

SIGNIFICANCE OF FARMERS' SOCIAL NETWORKS IN THE UPTAKE OF NERICA TECHNOLOGY IN MIGORI, KENYA

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Abstract

Uptake of agricultural technologies has remained low in Africa. Social networks may improve the uptake of these technologies in the rural areas where majority of the communities rely on farming. The main objective of this study was to explore how social networks contributed to the uptake of NERICA rice technology. The study was conducted in Migori County, Kenya. Using a mixed-methods approach a survey of 263 NERICA rice farmers was carried out, and 8 focus group discussions (FGD) consisting of 10 to 12 people were conducted in Uriri and Awendo Sub Counties. Twenty-two (22) key informant interviews were also conducted with relevant stakeholders in the study area. Quantitative data were analyzed using the SPSS computer software and the results were presented in frequencies and percentages. Qualitative data were transcribed and analyzed using thematic analysis. The findings showed that social networks influenced the adoption of NERICA rice technology in the study area.

Keywords: NERICA Agricultural Technology; Social Networks; Livelihoods; Food Security; Social Capital.

Jel Codes: Q18, D71, Q16, C83, C25

1. Introduction

FAO (2015) reports that Sub-Saharan Africa has the highest prevalence of undernourishment and food insecurity worldwide. FAO further indicates that the continent is a net importer of food which puts additional strain on earned foreign exchange. Kijima *et al.*, (2008) state that the importance of adopting modern agricultural technologies in Africa cannot be underestimated. Despite the importance of these modern technologies in agriculture, the uptake remains low in Sub-Saharan Africa (Langat *et al.*, 2013).

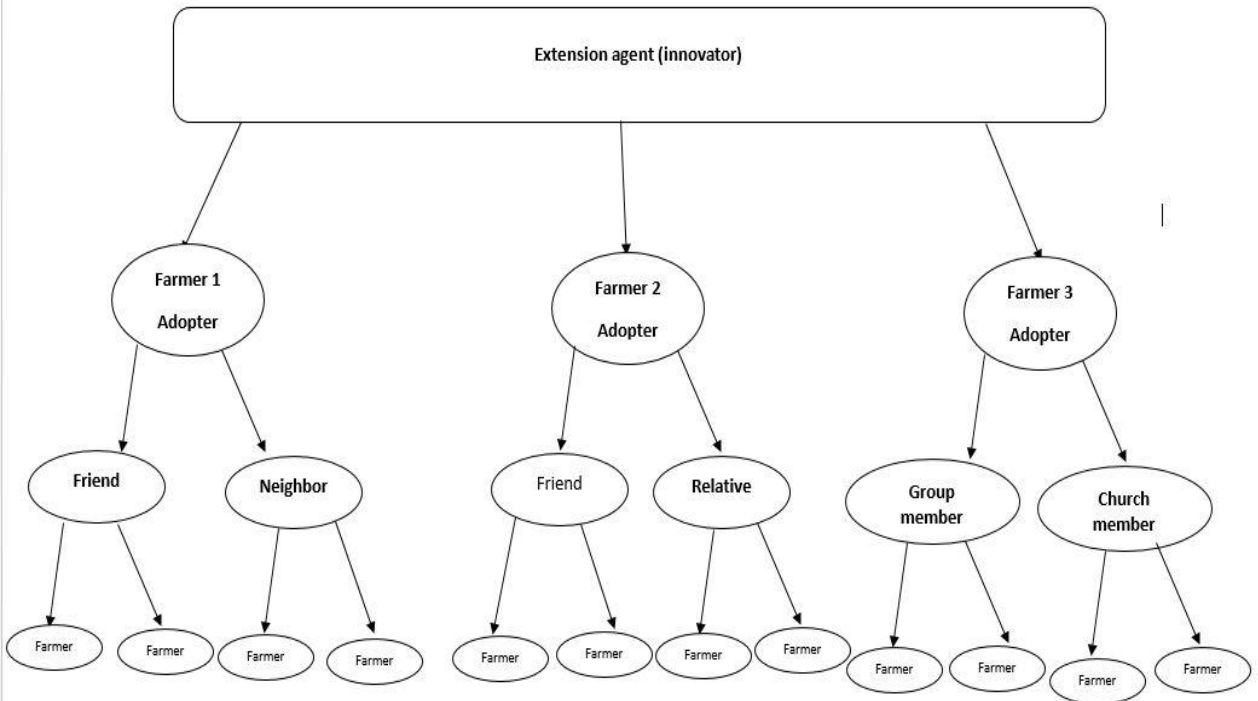
Several countries in Sub-Saharan Africa have been on the front line in implementing macroeconomic, sectoral, and institutional reforms from the beginning of the 1970s. Their focus was to ensure sustained economic growth, poverty alleviation, enhanced food security, and improved rural livelihoods. For example, the government of Kenya implemented

successful programs and projects including the National Agricultural and Livestock Extension Programmes (NALEP), the National Accelerated Agricultural Input Access Programme (NAAIAP), the Agricultural Sector Programme Support (ASPS) and Kenya Agricultural and Productivity Project (KAPP). The government, through Kenya Agricultural Research Institute, developed water and soil conservation technologies, improved seeds, improved storage facilities, and labor-saving technologies. Olwande (2009) observed that a lot of resources had been invested in agricultural enhancement technologies; improving crop varieties, agronomic practices, disease, pest control techniques, and natural resource management. Despite all these developments, there is still low adoption of these technologies in sub-Saharan Africa (World Bank, 2008; Odame *et al.*, 2013). Agricultural Research in Eastern and Central Africa (ASARECA) conducted an evaluation which revealed that the adoption of dairy technologies in East Africa was less than 20%, while that of hybrid maize was 40 to 70% in Kenya and Tanzania (Odame *et al.*, 2013). Kenya is one of the countries in Sub-Saharan Africa that reports low adoption of agricultural technologies despite the government's efforts to implement these technologies (Ogada 2014; Olwande 2009; Makokha *et al.*, 2001). This low uptake of technologies is a cause for concern in Africa where food security is threatened by many factors (FAO, 2015).

Research has shown that peer influence has a powerful effect on people's behavior (Ostrom 2000). People usually interact with agricultural technologies through the social networks in their localities, and this may influence the adoption decision and process. Farmers do not act unilaterally, instead, they collaborate, consult and negotiate the meanings of the technologies encountered. This kind of interaction gives way to a flow of ideas, information, and knowledge that guide adoption of new or improved agricultural technologies.

According to Bandiera & Rasul (2006), the choices of networks of family and friends, neighbors, and social groups affect farmers' adoption decisions. Similarly, Conley & Udry (2010) reported that farmers adjust their inputs to align with those of their neighbors who were successful in previous periods. Social networks based on kinships, friendships, or religion facilitate the dissemination of technologies through farmers. Additionally, Foster & Rosenzweig (1995) revealed that farmers with experienced neighbors had significantly more profitable farms than those with inexperienced neighbors. Similar sentiments were offered by Langyintuo & Mekuria (2008) who reported that neighbors' adoption influences farmer's adoption, but also that members in farmer associations and contact with extension officers positively affected the adoption of improved maize in Mozambique. Mignouna *et al.*, (2011) established that belonging to a social group enhances social capital allowing mutual trust and the free exchange of information. Farmers within a social group learn from each other the benefits and correct usage of new technology. Similarly, Uaine (2009) reported that social networks are important in the adoption of agricultural technologies because farmers share information and learn from each other. Networks can hence reduce the risks associated with the adoption of new technologies by providing information on how to use the technologies and the expected benefits (Kimura, 2010).

The goal of this study was to explore how farmers used the existing social networks in their local community to adopt NERICA rice agricultural technology in Migori, Kenya. The study examined the extent to which social networks enhanced the adoption. The study is an addition to the existing knowledge on the adoption of agricultural technology studies. NERICA rice technology was introduced in Migori County in 2009 as an alternative food crop to enhance food security for rural smallholder farmers (MIDP, 2013).



Source: Adapted and modified from graph of nested analytical approach (Ramirez AK, 2010)

Figure 1. Extension-Pilot Farmers and Other Social Networks in Adoption Process.

1.1 Social Network Perspectives

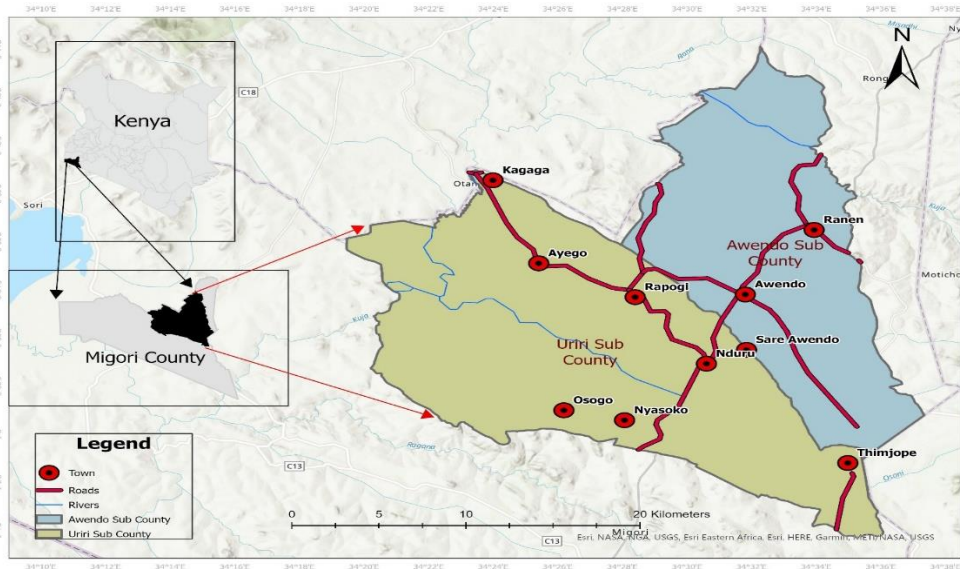
Social network theory views social relationships in terms of nodes and ties. Nodes are the individual actors within the networks and ties are the relationships between the actors. There can be many ties between the nodes. A social network is a map of all the relevant ties between the nodes being studied. The network can also be used to determine the social capital of individual actors. Networks form either bridging or bonding ties (Granovetter, 1973). The bonding ties are relational ties between family members, friends and relatives, and group memberships. These relations explain the existence of strong bonding ties. (Granovetter 1973) further adds that these ties act as pathways for information that exist on members of another network to another member. While bonding ties may restrict the diffusion of information outside a group and result in the development of restricting norms, bridging ties enable an actor to access information from other networks (groups) and this overcomes the restrictions imposed by the bonding ties. Similarly, Newman & Dale (2005) assert that bridging ties are important in community mobilization. Social networks have an impact on extension services and support to the farmers. They accelerate the adoption of innovative technologies for smallholder farmers in developing countries (IFPRI, 2010).; Bandiera & Rasul, 2006) argue that agricultural extension links exist among extension agents and farmers that either promote (or hinder) the adoption of new technologies. Farmers in social networks learn how to cultivate new crops from the choices of other farmers cultivating the same crops (Foster Rosenwein, 2010; Conley & Udri, 2010).

2. Materials and Methods

2.1. Description of The Study Area

The study was conducted in the villages of Awendo and Uriri Sub Counties in Migori County. Migori is located in south-western Kenya bordering Homa-Bay, Kisii, and Narok Counties. (Fig 2). The County consists of six administrative sub-counties, namely; Uriri, Awendo, Rongo, Kuria, Migori, and Nyatike. The inhabitants are Luos, Luyha, Abagusii, Suba-Luos, Somalis, Nubians, Indians, and Arabs. The total population of Migori was 1,116,436 persons comprising 553,618 males and 580,214 females (KNBS, 2019).

The study purposively selected Awendo and Uriri sub-counties because they were the only ones where NERICA rice was grown, the two were identified to be food insecure because they were dominated by smallholder farmers who overly relied on monoculture of sugarcane and tobacco which paid them poorly after waiting for 24 months (Kibwage 2007). Awendo is purely Luo-speaking people while Uriri has inhabitants from Kuria and Maragoli who have over time been assimilated into the Luo culture and language. The county's altitude ranges between 1140m above sea level at the shores of Lake Victoria in Nyatike Sub County to 4625m above sea level in Uriri Sub County. The county experiences two rain seasons in a year; March to May and October to December. The temperatures range between 21°C and 35°C. The soils are well-drained and tend to be loamy. The major crops grown are; vegetables, tobacco, beans, maize, sugarcane, groundnuts, and coffee on a small scale basis. In livestock farming, farmers in the county keep both free-range and zero-grazed cattle, sheep, goats, and poultry.



Source: IEBC, 2017

Figure 2. Map of Migori Showing Uriri and Awendo Sub Counties (Subsite Study Areas)

2.2 Study Design

The study was a mixed-method descriptive research design, encompassing qualitative and quantitative approaches. The study utilized the strengths of both qualitative and quantitative approaches. A Household survey, focus group discussions and key informant interviews were conducted. According to (Campbell *et. al*, 1999) mixed methods are a powerful way to enhance the validity of results.

2.3 Data Sources

Primary and secondary data were used in the study. The primary data were collected through focus group discussions (FGDs), key informant interviews(KIIs), and household interviews in 2020. The FGDs and KIIs took an in-depth approach whereby the respondents freely discussed the livelihood, food security and farming of NERICA and its effect on livelihoods. A checklist of questions was used to guide and narrow the discussions to relevant issues around the research objectives. Secondary data were collected from the documents with information pertinent to the study. Policy documents, including the National Rice Strategy, the Migori County Integrated Development Plan, County Annual Plans, and journal articles, were reviewed. Data of the household survey were triangulated with the qualitative data from the focus group discussions and key informant interviews. This is in line with Descombe (2010) who supported using methodological triangulation with alternative data collection methods to complement or supplement the findings from other methods.

2.4 Sampling and Sampling Procedures

Multistage sampling was used, whereby a combination of purposive and simple random sampling procedures was used. Migori County was purposively selected in the first stage of the sample out of the 47 counties in Kenya, based on a study on the national food security status that ranked Migori number 43 out of the 47 counties in terms of national food insecurity status. In the subsequent stage, Awendo and Uiri Sub counties were purposively selected because they were identified as the most food-insecure owing to their monoculture of sugarcane and tobacco, which had occupied large acreage of their land with minimal returns and little land left for food crops. The two sub-counties were the only ones farming NERICA rice, having been identified by the Migori County Government for the rice intervention to enhance food security. Purposive sampling was further used to determine the villages of the rice farmers. Finally, the rice farmers were selected using a simple random sample, creating a sampling frame.

The representative sample size of the household interviews was computed. The sample size was calculated from a finite population at a 95% confidence level and 5% of variability using the Krejcie & Morgan [21] sampling model given by

$$n = \frac{X^2 Npq}{d^2(N-1)+X^2pq}$$

Where, n = the desired sample size, X^2 = Chi-square value for 1 degree of freedom at 95% confidence level, N = Target population, p = population proportion, q = 1 - p, d = degree of accuracy (margin of error) expressed as a proportion (0.05). Given the target population of 822 NERICA farmers, the sample size was determined to be

$$n = \frac{3.481*822*0.5*0.5}{0.05^2(822-1)+3.481*0.5*0.5} = 263 \text{ farmers.}$$

From the above sample, the study distributed it proportionately to the two sub-counties, Uriri and Awendo, whose populations were 226 and 596 farmers, respectively. These samples are given as

$$\frac{226}{822} * 263 = 72 \text{ farmers and } \frac{596}{822} * 263 = 191 \text{ farmers, respectively.}$$

Eight villages were purposively sampled for FGDs. The eight villages spread across the two sub counties purposively selected for the study. These include Kamuresi, Nyarombo, Nyakuru, Nyambicha, Oyuma, Mori, Pinyowacho, and Thim Jope. The villages spread across the two sub-counties of Awendo and Uriri. The researcher facilitated the discussions and outlined the goals of the study.

Eight focus group discussions were conducted, one in each of the purposively sampled villages with each FGD constituting 10 - 12 rice farmers. The researcher facilitated the discussions and outlined the goals of the study. A checklist of questions was used to guide the discussions and field notes were made. Twenty-two key informant interviews were conducted. The Key informants who were from the relevant stakeholders in the rice value chain were purposively sampled and interviewed using an interview guide. The key informants included sub-county extension officers, sub-county agricultural officers, the county director for agriculture, and the crops officers in both Awendo and Uriri sub-counties. The experienced and resourceful rice farmers in the community were purposively identified and interviewed as key informants as well. These were the ones regarded by the community as opinion leaders because they represented the community in cultural activities, rites and rituals and other important community matters. A total of 22 key informant interviews were conducted.

2.5 Data Collection Methods

The primary data were collected using a mixed-method approach. Quantitative data were collected through a household survey. The household survey was conducted using a structured questionnaire with open-ended and closed-ended questions. Qualitative data were collected using focus group discussions (FGDs) and key informant interviews (KIIs). A checklist of structured questions corresponding to the study's variables was used to guide the FGDs and KIIs. These were meant to provide in-depth information on the adoption of NERICA rice and its contribution to household livelihood security.

The data analysis methods used were descriptive statistics and qualitative thematic analysis. The survey data were cleaned, coded, and analyzed using Statistical Package for Social Sciences (SPSS) Version 23. Descriptive statistics of the main variables of the study were calculated and presented using frequency distribution and percentages.

Regarding qualitative data, transcription of field notes from the FGDs and KIIs were analyzed manually for repeated patterns and emerging themes corresponding to the study objectives. Further description of the data around patterns was done to make meaning of the emerging themes and draw appropriate conclusions. The themes were built into the writing process and demonstrated further using vignettes from the corpus of qualitative data, which further reflected the findings' authenticity.

3. Results and Discussion

Farmers do not act unilaterally, instead they collaborate, consult and negotiate within their environment and outside. A flow of knowledge, ideas and information that shape their decisions to adopt a technology is embedded in these interactions. Adoption of agricultural technology such as NERICA rice farming was greatly influenced by social networks. The study findings reported that social networks existed in form of social groupings such as farmer groups, youth groups and women groups, families and their extended family members, friends, neighbors and church members. All these groupings created nodes and ties which facilitated in many ways towards the adoption of NERICA rice agricultural technology.

The study findings further revealed that social groupings existed in the community long before the NERICA rice technology was introduced. Within the community, it was common for people to belong to a group of their choice depending on the issues that needed to be addressed. The groups were forums where social economic issues were discussed, shared and solved. Since most people had these kinds of challenges, it was inevitable for one not to belong to a group. Similarly, the farmers organized themselves into various groups such as youth groups, women groups and men and women groups. The youth used these forums to discuss important issues affecting or influencing their lives in the community, such issues as education, early pregnancies, reproductive health and income generating ventures to improve their wellbeing. The women too had their own social economic issues to address in the groups. Some of them were how to raise income to enable them take care of their family needs. All these groupings were social networking forums in the community.

The extension agents used these existing groups to identify the initial pilot farmers for the uptake and farming of NERICA rice both in Awendo and Uriri sub counties. The initial pilot farmers that were identified had to be opinion leaders in the community meaning that they commanded respect and authority and knew how to approach the people, were relatively educated and understood modern farming practices, majority of them had previously attended capacity building trainings, workshops and exhibitions on modern farming practices or learned from friends. They had to be members of the local farming groups and implementing other farming practices such as aqua culture, bee keeping, dairy farming, green house farming and so on. The influence these farmers had on other farmers was based on their ability to bond well with their community members and contact with external sources of information. These farmers created the nodes for social networking that enhanced the initial adoption because they had bonding ties within the community through neighbors, friends, relatives, church members and their farmer groups. They also had bridging ties with the extension officers and the agricultural officers in the sub counties.

The authors examined further on the aspect of farmer group membership in the community to understand its involvement in adoption process. According to Asante et al., (2011; DEVIVA, 2005; Uliwa & Fisher, 2004) the term farmer groups, farmer associations, farmer cooperatives and farmer's societies can be used interchangeably. It refers to a group of farmers with common interests who share experience to enhance their common goals. The authors further assert that Farmer groups can be incentivized to provide benefits to its members. These benefits may include inputs delivery and access to services which leads to the improvement of farm performance and profitability.

There were 41 active groups in the study area. As shown in Figure 3, the majority of respondents (73.0%) were members of different social groups, whereas 27.0% claimed that they were not members of any group.

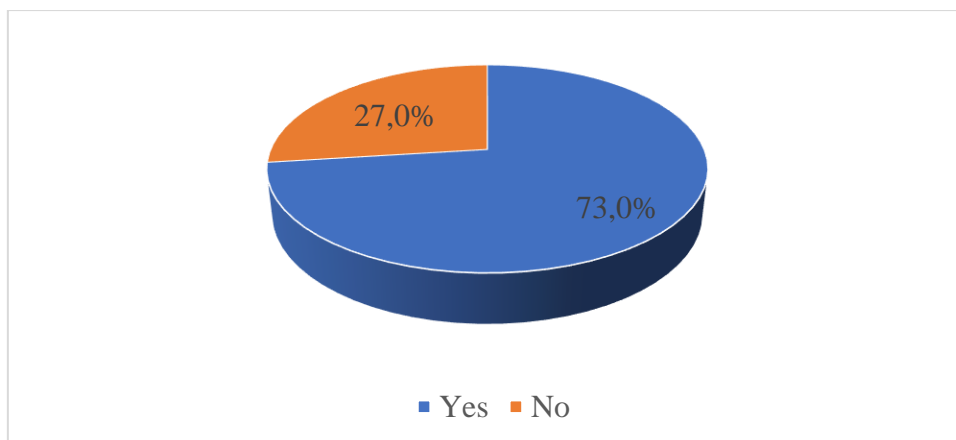


Figure 3. Membership to Farmers' Group

Table 1. Association Between Membership in Farmers' Social Groups and Adoption of NERICA Rice Farming

Membership to a farmers' social group	Adoption of NERICA			Total
	Low	Medium	High	
Yes	8	26	149	183
No	9	17	44	70
Total	17	43	193	253
Chi-square =10.739; df=2; p=0.005				

The p-value of 0.005, which is much lower than the significance level ($=0.05$), indicates that the findings in the above table demonstrate a statistically significant association between the adoption of NERICA rice technology and membership in farmers' social groups. This indicates that membership in a farmer's social group is crucial for adoption of NERICA rice technology. The likelihood of a farmer adopting or not adopting NERICA rice farming increases with their likelihood of belonging to farmers' social groups in general.

Table 2. Test for Association Between Formal Registration of the Group and Adoption of NERICA Rice Farming

Formal registration of the group	Adoption of NERICA			Total
	Low	Medium	High	
Yes	4	20	140	164
No	13	23	53	89
Total	17	43	193	253
Chi-square =24.074; df=2; p=0.000				

The findings in the preceding table show a statistically significant relationship between the adoption of NERICA rice technology and formal group registration, as indicated by the p-value of 0.000, which is far less than the significance level ($=0.05$). This implies that the adoption of NERICA rice technology is highly dependent on the group being formally registered. The greater the likelihood of a farmers group being registered in general, the greater the tendency to adopt NERICA rice farming.

Table 3. Test for Association Between Existence of a Group Constitution and Adoption of NERICA Rice Farming

Existence of a group constitution	Adoption of NERICA			Total
	Low	Medium	High	
Yes	4	19	142	165
No	13	24	51	88
Total	17	43	193	253
Chi-square =27.352; df=2; p=0.000				

The p-value of 0.000, which is much below the significance level ($=0.05$), indicates that there is a statistically significant correlation between the use of NERICA rice technology and the presence of a group constitution in the results presented above. This implies that having a constitution is crucial for a group to embrace the NERICA rice technology. The likelihood that a farmers' organization will accept or reject NERICA rice farming increases with the likelihood that the organization has a constitution.

Farmer groups are expected to serve as channels for extension delivery to farmers. Even though farmer groups have some benefits that farmers can get directly, they are voluntary associations and therefore farmers are not compelled to join any group. Joining a group is based purely on individual decision. An individual farmer joined a particular group depending on the objectives of that group if they were in line with his or her personal goals.

The findings imply that the majority of the farmers belonged to one group or the other. This means that most of the farmers were aware of the benefits of joining the groups or they had already witnessed or enjoyed some of those benefits. It also means that there was a high level of social networking that influenced the enrollment of many farmers into groups. For the few that did not belong to any group, they still went on with farming and some of them were very successful farmers. This may have been the result of informal relations that delivered knowledge on NERICA rice in social spaces outside of the actual social groups.

The study sought to establish why people came together to form groups and Table 4 shows some of these reasons. The results in Table 4 show that most farmers, (60.4%) joined the various farmers' groups in order to access farm inputs, 55.2% joined due to the empowerment initiatives available in the various groups, 53.6% joined for the benefits of obtaining funding while 51.0% joined to network.

Table 4. Reasons for Joining Farmers Group

Reason for joining	Frequency	Percent
Moral support	93	48.4%
Empowerment	106	55.2%
Funding	103	53.6%
Networking	98	51.0%
Farm inputs	116	60.4%

These findings aligned to Abebwa & Haila, (2013) who asserted that farmer groups facilitate easy access to rural credit, inputs and markets. A similar sentiment was expressed by Ashby et al., (2009). Shiferaw *et al.*, (2011) added that farmer groups expedite efficient information flow on available improved agricultural technologies. The focus group

discussions revealed that it was through sharing of information in the groups that other farmers got to know where they could access inputs, credit facilities which were given through table banking in the groups or support for farming from the county government. The respondents further indicated that it was through the groups that they learned on how to plant NERICA rice. They learned the use of inputs and farm management practices, discussed the challenges they were facing with the rice and how best to handle them. The networking helped overcome some of these challenges. This implies that through joining and interacting with other members in the groups a lot of benefits were realized among them the information and adoption of NERICA rice. This is in agreement with Centola (2010) who asserted that networks served as pathways through which farmers could access information and other support services which may be crucial in the initial stage of adoption but may not be accessible when farmers operate as individuals away from the groups.

The other type of social networks that existed in the study area was network of friends. It was reported from the FGDs that some of the farmers accessed information about the NERICA rice through these friendships and a lot of discussions and engagement went on before these farmers chose to adopt NERICA rice farming. Some of the respondents alluded to how they accessed the first seeds to plant through friends while some of them saw good harvest of rice after visiting their friends and this encouraged them to try farming in their own gardens.

An FGD discussant from Nyakuru, Awendo sub county remarked,

"I used to own a kiosk, then one morning a friend of mine came to charge his phone, when he was done I overheard him talk to someone over the phone regarding some new rice that had been introduced in Ndhiwa in Homa Bay County. He was telling the friend to help him with some seeds to try on his farm. When he finished talking, I asked about this rice that he was talking about and he explained it to me. I was happy and asked when he intended to go for it and since he was my friend, he let me accompany him and that is how I planted my first seeds. Then my friends around Nyakuru visited my rice farm, I also gave them to try and that is how people around here planted NERICA variety 4".

Some of the friends learned later after visiting their friend's home and eating rice with them and were informed on how to farm and they became rice farmers. Some of them reported that they visited their friends when they were weeding the rice and they were impressed at how good the rice looked in the fields and that is how they also started planting the rice. This finding is aligned to Othieno (2013) who argued that the network of friends forms an inner circle of bonding ties which enables information flow from one friend to another and this facilitates diffusion and adoption of agricultural technologies.

Friendships are very important in the rural communities. People value their friends and regard them highly. Friendships can exist within a family, neighborhood, at village level and within the community. People keep individual friends while two or more families can share friendships. Friendships form a bonding tie where people visit each other on regular basis to share food, exchange gifts and pleasantries. Within such friendships a lot of information and advice is given regarding social issues around the families and community at large. This implies that social networking through friends contributed to the adoption of NERICA technology since information moved from two friends to several friends and eventually a big group of farmers within the community adopted the rice farming. Social network through friends may thus be a very important pathway to adoption of new agricultural technologies.

Social networking of neighbors was also identified as one of the ways that facilitated the flow and adoption of NERICA rice technology. Farmers reported to have shared information with their neighbors about the new rice. Other farmers confessed on having had a practical observation in their neighbors' farms and this created curiosity which was followed by further enquiry about the new crop.

Key informant from Dede Awendo Sub County remarked:

“One Saturday afternoon I was from church, I decided to pass through my neighbor Mzee Osogo’s house to find out why he did not attend church and of course to greet him. When I arrived near his house from the left side of his farm, I saw some new crop growing, I quickly moved near then I entered his homestead and found that he was sick from malaria. So, we exchanged greetings and I enquired about the crop, and he said it was a new variety of rice. We agreed that when he harvests, he calls me to see. He did and I liked it, that is how I got my first seeds from him and planted mine”.

The report from the FGDs showed that neighbors in the study area kept very close interactions and from these interactions they learnt from each other about the NERICA rice and how to farm it, they could see a new crop in a neighbor’s farm and physically walk there to find out how to access the seeds and plant in their own farms. Many rice farmers indicated that they learned from their neighbors and decided on their own volition to try it in their farms without any formal training. People in the rural communities seem to be socially attached to their neighbors. As they wake up every morning they meet their neighbors along the road, they share greetings, amenities like water from the streams and many other natural resources. Neighbors share the same climate, similar soil and plant similar crops. The natural forces and similar infrastructure create a rhythm which same people in the neighborhood enjoy. The same forces create some cohesion and warmth that brings a positive natural bond. Good neighborliness was regarded as a ground for good networking for the farmers. The respondents coexisted as good neighbors who were willing to share information on farming to improve their lives and livelihoods. It is through this kind of interactions that neighbors formed strong social networks that enabled them to manage their day to day lives and sustain their social economic lives. This means that good neighborliness is a pathway through which information about a new technology can spread because neighbors observe and get motivated by their successful neighbors. These findings are in line with Udry, (2010) who reported that farmers adjust their inputs to align with those of their neighbors who were successful in previous periods. The study findings further concur with Foster and Rosenzweig (1995) who reported that farmers with experienced neighbors were significantly more profitable than those with inexperienced neighbors. Similarly, Langyintuo & Mekurie (2008) found that neighbors’ adoption influences farmer’s adoption. This implies that the only farmers who will adopt are the ones surrounded by successful or experienced neighbors. This means that neighbors as a node for diffusion and adoption of technology is effective if all the surrounding neighbors to the farmers have a success story on their previous adoption or have had experience that can be positively shared and motivating. This also means that not all neighbors can be effective agents of adoption of technologies to the farmers.

Family and kinship were identified as a category of social network that may promote the diffusion and adoption of technologies. Family and extended families and relatives naturally keep ties through networking.

A discussant from the FGD in Pinyowatcho remarked:

“My sister is married not far from here, she came visiting me one time and I was harvesting rice, she stayed over for one week and we finished harvesting and we ate the rice together, she liked it and when she was leaving, she took some to plant in her farm. She later gave some seeds to her friends and neighbors, they were all happy”.

A key informant from Uyomo in Uriri Sub County remarked:

“I went to visit my parents in Nyakachi with my children, we carried some rice for my mother, and while I was there my brother who lives in Nyatike came and found the rice, he liked it and he later came to my place I gave him some to plant”.

It was established from the key informant interviews and FGDs that these family networks enhanced the adoption of NERICA rice technology. Some of the farmers reported that they were able to share information about the rice with their relatives, some picked it up and started

planting. Some of them reported that their relatives visited them in the farms and learned about the rice and in the process, they were able to start farming NERICA rice as well. They were able to learn all the requirements for farming of the rice and where to access it. These findings are similar to Bandiera & Rasul (2006) who reported that the choices of networks of family, friends and neighbors and social groups have an effect on adoption of technologies.

A family relationship is strengthened through visiting other extended family members and relatives and knowing how they are doing. Visitations are done very frequently, and gifts are exchanged to cement relationships and to revive dying relationships as well. In rural communities, relatives visit each other on important occasions without failure. Such occasions like funeral ceremonies, weddings and sometimes when a child is born. Sometimes relatives visit during harvesting time to help provide labor if the harvest was plenty and in turn, they were given some of the harvest to carry back home as a sign of appreciation. In some cases, the newly married ladies after they had given birth to two or three children, they would be allowed to visit their parents back home and they could go along with their children to be known. In all these family interactions and networking, a lot of food was shared and there was plenty to eat. This means that the family networks have bonding ties which are permanent and can be utilized from time to time to facilitate adoption. It also implies that family and kinship play a significant role in adoption of agricultural technologies and cannot be overlooked.

The authors noted the role of the church as a place that created its own social networks that facilitated the adoption of NERICA technology. Local churches are places of worship where people of the community go once a week either on Saturdays or Sundays to gather and worship. The priest and pastors pray and preach to heal the soles of the people and to give hope to people both young and old. Churches also create a conducive environment for people to socialize and create networks. These interactions go a long way in accomplishing many personal needs and objectives. The church hence creates a very conducive environment for networking and sharing information of social and economic importance in the community.

The priests take up the responsibility of sharing new happenings in the community that need to be taken note of. The findings from the FGDs reported that some of the farmers got to know about NERICA rice technology from the church. Some indicated that the pastor announced about the new rice in church and informed them about the benefits of the rice that they could access more information from the County Agriculture Office while others said they learned about the rice from other worshippers who were in the same church who had already planted and harvested for a while, and this motivated them. This means that the church created a conducive environment not only for prayer and worship but for networking about agricultural technologies and many other social economic issues for individual development in the community. These findings on the critical place of the church in the spread of NERICA rice in the study areas were in line with Ontita, (2012) argument that worshippers use the church as an arena to construct and extend their livelihoods.

Adoption of NERICA technology was also motivated through political engagements and interactions. The local administration starting with the village elders, sub chiefs, chiefs and ward representatives had a political role to play in terms of NERICA adoption. This is because it is normally a policy directive that any new happening in the rural community that is meant to drive a government agenda is naturally supported by the local administration. At times information on such policy directives is passed to the people through the village elders and the chiefs in their meetings or *barazas*. This kind of directive is meant to sensitize the community about national and county government policy directives to make sure that the community is implementing what the national or county government wants.

People in rural communities have an appreciation for political involvement. They appreciate when the local chief calls them for *barazas* (meetings) to discuss issues that affect their day to day lives and livelihoods. Further to this, they appreciate when a local leader like

a member of parliament shows up to for a meet - the -people tour. In these meetings they will come almost an entire village just to listen and feel part and parcel of the community. The local leaders will then give a speech and address issues of social and economic importance to the community, and developmental projects that are meant to alleviate poverty and improve the wellbeing of the people. The respondents indicated that in such forums, NERICA rice was introduced to them by the chief and the extension officer who had come along from the Sub County Agricultural Office. The extension officer was given an opportunity to explain all about the New rice and its benefits to the entire community and farmers were advised to go to the county office for some certified rice seeds. By the time he finished many people had learned about the rice. Such meetings were regular and those who attended were able to share the information with the rest of the community members. Through these political gatherings and chief's *barazas* many farmers were able to learn about NERICA rice and adoption. This implies that the political forums in the community were conducive networks for dissemination of information and inputs and their role in adoption of technologies cannot be overlooked.

4. Conclusion

This study examined the significance of social networks in the uptake of agricultural technologies. The study focused on NERICA rice in Migori County. The study identified the types of social networks that existed in the community and their effectiveness in diffusion and adoption of agricultural technologies. The findings revealed that social networks such as farmer social groups, friends, neighbors, family and extended relatives, churches and political forums enhanced the adoption of agricultural technologies in Migori County. These social networks were useful in enabling the farmers access information on NERICA rice, inputs and new farming practices. Through these forums the rice farmers improved on their farming skills by learning from each other and through peer learning. Knowledge, skills and practices were transferred to other farmers. However, the social networks had their own setbacks which were noted in the manner in which the adoption process, production and the yields of the rice. Some of the farmers who did not receive the initial training from the extension agents and did not have full information on rice farming, ended up coping what the previous farmers had done. This learning from neighbors meant that mistakes of the previous farmers were carried to the next generation of farmers. For instance, a practical observation by walking through the NERICA rice farms one could note a few challenges on agronomic practices such as wrong line spacing, over broadcasting of the rice, lack of fertilizer leading to poor crop and sometimes harvesting the rice before it was completely dry.

The research concluded that as much as the social networks enhanced the adoption of rice, it equally affected the quality of the rice and its sustainability. The researcher concluded that social networks alone may not be adequate in achieving optimal results in agricultural technology adoption especially in the rural environment without the presence of extension support.

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