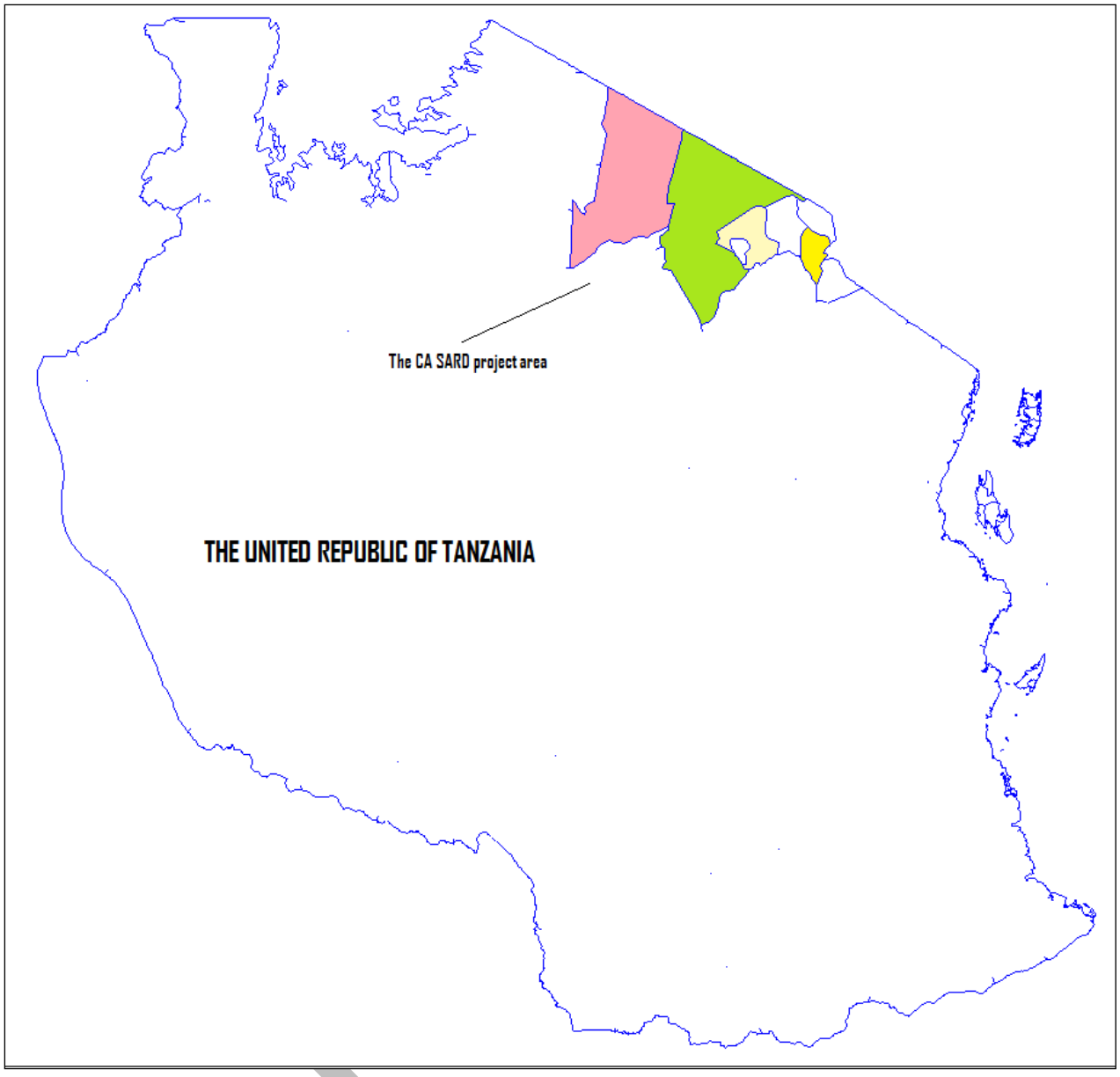


Figure 1 A map of Tanzania showing the location of CA SARD project districts

who were aware of the CA SARD project implementation arrangement (Appendix 2). Meetings were held with national project coordinator and national and district facilitators respectively in Dar es Salaam and Arusha. Also key informant interviews were held with district agricultural and livestock development officers, representatives of non governmental organizations and CA implements manufacturers who participated in CA SARD project. Interactive discussions were held with some stakeholders in the input supply business such a representative from the input trust fund, Tanganyika Farmer Association and Tanzania Fertilizers Company. The in-depth household interviews were conducted in the selected villages involving both beneficiary and non beneficiary farmers. A total of 156 beneficiary and 44 non beneficiary farmers were interviewed. The interviews were conducted using a structured questionnaire presented as Appendix 3. The questionnaire was administered by extension staffs that were trained for one day to ensure common understanding of the questions and how to conduct the interview.

2.3 Data analysis

A combination of qualitative and quantitative methods was used to analyze the data collected from this study. Qualitative data was used to capture the information from aspects which could not be quantified especially that collected through meetings and focus group interviews. On the other hand quantitative data were used to determine quantifiable factors such as the extent of reach of project activities, adoption and impact parameters.

The data were analyzed using the Special Program for Social Scientists (SPSS) which is appropriate for analyzing social economic data. The effect of project interventions on various indicators of adoption and impacts was determined for beneficiary and non beneficiary households.

3 FINDINGS OF THE STUDY

3.1 Project Approach

The project followed the Farmer Field School (FFS) group-based learning approach for which farmers carried out experiential learning activities that helped them understand the ecology of their crop fields and performance of CA implements. The activities involved simple experiments, regular field observations and group analysis. The knowledge gained from these activities enables participants to make their own locally-specific decisions about crop management practices and the implements.

Table 2 shows the number of Farmer Field School Groups reached in the respective districts. During the two phases of the project, 4908 farmers in 228 FFS and 73 villages were reached by the project. About 40% of members in the FFS groups were females while 60% were men. A total of 49 FFSs were established in phase 1 while 179 FFSs were established in phase 2. Some of the FFS were established by the farmers themselves having copied from fellow farmers within the villages. One report claimed that a few of these were initiated by trained farmers and others with support from local NGO's. The consultant witnessed two such groups (Tumaini and Hongera FFSs) in Karatu district which were initiated by the farmers themselves. The groups constituted of a ratio of about 1:2 of men to women. Most of the groups operate under credit and savings arrangement with regulated constitutions for which they also operate bank accounts.

Table 2: The number of Farmer Field School Groups reached in the respective districts

District	No of villages	No of FFS groups	Members of FFS groups		
			Male	Females	Total
			Phase 1		
Karatu	7	13	187	210	397
Hanang	9	14	283	68	351
Babati	5	5	88	47	135
Arumeru	-	-	-	-	-
Arusha	8	11	159	166	325
Moshi	3	6	69	61	130
Sub Total	32	49	786	552	1338
			Phase 2		
Karatu	13	37	307	544	851
Hanang	6	54	729	243	972
Babati	4	32	258	110	368
Arumeru	4	17	287	155	442
Arusha	11	32	549	283	832
Moshi	3	7	37	68	105
Sub Total	41	179	2167	1403	3570
Grand Total	**73**	**228**	**2953 (60.2%)**	**1955 (39.8%)**	**4908**

The FFS activities included the training of group CA facilitators (71) and extension officers (154) which were then used to facilitate operations in the FFS groups. The project also supplied some CA implements to all groups for the purpose of

training. The essential implements for each group were three jab planters and one ripper. Some groups received one Draft Animal Power (DAP) direct seeder and a Zamwipe. Farmers received practical hands on training on use and advantages of the implements. This was accompanied by the theoretical narrative education of the principles of CA as opposed to negative effects of conventional agricultural practices. In case of DAP operated direct seeders and rippers some group members who owned of draught animals were trained as operators so as to enhance uptake and promotion of the DAP based CA implements. In the same respect, local artisans were trained in maintenance and repair of the CA implements.

Each group was facilitated to establish one acre of FFS plot for the training process. During phase 1 the farmers were trained based on four CA technologies and compared with their own local practice as outlined below:

i. Maize + lablab; No ripping
ii. Maize + lablab + ripping
iii. Maize + pigeon peas; no ripping
iv. Maize + lablab + ripping
v. Farmer practice

During phase 2 three options were tested by farmers as follows:

i. Ripping + maize + lablab
ii. Ripping + maize + pigeon peas
iii. No-tillage + direct planting + maize + lablab or pigeon peas cover crop
iv. Farmers practice

The farmer practice consisted on ploughing by ox-plough or tractor followed by planting maize intercropped with beans and or pigeon peas. The plots were used as training blocks over the crop growing seasons. The FFS were facilitated by selected farmers trained in FFS principles and practices through regional and national trainings. The following technologies were involved in the field training:

i. Recommended agronomic packages in terms of crop spacing and use of improved maize seeds;
ii. Reduced-tillage using rippers, sub-soilers, no-till direct planter or jab planters and potholing before the first rains when the soil was friable to ensure the first rains are harvested and runoff losses are reduced;
iii. Planting of cover crops mainly lablab, mucuna, pigeon peas, pumpkins or finger millet to enhance permanent soil cover and for soil fertility amelioration;
iv. Crop residues retention after harvesting to maintain soil cover and soil organic matter;
v. Weed control using glyphosate: a systemic herbicide more effectively in relatively high rainfall areas; and early weeding in area of low rainfall regimes

vi. Crop livestock integration techniques including crop residue harvesting for feeding livestock and use of manure from livestock for soil fertilizing effects

As part of training process the farmers collected field data through a participatory monitoring and evaluation approach that incorporated the agricultural ecosystem analysis (AESA). Data collected included rainfall, labour input for the field operations, soil characteristic changes, crop diseases, insect attack and coping strategies. Other data included maize and cover crop grain yield. In order to out scale the effects of FFS training arrangement in the districts some field days and farmers exchange visits were conducted within Tanzania and between FFS groups from and to Kenya.

3.2 Extent of Adoption of Conservation Agriculture

It was well established from the study that all project beneficiaries received training from the FFS training plots and some additional training of 154 extension officers, 71 group facilitators (Farmer-farmer trainers), exchange visits and organized farmer field days. All these activities had a bearing on impacting knowledge, skills and empowerment for the target farmers to practice CA in their own fields. The most important impact has been adoption of CA technologies. Table 3 shows the number of CA adopters from the FFS groups in the respective target districts. A total of 1959 and 660 households were reported to have adopted CA (in phase 1 and phase 2 respectively) being about 108% of the total reached households in the target FFS groups.

Table 3: The number of farmer adopters from the Farmer Field School Groups in the respective districts by number and proportion of FFS participants

District	**Members of FFS groups**			**Proportion of adopters (%)**		
	Male	**Females**	**Total**	**Male**	**Females**	**Mean**
			Phase 1			
Karatu	214	286	500	79.0	76.9	77.8
Hanang	855	386	1241	302.1	567.6	353.6
Babati	73	33	106	83	70.2	78.5
Arumeru	-	-	-	-	-	-
Arusha	62	50	112	39.0	30.1	34.5
Moshi	-	-	-	-	-	-
Sub-Total	1204	755	1959	125.8	186.2	136.1
			Phase 2			
Karatu	214	280		114.4	133.3	124.4
Hanang	325	93	418	165.0	178.8	167.9
Babati	17	10	27	24.3	20.8	22.9
Arumeru	-	-	-	-	-	-
Arusha	58	23	81	28.43	12.64	20.98
Moshi	64	70	134	67.4	72.2	69.8
Sub Total	678	476	660	79.9	83.5	81.2
Grand Total	**1882 (60%)**	**1231 (40%)**	**3113 (100%)**	**102.8**	**134.9**	**108.6**

The extent of adoption in phase 1 varies with district being highest in Hanang (353.6%) Karatu (77.8%) and Babati 78.5%) districts, and lowest in Arusha district (34.5%). Similarly in phase 2, adoption was highest in Karatu (124.4%) and hanang (167.9%). The adoption rate seems to be proportional to the extent

of activities in the respective districts. For example among the 71 of the Farmer facilitators in the target districts 62% were in Karatu, Hanang and Babati districts. Similarly 73% of the extension officers of the total trained as facilitators were from the districts in which adoption rate was highest. However farmers facilitators are more pragmatic educators than the extension officers. It is a general knowledge that farmers are much more believed as a source of knowledge and information for their fellow farmers. Figure 2 proves this argument by indicating that most of the farmers who got information on the project were from fellow farmers (73%) and a few from extension workers (19%) and village leaders (8%) (Figure 3). That is to say those, about 42.9 to 100% of non beneficiary farmers were made aware of the CA SARD project mostly by fellow farmers. Probably that is the reason which enabled most adoption to go beyond the FFS group members in all the districts with varying degree of proportions.

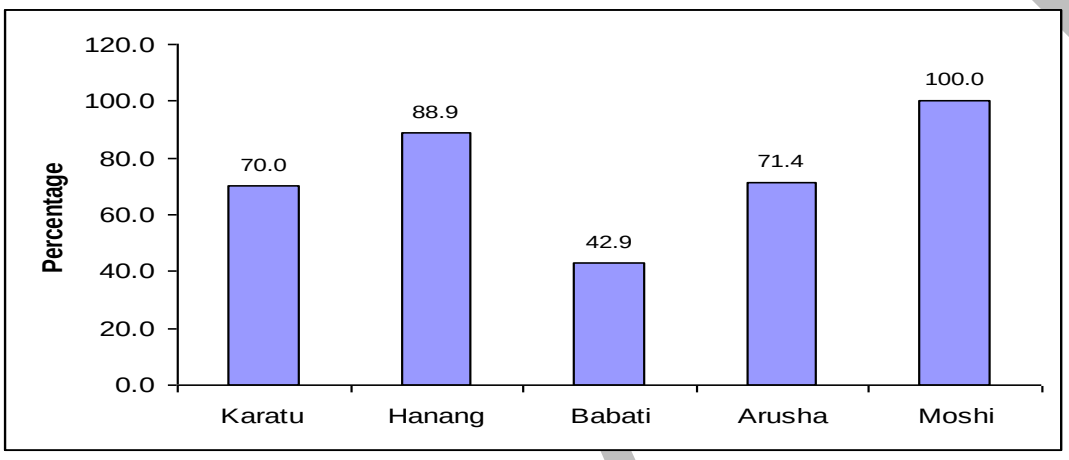


Figure 2: proportion of non beneficiary farmers who were aware of the CA SARD project activities

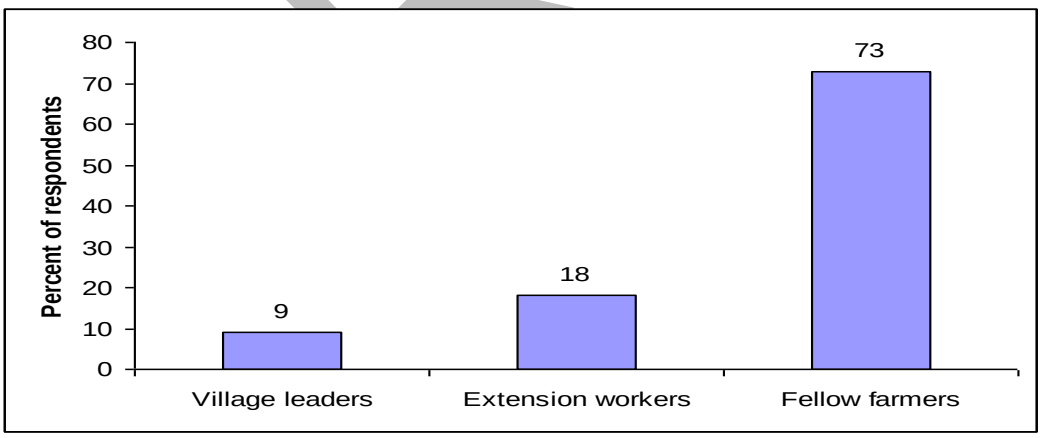


Figure 3: Proportion of respondents indicating sources of information about CA SARD project.

The non beneficiaries learnt a lot from CA SARD using the methods mentioned in figure 4. Most of them attained knowledge on two issues that is; use of CA implements (27.6%) and planting of cover crops (29.5%). Other technologies learnt were the use of glyphosate in weed control (6.6%), use of improved seed (8.2%), intercropping (4.9%) and use of proper spacing (4.9%). All of the

knowledge attained and used by non beneficiaries was similar to that introduced in FFS groups training for the beneficiaries presumably attained through diffusion from fellow farmers.

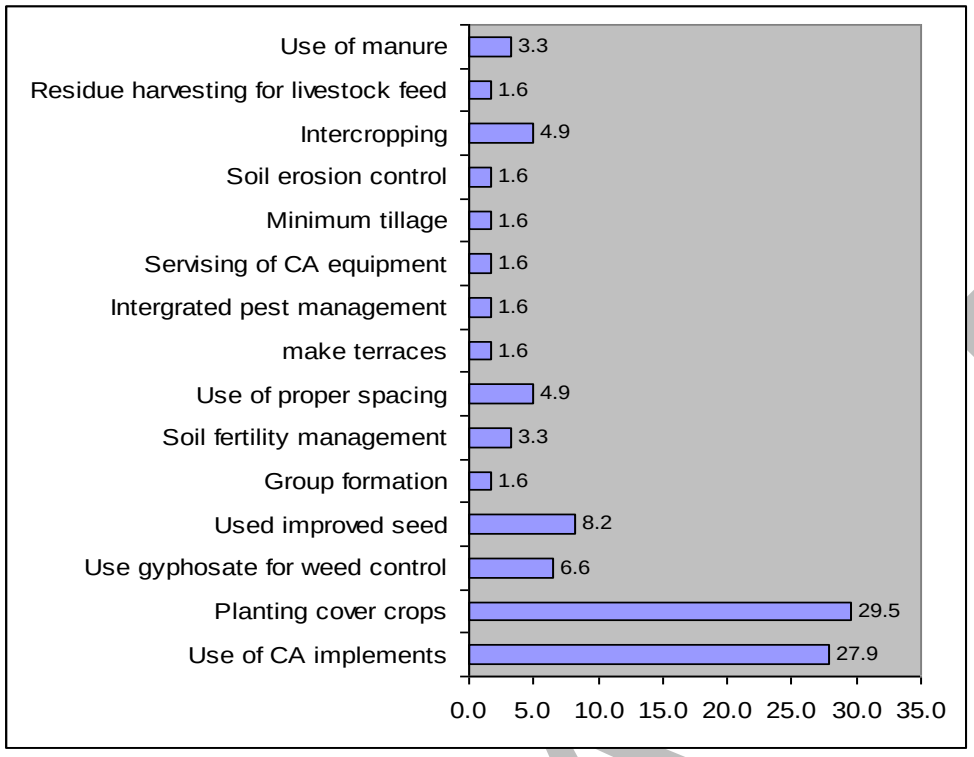


Figure 4: Proportion of non beneficiaries indicating the lessons they learnt from CA SARD activities in the study area

3.2.1 Impact of CA SARD training on understanding and use of CA technologies

While all the target farmers received FFS training, only some of them attained knowledge and skills intended for them. There was a wide range of skills that farmers attained due to the FFS training including those that were not primarily intended (Figure 5). All the farmers who attended the FFS training attained skills of using the CA implements especially the minimum tillage implements. The implements were mainly the ox-drawn ripper, Jab planter and an ox-drawn direct seeder. This is probably because these implements represent a basic operation of land preparation which is fundamental in farming business. These implements have shown great effects in labour reduction, favourable effects in rain water harvesting and cost effectiveness in terms of labour and energy use. A large proportion of farmers have also acquired skills in planting cover crops (79%). It was similarly found that the greatest proportion of farmers used both the skills in use of CA implements (84.8%) and planting of cover crops (72.5%). Other skills that the farmers acquired were soil fertility management (17.4%), use of improved seed (29.7%), use of glyphosate in weed control (23.2%), proper plant spacing (24.6%) and servicing of CA implements (21%). There are many other skills that farmers acquired due to CA SARD interventions though in a lesser extent of understanding and use. The extent of actual use of the skills acquired was even at a lower proportion than the proportion of farmers who attained the skills.

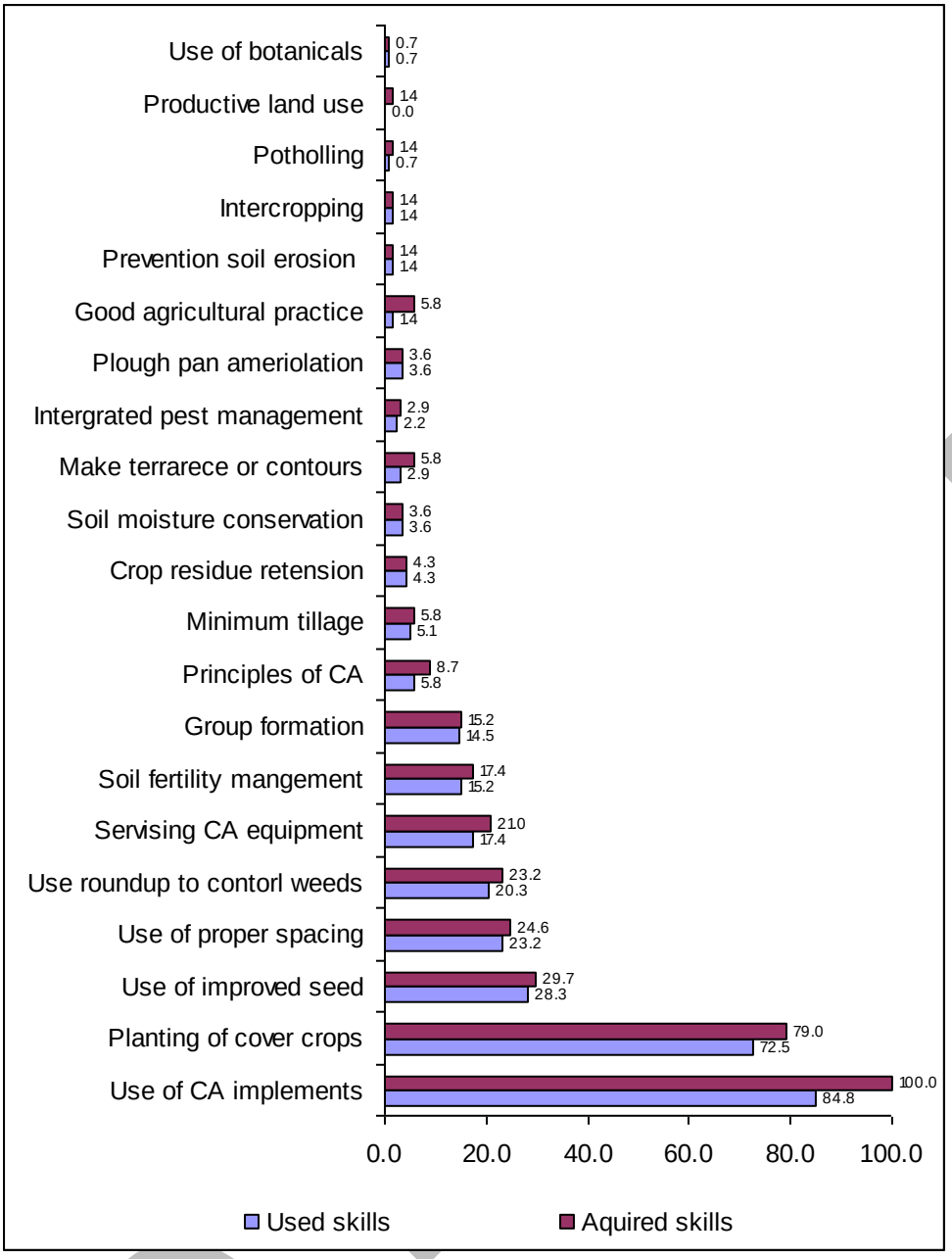


Figure 5: The proportion of farmers indicating the knowledge they acquired after participating in the FFS group trainings

Reasons for not applying the skills gained after training were many and diverse but many were on accessibility of CA equipment. The reasons given were such as lack of CA equipment, Insufficient CA equipment and low economic ability to hire CA equipment. In connection to this many households were queuing for the CA implements supplied by the project for which a large proportion of them could not get opportunity to access them. Hence some of them reverted to conventional tillage methods so as to make use of the unpredictable rainfall at the beginning of the season. The other reason probably also connected to implements is lack of draught animals. Many farmers claimed that they had no animals trained for operating rippers and direct seeders. There was also a perception that made some of them avoid engaging their animal to operate the implements claiming that they were heavy and could hurt their animals. There was an interesting observation that many farmers were aware of advantages of

cover crops but lack of cover crop seed is a setback. It is evident that there is land pressure in northern Tanzania indicated by farmers' very small land holdings to an average of 1 acre of land. Some farmers have been sceptical to try new technologies to the only landholding bearing their household food security. This has been the case for women farmers who participated in FFS groups. Most of them claimed that they could not get permission to use part of household land to try the new CA technologies. So lack of access to land was the reason given by some of the farmers for not using the skills acquired after training. However for the farmers who were involved in FFS training during phase 2 this time of study was too early for them to test the technologies in their plots because it was just at the end of first season of training.

However CA-SARD is not the first initiative in the area to promote CA technologies. Hence the study probed further so as to be able to attribute farmers understanding and uptake of the technologies to relevant initiatives and to CA SARD. Table 4 show the proportion of farmers who have ever used any of the CA technologies even if is was well before inception of the project and the proportion of those who continued and have discontinued using the technologies.

Table 4: Proportion of farmers who have ever used any of the components in conservation agriculture

Technology	Beneficiaries			Non Beneficiaries		
	Practiced	% Discontinued	% continued	Practiced	% Discontinued	% continued
Ever practiced ripping	80.8	10.9	69.9	25.0	9.1	15.9
Ever used jab planter	71.8	11.5	60.3	6.8	2.3	4.5
Ever used direct seeder	56.4	7.1	49.3	11.4	4.5	6.9
Ever done early weeding	72.4	0.0	72.4	61.4	2.3	59.1
Ever used roundup for weed control	69.9	7.1	62.8	27.3	4.5	22.8
Ever used zamwipe	25.6	9.6	16.0	2.3	0.0	2.3
Ever retained surface crop residues	82.7	5.1	77.6	40.9	6.8	34.1
Ever planted cover crops	87.2	3.8	83.4	59.1	4.5	54.6
Ever used compost manure	42.9	21.2	21.7	13.6	11.4	2.2
Ever used kraal manure	84.0	1.9	82.1	70.5	2.3	68.2
Ever practiced crop rotation	69.2	4.5	64.7	36.4	0.0	36.4
Ever intercroped	95.5	1.3	94.2	86.4	2.3	84.1
Ever practiced improved fallow	22.4	5.8	16.6	6.8	2.3	4.5
Ever used crop residues as feed	90.4	1.3	89.1	86.4	0.0	86.4
Ever planted forage crops	44.2	1.3	42.9	34.1	0.0	100.0

A larger proportion of the beneficiary households have practiced some components of CA in their lifetime than the non beneficiaries. For example the households which participated in the project practiced ripping (80.8%), used direct seeder (56.4%), jab planter (71.8%), Intercropping (95.5%), planting of cover crops (87.2%), crop rotation (69.2%) and crop residue retention (82.7). For the non beneficiaries only 25% ever did ripping, 11.4% used direct seeder, 6.8% used jab planter, 39.4% practiced crop rotation and 59.1% planted cover crops.

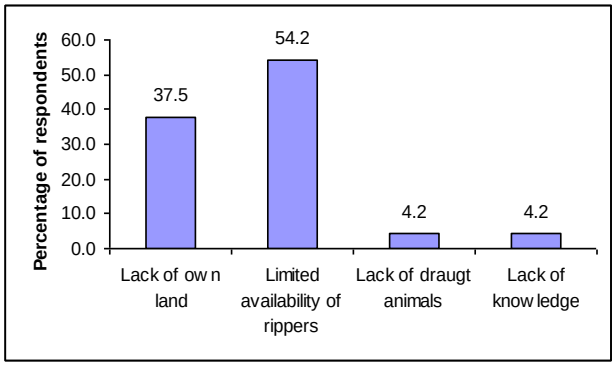
Most of these technologies it was CA SARD which has most widely promoted in the area. It is evident that a great proportion of non beneficiary households practice intercropping with leguminous plant because this has been widely promoted in the past and is also an important as food security insurance measure. The study found three major sources of knowledge on CA technologies among beneficiary and non beneficiary households (Table 5). They were CA SARD project, regular extension service and knowledge inherited from fore fathers. CA SARD project was the major source of CA knowledge among both the beneficiaries (71%) and non beneficiaries (42%). The extension service was the second important source of CA knowledge especially for non beneficiaries presumably the knowledge passed from the project to the extension service.

Table 5: Source of Knowledge of the various technologies used by the respondents

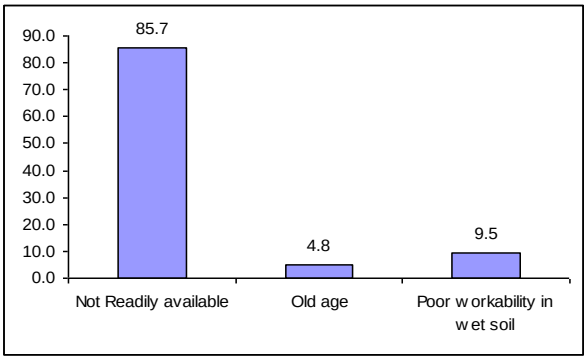
Source of knowledge

	Ripping	Jabbing	Direct seeder	Roundup	crop residue	Cover crops	Crop rotation	Inter cropping	Improved fallow	Harvest crop	Planting forage	Total
					Beneficiaries							
CA SARD	90.3	90.9	94.2	87.0	90.0	86.8	66.7	53.9	47.1	38.8	44.3	71.8
regular extensio service	8.9	9.1	4.7	11.1	7.7	8.1	9.3	13.5	29.4	23.7	27.1	13.9
Traditional inherited skill	0.8		1.2	1.9	2.3	4.4	24.1	32.6	23.5	37.4	28.6	15.7
					Non Beneficiaries							
CA SARD	54.5	100.0	50.0	4.0	43.8	45.8	35.3	31.6	66.7	23.7	7.1	42.0
regular extension service	36.4	0.0	50.0	6.0	50.0	33.3	17.6	26.3	33.3	28.9	57.1	30.8
Traditional inherited skill	9.1	0.0	0.0	1.0	6.3	20.8	47.1	42.1	0.0	47.4	35.7	19.0

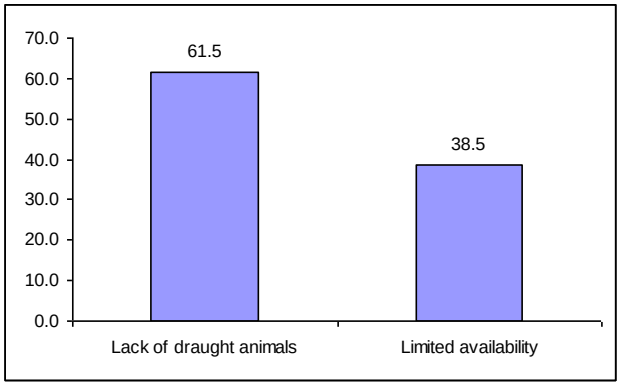
In this regard it is important to mention the past initiatives in promoting CA such as the GTZ funded Agricultural Mechanisation Management Project - AMM (1999-2000) and the GTZ/TFSC-PPP Project (2000-2003) promoting mainly ripping and sub-soiling in Hanang and Karatu districts. The CIMMYT conservation agriculture research project which conducted a series of on-farm experiments in Arumeru and Karatu Districts during the seasons 2003 and 2004 was another source of knowledge for the farmers. There were other CA related projects complemented by the Non Governmental Organizations in Arusha, Hanang, Babati, Arumeru and Karatu districts prio and during CA SARD operations. All these initiatives involved the regular extension service to reach the target farmers after training them as facilitators. Hence there is definitely potentially a wealth of knowledge on CA technologies among the extension workers spread all over the rural northern Tanzania. This needs a concerted strategy to harness this knowledge to have effective and cost efficient out-scaling of CA. Figure 6 shows the reasons given by farmers for discontinuing CA technologies after having practiced them for some seasons. For example about 37.5% and 54.2% of the respondents discontinued ripping for lack of own land and limited availability of rippers.



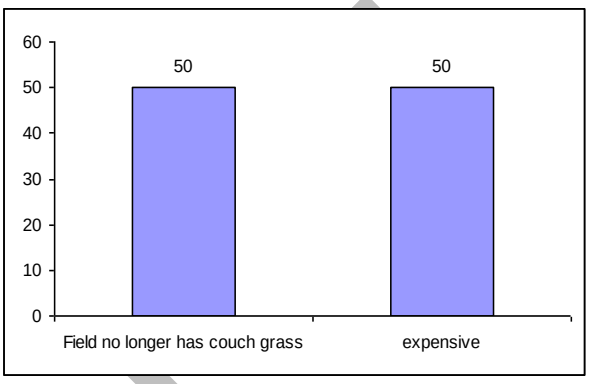
(a) Ripping



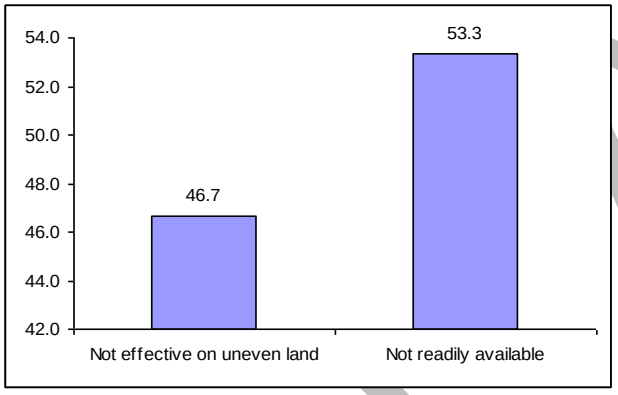
(b) Use of jab planter



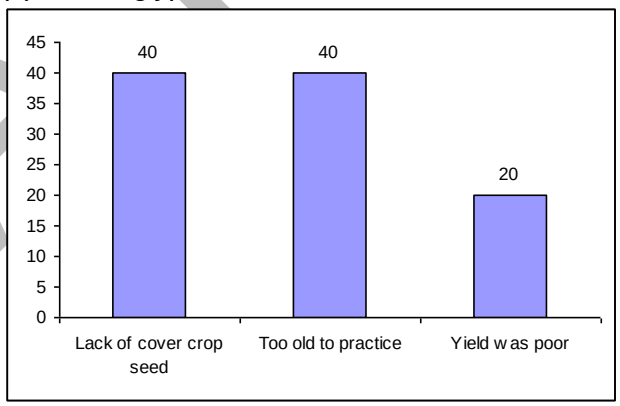
(c) Use of ox-direct seeder



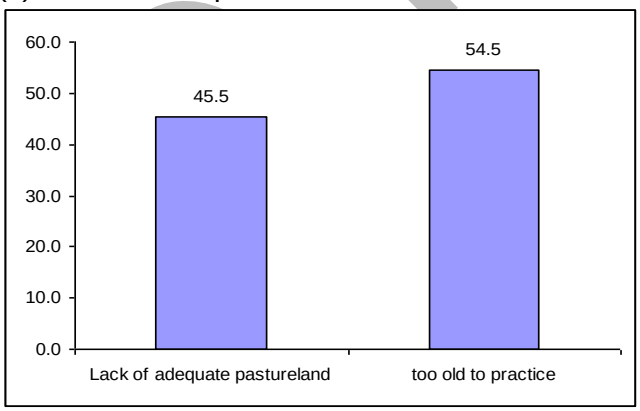
(d) Use of glyphosate for weed control



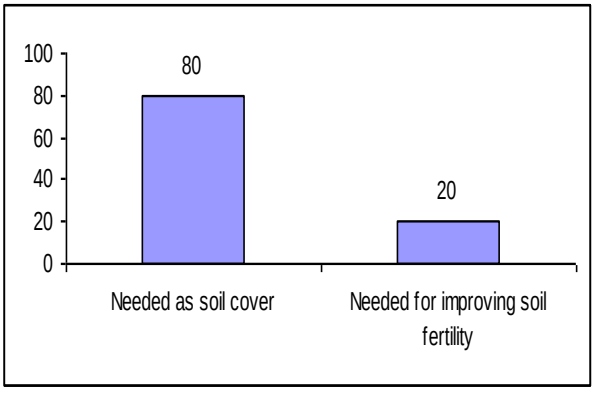
(e) Use of Zamwipe



(f) Planting of cover crops



(g) Surface crop residues retention



(h) Harvesting crop residues for feed

Figure 6 Reasons given by farmers for discontinuing the respective CA technologies after primary testing and or adoption

Limited availability is probably the most frequent reason given by farmers for abandoning use of Jab planter (85.7%), direct seeder (38.5%), Zamwipe (53.3%) and other CA implements. A jab planter is blamed for poor performance in wet soil (9.5%) while glyphosate was discontinued for being expensive (50%). The farmer who abandoned planting cover crops was because of lack of seed (40%) mainly because the farmers have not been able to multiply them due to poor weather resulting to low yield (20%). Retention of crop residues has been difficult for farmers for lack of adequate pasture land (45.5%). This is related to issues of land scarcity which also affect adoption of other CA technologies.

One of the most important components in CA is crop rotation for which according to farmers who discontinued practicing (100%) mentioned land scarcity as a major reason. Another interesting finding was that of attributing adoption of some CA technologies to age of farmers. Some farmers attributed abandonment of planting of cover crops (40%) and surface crop residue retention (54.5%) to old age. For these farmers planting of cover crops involves extra labour demand needed for establishment and harvesting as well the retention of crop residues presents more problems demanding much more labour in weed control. People of old age cannot supply sufficient labour to meet such increasing demands. The aged also have very little prospects for future development and may not be proper to target them for as pioneers for other farmers to learn from them.

On the other hand the farmers identified several reasons for continuing to practice some CA technologies as shown in Appendix 4. Most of the reasons reflect the advantages of practicing the various CA components. The advantages are such as prevention of soil erosion, conservation of soil moisture, improvement of soil fertility, saving time and labour, improvement of yield, cost effectiveness and easy of use. Practically indicating that they have adopted the CA technologies after having been convinced on its' advantages over conventional agriculture. Indeed farmers have identified both advantages of the technologies as well as problems hindering adoption. This indicates also the outcome of the project training activities mainly enhancing knowledge of farmers in CA technologies and respective factors which can hinder adoption. These factor hindering adoption are particularly important to device counteractive measures geared to further enhance adoption.

Intercropping is one of the important CA components that has found root in both beneficiary and non beneficiary farmers. Actually it is the most widely used practice by beneficiaries (94.4%) and non beneficiaries (84.1%) (Table 4). Initiatives other than CA-SARD such as the GTZ funded Agricultural Mechanisation Management Project - AMM (1999-2000), the GTZ/TFSC-PPP Project (2000-2003) and the CIMMYT funded CA projects might have influenced wide adoption of this practice. However the variety of leguminous crops incorporated in the cropping systems are much wider now than before. CA SARD had introduced new crops such as lablab and pigeon peas in the inter-cropping systems. Both were preferably introduced to take advantage of sufficient biomass they produce, the soil fertility enriching effect and the effect of biological sub surface hard pan breaking ability by means of long tap root effect. That is the reason for maize-lablab and maize-pigeon peas to be the most prominent and basic intercropping systems in the study area (Figure 7). The

most common intercrops in the area were therefore the maize-pigeon peas (35%), maize pigeon peas lablab (20%), maize-lablab (20%) and maize-beans (14%). Other cropping systems are either a modification of these, such as maize-pigeon peas-beans (8%), maize pigeon peas-beans-lablab (7%) and maize-pigeon peas-beans-sun flower (2%). Very rarely can maize be found as a sole crop in the study area (3%) and this was more frequently found in Moshi district.

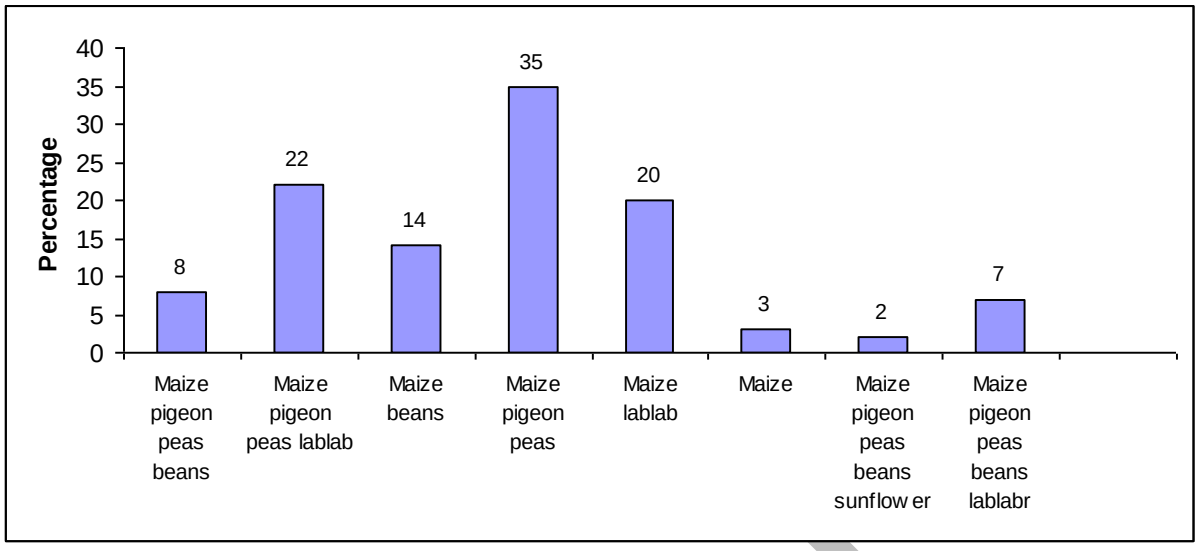


Figure 7: Proportion of who practiced the respective cropping system in the 2008/09 season

3.3 Key Partners in promotion of conservation Agriculture in Tanzania

There are several institutions that in one way or the other have been involved in promotion of CA in northern Tanzania. Magunzu *et al* (2007) have outlined most of the institutions in the historical perspective. They include the Selian Agricultural Research Institute (SARI) (1999 to date) in Arusha, Soil Conservation and Agroforestry Programme in Arusha (SCAPA) (1989 to 2003), Research Community and Organizational Development Associates (RECODA) in Arusha (2002 to date) and the Participatory Agricultural Development and Empowerment Programme (PADEP). Other institutions are the ministry of Agriculture under the department of mechanization, the local government authorities, Women Agricultural Development & Environmental Conservation (WADEC) and CPAR (Canadian Physician for Aid and Relief Services) in Karatu District; and Farm Africa in Babati and Hanang Districts. Table 6 shows the inventory of institutions and districts involved in promoting CA after being involved with CA SARD. Although there were several institutions involved with CA SARD to promote CA, RECODA and CPAR had outstanding percormance and outputs. Some detail of activities is narrated in the following sections

3.3.1 Research, Community and Organizational Associate (REDOCA)

RECODA is an NGO which was started in 2000/01 to with the aim of promoting sustainable agricultural practices with the approach of crop livestock integration. It was first involved with CA SARD in the 2005 season. Since then RECODA mainstreamed CA promotion in all its activities in Karatu, Arusha, Meru, and

Korogwe districts. RECODA used lobbing and advocacy with Farmer-farmer training approach to promote CA in banana based farming systems. Achievements have been the training extending from one village in one district covering two groups in 2005 up to a total of respectively, 34 villages in four districts and a total of 68 FFS groups in 2010. The NGO continues with activities in the designated districts with funding from a Danish organization known as Rockwool foundation. RECODA extended CA promotion activities to locations that could not be reached by directly by CA SARD project.

Table 6: Inventory of key institutions and projects involved in CA SARD

No.	Institution or project	Activities, Location and Duration	Out comes and target group
1	The Ministry of Agriculture Food and Cooperatives; Department of Agricultural Mechanization	To introduce and support the use of power tiller and tractor conservation agriculture implements in 10 districts by 2011	The project is under implementation
2	Local Government Authorities (LGAs)	The LGAs in Karatu Hanang Babati, Arumeru, Arusha and Moshi districts have set aside budget for CA FFS trainings	Several FFS training groups are operational
3	Women Agricultural Development & Environmental Conservation (WADEC)	Trains women farmer groups in organic farming and have introduced leguminous cover crops and ripping in Arusha and Arumeru districts	Women farmers have been linked to agricultural credit and training
4	*CPAR (Canadian Physician for Aid and Relief)*	Since 2004 CPAR have streamlined Conservation Agriculture into her main activities since 2004	Have trained 400 farmers in eight villages in Karatu district
5	Research, Community and Organizational Associate (REDOCA)	Promotes conservation agriculture in Karatu, Arumeru and Arusha districts as part of implementation of CA SARD since 2004	Have trained a total of 2040 farmers
6	Participatory Agricultural Development and Empowerment Project	After CA SARD interventions in Karatu and Hanang and Babati districts the farmers identified CA in the participatory planning meetings.	Some groups of farmers were empowered to use Ca in their fields

3.3.2 Canadian Physician for Aid and Relief (CPAR)

The NGO with operations in Karatu district was started in 2002 with community based programmes mainly based on water and sanitation services between 2002 and 2004. During the 2004 some 2 senior local CPAR officers were involved in a CA SARD training after which the focus of activities changed to agricultural development promotion among smallholder farmers. One of their first agricultural promotion projects was a three year project (2004 – 2006) coined 'moving beyond hunger' initiative in Kilimatembo, Kasai and Getamo villages in Karatu district. In the 2006 CPAR won a second phase of the the same project for which CA promotion was still the primary objective. Over the years CPAR was able to train 400 farmers in eight villages in 16 FFS groups (Table 7). In another development CPAR convinced donors to grant a project

titled "Farmer First' which began in 2009 and is expected to end in 2014 with emphasis in CA promotion among other technologies.

Table 7: Trend of outputs of CPAR activities in Karatu district after involvement with CA SARD

Indicators	2004	2005	2006	2007	2008	2009	2010	Total
No of FFS involved	5	5	14	14	27	16	16	97
No of demonstrations	5	5	14	14	14	16	16	84
No of farmers trained	125	125	350	350	350	400	400	2100
No of villages covered	1	1	4	4	4	3	3	8

3.3.3 Ministry of Agriculture food and cooperatives

Despite the benefits observed with CA SARD, the ministry was of the opinion that the pace of adoption still remains low amongst smallholders. It seems that too much emphasis has been placed on crop productivity, paying little attention to the aspect of labour saving. There are still many pertinent questions such as; (i) How is saved labour from CA gainfully exploited? And (ii) Are there on/off farm investment opportunities for farmers? In Brazil the high adoption of CA has been linked with the use of herbicides in weeding, reduced erosion as a result of using no till seeders and reduced machinery operational costs in commercial large scale farming. While in small holder farming, CA adoption has always been linked with reduced labour input and investment of the time saved to other income generating activities including value addition. Therefore CA interventions have to be looked at across the board from smallholder farmers to medium/large scale farmers.

The ministry though own budget has decided to introduce and support the use of power tiller and tractor conservation agriculture implements in 10 districts of the country by 2011. The activity is being carried out in collaboration with Selian Agricultural Research Institute (SARI), the African Conservation Tillage Network (ACT) based in Nairobi Kenya and the ten local government authorities in Arusha, Manyara, Kilimanjaro, Tanga, Morogoro and Dodoma regions. Two major activities are being implemented; as facilitation of FFS groups and introduction of ripping and direct seeding in tractor based systems. Activities have just started therefore there are not yet any tangible outputs.

3.4 Conservation Agriculture Implements supply Chain

The typical equipment supply chain involves one basic route and two branches providing enabling environment for the chain to operate efficiently. Figure 8 shows a scheme of the chain as it operates in Tanzania. The basic chain involves Manufacturers or importers who supply the needed products to the stockists. Stockists are business operators with medium to high capital outlays maintaining stocks of products for retailers from which farmers are expected to access the products. The other arm of the chain is the policy framework which is necessary to regulate the supply chain and is mainly managed and

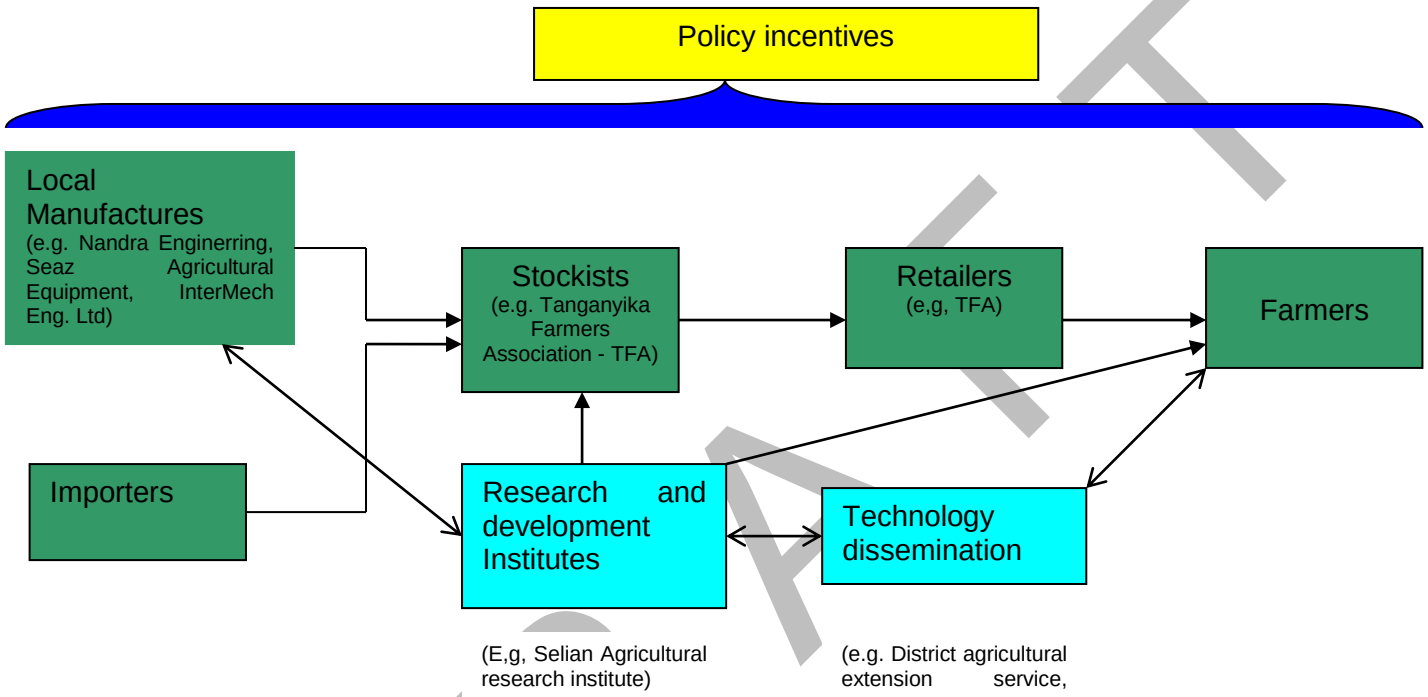


Figure 8: The equipment supply chain in Tanzania

dominated by government. The other arm involves technology development and promotion represented by research and development institutes together with institutions engaged in technology dissemination and technical support. All this will not be sustainable without well developed demand of the CA equipment indicated by a sufficient mass of CA farmer adopters tallied with well developed market oriented conservation agriculture enterprises. The market will prime-move the farmer demands for the CA equipment which in-turn will make the whole supply chain vibrate in resonance and sustainability.

3.4.1 Stakeholders in the equipment supply

3.4.1.1 Equipment Manufacturers

CA equipment imports, manufacturing, stocking and retailing in Tanzania is still patchy. The business is as young as the technology adoption which has relatively light footing in the country. The supply of CA implements has been developing in the same pace as promotion dynamics. The initial influx of CA equipment has been done by projects promoting CA through research and extension activities. For example animal drawn rippers, direct ripper planter and sub-soilers have been introduced in Tanzania from Zambia (Magoye) by LAMP project promoting conservation tillage in Babati district in early 1990s. The local manufacturing started later in mid 2000s while stocking and retailing has been very intermittent. CA-SARD project had combined promotion of the CA equipment together with development of its supply chain. Hence there has been involvement of key stakeholders from manufacturing through retailing to end users of the products.

The initial intervention has been to encourage local manufacturing to enhance availability of appropriate equipment adapted to local conditions of Tanzania. In this respect CA SARD facilitated training of engineers and technicians from some key agricultural manufacturing companies. Major input was facilitating three study tours of the engineers from the targeted companies to Brazil. The output of such efforts was a slowly evolving but promising and sustainable development of design and development of CA equipment. Three major companies involved in CA implements manufacturing as a result of SA SARD activities are InterMech Company Limited, Nandra Engineering Company Limited and Seaz Agricultural Equipment Limited.

(i) Intermech Company Limited

InterMech limited was operates from Kihonda industrial area in Morogoro municipal council in Tanzania with the major objective of manufacturing agricultural equipment. The company connection to the Morogoro engineering cluster has been opportune strength enabled it to harness ample engineering skills needed in the equipment manufacturing business. Intermech has been one of the first beneficiaries of CA SARD organized trip to Brazil which have raised awareness of the company engineers who have become strong believers and practitioners of CA through design and

development of CA equipment. Initially the company was contracted to access the local capacity to manufacture CA implements by CA-SARD.

Their major activity has been to design and develop prototypes of CA equipment. A major output has been to develop two types of single axle tractor direct seeders. One of them is under field testing with the Centre for Appropriate and Rural Mechanization Technologies (CARMATEC) a statutory organization mandated for testing of agricultural equipment in Tanzania. These seeders are important equipment for extending the CA technology to farmers who have access to single axle tractors. Actually it is an important input to tally with growing use and imports of the tractor in Tanzania influenced by government policy to zero tax, provide soft loans and subsidies for the tractors.

(ii) Nandra Engineering

Nandra Enginnering company limited operates from Moshi town in Kilimanjaro region with the objective of manufacturing a variety of metal products. Nandra Company entered into manufacturing CA equipment for the first time in the late 1990s after interaction with SIDA funded Land Management Project (LAMP) operating mainly in Babati district. The first products the Nadra engineering produced were the Magoye ripper, jab planter and sub-soiler as copied from Magoye designs. LAMP linked the company with the district councils, extension officers and individual farmers as facilitation for marketing of the products. CA-SARD project introduced more products from Brazil including the Brazilian jab planter and the ox drawn direct seeder. The project added much more element to enhance the manufacturing which was the hands-on training sessions within and outside the country (Brazil). This made the company to play an extra and very important role; that is adapting the jab planter and direct seeder to suit manufacturing technology, farmers' needs and soil conditions. Therefore although slow at the beginning but later Nandra was able to streamline CA equipment manufacturing in its business. Currently Nandra is a resourceful company and reliable dealer of CA equipment in three aspects:

- Adapting the foreign designs of CA equipment to suit local field conditions
- Prompt supply of CA implements on demand (especially to CA SARD farmers)
- Maintains a reasonable stock of CA implements to the needy farmers

(iii) Seaz Agricultural Equipment (SAE)

SAE operates from Soweto industrial area in Mbeya Tanzania. SA SARD sponsored two engineers from the company in the Brazil tours. This enhanced capacity of SAE to manufacture the needed equipment. The production engineer of the company asserts that the present data does reflect the production capacity but rather the supply of equipment in response to order level. Most of the equipment have been manufactured and supplied on demand basis. According to him the company has capacity to manufacture up to three times as the quantities show in the table.

3.4.1.2 CA equipment importers

Currently there are no formal importers of CA equipment for which most of the importations are through development projects such as CA SARD and LAMP projects. This import business is not well developed because the volume of equipment demand does not justify threshold order levels, costs of imports, transportation and delivery. Development of CA equipment imports and even manufacturing depends on increases in adoption levels which will definitely increase the demand. On the other hand increases in import levels may frustrate local manufacturing due government policy of zero taxation of agricultural equipment imports. For example the executive director of InterMech limited was particularly concerned by the interest of Brazilian manufacturers to invest in imports of their CA products in Tanzania. The interest was indicated by the participation of Brazil in the 2010 Dar es Salaam trade fair and the visit of Brazilian president to officiate the event. However this competition would be healthy for the end users and may spearhead fast development of local manufacturing industry because they have a better chance with ability to adapt CA technologies to local social economic context.

3.4.1.3 Stockists and retailers

Just like in the case of importing and manufacturing the stocking and retailing of CA implements is still evolving. In the current situation the manufacturers does much of stoking and retailing themselves. This is not very sustainable because the manufacturers are linked directly to farmers by the projects, programmes, NGOs and district councils engaged in promotion of CA. The only retailers and at the same time stockists of the CA implements with widespread activity with branches all over Tanzania and over 40 year experience in the input supply business is the Tanganyika Farmers Association (TFA). They are therefore a good sample to represent behaviour of input stockist and retailers in the country. A visit to TFA Karatu, Arusha and Mbeya branches found that the company does not stock the CA implements but supplies the equipment in response to pressed orders. Most orders are again from projects, programmes, NGOs and district councils promoting CA. TFA uses Nadra engineering company to fulfil most of the orders. Actually as stated in the preceding sections manufactures maintains a limited stock of CA equipment to respond to such orders. So in essence the manufacturers are stockists a well.

This is contrary to the sustainable product supply chain normally needs to start with demand (farmers), springing back to retailers and stockists (such as TFA) and runs up to manufacturers thus setting the business chain vibrant naturally. Projects are short lived but once the stokists and retailer become involved, the basic product supply chain becomes persistent regardless of its structure and nomenclature. However, full involvement of key players in the implements supply chain will mainly depend on wide adoption of CA technology among beneficiary farmers. CA-SARD has done good to promote manufacturing but needs in future to involve all key players

in the implement supply chain within the CA technology promotion process. Future programmes must be developed together with such stakeholders to enhance their participation and input.

3.4.1.4 Farmers

This is the most important factor in the CA implements supply chain business because it determines the demand which is the most elastic for which it's potential has not yet been fully explored. Meaning that the CA equipment supply chain needs a critical mass of CA adopters to attain an equilibrium operating level not yet achieved. From the CA-SARD past effort it seems the manufacturing potential is already established to a reasonable level. It waits for a critical mass of demand for making the supply chain operational. For example there are only 3113 adopters within the CA SARD study area while the production capacity of rippers is more than 2000 units, the demand is however lower than supply dictated. The demand is dictated by how many farmers have adopted as well as the farmers' perceptions, affordability of equipment and purchasing power of farmers.

(i) Accessibility and affordability of CA Implements

In the current arrangement CA SARD has provided limited sets of CA equipment in the FFS groups for training and being the major accessible equipment for the farmers in the target locations. Perceptions on use affordability and accessibility are mainly based on this factor. The fact that most farmers in Tanzania rely on hand labour and animal traction also determines perceptions and affordability criteria. For example Table 10 shows that most farmers (88.4%) in the study area have access to animal traction and a few (20.6% and 35.9%) to single axle and two axle tractors, respectively.

Table 8: Proportion of farmers with access to various farm power sources for farm mechanization

Total	Access to animal power		Access to power tiller		Access to tractor power	
	Yes	no	Yes	no	yes	no
Karatu	89.7	10.3	10.0	90.0	32.5	67.5
Hanang	94.7	5.3	23.7	76.3	48.6	51.4
Babati	94.6	5.4	24.3	73.0	29.7	70.3
Arumeru	95.0	5.0	50.0	50.0	30.0	70.0
Arusha	81.8	18.2	27.3	72.7	40.9	59.1

Moshi	**76.2**	**23.8**	**7.1**	**92.9**	**33.3**	**66.7**
Total	**88.4**	**11.6**	**20.6**	**78.9**	**35.9**	**64.1**

This suggests that there is a more potential impact in promoting animal traction based CA implements than other sources of power. This is given footing by the fact that most farmers have indicated highest ability to purchase rippers (70%) and jab planters (79%), respectively the animal and hand labour based implements (Figure 9). These implements are more affordable and acceptable by the majority of farmers. The issue of acceptability and affordability is very important in adoption because a zamwipe, for example, costs 25 USD per piece (as cheap as a jab planter) but only 0.5% of the respondent households indicated ability to purchase them (Figure 10). Also a direct seeder is accepted by farmers to be more effective than a ripper because it combines key planting operations of opening planting furrow, drops seed and burries before pressing the soil on top. However the cost of the seeder is about 2 times as a ripper, such that only 11% of the respondents indicated ability to purchase them. Thus the human perceptions on cost and effectiveness of a product are very dynamic and needs thorough consideration during dissemination for effective adoption and impact.

Table 11 shows that most farmers depend on CA SARD supplies of CA equipment (73.7%) in their farm operations, a few have purchased own equipment (12.2%), a much smaller proprtion have hired (8.8%) and borrowed (6.3%) from friends. Credit and subsidy access was explored by only 0.4% of households. Hence the CA equipment demand among farmer adoptors is as low as 12.2%, where as a large proportion of adopters is yet translated to actual demand. It is supprising though that the question of limited supply of the equipment has not been major deterrent to fostering increasing demand ruther it was lack of understanding and convinction among farmers on performance of the equipment. Above all it seems affordability of the equipment rather is more pragmatic factor in adoption than availability because if thier perceptio is possitive farmers will look for the product they need from any remote source.

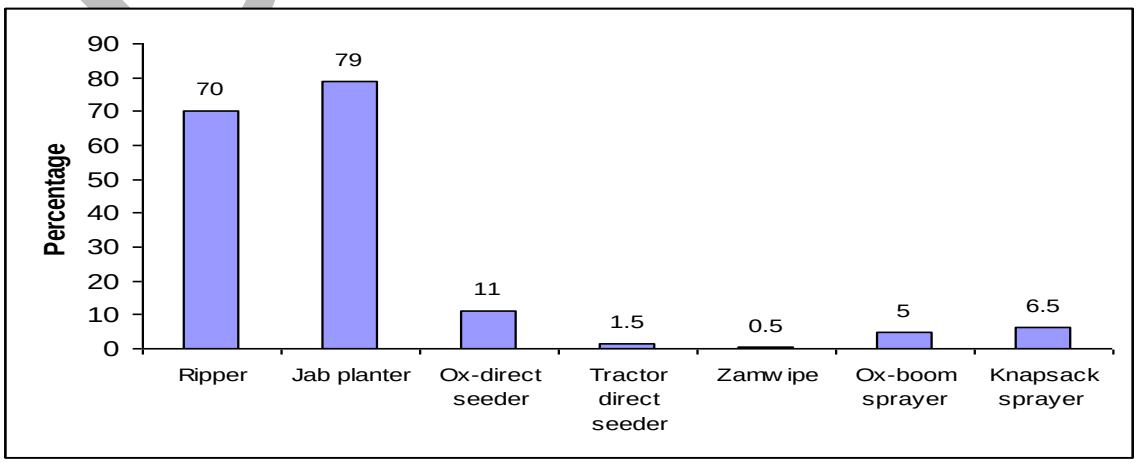


Figure 9: Proportion of farmers indicating ability to purchase the different types of CA implements

Table 9: The proportion of farmers indicating the different sources of implements they used in the 2008/09 season

Implement	CA SARD Project	Purchased	Subsidized	On credit	Hired	Borrowed
Ripper	96.6	2.6	-	-	0.9	-
Jab planter	95.0	3.0	-	-	1.0	1.0
Ox-direct seeder	85.2	7.4	-	-	6.2	0.4
Knapsack sprayer	74.4	2.3	-	-	2.3	20.9
Zamwipe	17.3	45.9	1.0	1.0	33.7	9.1
Mean	73.7	12.2	0.2	0.2	8.8	6.3

(ii) The role of CA service provision in the supply chain

Promotion of CA service provision is another intervention that CA SARD had devised to curb problem of farmers ability to purchase CA equipment. Table 12 shows that there is a high proportion of farmers with intention to offer CA services. For example in the 2008/09 season about 66.7% of farmers had offered at least one kind of service to fellow farmers. However the most frequent service offered was training (89.5%) on various issues in conservation agriculture.

Table 10: Proportion of farmers indicating involvement in offering various types of CA services

District	service providers	Types of service provided					
		Ripping	Jabbing	Direct seeding	Zamwipe	Knapsack spraying	Training
Karatu	70.0	9.5	14.3	4.8	4.8	4.8	100.0
Hanang	69.0	40.0	10.0	10.0	0.0	5.0	85.0
Babati	70.0	19.0	4.8	0.0	0.0	0.0	81.0
Arumeru	65.0	46.2	30.8	15.4	7.7	0.0	76.9
Arusha	73.3	27.3	36.4	9.1	9.1	0.0	100.0
Moshi	53.1	23.5	5.9	0.0	0.0	0.0	94.1
Average	66.7	27.6	17.0	6.5	3.6	1.6	89.5

This mainly constituted ushering theoretical concepts of CA to fellow farmers with some few practical aspects of use of CA implements. Services rendered

in actual CA operations such as ripping (27.6%), Jab planting (17%), direct seeding (6.5%) and glyphosate application (with zamwipe - 3.6% and knapsack prayer – 1.6%) were proportionally little. Most of these services were rendered to CA-SARD project beneficiaries using CA equipment provided by the project.

Also it was noted that most frequent service requested was ripping and jabbing, the most adopted CA technologies. The farmers charged reasonably for the service they offered and charging was almost the same in all locations (Table 13). Training to fellow farmers was free of charge suggesting that the approach where farmer train others could be much more intensified for cost effectiveness. Despite the reasonable charged tariffs farmers perceived that the equipment hire business was profitable.

There is therefore an opportunity to utilize the fact that there is a potential number of farmers in need of CA services and potential profitability of the business as a platform to ride on increasing demand for CA implements. In other words the other avenue to set the CA implements supply chain in motion is to fully develop and further encourage local hire service of the CA equipment.

Table 11: Costs charged by service providers in the study area in the 2008/9 season

District	Ripping	Jabbing	Direct seeding	Knapsack spraying	Zamwipe	Training
Karatu	**15000**	**10000**				**Free**
Hanang	**15000**			**2000**		**Free**
Babati	**15000**					**Free**
Arumeru	**15000**				**5000**	**Free**
Arusha	**15000**		**10000**			**Free**
Moshi	**15000**	**10000**				**Free**
Average	**15000**	**10000**	**10000**	**2000**	**5000**	**Free**

(ii) The policy incentives on CA equipment supply

Implement supply chain is a systematic economic activity that needs to be regulated by the government through policies, regulations and laws. Tanzania is committed to market economy whereby the private sector takes

the lead in driving economic growth while the State plays a regulatory role while creating an enabling environment for the private sector to operate. There are several policies and strategies guiding agricultural mechanization that influence operations of CA implement supply chain. The major policy having direct influence to the agricultural equipment supply is the Tanzania Agricultural Mechanization Strategy (TAMS). The thrust of this strategy is to improve agricultural production and productivity through commercialized crop and livestock production by increasing accessibility and availability of appropriate farm machinery and implements and value addition through agro-processing and rural based agro industries. The strategy aims at increasing the accessibility of farm power to farmers by facilitating the private sector to establish tractor hire service centres and support provided for local manufacturing of implements. The strategy points out several areas of intervention to enhance implementation and achieve the set objectives.

Most of the intervention points have been laid out in the Tanzania Agricultural Sector Development Strategy (ASDS) and implemented by the Agricultural Sector Development Programme (ASDP). The ASDP recognises that the "hand-hoe syndrome" among Tanzanian smallholder farmers is both a cause and symptom of rural poverty and strives to eliminate it. To this the ASDP emphasizes promotion and utilization of labour-saving technologies (such as appropriate forms of mechanization, conservation tillage techniques, etc.) as central to improvement of labour productivity. The ASDP implements some elements of the Sustainable Industrial (SI) Development Policy (1996) and Small and Medium Enterprises (SME) Development Policy (2003) among other policies. The SI Development Policy (1996) places emphasis on the promotion of small and medium industries, encouraging informal sector businesses to grow and formalize and in particular indigenous entrepreneurs, women, youth and people with disabilities. The SME Development Policy aims at increasing the contribution of Small and Medium Enterprises (SMEs) to the Gross National Product and export earnings as it recognises that the SME sector has the potential in creating jobs and contributing towards economic growth.

Two national policies the Cooperative Development Policy (1997) and National Micro Finance Policy (2000) both provides for strengthening collective economic bases of the farmers to enhance their ability to access agricultural equipment. Cooperative Development Policy (1997), which provides a framework for the restructured cooperatives to operate on the basis of independent, voluntary and economically viable principles. To implement this policy the government has developed a strong cooperative department and enacted relevant laws to regulate social cooperative groupings. To date a lot of savings and Credit Societies exist all over the country to extend microfinance services to poor farmers for easing access of the necessary agricultural equipment. This has quite well functioned complimentarily with the National Micro Finance Policy (2000) which aims at establishing a basis for the development of a micro-finance system that will serve low-income households, smallholder farmers, and small and micro enterprises.

Hence there exist ample incentive policy instruments for enhancing the manufacture or importing, stoking and retailing of CA implements with very reasonable business conditions. The microfinance policies also are geared to provide farmers with credit facility through microfinance services. It is upon the farmers to utilize the opportunities in place. However only some few farmers in the study area ever utilised the credit facilities in Arumeru (35%), Karatu (15%) and Babati (13.5%), Arusha (9.1%) and Moshi (9.3%) districts (Figure 10). Most of the farmers accessed credit from SACOS (83.3%), and a few from NGOs (12.5%) and Banks (4.2%) (Figure 11). There is still a big potential for farmers to access credit using the available facilities to increase demand of farm equipment and foster development of CA equipment supply chain. It was surprising though that the farmers indicated an increasing access of the credit facilities after having involved in CA SARD project (Table 14). About 62.2% of farmers had perceived that credit facilities increased, 8.9% remained the same and 28.9% indicated a decrease. The increase referred here may be attributed most to the development of FFS groups into savings and credit societies. This is signified by high dependence of SACOS in credit provision. Turning FFS groups into SACCOs seemed to be own farmers initiatives for which in future need to receive due attention. This is because SACCOs grouping and the resulting credit schemes are highly sustainable means to develop demand level for CA equipment.

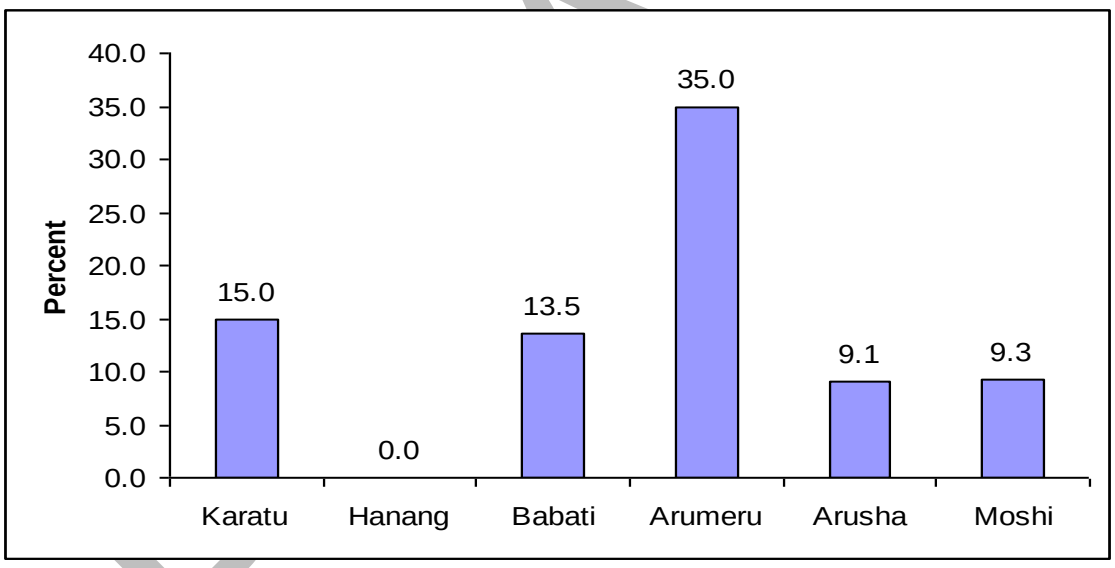


Figure 10: Proportion of farmers indicating access to agricultural credit in their lifetime

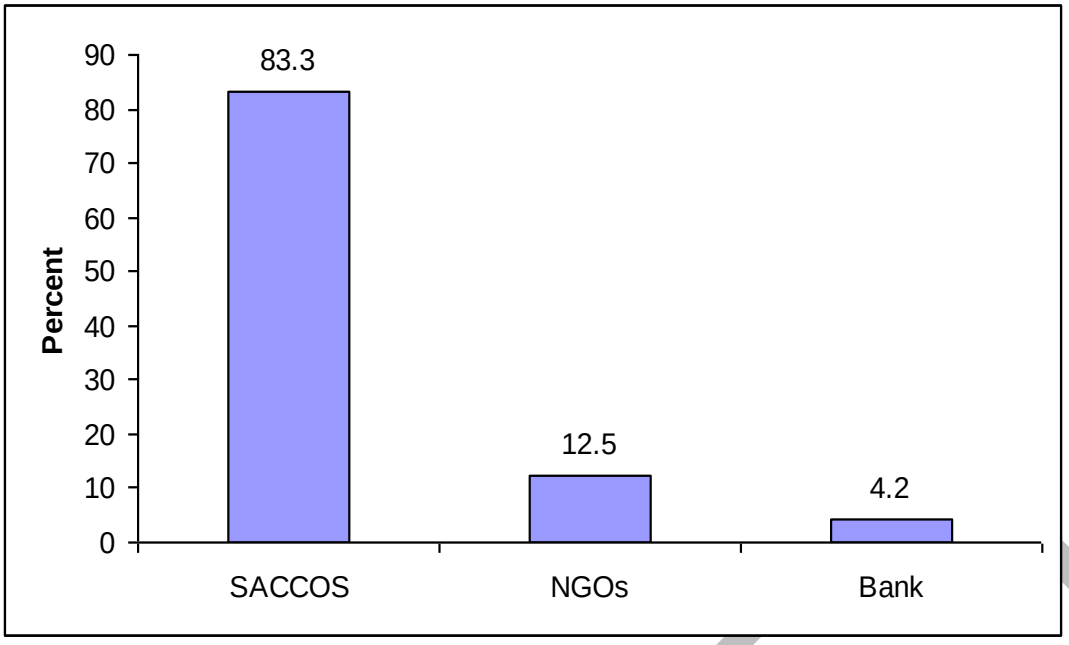


Figure 11: Proportion of farmers indicating sources of agricultural credit

Table 12: Proportion of farmers indicating availability of credit after involvement in CA SARD

District	Increased	Remained the same	Decreased
Karatu	**80.0**	**10.0**	**10.0**
Hanang			**100.0**
Babati	**100.0**		
Arumeru	**71.4**	**28.6**	
Arusha	**40.0**		**60.0**
Moshi	**45.5**	**9.1**	**45.5**
Average	**62.2**	**8.9**	**28.9**

Also the government has established the loan portfolio of the Agricultural Inputs Trust Fund for agricultural machinery (including both animal drawn implements and tractors) to increase access to financing for improvement of the uptake of mechanization technologies. This facility covers a wide economic spectrum of farmers: the poor, middle class and wealthy farmers alike. Also in the ten past years the government has implemented an incentive policy to zero taxing of agricultural equipment imports. This has increased imports of various types of machinery including those of

conservation agriculture, thus enhancing development of the equipment supply chain.

3.5 Agricultural Input Supply chain

3.5.1 The key players in the input supply chain

The input supply chain is very similar to the equipment supply chain only that Tanzania has no manufacturing industry for the inputs which are mainly the agrochemicals. Almost all the agrochemicals used in Tanzania are imported from outside the country. Before major economic reforms in the mid 1980s with government dominance, Tanzania Fertilizers Company (TFC) and Agricultural Input Supply Company (AISCO), both the public companies, were sole importers of fertilizers and other inputs, respectively. After the reforms several private companies have entered into the business where as the government regulates the importing business through TFC. The schematic representation of the input supply chain is shown in Figure 12. Players in the input supply business range from importers, transport companies, stockists, financial institutions, government policy and regulatory authorities.

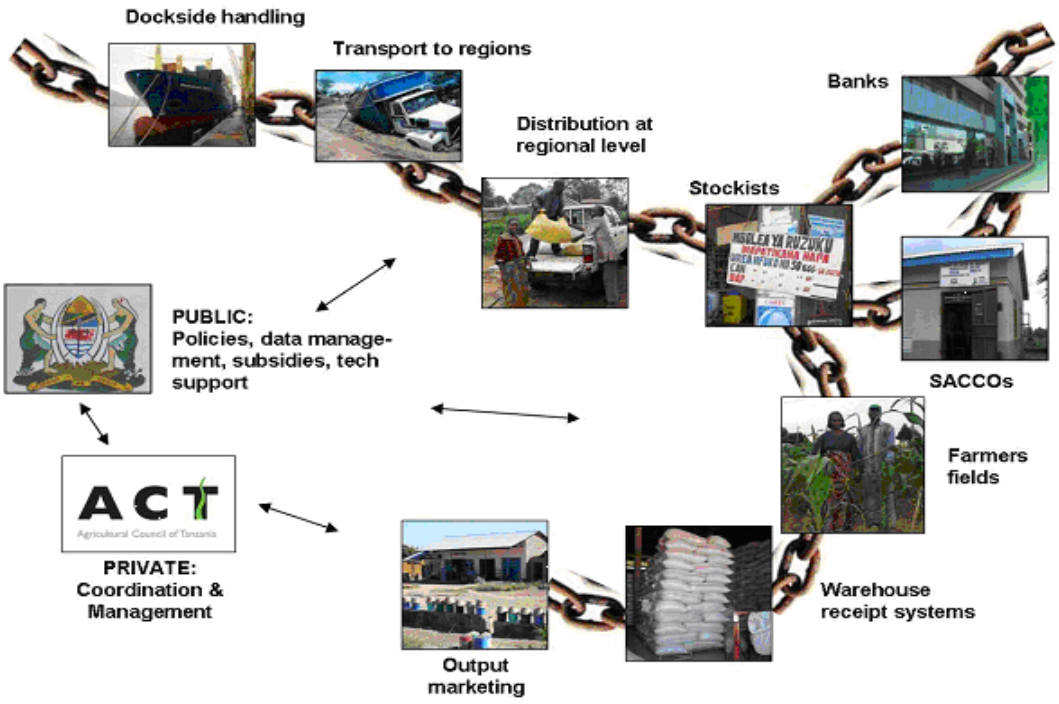


Figure 12: Schematic representation of the Tanzania input supply chain

3.5.1.1 Importers, stockists and retailers

Primarily the importers have to be registered by the ministry of agriculture food and cooperatives (MAFC) who maintain the catalogue of importers for the purposes of regulation. Main importers of inputs are the TFC, Mohamed

enterprises, STACO limited, Premium Company limited, Seif Impex limited, and Collman (T) Limited. Other companies are Balton Tanzania Limited, Tanganyika Farmers Association, TLTC limited and Dimon company limited. The later two companies specialize in imports and supply of inputs for tobacco producing areas. Among other companies TFA and Balton (T) limited have main activities in northern Tanzania where CA SARD operates. The importers supply the needed inputs to stockists spread all over the country. Sometimes the importers play the role of stockists extending business tentacles to regions near the prospective retailers.

A good example of this is the two companies working in northern Tanzania, TFA and Balton (T) limited. TFA stocks the inputs but at the same time operates retail outlets mostly to districts headquarters. There are several other retailers or agro-dealers spread to small townships and sometimes in remote villages. In the study area most of these outlets are within 3 km reach (57.6%) (Table 15). However in some instances the input retail outlets are between 4 – 10 km distance away from residences and a few in more than 11 km away. Retail business is the most important component in the input supply chain because it ensures access of the products to the end use farmers who can not reach out to long distances. Hence access to inputs for the smallholder farmers in indicated by the development of retail business.

Table 13: Proportion of farmers indicating distances from residences where they accessed inputs during the 2008/09 season

Type of input	Less than 3km	4-10 km	11 – 20 km	More than 20 km
Main crop seed	73	38	9	15
Cover crop seed	58	29	8	15
Fertilizers	45	23	2	11
Insecticides	59	34	8	12
Herbicides	53	35	7	13
Mean	57.6	31.8	6.8	13.2

3.5.1.2 Credit facility

The government of Tanzania has instituted the input trust fund as per the Agricultural Inputs Trust Fund Act of 1994 to facilitate credit access for all players in input supply business. Also policy has facilitated enabling environment for operation of commercial banks which offer suitable credit facilities and products for the private business including input dealers at any level. Connected to this, are the SACCOs institutions with network down to grass-root level, which play an important role of credit provision to low income households. This is the most accessible source of credit for most farmers in CA-SARD operating areas. CA-SARD has not directly intervened

on enhancing accessibility of inputs, but most farmers indicated an increase to access of inputs after involvement in CA SARD project (Table 16).

This may be related to the development of SACCOs facilitated credit access resulting from the FFS group dynamics due to project involvement. The study did not have access to baseline data but the data collected indicated that a considerable proportion of farmers (between 65.1% and 85%) used inputs. This is on the high side as far as smallholder farmers in Tanzania are concerned. In a recent impact study of a Participatory Agricultural Development and Empowerment Project (PADEP), only 29.5% of the beneficiaries in sample districts of Tanzania mainland and Zanzibar used to inorganic fertilizers. The high use of fertilizers may be due to low level of soil fertility necessitating this practice to sustain productivity. However, fertilizer use in this study did not discriminate use of manures. This is the area where most farmers are livestock keepers so use of manure is a common practice among farmers.

Table 14: Perception of farmers on the trend of access of inputs over the past five years (% of respondents)

Type of input	Increased	Remained the same	Decreased
Main crop seed	79	14	7
Cover crop seed	40	19	40
Fertilizers	68	18	13
Insecticides	70	24	6
Herbicides	53	35	12
Mean	62	22	15.6

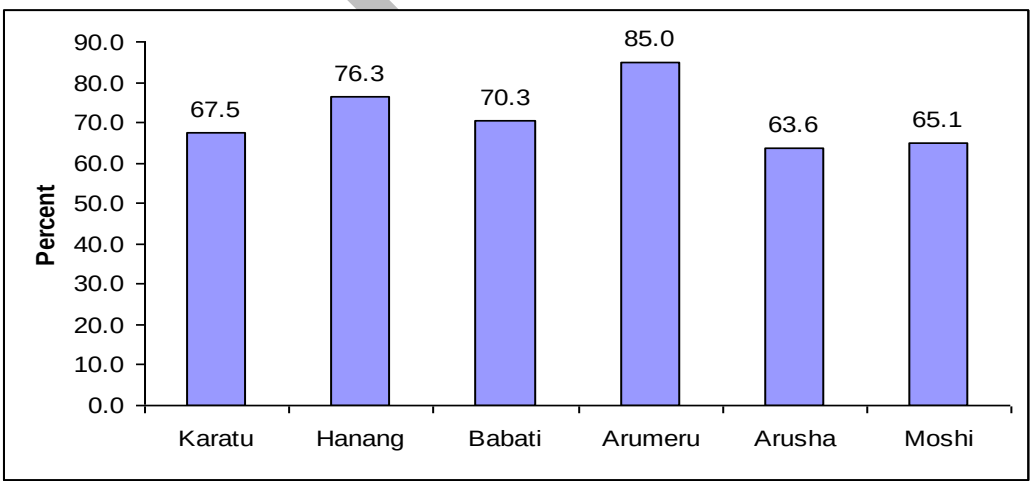


Figure 13: Proportion of farmers who used fertilizers in the 2008/09 season in the respective districts

3.5.1.3 Policy incentives on input supply chain

Government has put in place several policies to regulate and facilitate efficient and affordable supply of inputs. Most important is the input subsidy which has benefited many poor farmers. Although not sufficient but some 96 bill Tshs were used for the scheme in the 2009/10 season and 126 bill Tshs have been budgeted for the 2010/11 season. This scheme does not benefit all the needy farmers and therefore its impact is limited to the direct beneficiaries of the scheme. In this study only 20% of the farmers interviewed benefited from the scheme mainly fertilizers (58.6%) and seed(39%). Most farmers (72.3%) purchased their own inputs including those used in conservation agriculture such as cover crop seed (83.3%) and herbicides (93.5%). This is a good indication of self-sufficiency among farmers which can be harnessed for the good of promoting CA. It seems farmers in this area have understood the importance of using inputs to enhance production. The project needs to understand that if farmers have not adopted CA it is because the project has not sufficiently trained them not because they are laggards.

Table 15: Proportion of farmers (%) indicating diferent sources of inputs they used during the 2009/10 season

	CA SARD Project	Purchased	Subsidised	Loaned	Own source
Main crop seed	2.1	55.3	39.0	0.7	2.8
Cover crop seed	11.1	83.3	0.9	-	4.6
Fertilizers	4.3	37.1	58.6	-	-
Insecticides	6.3	92.0	1.8	-	-
Herbicides	6.5	93.5	-	-	-
Mean	6.1	72.3	20.1	0.1	1.5

3.6 Impact of CA SARD on Food Security and Income

As pointed out earlier CA SARD seeks to contribute to higher level development goal of reduced rural poverty and food insecurity through sustained agricultural growth geared by wide adoption of conservation agriculture technologies. This section evaluates the extent to which the set objectives have been achieved. Figure 14 shows the extent to which beneficiaries and non beneficiaries have attributed some impacts to CA SARD project.

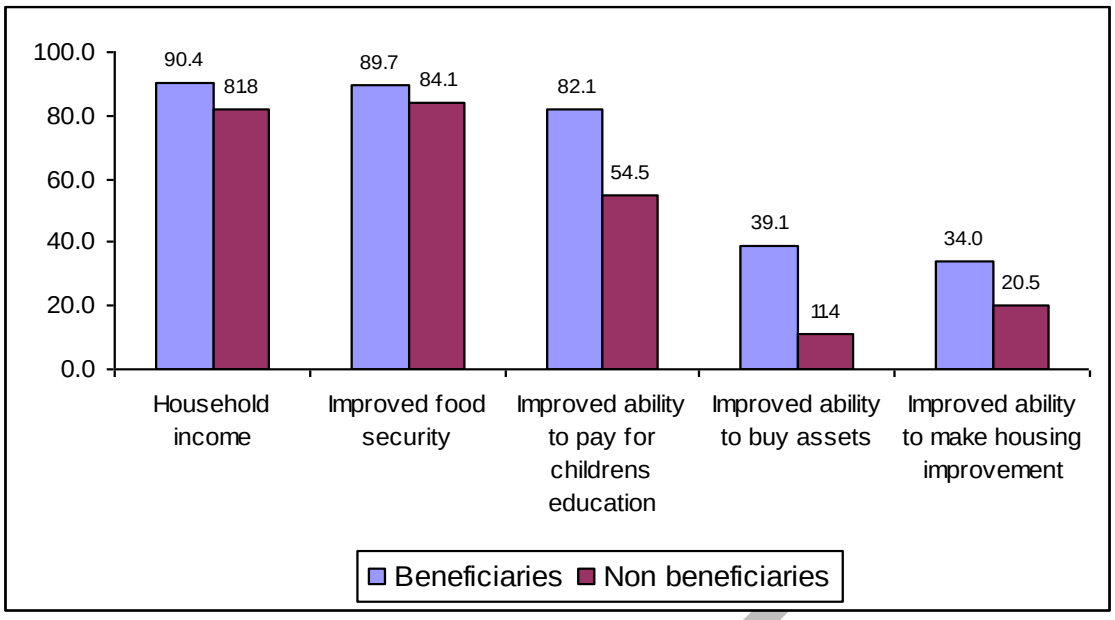


Figure 14: Proportion of farmers attributing some impacts to CA SARD project

Both non beneficiaries and beneficiaries attributed improvement to household income, food security and ability to pay for children education to CA-SARD project. The extent was lower with beneficiaries than non beneficiaries. The small difference is due to the fact that many of the non beneficiary respondents had already developed interest and have started adopting some of the components of CA. However there is an indication that income was significantly higher with beneficiaries that non beneficiaries. This is because there were only 54.5% of non beneficiaries who were able to pay for children education as compared to 82.1% of the beneficiaries. Also only 11.4% of non beneficiaries could buy assets as compared to 39.1% of beneficiaries. This suggested that project beneficiaries had accumulated much more income from CA based agricultural enterprises that non beneficiaries.

3.6.1 Impact on Food security

Majority of farmers who participated in CA SARD were able to sustain own food production (90.5%) and purchase supplementary food (71.3) in times of poor production due to bad seasons (Figure 15). Own food is ranked as first priority source of food followed by purchasing food from other sources. This is a prime indicator of food security that ensures self sufficiency. Farmers of this sort have accumulated enough income during good seasons which they use to buy food during bad seasons.

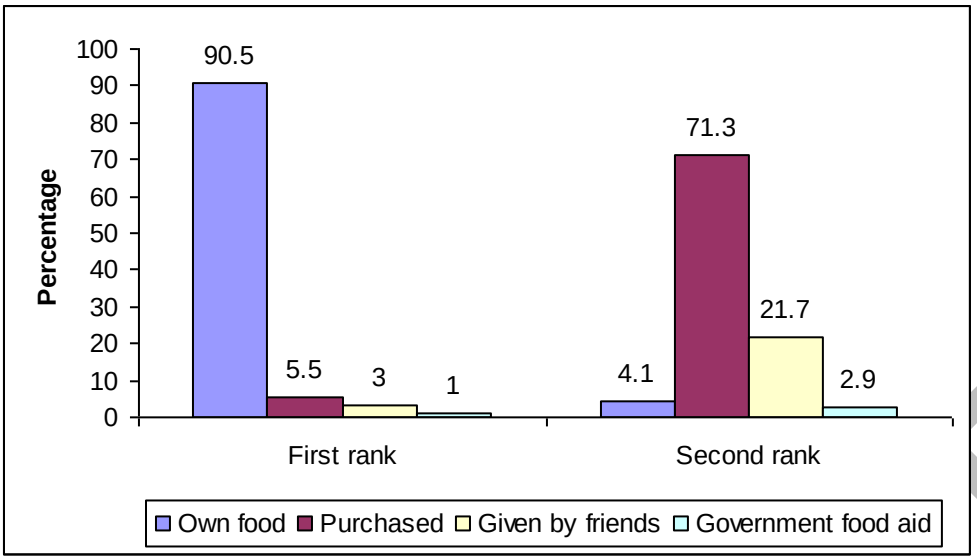


Figure 15: Ranking of the various food sources in the households which benefited from CA SARD project

Project beneficiaries also had sustained food reserves for relatively longer period (5 months) in a year than non beneficiaries (4 months). Sustainable periods of food reserve are longest in Karatu (8 months) and shortest in Moshi (4 months) which is more related to weather conditions being more favourable in the former (Table 18). However there was no significant difference in the number of meals consumed by the non beneficiaries and beneficiaries which is about 3 meals a day. When asked to indicate if food security has increased over the past three years, the majority (88.4%) of project beneficiaries were of the opinion that their household food security base has improved during the past three to five years (Table 19). They attributed the improvement to the increase in productivity resulting from adopting conservation agriculture.

Table 16: Average number of months per year and meals per day a household is able to feed itself without external support

	Mean number of months per year		Mean number of meals per day	
District	Beneficiaries	Non beneficiaries	Beneficiaries	Non beneficiaries
Karatu	8	5.0	2.8	2.8
Hanang	6	3	2.9	2.9
Babati	4	-	3.0	-
Arumeru	4	-	2.9	-
Arusha	4	-	2.6	-
Moshi	4	-	2.9	-
Total	5	4.	2.9	2.8

Table 17: Proportion of respondents attributing improvement of food security in their households in the past 5 years

District	Improved	Remained the same	Decreased
Karatu	**80.0**	**7.5**	**12.5**
Hanang	**97.3**		**2.7**

Babati	**94.4**	**5.6**	
Arumeru	**94.4**		**5.6**
Arusha	**72.2**	**11.1**	**16.7**
Moshi	**87.5**	**2.5**	**10.0**
Average	**88.4**	**4.2**	**7.4**

3.6.2 Impact of CA SARD on income

Income security is also a target to be achieved by the project. A household that is income secure has better chances to meet basic needs than the household that is income insecure. The introduction and implementation of CA-SARD has enabled cost effective production enterprises which yielded sustainable benefits. Majority of the beneficiaries (67.7%) indicated that they practiced conservation agriculture as cost effective production measures in the first priority enterprises (Table 20). Farmers normally classify farm plots according to perceived priority. The first priority enterprises are those which are considered most important in terms of contribution to income and food security. In this respect fewer beneficiary farmers (26.7%) practiced CA in second priority plots. For non beneficiaries the adoption of CA was low, hence a few of them practiced CA in either first or second priority enterprises.

Table 18: Proportion of respondents indicating application of conservation agriculture in their farming enterprises for the 2008/09 season

	First priority enterprise		**Second priority enterprises**	
	Beneficiaries	**Non beneficiaries**	**Beneficiaries**	**Non beneficiaries**
Karatu	**76.7**	**20.0**	**60.0**	
Hanang	**79.3**	**44.4**	**27.8**	**33.3**
Babati	**56.7**	**14.3**		
Arumeru	**75.0**			
Arusha	**100.0**		**33.3**	
Moshi	**38.7**			
	67.7	**15.9**	**26.7**	**33.3**

The interesting observation has been that both the beneficiary and non beneficiary farmers have been practicing intercropping. However, beneficiary farmers have adopted more intercropping systems than non-beneficiaries.

There were 14 intercropping systems practiced by beneficiaries as compared to 6 practiced by non beneficiaries (Table 21). The only explanation for this could be there was direct facilitation by the project on the beneficiaries who were introduced to various types of cover crops cultivars. When asked whether participation in CA SARD has influenced income, the majority of both beneficiaries (95.7%) and non beneficiaries (81.3%) indicated that income has increased after being involved in CA SARD (Figure 16). This is attributed due to increase of yield resulting from adoption of CA. Most beneficiary farmers (61.2%) and some non beneficiaries (42.3) have also indicated that income from CA is very reliable (Table 22). This is due to sustainable nature of CA productivity despite the variation in household income.

Table 19: Proportion of beneficiary farmers indicating the various cropping systems applied in the 2009/10 season as first priority enterprises

Serial	1	2	3	4	5	6	7
District	Maize-pigeon peas-beans	Maize-pigeon peas lablab	Maize beans	Maize pigeon peas	Maize pigeon peas pumpkin	maize lablab	Maize
Karatu	10.0	13.3	3.3	50.0		3.3	3.3
Hanang	17.2	20.7	6.9	17.2	3.4	10.3	
Babati	3.3	6.7		70.0		6.7	
Arumeru		10.0	40.0	30.0			10.0
Arusha		13.3	13.3	6.7		60.0	
Moshi		3.2	71.0			9.7	12.9
Total	**5.8**	**11.0**	**22.6**	**31.0**	**0.6**	**11.6**	**4.5**

Continued	8	9	10	11	12	13	14
District	Maize chick peas beans	Maize pigeon peas sunflower	Maize pigeon peas sunflower beans	Maize pigeon peas beans lablab	maize, pigeon pea lablab	maize, lablab, beans	Maize sunflower
Karatu	3.3	3.3	3.3	6.7			
Hanang				17.2	6.9		
Babati		6.7	6.7				
Arumeru						10.0	
Arusha				6.7			
Moshi							3.2
Total	**0.6**	**1.9**	**1.9**	**5.2**	**1.3**	**1.3**	**0.6**

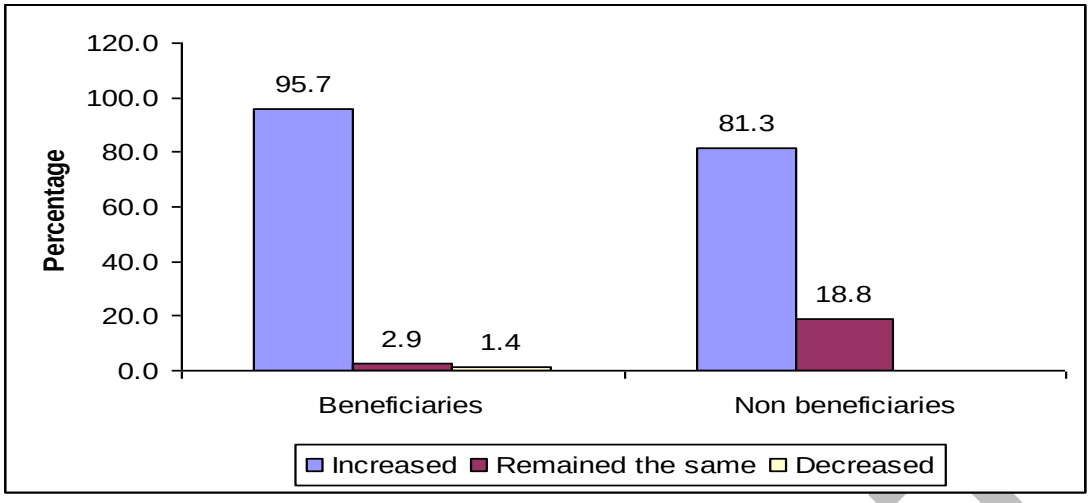


Figure 16: Proportion of farmers indicating status of income after being involved in CA SARD

Table 20: Proportion of farmers who benefited from CA SARD indicating reliability of income from CA

District	Direct beneficiaries			In direct beneficiaries		
	Very reliable	Somehow reliable	Less reliable	Very reliable	Somehow reliable	Less reliable
Karatu	**63.3**	**36.7**		**33.3**	**66.7**	
Hanang	**57.1**	**39.3**	**3.6**	**71.4**	**28.6**	
Babati	**64.3**	**35.7**		**25.0**	**50.0**	**25.0**
Arumeru	**70.6**	**23.5**	**5.9**			
Arusha	**66.7**	**25.0**	**8.3**			
Moshi	**50.0**	**50.0**			**100.0**	
Total	**61.2**	**36.7**	**2.2**	**43.8**	**50.0**	**6.3**

The smallholder farmers in Tanzania are known to have small land holdings. This situation is even more serious in northern Tanzania where land is scarce. Nevertheless, farmers in the study area have practiced intercropping with leguminous cover crops in almost all available land put to agriculture. Land area under intercropping was as high as 16 acres per household at an average of 2.4 acres in the overall (Table 23).

Table 21: Mean land area under conservation agriculture for the first priority agricultural enterprise

District	**Land area enter 1 (acres)**
Karatu	2.2
Hanang	1.9
Babati	4.1
Arumeru	2.0
Arusha	2.1
MoshI	2.0
Total	2.4

Gross margin analysis considered only the enterprises under CA and particularly with various intercropping systems. Gross margins varied

significantly from Tshs. 595,986 with maize-lablab to Tshs. 1,760,000 with Maize-pigeon peas-beans-sunflower. Maize-pigeon peas-beans, Maize-pigeon peas-beans-lablab and Maize-pigeon peas-beans-sunflower cropping systems were most profitable systems. Interestingly the more the crop type combination is used the more stable the income and profit is realized. Maize pigeon peas intercrop seems to be the most profitable where as maize-lablab being the least profitable. It was evident from other research that maize-lablab intercrop results to reduced yield of both crops due to strangling behaviour of climbing type lablab. The yield reduction is up to 40% of maize crop (ARI Uyole, 2003). Intercropping was found to be the most widely adopted component of CA in all the project districts. The advantages of this is clearly outlined in the by farmers perceptions earlier on that; it is a food security insurance, produces sufficient biomass for soil amelioration, provision of livestock feed and for adequate soil cover needed as a prerequisite condition for conservation agriculture.

Table 22: Gross margin of the most important cropping enterprises based on the 2008/09 season costs and revenues

Cropping enterprise	Gross Margin	Rank
Maize pigeon peas beans sunflower	1760000	1
Maize pigeon peas beans	1459638	2
Maize pigeon peas beans lablab	1342900	3
Maize	1187000	4
Maize beans	1175573	5
Maize pigeon peas	962324	6
Maize pigeon peas lablab	858242	7
Maize lablab	595986	8

4 CONCLUSIONS

4.1 Institutional empowerment

i. The impact assessment has found that the interventions of the project have strengthened capacity of institutions involved in implementing various activities at district, community level, farmers groups and NGO institutions. At district level the project has built capacity of the extension experts in promotion of CA among farmers in the local areas. At farmers level farmers have been empowered to build groups of knowledge exchange and technology dissemination among themselves. The groups have developed into perpetual cohesive SACCOS which can be used to enhance access of credit for purchasing CA implements. Some of the groups have emerged to be entrepreneur business groups for CA service provision.

ii. The NGOs like RECODA and CPAR have now capacity to carry out CA promotional activities on their own initiatives. In future CA-SARD can use these institutions for cost effective promotion of CA technologies. The involvement of the ministry of agriculture and the local government authorities have enhanced capacity of the staff of

respective institution to realize the relationships between the private and public service delivery to farming communities. Also at community level involvement of Farmer-farmer trainers in managing and implementing training activities have enhanced capacity of farmers in disseminating CA technology to fellow farmers.

4.2 Extent of Reach, Adoption and Impacts

i. The number of farmers that project has directly reached (about 3500) over the two phases of the project is not much compared to the resource pool extended. This is because by the project design, there was no incentive for the farmer-farmer trainers to task themselves towards reaching a larger section of farmers. There was a higher dependence of Extension officers cum group facilitators who could not make the needed impact. It was crystal clear from the findings that impacting of skills and adoption was much more evident in areas where there were a greater number of farmer-farmer trainers in addition to the extension officers.

ii. The most adopted CA technologies were ripping (80.8%), use of direct seeder (56.4%) and jab planter (71.8%) in the the same extent in all the agro ecological locations in the study area. The use of CA implements was always going together with planting of cover crops. Adoption of improved seed use of glyphosate in weed control, proper plant spacing was patchy.

iii. Intercropping was found to be the most widely adopted component of CA in all the project districts. The advantages of this is clearly outlined by farmers perceptions that; it is a food security insurance, produces sufficient biomass for soil amelioration, provision of livestock feed and for adequate soil cover needed as a prerequisite condition for conservation agriculture. Maize-pigeon peas-beans, Maize-pigeon peas-beans-lablab and Maize-pigeon peas-beans-sunflower cropping systems were most profitable cropping systems. The more the crop type combination is used the more stable the income and profit is realized.

iv. Participation in CA SARD has increased farmers income, food security and ability to pay for children education. The Project beneficiaries also had more sustained food reserves for relatively longer period in a year than non beneficiaries.

4.3 The CA Equipment and Input Supply chain

i. The CA equipment supply chain is still undeveloped because of the mismatch between low equipment demand and potential high supply. The project was successful enough in supporting the supply management side of CA equipment but has not yet been able to establish the matching demand. Despite of a success in reaching a

number of adopters the CA equipment demand among farmer adoptors is as low as 12.2%, where as a large proportion of adopters is yet translated to actual equipment demand. There is still needed effort to concretise training so as to make farmers understand and be convinced that the CA equipment make the difference in their business carrier.

ii. Also affordability and positive perception of the farmer on the equipment rather than availability, is more determinant in adoption because some farmers were able to reach distant locations to get the equipment they were convinced that they are useful. Inconnection to this; the SACCOs institutions are the most convenient arrangement for microfinacing of equipment and input supply and to address the question of affordability of CA equipment. In a way the SACCOs groupings and the resulting credit schemes are highly sustainable means to develop demand level for CA equipment.

iii. The government of Tanzania has provided some incentive policies which have created favourable environment for enhancing development of CA equipment manufacturing and inputs supply for the farming business. Some farmer beneficiaries have benefited from the input subsidy.

iv. Ample incentive policy instruments exists for enhancing the manufacture or importing, stoking and retailing of CA implements with very reasonable business conditions. The CA equipment supply chain has not yet fully utilized the opportunity.

v. Equipment hire service in an opportunity to available to foster equipment demand because there are a potential number of farmers in need of CA services which are potentially profitable for the local providers. The project has not yet fully utilized local service provision business as a platform to ride on increasing demand for CA implements. Increased effort towards promoting CA service provision can make astronomical difference in the technology uptake adoption and impact because the same service providers can be pundits in CA technology dissemination

vi. Equipment manufacturing firms such as Nandra Engineering Ltd and Intermech have done well in terms of equipment adaptations to local conditions however there was limited linkage with the national agricultural research system expected to offer the needed backstopping to the manufacturers. Collaboration between manufacturers and the engineering research institutes would have provided our farmers with a wider range of appropriate adaptable technologies needed to enhance development of CA in the country.

4.4 Involvement of collaborating institutions

Involvement of institutions in implementing project activities was the strongest component in the sustainability of the project. There is already indication that the institutions involved have laid foundations for future initiatives in CA promotion in the area. The foundations laid out can be useful for future projects to ride on and stepping stones to higher heights of CA promotion in the region.

5 RECOMMENDATIONS

i. For sustainability purposes, the district councils with facilitation of ASDP, should be encouraged to facilitate farmers to engage in private service provision of CA technologies to bridge the gap that is created by inadequate public extension service. The use of Farmer-farmer extension service must be encouraged for efficiency in knowledge transmission as well as for cost effectiveness. The prospective future initiatives need to assist the LGA to put this structure in place.

ii. In connection to above recommendation, while there is commendable extent of adoption there still a need to strategise so as to fasten the adoption rate. One of the strategies would be to promote further, the local CA service providers who should be moulded to become paraprofessionals benefiting from service provision business but at the same time disseminating knowledge to fellow farmers.

iii. CA-SARD has done well to promote manufacturing but needs in future to involve all key players in the implement supply chain within the CA technology promotion process. Future programmes must be developed together with all stakeholders in the CA equipment supply chain to enhance their participation and input. Involvement of the manufacturers alone has failed to link supply with demand. Also there there is still needed effort to concretise training so as to make farmers understand and be convinced that the CA equipment make the difference in their farming business.

iv. The project must provide in its objectives the strengthening convention of FFS groups into SACCOs institutions for microfinacing of equipment and input supply and to address the question of affordability of CA equipment.

v. Concerted strategy and action is needed for the future project activities to fully benefit from the opportune incentive policies for enhancing development of manufacturing importing, stoking and retailing of CA equipment and inputs.

vi. Collaboration between manufacturers and the engineering research institutes needed backstopping would have provided our farmers with a wider range of appropriate adaptable technologies needed to enhance development of CA in the country.

vii. The participation of NGOs in project implementation was very useful and cost effective. However these institutions were taken on board well after the project inception for which they were not fully committed deliver to project expectations. Despite the successes the going was not as smooth as planned. Such key Institutions need to be involved from the beginning of project planning so as to harness their full enthusiastic participation and make use of their resource endowments to make the project resources more cost responsive.

6 DOCUMENTS CONSULTED

Appendix 1: Itinerary and Names of People Met

Date	Activity	Names of people
1 – 6 August 2010	Review of documents	
3 August 2010	Meeting with National CA SARD coordinator	Eng. Richard Shetto
6 – 8 August 2010	Meeting National CA SARD facilitators in Arusha	Wilfred Mariki Marieta Owenya
7 – 8 August 2010	Pre-testing of the questionnaire and training of enumerators at Arusha	Wilfred Mariki **Marieta Owenya**
7 August 2010	Meeting with key stakeholders in input supply chain in Arusha	Dr. Mbano the Loan Processing and disbursement officer of the Input Trust fund
8 August 2010	Meeting with district extension officer responsible for mechanization in Babati district also the Babati district CA SARD facilitator	Mr. Aley Mbisse
9 August 2010	Meeting with RECODA management	Dominic Ringo ang Catherine Magunzu
10 August 2010	Meeting at DALDOs office at Karatu **In-depth interview Tloma village Karatu District** **Meeting with CA SARD collaborator at CPAR Karatu**	Emmanuel Njumbo – DALDO Karatu Miss. Hoise Baida CA SARD district facilitator Mary Maeda VEO – Matowa village Farmers in FFS group – chairman Mr. Damian B, Neema Japhet Emmanuel Programme Manager Deo Ngotio – Project officer
12 August 2010	Meeting at Hanang DALDO's office Continued with indepth interview	Mr. Lukumay – Crops officer
13 August 2010	Meeting at DALDO Babati office Continued with in-depth interview at Gidabagar, Ng'wang'weri and galapo villages	Mr. Husein Kilonzo DALDO Babati Sophia Kilonzo Extensio officer
14 August 2010	Discussion with farmers with Parachichi FFS group in Moshi district **Continued with in-depth interview in**	Farmer group
17 August 2010	Continued with in-depth interview in Makuyuni village Moshi district Visited Samada Engineering company limited - had discussion with director Visited Moshi district council DALDOs office	Kassim Khatibu Mongi VEO Kilimo Makuyuni Samwel Moshi Director PFM 200o Director Fridolon Mpanda Agric Engineer
18 August 2010	Meeting with DALDO Arumeru	Grace Solomon DALDO Arumeru district
19 August 2010	Discussion with CA SARD facilitators	Mr. Wilfred Mariki

	in Arusha	Mrs. Marieta Owenya
20 August 2010	Visit to Nandra engineering company Ltd discussion with director	
24 August 2010	Discussion with InterMech Ltd Morogoro, Kihonda Industrial area	Engineer Chisawilo

Appendix 2: Terms of reference for Conservation Agriculture Farmer Field School Consultant July 2010

I. INTRODUCTION

The African Conservation Tillage Network (ACT) in partnership with Food and Agriculture Organization of the United Nations (FAO), and Ministry of Agriculture Food and Cooperatives (MAFC) of the United Republic of Tanzania through Selian Agricultural Research Institute (SARI) are involved in the implementation of Conservation Agriculture Project (CA-SARDII) in Arusha, Karatu, Babati, Hanang and Moshi districts. The project is being implemented through the farmer field school FFS approach with each district having an average of 10 FFS comprising of 25-30 farmers. The extension wing of the ministry of agriculture MoA are the direct implementers of the project on the ground in collaboration with local partners.

The purpose of CA-SARD project is to contribute to the promotion of growth and improved food security in Tanzania through the scaling up of conservation agriculture (CA) as a sustainable land management (SLM) tool.

CA-SARD project has been implemented in the 5 districts since 2004 with phase 1 ending in 2006 and 2nd phase starting from 2007 to 2010. In both phases, emphasis has been put in using the farmer field school approach to introduce the technology to the farmers then focus on individual farmer adoption afterwards. The groups targeted in phase 2 are different from those involved in phase one hence there exist a critical mass in every district of farmers exposed to CA technology. The project approach has been holistic in articulating cross cutting issues complimenting adoption of CA technology by smallholder farmers. These include involvement of private sector especially the input supply chain, CA implement supply chain, agro-processing and market access. Since its inception, the project has played a critical role in providing a benchmark and lessons for establishment of new projects by new players in the agricultural sector. It is based on the above multi-diversity nature of the project that the project coordination team have agreed to carry out M&E impact study to map out the extent of adoption of CA in the country and specifically in the project districts.

Specific tasks

Under the overall technical supervision of the M&E officer, the study consultant will undertake the following;

- Determine how many CA - FFS groups established in both phase 1 and 2 and by interacting with group members, district coordinating team and National Project Coordinator establish the adoption extent in every district.

- Identify the most preferred CA option adopted by farmers under various AEZ and reasons for success and challenges.
- Inventorize at national and local level key institutions/projects involved in promotion of CA as a result of interaction with CA-SARD with specific emphasis on the location, what they do, target group and outcome.
- Map out the input supply chain and determine accessibility and affordability of farm input to the target group.

- Map out the CA implement supply chain with specific emphasis on the key players involved, utilization of the implement by the groups and individual

farmers, hire service provision by local entrepreneurs, accessibility and affordability.

Expected output

- Number of farmers reached through the CA farmer field schools by gender, village and age group (Phase 1 and 2)
- Number of CA adopters for each FFS group by gender, village and age group.
- Analysis of most preferred CA options adopted by farmers.
- Synthesis of challenges and successes of CA adoption
- Data base of national and local level key institutions/projects involved in promotion of CA (NGOs, Government agencies,CBOs, equipment manufactures, input suppliers, training institutions, projects)
- Gross margins for selected enterprises under CA.

Deliverables

- Submission of data collection methodology and tools.
- Presentation of the preliminary findings of the study.
- Submission of zero draft reports
- Submission of final Detailed study report

Requirement

- A minimum of Msc in agriculture or related field.
- Practical experience in data analysis software packages (SPSS etc)
- More than 5 year experience in rural development initiatives involving data collection analysis and reporting.
- Excellent communication skills especially in English and Kiswahili
- Experience in Conservation agriculture would be an added advantage
- Experience in Farmer Field School (FFS) approach would be an added advantage
- Computer literate (Microsoft suite)

Consultancy duration breakdown

Activity	**Days**
Development of data collection tools	1
Briefing/consultation/debriefing sessions with ACT and NPC	2
Field work – collecting information and local stakeholders (4 days per district * 5 districts plus travel)	20
Meeting/interviewing key stakeholders at national level	2
Report compilation	5
Total	30 days

Application deadline
20th May 2010

How to apply
Suitable candidate will be required to submit a budget based proposal on how they intend to undertake the assignment together with an updated CV and application letter.

To
African Conservation Tillage Initiative (ACT)
P.O Box 10375-00100
Nairobi, Kenya
Email: info@act-africa.org

Appendix 3: CA-SARD Impact Monitoring Study Questionnaire for Household In-depth Interviews

Name of Respondent: ……

Identification: (P if in CA-SARD subproject and N if Not) ……..

District …… Village: ……

Date of Interview: …… Name of Interviewer…….

SECTION A: BASIC INFORMATION

A1. Age of the respondent ……(Years)

A2. Gender of the respondent 1=Male 2=Female

A3. Level of education (Enter years of schooling as appropriate)
Primary Secondary Adult education Other (Specify) None

A4. People living in homestead

Children (0-17)		Adults (18-59)		Elderly (>60)	
M	F	M	F	M	F

A5. Does the household have access to animal draught power? 1=yes, 2=no ☐

A6. Does the household have access to 2 wheel tractor power? 1=yes, 2=no ☐

A7. Does the household have access to 4 wheel tractor power? 1=yes, 2=no. ☐

SECTION B: EMPOWERMENT (*Only for Farmers in CA-SARD project***)**

B1. Have you ever attended any type of training organized by CA-SARD? 1=yes, 2=no ☐

B2. If yes, please provide the following information.

Type of training	Type of skills gained	Ever used the skills gained?	
		Yes	No
1	1.		
2	2.		
3	3.		
4	4.		
5.	5.		
6.	6.		

B3. If you have not been able to use the knowledge and skills gained, what are the major reasons?

……

……

……

……

SECTION C: ADOPTION OF TECHNOLOGIES

C1. Have you ever used any of the following practices (for crops)? (*Both for CA-SARD and non-CA-SARD farmers*)

Type of Technology (√ if used and X if never used)	Source of knowledge	Whether farmer has ever discontinued adoption of technology			
		Yes	Main reason for discontinuation	No	Main reason for continuation
i) Minimum tillage					
Ripping					
Planting basins					
Pot holing					
Jab planter					
Direct seeder					
ii) Weed control					
Early weeding					
Roundup spray after sowing					
Zamwipe					
Other (specify)					
iii) Organic soil cover					
Surface crop residues					
Cover crops (specify)					
iv)Organic amendments					
Compost manure use					
Kraal manure use					
v) Crop associations					
Crop rotation					
Inter cropping					
Improved fallow					
Other (specify)					
vi)Crop-livestock integration					
Used manure for fertilizer					
Used livestock for draft power					
Used crop residues for livestock feed					
Planted forage crops					
Other (specify)					

C2. Please indicate the extent to which each adopted technology has been used. (*Both for CA-SARD and non-CA-SARD farmers*)

Type of technology /practice	**Extent of use e.g acres under ripping, planting basins, jab planter, direct seeder etc.**				
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**
Ripping					
Pot holing					
Jab planter					
Direct seeder					
Crop rotation					
Inter cropping					

Surface crop residues retention					
Cover crops					
Roundup spray after sowing					
Zamwipe					

SECTION D: ACCESS OF INPUTS AND CA IMPLEMENTS (*CA-SARD farmers only***)**

D1.Did you use any inputs in the last cropping season? 1=yes, 2=no ☐

D2. If yes, how did you access the inputs you used in the 2008/09 season?

Input type	Granted by project (CA-SARD)	Own Purchase (full cost)	Own Purchase (subsided)	Loan/ credit	Reason/ comment
Main crop seed					
Cover crop seed					
Fertilisers					
Insecticide					
Herbicides					
Other (specify)					

D3. If you purchased the inputs, how far from your household did you make the purchase?

Input type	within 3 km reach	between 4 and 10 km away	Between 11 and 20 km	more than 20 km away
Main crop seed				
Cover crop seed				
Fertilisers				
Insecticide				
Herbicides				
Other (specify)				

D4. Has access of inputs generally increased, remained the same or decreased during the past 3 to 5 years?

Inputs whose access has increased	Inputs whose access has remained the same	Input whose access has decreased

D5. Which CA implement can you afford to buy without any financial assistance?
……
……
……

D6. How did you access the following CA equipment/implement you used last season?

CA equipment	Given by project (CA-SARD)	Own Purchase (full cost)	Own Purchase (subsided)	Own purchase (Credit)	Hired	Borrowed from relative
Ripper						
Jab planter						
Ox-direct seeder						
Tractor direct seeder						
Zamwipe						
Ox-boom						

sprayer						
Knapsack sprayer						
Other (specify)						

D7. Has access of CA implements generally increased, remained the same or decreased during the past 3 to 5 years?

Implements whose access has increased	**implements whose access has remained the same**	**implements whose access has decreased**

SECTION E: HOUSEHOLD FOOD SECURITY (*Both for CA-SARD and non-CA-SARD farmers*)

E1. Rank the sources of food in your household in 2008/09 in order of importance (Most important =1)

Source of food	**Rank**
Own farm	
Purchase	
Given by neighbours/friends/relatives	
Government	

E2. Would you say your household income has increased after getting involved in CA-SARD project?

1=Increased, 2=Remained more or less the same (No change), 3=Decreased ☐

E3. How reliable is income obtained from CA project enterprise.

1=Very reliable, 2=Somehow reliable, 3=Less reliable, 4=Not reliable at all ☐

E4. On average, how many months in a year is your household able to adequately feed itself? ------- (Number of months)

E5. On average, how many meals per day can your household provide to its members? --------- (Number of meals)

E6: Compared to the past, has the food security situation improved over the past 3 to 5 years?

1=Increased, 2=Remained the same, 3=Decreased ☐

F: SUSTAINABILITY (*Only Farmers in CA-SARD project***)**

F1.Have you ever provided any CA service to your fellow farmers? 1=Yes 2= No ☐

F2. If yes, which service(s)

Type of service Type / amount of payment per unit measure

F3. Have you ever obtained and used agricultural credit? 1=Yes 2= No ☐

F4. If yes, indicate source (s) of the credit

Source of credit Type or amount of credit

F5. Would you say availability of agricultural credit has increased after getting involved in the CA-SARD project? ☐

1=Increased, 2=Remained the same (No change), 3=Decreased

G: DIFFUSION OF CA-SARD PROJECT INTERVENTIONS (*For Non-CA-SARD Farmers***)**

G1. Are you aware of CA-SARD Project activities in your village or nearby villages? 1=Yes, 2=No ☐

G2. If yes, where did you get information about the Project? ☐

1=Village leaders, 2=Extension workers, 3=Farmers in the village, 4=Others (specify)

G3 Have you learned any new thing that was introduced by CA-SARD project? 1=Yes, 2=No ☐

G4 If yes, mention

……

……

……

G5. Which of the following items in your household can be attributed to CA-SARD project? (Both CA-SARD and non CA-SARD respondents)

1. Increase in household income ☐
2. Improvement in household food security ☐
3. Increased ability to pay for your children's education ☐
4. Purchase assets (specify) ---------- ☐
5. House improvement ---------- ☐
6. Others (specify) ---------- ☐

SECTION H: COST OF LABOUR, FARM INPUTS AND INCOME FROM SELECTED CROP ENTERPRISES (*Both for CA-SARD and non-CA-SARD farmers***)**

H1. Please provide information on cost of labour used for various activities performed in relation to crop enterprises during last (2008/2009) season as appropriate (Please indicate CA if the crop enterprise was under conservation agriculture and CN if it was under conventional agriculture)

Crop Enterprise	Area (Acres)	CA/ CN	Activity	Hired labour (Tshs)	Family labour		Total (Tshs)
					Mandays	Tshs	
1			Land preparation				
			Planting/ seeding				
			Weed control				
			Fertilization				
			Spraying				
			Harvesting				

2			Land preparation				
			Planting/ seeding				
			Weed control				
			Fertilization				
			Spraying				
			Harvesting				

H2. Please provide information on variable costs of inputs used during last (2008/2009) season

Crop Enterprise	CA/ CN	Inputs used, amounts and costs			
		Type of input	Amount Bags/kg/litre)	Cost per unit e.g Shs/Bag	Total cost
1.		Seed			
		Insecticides			
		hebicides			
		Fertilizers			
		Manure			
2.		Seed			
		Insecticides			
		hebicides			
		Fertilizers			
		Manure			

H3. What was the income from all crop enterprises during the last (2008/09) season?

Crop Enterprises	Type of produce	Amount produced (specify units)	Selling price per unit (e.g. Shs/bag)	Income
1.				

THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION

Appendix 4: Reasons given by farmers for discontinuing or continuing adopting some conservation agriculture components

Reason for Discontinuing	%	Reason for continuing	%
Ripping			
Lack of own land	37.5	Conserve soil moisture	36.3
Limited availability of rippers	54.2	Harvest rain water	42.2
Lack of draugt animals	4.2	Save time	7.8
Lack of knowledge	4.2	Improve yield	1.0
		Save labour	2.0
		Cheap operation	6.9
		Break hard pan	3.9
Using jab planter			

Not Readily available	85.7	Simplify work	45.7
Old age	4.8	Easy to use	25.9
Poor workability in wet soil	9.5	Save time	23.5
		Cheap	2.5
		Good planting effect	2.5
Direct seeder			
Lack of draught animals	61.5	Increase yield	39.6
Limited availability	38.5	Saves time	35.8
		Easy operation	20.8
		Precise planting operation	3.8
Glyphosate in weed control			
Field no longer has couch grass	50	Effective weed control	25.3
Expensive	50	Saves time	27.5
		Cheap weed control	40.7
		Imroves soil fertility	6.6
Zamwipe			
Not effective on uneven land	46.7	Easy to use	38.9
Not readily available	53.3	Affordable	22.2
		Saves time	38.9
Surface crop residue retention			
Lack of adequate pastureland	45.5	Conserve soil moisture	31.7
too old to practice	54.5	Prevents soil erosio/ conserves soil	35.0
		Lack of Livestock	23.6
		Improves soil fertility	9.8
Planting of cover crops			
Lack of cover crop seed	40	Prevents soil erosion/ conserves soil	35.5
Too old to practice	40	Conserves soil moisture	29.8
Yield was poor	20	Adds to farm income	22.7
		Provides firewood	8.5
		Decreases weed intensity	1.4
		Improves soil fertility	2.1
Crop rotation			
Land scarcity	100	Improves soil fertility	41.8
		Breack pest circle	20.9
		Ensure crop yield	25.5
		Reduce weed intensity	10.0
		Helps to avoid risk of crop loss	1.8
Intercropping			
None		Increase yield	13.1
		Improve soil fertility	17.9
		Enhance food security	26.2
		Adds to farm income	10.7
		Avoid risk of crop loss	7.1
		Enhance sustainable food production	10.7
		Enhance crop diversification	14.3
Improved fallow			
Land scarcity	100	Improve soil fertility	50
		Increase yield	30
		Reduce pest infestation	20
Harvesting crop residues for feed			
Needed as soil cover	80	Lack of sufficient pasture	35.2
Needed for improving soil fertility	20	Important source of feed	33.3

		Increase production of manure	28.4
		Cheap source of feed	2.5
		increase milk yield	0.6
Planting forage crops			
None		Provide ready feed within farm	36.0
		Soil erosion control	25.3
		Ensure livestock feed availability	34.7
		More milk yield	4.0

Appendix 5: CA-SARD Impact Monitoring Study: A check list for NGOs involved in project implementation

1. What change in CPAR/RECODA/WADEC objective that was made as a result of your NGO involvement in CA SARD project?

2. Which Innovative Technology dissemination approach is used by CPAR/RECODA/WADEC for which you think is instrumental to your NGO's success?

3. Who are key stakeholders in your NGO operations? Which reasons that make them important to your operations in connection to CA promotion?

4. Kindly provide data indicating progress of CA promotional activities in your area of operations since year 2004?

Indicators	2004	2005	2006	2007	2008	2009	2010
No of FFS involved							
No of demonstrations							
No of farmers trained							
No of villages covered							
Other indicators (specify)							

5. Which villages have so far been covered with your NGO CA promotional efforts? (Names of villages and wards)

6. Kindly attach relevant reports that will provide some detail on progress of CA activities by CPAR/RECODA/WADEC.

e.g. NGO profile, baseline reports, final progress reports for the different project phases,

7. Which projects did your NGO have on ground after year 2004

Name of project and Donor	Phasing period (years)	Main objective(s)	Specific CA promotion approach and activities	Achievements (No of FFS, farmers reached, no of demonstrations, no of CA implements distributed and any significant achievements
1				
2				
3				
4				

Appendix 6: CA-SARD Impact Monitoring Study: A check list for agricultural machinery/ implements manufacturers

1. Are you aware of CA-SARD project which is being coordinated by African Conservation Tillage Initiative? Do you participate in the project in any way? How? How was your participation solicited? What is your opinion on the approach used to take you on board?

2. What was your role in the project? Were you able to streamline the roles in your company objectives and activities?

3. How did CA-SARD project (ACT) facilitate your company in connection to the roles you were assigned?

4. What would you say was your significant contribution to CA-SARD project activities?

5. What is you immediate market outlet for the implements you manufacture? Do you find any future prospects in CA implements' market in Tanzania?

6. Are there competitors in implement manufacturing business? Who are they and how have you faced the competition?

7. What do you think the project should have done differently to assist in CA implements/ products development in the country?

8. What is your general advice for CA-SARD and similar projects in future?

9. Which implements have you manufactured in connection to CA-SARD? Kindly provide historical data on the manufacturing of agricultural implements by your company

Item	**Year in which 1st unit was manufactured**	**Number of units manufactured**									
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ox-plough												
Ox-ripper												
Jab planter												
Ox-direct seeder												
Others (specify)												

10, Where do you get the raw materials for the manufacture of the CA implements?

11. Who are your important stakeholders in the agricultural implements manufacturing business? (e.g. suppliers of raw material, machinery stockists and retailers, financial institutions, machinery designers/ researchers etc.)