INFLUENCE OF SOCIAL CAPITAL ON ADOPTION OF AGRICULTURAL PRODUCTION TECHNOLOGIES AMONG BENEFICIARIES OF AFRICAN INSTITUTE FOR CAPACITY DEVELOPMENT TRAINING PROGRAMMES IN KENYA

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ABSTRACT

Adoption of improved agricultural production technologies remains low amidst dissemination efforts by government and Non-Governmental Organizations in sub-Saharan Africa. This paper examines the role of social capital in the adoption of agricultural production technologies in Kenya. In particular, the paper focuses on how group participation, social trust, social support, social networks and collective action influence the adoption of such technologies. A survey research design employing a structured interview schedule was used to collect data from 120 respondents who were beneficiaries of training programmes implemented by the African Institute for Capacity Development (AICAD) in Kenya. Survey questions were analyzed using descriptive statistics, correlation coefficient and linear regression model. The findings show that group involvement and social support are the two important components of social capital that were positively associated with and significantly influenced adoption of appropriate agricultural production technologies. Conversely, social networks, social trust, and collective action did not significantly influence the adoption of agricultural production technologies. Based on these findings, it is recommended that capacity building programmes should work to strengthen the group approach in dissemination of technologies and exploit social support structures as part of an overall strategy to sustain and upscale the adoption of agricultural production technologies.

Key words: Social capital, agricultural production technologies, African Institute for Capacity Development, technology adoption, Kenya

1. INTRODUCTION

Agricultural productivity in Sub-Saharan Africa remains low, inadequate and considerably behind other continents and regions in the world (AGRA, 2013). The agricultural sector, which is characterised by smallholder mixed farming, is dominated by primary production. According to FAO (2009), the sector has not received sufficient support from sub-saharan governments. Whilst many agricultural development initiatives in Africa are now supporting the use of modern and appropriate technologies to enhance productivity (AGRA, 2013), farmers continue to be disadvantaged due to failure to adopt such technologies that would guarantee sustainable land use and improved productivity.

It is apparent from literature that the question of why technologies are not adopted as expected, regardless of their known benefits, has attracted a lot of research interest. The failure by farmers to adopt modern and appropriate technologies has previously been blamed on farm location, land tenure security and other personal related factors such as age, gender (Nyariki, 2011), lack of incentives (Masano and Miles, 2004), limited education, household income levels, socio-economic status (Adekoya and Babaleye, 2009; Ali, 2014), simplicity and usefulness of the technology (McDonald *et al.*, 2015). Notably, however, there have been attempts recently to include sociological considerations in the technology adoption process (Katungi, *et al.*, 2006; Rijn *et al.*, 2012). Emphasis here has been on social learning (Isham 2002), and social networks (Katungi *et al*., 2006; Abdulai and Huffman, 2014) rather than the entire spectrum of social capital indicators.

Social capital can be described as networks of quality relations (Winter, 2000) which operate as a resource to collective action on an individual, community or national scale. It takes the form of networks, norms and trust (Rijn *et al*., 2012) or perceptions of support, reciprocity and sharing. Studies elsewhere have shown that where social capital indicators are evident, local people are more likely to be motivated to participate with genuine commitment to collaborating with institutional actors for initiatives that lead to sustainable changes in agriculture and resource management (Kroma and Flora, 2001; Place *et al*., 2002; Adam and Roncevic, 2003; Njuki, *et al*., 2008).

The role of social capital in technology adoption, which may vary across locations or among farmers within the same location (Alesina and La Ferrara, 2000), has received limited attention in the economics literature despite having long been recognized as an important factor in rural sociological work (Katungi *et al*., 2006). More recent literature demonstrates that technology diffusion and adoption may be a function of social capital (Rijn *et al*., 2012).

Programmes such as National Agriculture and Livestock Extension Programme (NALEP) in Kenya have recognized the importance of collective approach in dissemination of agricultural technologies. In Cameroon for example, Village Community Projects (VCPs) realized through popular participation are relatively common. The VCPs have been found to be well managed and successful (Fonchingong and Fonjong, 2003). Self-help-driven development, which draws its strength from social capital, has proved its usefulness as an easy, all-on-board and results-oriented approach to contemporary modes of translating boardroom ideas into meaningful development. However, evidence on what and how of social capital influences on adoption of technologies that promote agricultural productivity remains limited in Kenya and the region. It is against this background that the present study was conceived to investigate the influence of social capital on the adoption of agricultural production technology packages provided and disseminated by the African Institute for Capacity Development (AICAD) in Kenya.

African Institute for Capacity Development (AICAD) is one of the regional organizations that have been involved in disseminating technologies on appropriate agricultural production practices including soil management, water management, crop production and protection. The institute does this through training programmes that target small-scale farmers in three East African states of Kenya, Uganda and Tanzania. The Training programmes target farmers drawn from established groups in the community so as to benefit from the cascaded effect of technological diffusion. These training programmes have since benefited over seven hundred small scale farmers in Kenya alone (AICAD, 2012).

2. MATERIALS AND METHODS

2.1 Research Area

African Institute for Capacity Development (AICAD) beneficiaries targeted for this study were spread out in four devolved units in Kenya namely Migori, Nakuru, Kirinyaga and Kiambu counties located in the western, rift valley and central regions of the country respectively. These counties have great potential for up scaling agricultural production through rain-fed and irrigation agriculture.

2.2 Research Design and target population

The research was modelled as a tracer study utilizing survey research design. Survey research involves the collection of information from a sample of individuals through their response to questions. The population comprised of 290 beneficiaries of AICAD training programmes that were exposed to agricultural production technologies between 2010 and 2012.

2.3 Sample Size and Sampling Techniques

Respondents were selected using multi-stage probability sampling strategy. The researchers obtained a list of beneficiaries of the institution’s programmes between 2010 and 2012. The beneficiaries were stratified based on the programme/course they attended. Simple random sampling was employed to select specific beneficiaries from each training programme. A total of 120 beneficiaries were selected.

2.4 Data Collection Procedures

A structured interview schedule was the main data collection tool. The interview schedule was administered by well trained enumerators to enhance convenience, high rate of response and provide clarification on questions not well understood by respondents. The sampled respondents were contacted directly through their mobile numbers obtained from the Country Office of the African Institute for Capacity Development Located in Egerton University. They were asked to indicate the most convenient time and venue for the interview. However, the researcher preferred that the interview takes place on the respondent’s farm for purposes of observing some of the technologies adopted. Field assistants were also engaged to guide the research assistants to the homes of selected respondents in the various targeted areas.

2.5 Measurement of Variables

The study involved one dependent and five independent variables. The independent variables were group involvement, social networks, social support, social trust and collective action, while the dependent variable was adoption of agricultural production technologies. The variables were operationalized as follows.

2.5.1 Adoption of Agricultural Production Technologies

This was generated as a sum of scores to responses on farming systems (crop rotation, mulching, agro forestry, organic farming) rated as ; 0=Not used, 1=used sometimes, 2 used often), crop management practices (early planting, use of certified seeds, recommended plant population, use of varieties suited for the area, use of inorganic fertilizers, intercropping, soil fertility management, contour farming; 0=Not used, 1=used sometimes, 2 used often), management of pests and diseases (composting crop residues, destruction of alternate hosts, use of clean planting materials, field sanitation, use of pesticides; 0=Not used, 1=used sometimes, 2 used often), Irrigation technologies (any of drip, sprinkler, bottle, pot, furrow and bucket irrigation methods; 0=Not used, 1=used sometimes, 2 used often), and water harvesting techniques (any of road runoff, roof catchment, retention ditch, water pan, micro catchment; 0=Not used, 1=used sometimes, 2 used often).

2.5.2 Operationalizing Key Variables

2.5.2.1: Group Involvement

This was a reflection of number of groups the respondents were affiliated to (0 to 10), membership to executive or management committee (1=member, 0-non member), and frequency of participation in group activities (1-rarely, 2=sometimes, 3=always).

2.5.2.2: Social Trust

This was taken as a measure of level of trust in local and non local institutions (relatives, neighbours, security systems, elected leaders, extension officers, brokers, religious institutions, provincial administration, and civic organizations; 0=not at all, 1=not much, 2=a fair amount, 3=a lot), and response to 8 statements measuring level of trust (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree).

2.5.2.3: Social Networks

This was measured as the level of interaction with neighbours, relatives, friends, and extension officers, elected leaders, NGOs, farmers from other communities, brokers and processors. The responses received a score of 1=rarely, 2=monthly, 3=weekly, 4=most days. Besides, social network was also a measure of frequency of using virtual (internet, face book/twitter, television, radio) and non virtual networks (relatives, friends, fellow farmers, extension officers) as sources of agricultural information.

2.5.2.4: Social Support

This was a measure of the number of possible sources of support (0 to 7), and yes or no response to six statements measuring social support.

2.5.2.5 Collective Action

This was a measure of participation in collective action in past year (0=never, 1=once, 2=a couple of times, 3=frequently), participated (1) or not participated (0) in 12 activities that require collective action, overall spirit of participation in the communities (1=very low, 2=low, 3=average, 4=high, 5=very high) and respondents perceived influence in decision making in the community (0=none, 1=not much, 2=some, 3=a lot).

2.6 Data Analysis

Survey questions were analyzed using three analytical tools. Descriptive statistics was used to describe adoption of agricultural production technologies and practices as well as social capital attributes. Pearson's correlation coefficient was employed to establish the significance of relationships between variables. Linear Regression Analysis was used to determine how the independent variables influence the expected values of the dependent variables in the study and also in determining the most important social capital aspects that affect adoption of agricultural production technologies. The analysis was done using the Statistical Package for Social Sciences, (SPSS) computer software version 17.0.

3. RESULTS AND DISCUSSION

3.1. Level of adoption of Appropriate Agricultural Production Technologies

The technologies under this broad category were those geared towards increasing the agricultural production of various crops grown by the small scale farmers. The technologies were further broken down into crop farming systems, management of pests and diseases and the technologies related to water harvesting and utilization.

3.1.1. Adoption of Crop Farming Systems

Low agricultural productivity has been linked to poor crop farming methods that are often not in conformity with the available water and prevailing climatic conditions (Mwangi and Kariuki, 2015). Crop farming systems are technologies that if adopted by farmers could increase agricultural production by reducing the cost of production, improving soil fertility and microclimate among other benefits (Wossen, *et al.*, 2015). The respondents were trained by AICAD on four such systems namely; crop rotation, mulching and intercropping, agro-forestry and organic farming.

On the one hand, crop rotation enhances soil nutrient balance and breaks the cycle of crop pests and diseases, while on the other hand, mulching and intercropping have the advantage of maintaining soil moisture and temperature, as well as suppressing weeds. Agro-forestry and organic farming improve soil organic matter which enhances soil structure and moisture retention capacities. Respondents were therefore asked to indicate how frequently they used these systems after attending the AICAD trainings. The results were as presented in Figure 1.

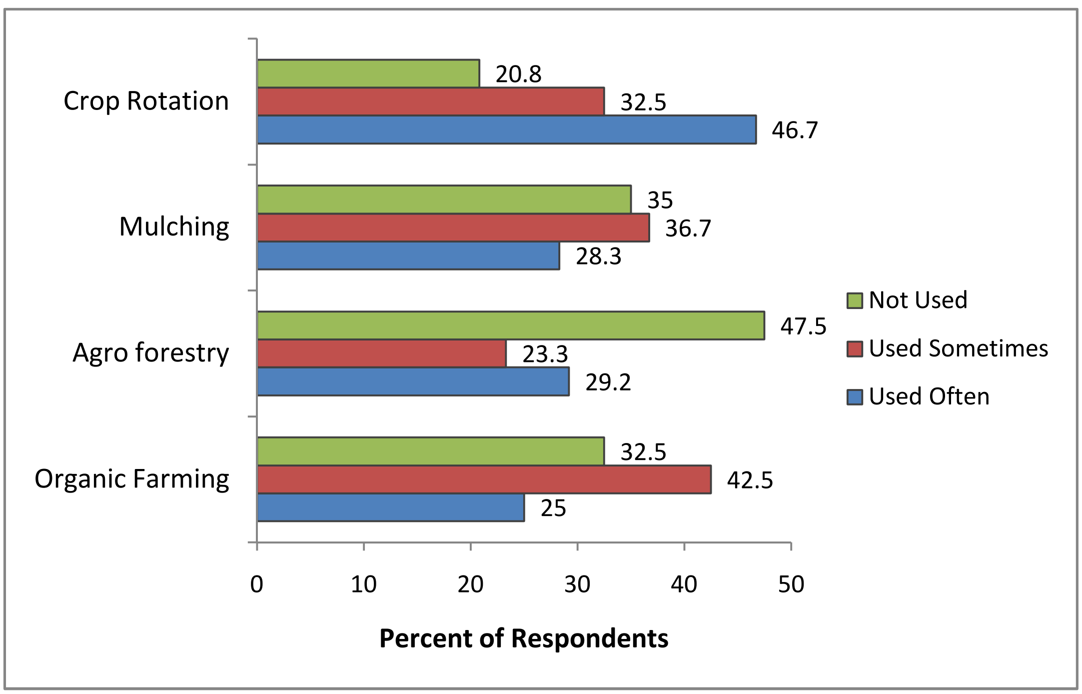

Figure 1: Frequency of Use of Crop Farming Systems

Source: Researcher, 2015

Results in Figure 1 show that over two fifths (46.7%) and (47.5%) of the participants reported using crop rotation often and agro-forestry systems respectively. Figure 1 also shows that over two fifths (42.5%) and over one third (36.7%) of studied farmers used organic farming and mulching, some of the times but not always, respectively. These results indicate that crop rotation (46.7%) was the most popularly used crop farming system among the interviewed beneficiaries of AICAD trainings, while agro-forestry was less (29.2%) popular.

The popularity of crop rotation (46.7%) as an agricultural technology may be attributed to the fact that its adoption does not require massive capital outlays in investment in infrastructure, external inputs, and extra labour. Consequently, crop rotation would be a necessary technology for farming households experiencing a reduction in land holding (average 4 acres) and experiencing increased population pressure. This could also explain why agro-forestry is less popular of the four biological crop farming systems. The farmers rationalize that trees compete with crops for space and hence with reducing landholdings farmers would sacrifice trees even though their benefits on soil fertility are known to them. Besides, the benefits of conventional agro-forestry systems take longer to be realized.

Yila and Thapa (2008) reported similar findings among smallholder farmers in Nigeria. In their study on adoption of agricultural land management technologies, they found out that more than 50% of smallholder farmers adopted biological measures of land management systems particularly intercropping, crop rotation, mulching and use of residue barriers.

3.1.2 Adoption of Crop Management Practices

Adoption of good crop management practices are recommended to improve the yields of specific crops and optimize total output in a sustainable manner (Ali, 2014). The practices include early planting, use of certified seeds, recommended plant populations, use of crop varieties recommended for the type of soils farmers have, use of inorganic fertilizer, and relay or intercropping. Other practices involve contour farming on sloping land and soil fertility management. The respondents were asked to indicate the frequency of use of each of the practices and the results were as presented in Table 1.

Table 1: Frequency of use of crop management practices

Crop Management Practices	Frequency of Use (% of respondents)		
	Not used	Used sometimes	Used often
1. Early planning	20.8	30.8	48.3
2. Use of certified seeds	26.7	19.2	54.2
3. Recommended plant population	30.0	24.2	45.8
4. Varieties suitable for the area	29.2	23.3	47.5
5. Use of inorganic fertilizers	16.7	39.2	44.2
6. Relay/Intercropping	19.2	34.2	46.7
7. Soil fertility management	23.3	24.2	52.5
8. Contour farming	25.8	26.7	47.5

Source: Researcher, 2015

Findings in Table 1 reveal that more than two fifths (45%) of the respondents reported practicing the recommended management practices often. Less than a third (30%) of the respondents were not following the recommended farming practices. Respondents from Migori County for instance used cassava varieties that were resistant to Cassava Mosaic Disease. On the other hand, the most common intercropped crop among respondents in Nakuru County was maize intercropped with beans or Irish potatoes.

The high adoption rate for most of the practices may be attributed to their level of education since, according to AICAD (2009), their selection into the programme was based on their ability to read, write and comprehend English and Swahili. Indeed, Tijjani *et al*. (2015) reported that the poor adoption of recommended practices was related to lack of formal education that would otherwise be necessary in enabling farmers utilize new technologies. Besides, the high adoption rate of recommended varieties particularly for respondents from Migori was as a result of a project of cassava bulking that was implemented by AICAD and the Ministry of Agriculture as a follow-up to the training. Majority of those trained could therefore access free cassava mosaic resistant cuttings.

These results are contrary to those of Tijjani *et al.* (2015) and Adong (2014). Precisely, Tijjani *et al*. (2015) reported poor adoption of innovative cowpeas production practices among small scale farmers in Nigeria, particularly on use of improved seeds, inorganic fertilizer application, recommended seed rate and spacing.

Their study reported an average adoption of 3% of the recommended practices by each farmer. In her study on household membership of farmer groups on the adoption of agricultural technologies in Uganda, Adong (2014) also reported poor adoption of improved seeds, and use of inorganic fertilizer. The poor adoption was blamed on age and level of education. However, the findings of this study are consistent with Namwata *et al.* (2010) who reported average to high adoption rates of agricultural technologies in Irish potato farming in Kenya and Tanzania such as seeding rate, timely sowing, fungicide application, improved varieties and pesticide application. The high adoption being attributed to contacts with extension agents and access to agricultural credits facilities.

3.1.3. Adoption of Pests and Diseases Management Practices

Crop pests and diseases are reported to lead to yield loss of approximately 30% in Sub-Saharan Africa (FAO, 2009). Ogendo (2004) reported that insect pests cause approximately 26% and 16% of field and storage food grain losses respectively in Kenya. This loses are occasioned by non application of recommended pest control measures by farmers who may be ignorant of such measures. AICAD exposed participants to various technologies that are recommended to mitigate such losses through pests and diseases using composting of crop residues, destruction of alternate hosts through crops such as napier, and use of clean planting materials, field sanitation and use of recommended pesticides. The respondents were asked to indicate how frequently they employed such recommended practices and the results were as presented in Figure 2.

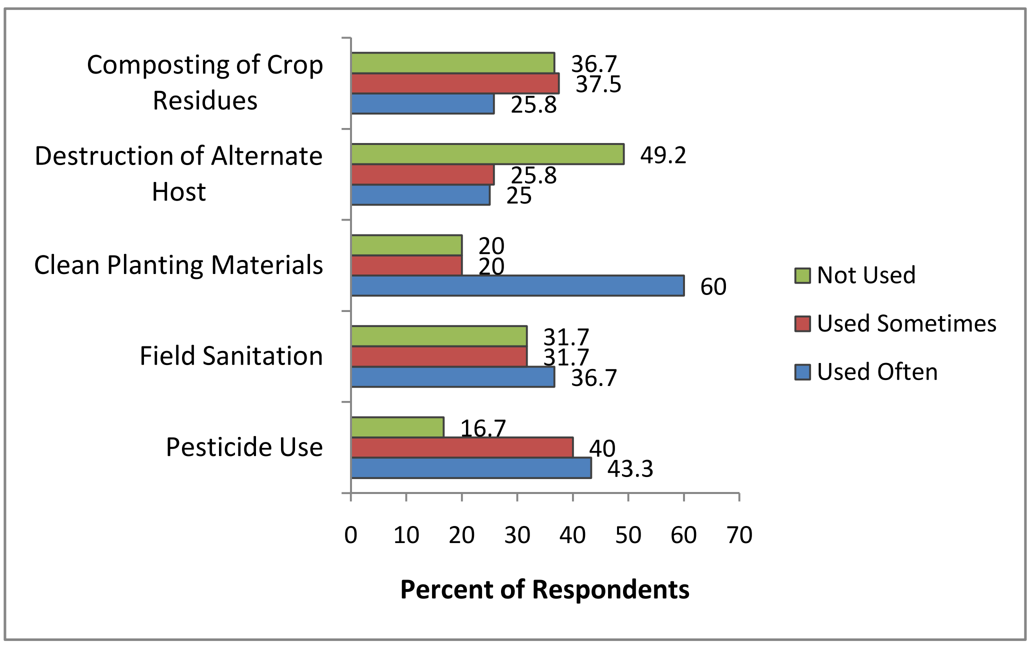

Figure 2: Frequency of use of Pests and Disease Management Practices

Source: Researcher, 2015

From the results in Figure 2, it is clear that three fifths (60%) of the participants often used clean planting materials. On the other hand, over one third (49.2%) of the respondents did not practice destruction of alternate hosts at all. Figure 9 also shows that over one third (43.3%) of the respondents often applied pesticides to their crops.

Literature shows that farmers do not always adopt the whole package of pest and disease management practices. For instance Jogo *et al.* (2013) reported that farmers were less likely to adopt pest control packages that were perceived to be labour intensive or less effective. Composting of crop residues and destruction of alternate hosts are generally labour intensive and time consuming. This may explain why their adoption rates were found to be lower than use of pesticides, which although it may be costly, it is perceived to be effective. Abang *et al.* (2013) also reported 90% adoption rate of pesticides use among vegetable farmers in Cameroon.

Results on the use of clean planting materials negates those of Jogo *et al.* (2013) who reported that only 14% of banana farmers used clean planting materials to manage pests and diseases. Farmers in rural areas have a tendency of sharing seeds or plant materials particularly for perennial crops such as bananas and cassava. However, the high adoption rate of clean planting materials is attributed to the presence, in two target regions of Migori and Nakuru, of projects funded by AICAD and other state agencies to bulk and distribute clean planting materials to farmers who need them.

One of the useful technologies in pest and disease management for crops is through destruction of alternate host by planting napier grass on the farm as a trap crop. Existing literature gives varied results. Berg (2013) reported that farmers who did not practice animal husbandry did not show interest in planting napier, while those who had domesticated animals adopted napier as a pest management option since it could also be used as fodder for their animals. This suggests that a technology that is perceived to have additional benefits is likely to be adopted than otherwise.

3.1.4 Adoption of Water Harvesting and Management Technologies

Data collected in the areas targeted by AICAD for trainings revealed that communities mostly practiced rain fed agriculture (AICAD, 2009). The rainfall was reported to be bimodal hence creating two cropping seasons. However, given the unreliability of rainfall in the two seasons and a dry spell between the seasons, water harvesting and management technologies were crucial if the production uncertainties of the targeted farmers were to be addressed. Farmers were therefore trained and embraced upon to adopt appropriate irrigation technologies such as drip irrigation, sprinkler irrigation, bottle irrigation, pot irrigation, and bucket irrigation. Farmers in areas that were supplied with sufficient surface water source could also practice furrow irrigation. Respondents were therefore asked to indicate how frequently they utilized either of these technologies and the findings are reported in Table 2.

Table 2: Frequency of use of appropriate irrigation technologies

Irrigation Technology	Frequency of Use (% of respondents)		
	Not used	Used sometimes	Used often
1. Drip Irrigation	90.0	7.5	2.5
2. Sprinkler Irrigation	72.5	8.3	19.2
3. Bottle irrigation	95.8	3.3	0.8
4. Pot irrigation	95.0	2.5	2.5
5. Furrow Irrigation	83.3	4.2	12.5
6. Bucket Irrigation	76.7	15.8	7.5

Source: Researcher, 2015

Results in Table 2 show that majority of the respondents did not use any of the recommended irrigation technologies; with a paltry 19.2% and 12.5% reported using sprinkler irrigation and furrow irrigation respectively. Consequently, only 4%, 5% and 10% of the respondents used bottle irrigation, pot irrigation and drip irrigation respectively at some point in time after the training.

The establishment of most irrigation technologies require substantial capital outlay, infrastructure and technical human labour due to their complexity. Consequently, a technology such as furrow irrigation requires coordinated adoption since its infrastructural development is done at the landscape level. This could explain why its adoption is a challenge by the surveyed farmers. Indeed, Akudugu *et al.* (2012) reported that modern agricultural production technologies that were capital intensive were less likely to be adopted. Armand *et al.* (2015) further reported that lack of security and the possibility of stealing parts and fittings of sprinkler irrigation were some of the concerns that affected adoption of sprinkler irrigation among farmers in Famenin County of Iran. Rahman and Bulbul (2015) linked poor adoption of the technologies with reduced contacts of farmers with extension agents. The agents would be useful in offering after training technical support that is necessary for most of the irrigation technologies.

3.1.5 Frequency of Use of Water Harvesting Techniques

As indicated earlier most of the target areas for AICAD activities experience perennial droughts that pose challenges to agricultural productivity. However, the areas have great potential for rain water harvesting, which farmers had not exploited (AICAD, 2012). To increase access to water for domestic and agricultural purposes, farmers were trained on water harvesting and management techniques. The recommended water harvesting techniques were road runoff, roof catchment, retention ditch, water pan and micro catchment. Participants were asked how frequently they utilized any of the techniques and the results were as presented in Figure 3.

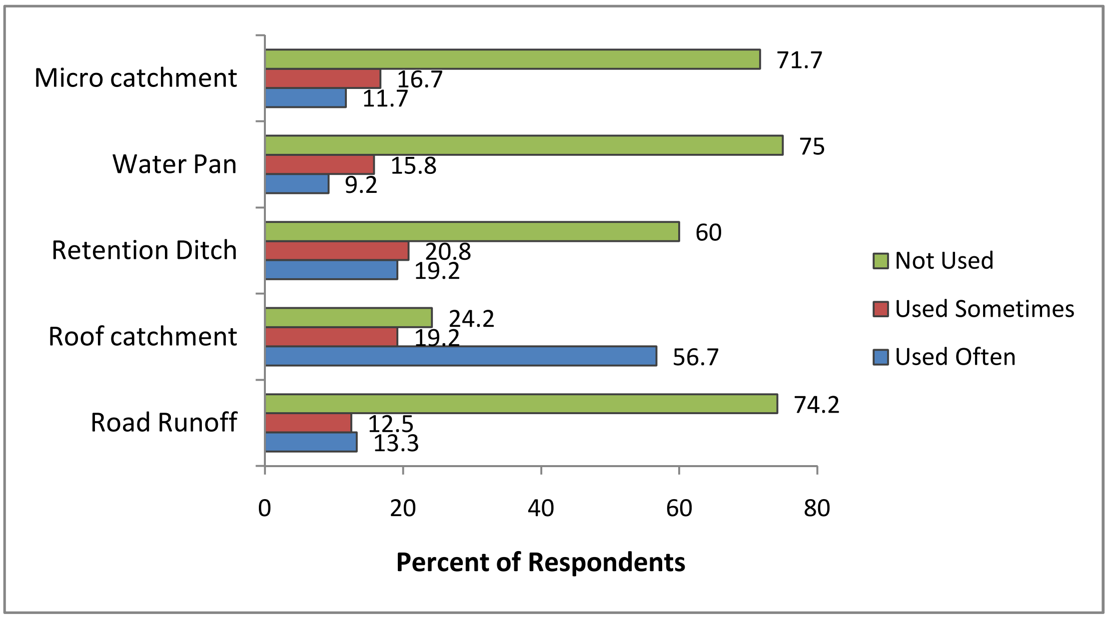

Figure 3: Frequency of Use of Water Harvesting Techniques;

Source: Researcher, 2015

Results in Figure 3 show that over half (56.7%) of the respondents often harvested water through roof catchment, while over three fifths (74.2%) did not use road runoff; three fifths (60%) did not use retention ditches, over three quarters (75%) did not use water pans and over three fifths (71.7%) did not use micro-catchment. Poor adoption for road runoff harvesting, retention ditch, water pan and micro catchment may be as a result of high labour and capital requirements which limit the capacity of farmers and households to adopt such technologies. These findings also explain why of the five techniques roof catchment was adopted by majority of the respondents. This is because roof catchment exploits already existing roof surfaces of households dwelling units. The popularity of roof catchment is also encouraged by the fact that traditional dwelling units, which were made of grass have long been replaced by corrugated iron sheeted roofs which are ideal for collecting large amounts of rain water.

Studies elsewhere have reported varying reasons behind low adoption of water harvesting technologies. In his study on determinants of rainwater harvesting technology adoption for home gardening in Msinga, South Africa, Baiyegunhil (2015) reported that lack of capital and credit and the labour intensive nature of the technologies contributes to negative perception of technologies and hence their poor adoption. Other reported constraint limiting farmers from adopting water harvesting technologies were lack of technical knowledge regarding rain water harvesting (Senkondo *et al.*, 1999) and contact with extension agents (Rahman and Bulbul, 2015). However, the later two explanations may not hold for farmers in this study since they received training specifically in all the above water harvesting techniques.

3.2. Influence of Social Capital on Adoption of Agricultural Production Technologies

The study hypothesised that social capital does not significantly influence adoption of appropriate agricultural production technologies among AICAD beneficiaries. To test the hypothesis, the index on adoption of appropriate agricultural production technologies was taken as the dependent variable, while indices of group involvement, social networks, social support, social trust and collective action were taken as independent variables representing social capital.

As a precondition to establish the influence of social capital components on adoption of agricultural production technologies, it was necessary to establish the nature of the relationship that exists between the dependent variable and the five components of social capital. Since the indices were numerical in nature, a Pearson's Correlation Coefficient (PCC) was generated and the results were as presented in Table 3.

Table 3: Relationship between adoption of agricultural production technologies and social capital components, a bivariate correlation coefficient

Independent Variable	Correlation Coefficient	Significance
1. Group involvement	0.539	**0.001*****
2. Social Trust	0.156	0.088
3. Social Networks	0.297	**0.001*****
4. Social Support	0.312	**0.001*****
5. Collective action	0.127	0.168

***. Correlation is significant at the 0.001 level (2-tailed); N =120

Results presented in Table 3 show a positive and significant correlation between adoption of agricultural production technologies and the three indicators of social capital namely group involvement (r=0.539**), Social Support (r=0.312**) and Social Networks (r=0.297**). The positive correlations imply that adoption of appropriate agricultural production technologies increased with increase in the levels of group involvement, size of social networks and the amount of social support accumulated by the respondents. The results on group involvement and adoption of agricultural production technologies were consistent with Matata *et al.* (2010) who reported positive and significant relationship between adoption of improved fallows and membership in farm groups among small holder farmers in Western Tanzania.

On the other hand, the correlation between adoption of appropriate agricultural production technologies and Social Trust (r = 0.156) and Collective Action (r=0.127) was positive but not significant. The implication of the results was that adoption of appropriate production technologies was not associated with social trust and collective action. In other words, high levels of social trust and collective action were not necessarily associated with high adoption of agricultural production technologies.

Considering that two components of social capital (social trust and collective action) did not reflect significant relationships with adoption of agricultural production technologies and that the correlation coefficient between social networks and adoption of appropriate agricultural production technologies was relative low, it was necessary to establish the influence of each social capital component on the dependent variable. A multivariate linear regression analysis was performed and the results are presented in Table 4.

Table 4: A multivariate linear regression for adoption of agricultural production technologies and the components of social capital

Model	Un-standardized Coefficients		Standardized Coefficients	t value	Sig.
	B	Std. Error	Beta		
(Constant)	3.653	4.160		0.878	0.382
Group involvement	1.701	0.305	0.491	5.585	**0.001**
Social Trust	-0.047	0.115	-0.035	-0.411	0.682
Social Networks	0.151	0.103	0.132	1.471	0.144
Social Support	0.526	0.223	0.192	2.360	**0.020**
Collective Action	-0.377	0.238	-0.135	-0.585	0.116

Dependent Variable: Appropriate Agricultural Production Technologies

R Square = 0.341, F = 11.815, Significance = 0.000

Table 4 shows that the coefficient of determination (R Square) for the model is 0.341. This implies that 34.1% of the variation in adoption of appropriate agricultural production technologies is influenced by the five indicators of social capital. The F value (F=11.815, Sig <5%) demonstrates that the results of the regression model are statistically significant. The results therefore show that group involvement and social support are the most significant contributors to the variance in adoption of agricultural production technologies. Social trust, social networks and collective action do not contribute much to the model as indicated by the non significant Beta values.

However, while the influence of social networks and social support on adoption of agricultural production technologies was positive, a negative influence on adoption was observed with social trust and collective action. This implies that respondents who had strong social trust and collective action attributes were less likely to adopt agricultural production technologies. On one hand, strong social trust means that farmers were dependent on significant others and hence reluctant in adopting new technologies for poor production may be cushioned by those they trust, may be strong family networks. On the other hand, collective action diffuses personal responsibility, hence explaining the observed low adoption of agricultural production technologies in the study area. However, the findings are contrary to the assertions by Amudavi (2005) who reported that cultivating a mutually trusting relationship between outside agencies and rural communities was a necessary ingredient to adoption of sustainable livelihoods. These findings may further be explained by the tendencies for maintaining status quo or resistance to change among rural communities in developing countries. A strong social trust and collective action may succeed in reinforcing such status quo or resistance, which is anti-innovation or change, aptly explaining the findings of the study.

Group involvement, with a Beta of 0.491 is the most significant variable influencing adoption of agricultural production technologies. This implies that for every unit change in group involvement adoption of agricultural production technologies would be improved by 0.491 units. These results are consistent with those of Matata *et al*. (2010) who in their study on socio-economic factors influencing adoption of improved fallow practices among small scale farmers in Tanzania found out that membership in farmers groups significantly influenced adoption of improved fallows. Similar results were also reported by Rodriguez-Entrena *et al*. (2014) in their study on soil conservation practices in Andalusia, Spain. They found out that social capital measured in terms of membership to groups significantly influenced adoption of soil conservation practices. Adong (2014) also reported positive influence of group membership to adoption of improved seeds, use of organic fertilizer and improved livestock breeds in Uganda. However, Wossen *et al*. (2015) reported that membership to any groups does not necessarily influence adoption positively. In their research on social capital, risk preference and adoption of improved farm land management practices in Ethiopia, membership to funeral insurance groups affected adoption negatively. Wang *et al*. (2015) also reported that membership to water management associations had negative, although, insignificant influence, on adoption of water scheduling methods.

Further, social support exerted statistically significant positive influence on adoption of appropriate agricultural production technologies (Beta = 0.192, Sig = 0.02). This implies that the more support a beneficiary was likely to received from the community the more likely they were to adopt agricultural production technologies. These results were consistent with Heilemariam *et al*. (2012) who reported that the number of relatives inside and outside the village that the farmers can rely on for support in times of need significantly influence adoption of crop rotation and conservation tillage in Ethiopia. They also found that households who believed that the government would provide support when crops fail were more likely to adopt seed and inorganic fertilizer. Di Falco and Bulte (2011) also reported similar results in their study on adoption of agricultural technologies in developing countries; they reported that households with a greater number of relatives were more likely to adopt new technologies because they are able to experiment with technologies, while spreading the risks over more people and resources.

It was surprising that social network did not yield significant influence on adoption of agricultural production technologies among AICAD beneficiaries ((Beta = 0.132, Sig = 0.144). The results were not consistent with most research findings reported in literature. For instance Lee (2015) reported that network size exerted statistically significant influence on levels of tourism technology adoption in South Korea. Jensen *et al*. (2014) indicated in their findings that having a relationship with growers of improved variety food crops and the closeness of this relationship significantly influenced adoption in Timor. The results were however, consistent with those of Thuo *et al*. (2014) who found out that network factors do not influence adoption even though such networks played a significant role in influencing information acquisition among farmers in Eastern Uganda and Western Kenya.

The results on social trust and collective action although not significant were consistent with some researches earlier reported. For instance, Lee (2015) reported that social trust did not exert a direct effect on technology adoption for destination marketing in South Korea.

4. CONCLUSIONS AND RECOMMENDATIONS

First, the empirical results established group involvement as being a significant predictor of adoption of appropriate agricultural production technologies. The findings suggest that farmers who were active in group activities were most likely to adopt appropriate farming systems and crop management practices, engage in irrigation farming and other agricultural production practices. It is therefore recommended that Capacity building institution should be cognizant of group involvement of target communities when designing training programmes through which appropriate agricultural production technologies are to be transferred and disseminated. Where such attributes are missing the programmes should build in the curriculum modules on group formation, mobilization and management. Further, the group approach to dissemination of agricultural value chain technologies should be strengthened by extension officers and other players in the agricultural productivity sector. This is because group involvement offer many benefits to its members such as sharing information, labour, skills and other relevant resources.

Second, the study also established social support as a significant predictor of adoption of appropriate agricultural production technologies. Indeed, farmers who had more sources of social support were most likely to adopt appropriate farming systems and crop management practices, engage in irrigation farming and other agricultural production practices. It is therefore recommended that the philosophy of self help form part of the overall strategy for sustaining or up scaling the adoption of agricultural production technologies. The financial and technical support from kins, neighbours and other community members is instrumental in pooling such resources for the successful adoption of financially and technically demanding agricultural production technologies such as drip irrigation. However, efforts need to be made to encourage selfless social support to avoid reciprocal demands that may negate its usefulness.

This study also concludes that contrary to findings from previous studies social networks may not be entirely a necessary condition in adoption of agricultural production technologies particularly for farmers who have already been empowered with relevant technologies. However, further empirical studies are needed to validate these findings in a variety of contexts and organizations

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