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NETWORKING OF SMALLHOLDER FARMERS AND FOOD SECURITY IN SIAYA COUNTY, KENYA

Olala, Gilbert Owuor*

Tedson Richard Nyongesa**

Abstract

How networking smallholder farmers contributes to food security remains a key challenge not only in Kenya but even globally. Despite the fact that smallholder farmers are the main rural actors in agriculture, they still experience food insecurity due an array of socioeconomic challenges that exists. The study was set to analyze the contribution of networking of smallholder farmers to food security in Siaya County, Kenya. Correlation design was used. The target population was 199,034 smallholder farmers selected from 6 Sub Counties of Siaya. Sample size of 384 was arrived at through Fisher's model. Sampling technique was stratified sampling. The research tool was structured questionnaire, which was tested for validity and reliability before administration. Networking had a statistically significant weak positive correlation($R=.258$; $p<.05$) with food security. Networking had a statistically significant contribution to food security ($F_{ratio} = 24.942$; $p< .05$) attributing 6.7% variance. It showed that for every one standard deviation increase in networking initiatives, food security improved by .258 units. In conclusion, networking of smallholder farmers made a small contribution in food security in Siaya County, Kenya. The study recommends that: field agricultural officers should intensify networking initiatives with a view to enhancing sustainable food security; and Siaya County Department of Agriculture should invest in research to identify various networking interventions to be used for sustainable food security. The study was justified because it informed networking interventions that supports the realization of smallholder farmers' food security situation not only in Kenya but globally.

Key words: networking; smallholder farmers; and food security

* Department of Mathematics and Computer Science, The Kisumu National Polytechnic, P.O. Box 143, Kisumu, Kenya

** Department of Commerce, Entrepreneurship and Social Sciences, Jomo Kenyatta University of Agriculture & Technology, P. O. Box 3433, Kisumu, Kenya

1. Introduction

In this section, the topic of the study is discussed. In particular, networking, smallholder farmers and food security are discussed.

1.1 Networking

A network is a combination of nodes and links. The links connects the nodes. In social network analysis the nodes of concern are people, groups and organizations (Wasserman & Faust, 1994). In other areas of network analysis the nodes of concern may be pages in the World Wide Web, different species in an ecosystem or different compounds in a cell. In social network analysis links may be social contacts, exchanges of information, political influence, money, joint membership in an organization, joint participation in specific events or many other aspects of human relationships (Rick, 2003). The defining feature of social network analysis is the focus on the structure of relationships between people. This is contrasted with other areas of the social sciences where it is claimed that the focus is on the characteristics of people, groups and organizations, rather than the relations between them (Monge & Contractor, 2003).

Network is generally used as a structure of ties among the actors in a social system. These actors could be roles, individual persons, organizations, industries, or even nation states. The ties may be based on conversation, affection, friendship, kinship, authority, economic exchange, information exchange, or anything else that forms the basis of a relationship. In networks, flows between objects, actors and exchanges, which might contain an advice, information, friendship, career or emotional support, motivation, and cooperation, can lead to very important ties (Nohria & Eccles, 1992).

Networking of farmers may mean farmers working with other farmers or other institutions without any formal contracts with a view to accessing some gains. These may include supplier relationships, resource flows, trade association memberships, interlocking directorates, relationships among individual farmers, and prior strategic alliances (Nanthagopan, 2010).

According to Habyarimana (2009), networking theory applied in the field of food security enhances the flow of food security information and the transmission of food security information from one institutional unit to another. These characterize the interconnection between food security actors, analysts and policymakers in an economy and their reactions towards food security policy formulation and implementation.

1.2 Smallholder farmers

Smallholder differs between countries and between agro-ecological zones. In agriculturally favorable areas with high population densities they often cultivate less than one hectares of land, whereas they may cultivate 10 hectares or more in semi-arid areas, or manage 10 heads of livestock. Smallholders represent a large number of holdings in many developing countries. Evidence from the World Census of Agriculture for small number of selected countries in Africa shows that between 1980 and 1990, percentage of agricultural holdings of less than one hectare had increased from 50 percent to about 78 percent (FAO, 2010).

Most smallholders have diverse sources of livelihood including significant off-farm income, yet are still vulnerable to economic and climatic shocks. Their characteristics differ by country and farming system zone. The actual farming system, household strategies, household behavior, and

livelihood patterns are determined by resource endowments and institutional factors such as access to markets, organization of markets and information, finances, towns, public institutions and services (Ellis, 2008).

In East Africa smallholders have faced several historical constraints such as: land tenure, access rights, and land management; credit access; access to input and output markets; infrastructure; extension services; institutional problems; climate change and food security; and global financial, food, and fuel price crises(Adeleke, Abdul & Zuzana,2010). The agricultural sector remains the backbone of the Kenyan economy, employing 70 per cent of the rural population who are predominantly smallholders (GOK, 2010).

1.3 Food security

Food security is a measure of having consistent access to safe, adequate and nutritious food for an active and healthy life. According to FAO (2010) food security, at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Most hungry people in the world depend on the market for much of their food, including smallholder subsistence farmers who usually do not produce enough to meet their food needs year round. For more than one billion people who live on less than $1 a day (half the world nearly three billion people live on less than $2 a day), much of their income is spent on food.
In Brazil, the crop protection market exceeded in value that of the US, with sales growing at 5.4% per year compared to 3% for the rest of the world. Despite making these strides, Brazil still face challenges related to agricultural input access and output marketing, coupled with high cost of credit facilities (Jel, 2008).

From 2008, Kenya has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality. Official estimates indicate over 10 million people are food insecure with majority of them living on food relief. Households are also incurring huge food bills due to the high food prices. Maize being staple food and due to its preferences it is in short supply. Also, most households have limited choices of other food stuffs (GOK, 2010).

Despite the fact that Kenya has been implementing a number of food security projects, over 10 million Kenyans still suffer from chronic food insecurity and between two and four million people require emergency food assistance at any given time. The 2010 Economic Review of Agriculture also indicates that 51 per cent of Kenyan population lack access to adequate food (GOK, 2010)

Siaya County Integrated Development Plan 2013/2017 shows that the county produces food that can last only for nine months in a year. The output is nonetheless not stable and thus food gaps go up to eight months in poor seasons. The three to four months food difference is sourced from the neighboring counties and even Uganda (Mango, 1999).

2. Objective

To analyze the contribution of networking of smallholder farmers to food security in Siaya County, Kenya

3. Hypothesis

H_0: There is no statistically significant contribution of networking of smallholder farmers to food security in Siaya County, Kenya.

H_1: There is statistically significant contribution of networking of smallholder farmers to food security in Siaya County, Kenya.

4. Literature

In line with Public Policy Statements (2007) on community food security position of dietitians of Canada, it was recognized that community food security has broad scope that emphasize systematic and comprehensive approach to promote food security for everyone, and implicitly recognize the role of the larger food system in ensuring food security. Public Policy Statements (2007) reported that community food security involves long-term planning with a wide range of stakeholders working together toward a healthy, just, and sustainable food security system. Dietitians of Canada strongly encourage networking amongst themselves about issues, processes and advocate individually through participation in coalitions for the development and implementation of policies and programs that improve food security.

According to Innes-Hughes, Bowers, King, Chapman and Eden (2010), their paper on food security, food access was increasingly recognized as a key determinant of food security. In their view access was a subject of market influences and could be achieved through trade, bartering and community support networks. Innes-Hughes, *etal* (2010) also analyzed food security systems on a large and small scale, from global, national, and regional levels. Household and individual levels were also analyzed with the observation that food security systems occur at multiple levels and linked in such a way that problems at global or national levels affect people at individual and household levels. However, food security systems may also operate inequitably, creating wide variations in food availability, access and utilization which can lead to food deficiency.

Food security position paper presented by The Regional Universities Network- RUN (2013) in fields critical for food security- production, postproduction and in maintenance of resource base, at relevant ecological, social and economic dimensions engage professionals with knowledge, skills, expertise and development capacity to pioneer advances in food security in Australia. Such professionals uniquely network with food producers and collaboratively drive and oversee the adoption of innovation for food security.

A study conducted by Masi, Holley, Jack, and Leslie (2014) on the future of food security in stark county revealed that hunger networks are the most developed. A dense core indicated a number of leaders with connections to peripheral groups. However, the network was vulnerable, with small number of people serving as the main connectors to others. Supportive and local food sectors were observed to have much less developed networks with no evidence of core and scattered connections. Supporting organizations do appear to provide a potential “bridging” role between individuals involved with hunger and local food with the view that addressing food

security comprehensively require a greater degree of connectivity between hunger organizations and others that can provide additional supports or sources of local, healthy foods.

Omosa (2013) while investigating the role of social relations and networks in household food security and nutrition in Kenya observed that ability to access and consume nutritious food is to some extent an outcome of membership and relationships with other members of the society such as daughters, sisters, mothers, daughter-in-laws, aunts, cousins, grandchildren, development sociologists, employees, land owners, and even students. Also, being able to access nutritious foods from any relatives, networks and market through gifts, exchange arrangements, loaning or purchase was also observable. However, individuals and households were no longer able to rely to a large extent on membership in society in achieving food and nutritional security.

According to Anne (2013) on the publication Kenya food security brief, in parts of the high potential farming livelihood zones, markets are highly connected within the livelihood zones and with key urban centers, due to a fairly sophisticated trade infrastructure. In these areas, distances from markets are relatively low, and there are a number of market participants across the marketing chain, thus minimizing transaction costs. Subsequently, food price fluctuations are fairly low leading to improved food security. However, poor market infrastructure, particularly in northern parts of the Kenya, restricts access to markets and results in higher transactions costs, more price fluctuations and volatility, and higher prices with a lot of food insecurity.

Lamb (2011) in a thesis investigating the relationship between smallholder farm household networks for food acquisition and agricultural production, food security and dietary quality in the Mount Elgon region of western Kenya and eastern Uganda revealed that both food acquisition networks and technology networks for agricultural production had a statistically significant positive impact upon calorie procurement across the sites included in the study. However, networks for agricultural production appeared to operate differently in various locations with regard to dietary quality.

5. Methodology

In this section research methodology is outlined. In particular, it addresses: research design; target population; sample design; research instrument; piloting; data collection procedure; and data analysis and presentation.

5.1 Research design

Research design is a way a study is designed to be carried out. It is a plan that is used to generate answers to research problems. It is a blueprint for conducting a study with maximum control over factors that are likely to interfere with the validity of the findings (Kothari, 2011). The study employed both descriptive survey and correlation designs. Descriptive survey design was considered suitable because it did not only involve analysis of the situation as it was without manipulation of data but also involved measurement, classification, comparison and interpretation of data (Kothari, 2011). In view of the current study, descriptive design was used to describe how networking of smallholder farmers relates to food security situation in Siaya County, Kenya. According to Saunders, Lewis and Thornhill (2009), correlation is the degree to which two or more variables relate. Correlation design was used to assess the degree of relationship that existed between networking and food security situation in Siaya County.

5.2 Target population

A population is a complete set of elements, persons or objects that possess some common characteristics. Target population is a particular group of people that is identified as the recipient for the purpose of a study or a set of elements having a trait of concern that are being investigated (Mugenda and Mugenda, 2003). The target population of the study comprised an aggregate of 199,034 smallholder farmers from Siaya County (Institute of Economic Affairs, 2011). The distribution is shown in table1.

Table 1: ***Distribution of the target population***

Sub County	Respondents	Respondents (%)
Alego	42,593	21.4
Bondo	29,457	14.8
Rarieda	28,462	14.3
Gem	29,059	14.6
Ugunja	29,059	14.6
Ugenya	40,404	20.3
Total	**199,034**	**100.0**

Source: Institute of Economic Affairs (2011)

5.3 Sample design

Sample design is a joint procedure of identifying the population of interest, estimating the sample size, deciding on appropriate sampling technique and selecting representatives from the population (Yogesh, 2006). In order to arrive at the required sample size, Fisher's model as cited in Mugenda and Mugenda, (2003) was used. In the model, when the target population is more than 10,000 the sample size may be approximated by

$$n = \frac{z^2 pq}{d^2}$$

where

$p =$ Proportion of target population with traits being investigated;

$q =$ Proportion of target population without traits being investigated represented by $(1-p)$;

$d =$ Statistical level of significance set; and

$z =$ Normal statistical deviation

The model further outlines that if the proportion of the target population with the trait being investigated is not known then 50% is considered appropriate. At 95% confidence level

$$\therefore \quad n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

$$\approx 384$$

The distribution of the sample size is shown in table 2.

Table 2: ***Sample distribution***

Sub County	Respondents	Respondents (%)
Alego	82	21.4
Bondo	57	14.8
Rarieda	55	14.3
Gem	56	14.6
Ugunja	56	14.6
Ugenya	78	20.3
Total	**384**	**100.0**

Source: Adapted from Institute of Economic Affairs (2011)

To collect data from the estimated sample, the study adopted stratified sampling. The strata were sub counties within Siaya County from which smallholder farmers were selected from randomly. The units of the study were small holder farmers in each sub county. The sample size in each sub county was apportioned in proportion to the target population. This technique was most appropriate because of its ease of administration and homogeneity of small holder farmers in each Sub County (Mugenda and Mugenda 2003). According to Denscombe (2007), the technique was more appropriate because the researcher could assert some control over the selection of the sample in order to guarantee that crucial smallholder farmers or factors were covered in proportion to the manner in which they existed in the wider population. This helped the in making generalizations from the findings of the study.

5.4 Research instrument

The study used structured questionnaire as data collection instrument. A questionnaire is a research tool designed to collect data, which can be used subsequently for analysis. It consists of a written list of questions. Each person who answered a particular questionnaire read identical set of questions and this allowed for consistency and precision (Denscombe, 2007; Kothari, 1990; Oso & Onen, 2009). Questionnaire was considered appropriate for the study because it was: of relatively low cost; easy to arrange; standardized in answers provided to the extent that all respondents were exposed to exactly the same set of questions; and pre-coded in answers for easy management at analysis (Denscombe, 2007). In particularly, standardized questionnaire showing networking of small holder farmers and food security indicators was used. The questionnaire was divided into three sections, namely; demographic characteristics of small holder farmers, networking and food security. Demographic characteristics included: sex; age; marital status; highest level of education; primary occupation; land ownership; and types of crops grown. Networking constructs inclusive of interconnections between food security actors; and food security considered both physical and economic conditions of the small holder farmers.

5.5 Piloting

Piloting is trying out a study in small scale to determine whether or not the study will produce expected results (Creswell, 2009). This stage was crucial in research process because it enabled the researcher to detect problems or weaknesses that could have been encountered during the main research. Piloting was conducted with smallholder farmers in Rarieda Sub County. According to Yogesh (2006) in order for piloting results to be valid, it should involve

respondents' equivalent to 10% of the sample size. In the current study, 38 smallholder farmers were randomly selected and engaged in piloting the questionnaire.

Validity is the extent to which the results of the study can be accurately interpreted and generalized to the populations (Mugenda and Mugenda, 2003). The questionnaire was tested to check its content, construct and face validity. Content validity was done to ensure that contents of the instrument contained adequate sample of the domain of content it was supposed to represent. Face validity deals with the format of the instrument and includes aspects like clarity of printing, font size and type, adequacy of workspace, and appropriateness of language among others. Construct validity determine the nature of psychological constructs or characteristics measured by the instrument. Validity was ensured through the use of research experts who were research supervisors at Jomo Kenyatta University of Agriculture & Technology. The questionnaire was given to the supervisors to evaluate and rate each item in relation to the objectives as not relevant or relevant on the 1-4 scale. Validity index was determined from the ratio $n_{3/4}/N$ as .82, where $n_{3/4}$ was the number of items marked 3 or 4 by both supervisors, and N was the total number of items assessed. The score was above the recommended minimum validity index of .70 (Oso & Onen, 2009). The questionnaire was therefore valid.

Reliability is the extent to which research results are consistent and replicable (Kothari, 2011). Reliability is the consistency of scores when the research instrument is administered from one set of items to another, and also from one point in time to another (Frankel & Wallen, 2006**)**. The instruments was pre-tested for reliability using Cronbach alpha (α) with a sample of 10% of smaller holder farmers randomly selected from the Rarieda Sub County. Ten percent was chosen for pre-test because it is the smallest number that yields meaningful results in data analysis of a survey research Yogesh (2006). The reliability index of .809 was computed and since it was greater than 0.7 the minimum recommended value the questionnaire was accepted as reliable

5.6 Data collection procedure

Permission to collect data was sought from The School of Graduate Studies Jomo Kenyatta University of Agriculture and Technology. Notification letters were thereafter be sent to village heads in the Sub Counties. While doing this, the researcher was cautious that short-circuiting proper channels of authority could have led to difficulty in getting data (Denscombe, 2007). Research assistants were: thoroughly trained on research ethics; made to understand the instructions and content of the instruments; instructed to take all measurements in the most consistent manner across all respondents; and advised to record and compile data accurately.Data collection took two weeks. A check list was used to monitor the despatch and return of questionnaires.

5.7 Data analysis and presentation

Data analysis is the examination of what has been collected and making deductions and inferences hence a process which involves uncovering underlying structures, extracting important variables, detecting any anomalies and testing any underlying assumptions (Yogesh, 2006). Preliminary to entering data in Statistical Package for Social Sciences version 20.0 ready for processing, completed questionnaires were: edited for consistency; and coded to enable the responses to be grouped into appropriate categories. Both descriptive statistics and inferential statistics were used to analyze quantitative data. While descriptive statistics was used describe the practice of networking and the position of food security in the county, inferential statistics

was used to analyze data on how networking contributed to food security. In particular, while descriptive statistics involved the mean, standard deviation, skewness and kurtosis, inferential statistics involved simple linear regression model. The general simple linear regression model used was

$$y = \beta_0 + \beta_1 x + \varepsilon \quad (1)$$

In model 1, y represented food security and x represented networking. The term ε was the *residual* or *error and* represented the deviation of the observed value of food security from that expected from the model. β_0 *and* β_1 were taken as constants to be determined. Results of the analysis were presented through tables with written interpretations and discussions of results.

6. Results and discussions

The contribution of networking of smallholder farmers to food security was analyzed, presented, interpreted and discussed. Descriptive results of valid data items, means, standard deviations, skewness and kurtosis for gender mainstreaming and food security were shown in table 3.

Table 3: ***Descriptive statistics for networking and food security***

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Food Security	351	4.30	.36	-.53	.13	1.90	.26
Networking	351	4.17	.38	-.13	.13	.42	.26

Key: 1.0 - 1.4- strongly disagree; **1.5 - 2.4-** disagree; **2.5 - 3.4-** not sure; **3.5 - 4.4**-agree; **4.5 - 5.0**-strongly agree
Source: Survey data (2017)

Table 3 showed the means and standard deviations for networking (M=4.17; SD= .38). There was general agreement that smallholder farmers were networked in Siaya County. Networking was achieved through: attending agricultural meetings; focusing on communication with other farmers; encouraging partnership with other farmers; accessing resources from other farm institutes; maintaining contact with other agricultural institutes; and interaction among smallholder farmers themselves. Table 3 also showed the mean and standard deviation for food security (M=4.30; SD=.36). There was general agreement that Siaya County had improved its food security situation; that is, there was improved food availability, accessibility; utilization and stability.

Though table 3 showed networking was being practiced among smallholder farmers in Siaya County and there was improved food security, it could not show how networking contributed to food security. Moreover, the mean for food security was higher than that for networking by some points casting doubt as to whether there was a correlation between them. Simple linear regression model 1 was therefore sought. Preliminary tests on model 1 were satisfied. The hypothesis, 'there is no statistically significant contribution of networking of smallholder farmers to food security in Siaya County, Kenya" was tested at 5% significance level. The results were shown in table 4.

Table 4: ***Regression statistics for networking and food security***

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.268	.208		15.700	.000
	Networking	.248	.050	.258	4.994	.000
	Best line of fit					
	R=.258					
	R^2=.067					
	Adjusted R^2=.064					
	F_{ratio}=24.942					
	P< .05					

a. Dependent Variable: Food Security

b. Predictors: (Constant), Networking

Source: Survey data (2017)

Table 4 showed a weak degree of statistically significant positive correlation (R=.258; p<.05) between networking and food security. R-square of .067 measured part of food security, which was explained by networking. It showed that approximately 6.7% of the variation in food security was attributed to networking**.** Table 4 and model 1 also provided an optimum simple linear regression equation between networking and food security as

$$Y = 3.268 + .248x \quad (2)$$

The linear regression model 2 was statistically significant (F_{ratio} = 24.942; p< .05). Standardized beta coefficients, showed that for one standard deviation increase in networking practices, food security improved by approximately .258 units. The linear regression model 2 also showed that without networking, food security situation was approximately 3.268 units and for every unit increment in networking, food security situation improved by .248units.

Public Policy Statements (2007) on community food security position of dietitians of Canada recognized that a larger food system had a role in ensuring food security. This was observed to involve long-term planning with a wide range of stakeholders working together toward a healthy, just, and sustainable food security system. While the current study cited networking strategies such as attending agricultural meetings; focusing on communication with other farmers; encouraging partnership with other farmers; accessing resources from other farm institutes; maintaining contact with other agricultural institutes; and interaction among smallholder farmers themselves, Public Policy Statements (2007) talked of stakeholders working together but did not specify what working together entails. Also the current study used linear regression models to reveal a metric contribution of networking to food security. Public Policy Statements (2007), however, was silent about the model of analysis and the metric contribution of stakeholders working together to food security.

Innes-Hughes, Bowers, King, Chapman and Eden (2010), in their paper on food security, observed that access to food through trade, bartering and community support networks was significant in enhancing food security. This was in agreement with the current study where networking of smallholder farmers was achieved through: attending agricultural meetings;

focusing on communication with other farmers; encouraging partnership with other farmers; accessing resources from other farm institutes; maintaining contact with other agricultural institutes; and interaction among smallholder farmers themselves. Though the current study was very explicit about the model of analysis and even revealed the contribution of networking to food security, Innes-Hughes, Bowers, King, Chapman and Eden (2010) results was silent about the model used and did not reveal the metric contribution to food security.

The results of the current study was also in agreement with the paper on food security presented at The Regional Universities Network- RUN (2013) where it was observed that relevant ecological, social and economic dimensions engage professionals with knowledge, skills, expertise and development capacity to pioneer advances in food security in Australia. Such professionals uniquely network with food producers and collaboratively drive and oversee the adoption of innovation for improved food security. While the current study applied regression models to arrive at the results, RUN (2013) did not specify the model applied in linking networking strategies to food security.

Masi, Holley, Jack, and Leslie (2014) while studying the future of food security in stark county revealed that hunger networks are the most developed and a dense number of leaders with connections to peripheral groups had better standards of food security. However, while the current study was so specific on networking strategies, Masi, Holley, Jack, and Leslie (2014) did not specify their networking strategies. Also, while the current study was more objective through revealing metric results, Masi, Holley, Jack, and Leslie (2014) results were rather subjective in approach.

Omosa (2013) while investigating the role of social relations and networks in household food security and nutrition in Kenya observed that ability to access and consume nutritious food is to some extent an outcome of membership and relationships with other members of the society such as daughters, sisters, mothers, daughter-in-laws, aunts, cousins, grandchildren, development sociologists, employees, land owners, and even students. Anne (2013) however, observed networking with reference to poor marketing infrastructure, restricting access to markets resulting into higher transactions costs, price fluctuations and volatility, and higher prices with a lot of food insecurity. Omosa (2013) and Anne (2013) studies support of the current study where networking was seen to significantly contribute to food security. However, the dimensions of networking were different in both studies. Moreover, Omosa (2013) and Anne (2013) did not reveal networking metric contribution to food security.

The current study found that networking significantly contributed to food security in Siaya County. This was in agreement with Lamb (2011) study on the relationship between smallholder farm household networks for food acquisition and agricultural production, food security and dietary quality in the Mount Elgon region of western Kenya and eastern Uganda where both food acquisition networks and technology networks had a statistically significant positive impact upon calorie procurement. Moreover, both the current and Lamb (2011) studies used correlation models.

7. Conclusion

There was a statistically significant weak positive correlation between variations in networking of small holder farmers and food security. Though networking smallholder farmers attributed to the variation in food security, the contribution was quite small.

8. Recommendations

Networking contributed to improved food security in Siaya County. The study therefore recommends that field agricultural officers should intensify its practice with a view to enhancing sustainable food security. Networking involve wide field with numerous operational interventions. Siaya County Department of Agriculture should therefore invest in research to identify various networking interventions to be put into use for sustainable food security.

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