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CAPACITY BUILDING INTERVENTIONS OF SMALLHOLDER FARMERS AND FOOD SECURITY IN SIAYA COUNTY, KENYA

Tedson Richard Nyongesa[1]

Olala, Gilbert Owuor[2]

Analysis of the contribution of capacity building interventions of smallholder farmers to food security remains a global challenge. Despite the fact that smallholder farmers are the main rural actors in agriculture in most parts of the globe, they still experience food insecurity. The purpose of the study was to analyze the contribution of capacity building interventions of smallholder farmers to food security in Siaya County, Kenya. The study was guided by training, networking and gender mainstreaming theories. Correlation design was used. The target population was 199,034 small holder farmers selected from 6 Sub Counties of Siaya. Sample size of 384 was arrived at through Fisher's model. Sampling technique was stratified random sampling. The research tool was structured questionnaire, which was tested for validity and reliability before administration. Data was analyzed through correlation and regression models and presented through tables. It showed that training with beta value of .175 ($p<.05$) made a statistically significant contribution to food security when networking and gender mainstreaming were controlled. Networking with beta value of .115 ($p<.05$) made a statistically significant unique contribution to the food security when training and gender mainstreaming were controlled. Gender mainstreaming with a beta coefficient of .316 ($p< .05$) made a statistically significant

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

[2] **Department of Commerce, Entrepreneurship and Social Sciences, Jomo Kenyatta University of griculture & Technology**

unique contribution to food security when training and networking were controlled. In conclusion, gender mainstreaming made the strongest unique contribution in explaining food security; training made the second strongest unique contribution in explaining food security; and networking made the least contribution in explaining food security. Recommendations of the study were: field agricultural officers should intensify capacity building with a view to enhancing sustainable food security; and investment in research to identify other capacity building interventions for sustainable food security. The study was justified because it informed better capacity building interventions that supports the realization of smallholder farmers' food security situation not only in Kenya but globally.

Key words: capacity building; training; networking; gender mainstreaming; smallholder farmers; and food security

1 Introduction

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

1.1 Capacity building interventions

Capacity building is viewed as improving or upgrading the ability of a person, team and institutions to implement their functions and achieve goals over time. It is important for all levels, from individuals to national organizations. Capacity building also alludes to building the organizational capacities of communities, and support to the formation of non-profit organizations (Horton, 2002).

The capacity building interventions discussed in this section are gender mainstreaming, training and networking.

1.1.1 Gender mainstreaming

Gender mainstreaming is the process of assessing the implication for women and men in any planned action, including legislation, policies or programmes, in all areas and at all levels (Strasbourg, 2004). It is a strategy for making women and men concerns and experiences an

integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that there is equity for both women and men in acquisition of benefits (Council of Europe, 2004).

Gender mainstreaming is essentially a contested concept and practice. It involves the reinvention, restructuring, and rebranding of key parts of feminism in the contemporary era. It is both a new form of gendered political and policy practice and a new gendered strategy for theory development. As a practice, gender mainstreaming is a process initiated to promote gender equality. It is also intended to improve the affectivity of mainline policies by making visible the gendered nature of assumptions, processes, and outcomes (Walby, 2005).

Jahan (1995) and Lombardo (2003) considered gender mainstreaming as either 'agenda setting' or 'integration', of women and men while Shaw (2002) contrasts it by considering 'embedded' as compared with 'marginalized'.

The advocacy for gender mainstreaming has been very successful and the ideas gained ground during the decade between the UN World Conferences on Women in Nairobi (Ria, 2013). Unit for the Promotion of the Status of Women and Gender Equality (2000) embraced the term gender mainstreaming as a strategy to redress women's unequal position in twelve critical areas of concern, including education, health, armed conflict, as victims of violence, economy, decision making and human rights.

According to Norad (2005) political commitment expressed in goals and objectives needs to be translated into a political commitment to making women and gender an active and visible part of dialogue, programming, and reporting, and that women and gender should be considered as across cutting issue at all levels of economic development.

The current study considered gender mainstreaming as a way of engaging both men and women smallholder farmers in planning, policy formulation, designing of programs, monitoring of programs and evaluating programs in the small farm sectors in Siaya County, Kenya.

1.1.2 Training

Manpower Services Commission U.K. (1981) defined training as a planned process for modifying attitude, knowledge, skills or behavior through learning experiences to achieve effective performance in any activity or range of activities. Its purpose, in the work situation, is to develop the abilities of the individual to satisfy current and future manpower needs of an organization. According to Sloman (2005) training endeavors to impart knowledge, skills and attitudes necessary to perform job-related tasks. It is characterized as an instructor-led and content-based intervention designed to bring desired change in behavior.

Opinions differ as to whether a change of attitude should be included in the definition of training. According to Wills (1994) attitudes are notoriously difficult to quantify and training a lone is insufficient to bring about major long-term changes in attitude. Instead, he defines training as the transfer of measurable knowledge or skills. Hare et al (1996) described training as any activity or course of action either formal or informal, which helps in acquiring the knowledge and skills important in doing a job.

According to Overman (1994) what peoples' heart feels are easily forgotten and what they see are easily remembered. Hughey and Mussnug (1997) likewise observed that most employees simply do not learn very well when they are talked to. Employees therefore need to be more actively involved in training and learning experiences so as to improve their efficiency and effectiveness.

The origin of training as a concept can be traced back to the middle Ages in the form of apprenticeships. Training evolved into vocational schools in the early 1800's and apprenticeship programs were shortened and what is now known as job instructional training was developed around the First World War (Desimone, Werner & Harris, 2002).

A variety of training methods have taken shape over the years. Lectures/demonstrations are the oldest forms and most traditional means of training. In its most basic state, lectures and demonstrations simply present information from the trainer to the trainee. On-the-job training is considered as a form of traditional training, which occurs in the workplace. It consists of

methods such as apprenticeship, internship, mentorship among others (Blanchard & Thacker, 2009).

Audio visual enhancements also provided a means for the trainees not only to absorb knowledge in a traditional basic way but also to gain insight by exploiting the auditory sense. In this case, retention is more easily transferred when easy viewing is exercised and technical difficulties eliminated. Today, audio visuals are made available by computer technology and it is hard to imagine the workplace where employees training take place without computer-generated assistance (Blanchard & Thacker, 2009).

1.1.3 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 showed that between 1980 and 1990, the 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.

World Summit declaration on Food Security held in Rome in 2009 reported that food security exists when all people, at all times, have physical and economic access to sufficient, safe, nutritious food to meet their dietary needs and food preferences for an active life (FAO, 2011). Most hungry people in the world depend on the market for much of their food. This includes smallholder subsistence farmers who usually do not produce enough to meet their food needs all the year round. For more than one billion people who live on less than $1 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 capacity building interventions of smallholder farmers to food security in Siaya County, Kenya

3. Hypothesis

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

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

4. Literature

In this section, literature was sought on: gender mainstreaming and food security; training and food security; and networking and food security.

4.1 Gender mainstreaming and food security

On a study commissioned by Asian Development Bank (2013) on gender equality and food security-women's empowerment as a tool against hunger reported that women's empowerment is not only a priority goal in itself but an intrinsic human right and is recognized as such both in pledges and commitments by governments. The report recognized instrumental value of gender equality and conditions for the society as factors leading to increased contribution of women to food security and adequate nutrition. Asian Development Bank (2013) further reported that the society urgently needs full potential of women's contribution. This can only materialize with wider recognition and acknowledgment the role of both women and men in the society.

A study conducted by FAO (2010) office of knowledge exchange, research and extension reported gender: inequalities along the entire food production chain, "from farm to plate" impede the attainment of food and nutritional security; inequalities in access to productive resources (land, labour, fertilizer, credit, technology, extension and markets) for example, negatively affect food availability; relations between and among men and women are important in determining vulnerability to food insecurity and malnutrition; and discrimination in the allocation of household resources, including those related to nutrition, may result in an increased incidence of malnutrition among women and girls.

Food and nutrition insecurity is a gender justice issue. Low status and lack of access to resources mean that women and girls are the most disadvantaged by the inequitable global economic processes that govern food systems and by global trends such as climate change. Evidence shows strong correlations between gender inequality and food and nutrition insecurity – for example, in India, thousands of women and girls still lack food and nutrition security as a direct result of their lower status compared with men and boys. Such inequalities are compounded by women and girls' who often have limited access to productive resources, education and decision-making (Bridge, 2014).

Empowering women and girls is not just necessary for their well-being, but also a means to broader agricultural development and food security, and economic soundness. Studies in Africa show that, if women farmers were given the same access to resources (such as land, finance and technology) as men, their agricultural yields could increase by 20 to 30 percent; national agricultural output could rise by 2.5 percent; and the number of malnourished people could be reduced by 12 to 17 percent (Senay, Tim, Lucy & Agnes, 2012). Senay, *etal.* (2012) observed that eliminating gender-based discrimination under the law, ensuring gender-sensitive policies and programming decisions, and giving women greater voice in decision-making at all levels are necessary for mainstreaming gender in agriculture and enhancing food security.

Senay, *etal* (2012) studied sustainable rural livelihoods programme in eastern Uganda designed to improve food security, nutrition and health at the household and community levels. The programme enriched women's human capital through training and experience gained in

developing leadership skills, improved nutrition and health, and community wide respect for sources of valuable knowledge. Women who were involved in farm groups and emerging marketing associations observed significant increase in household food security.

According to Kassie, Wagura, and Shiferaw (2012) women in Kenya face significant barriers in agriculture, especially inequalities in access to and control over crucial resources and inputs such as land, labour, fertilizer and formal finance. Women also face barriers to membership in rural organizations and cooperatives, agricultural inputs and technology such as improved seedlings, training and extension as well as in marketing services. Kassie, Wagura, and Shiferaw (2012) found that in Kenya female headed households are 13 per cent less likely to be food secure than male headed households. Their study also found that female headed households face 12 per cent higher probability of chronic and transitory food. This was observed could be attributed to gender based discrimination, which renders female-headed households more vulnerable to food insecurity and poverty.

4.2 Training and food security

Community food security position of dietitians of Canada recognized that community food security has broad scope that emphasizes systematic and comprehensive approach to promote food security for everyone. It also implicitly recognized the role of the larger food system in ensuring food security. It reported that community food security involves long-term planning with a wide range of stakeholders working together towards a healthy, just, and sustainable food security system (Public Policy Statements, 2007).

Agricultural training intervention is any type of program that aims at facilitating transfer of knowledge or skills on topics that are of agricultural benefit to farmers. Training interventions for farmers vary considerably. Some interventions focus directly on teaching farmers new skills using top-down 'training and visit' methods. Governments often package such interventions as extension services, a broad term for programs which aim to support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies (Anderson 2007).

Although traditionally considered a top-down approach, training and extension services have over time become more participatory in nature. Farmers' field schools in particular, which may be one component of broader agricultural extension services, use a more bottom-up approach to training and knowledge transfer. Such schools are participatory, empowering and experiential in nature, focusing on problems and priorities identified by the farmers, rather than on issues and challenges determined by outsiders (Waddington & Howard, 2014).

An assessment of the composition of the poor and hungry indicates that they are mainly smallholder farmers, including livestock keepers, crop farmers and those dependent on natural resources such as forests and fisheries for their livelihoods. Roughly half of the 1 billion hungry in 2009 were smallholder farmers, 22 % are rural landless, 20 % are the urban poor, and 8 % are populations that depend mainly on natural resources, such as fishers, herders, and forest dwellers (Scherr, Wallace & Buck 2010). However questions remain on whether these groups can organize into clusters to express their needs in improving production so they can have secure livelihoods.

The clusters imply eventual emergence of different interest groups around agricultural production. However, without adequate mobilization and support structures for the communities to contribute to policies that improve their lives chances are that they will remain locked in dependence cycle that leaves them vulnerable to all kinds of natural and economic shocks. The sheer numbers of households dependent on smallholder agriculture for their livelihoods makes this an important aspect of food security in the developing world, particularly in Sub Saharan Africa (Pasteur, 2009).

4.3 Networking and food security

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 plan 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, classifications, comparisons and interpretation of data (Kothari, 2011). In view of the current study, descriptive design was used to describe how training 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 capacity building interventions 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 & 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 size 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 size, 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 & 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 which they existed in the wider population. This helped 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 was subsequently analyzed. It consisted 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 capacity building interventions of small holder farmers and food security indicators was used. The questionnaire was divided into three sections, namely; demographic characteristics, capacity building interventions and food security. Demographic characteristics included: sex; age; marital status; highest level of education; primary occupation; land ownership; and types of crops grown. Capacity building interventions included gender mainstreaming, training, and networking. Food security considered physical, social and economic situations of smallholder farmers.

5.5 Piloting, validity and reliablity

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 & 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 at Jomo Kenyatta University of Agriculture & Technology. The questionnaire was given to the experts 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) and was considered 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 could yield 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 sent to the 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. It is therefore a process of 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 capacity building interventions and the position of food security in the county, inferential statistics was used to analyze data on how capacity building interventions contributed to food security. In particular, while descriptive statistics involved the mean, standard deviation, skewness and kurtosis, inferential statistics involved multiple linear regression model. The general multiple linear regression model used was

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_q x_q + \varepsilon \qquad (1)$$

Model 1 was a general multiple linear regression model representing change in food security, y, with respect to changes in observed q capacity building interventions $x_1, x_2, \cdots, x_q$ .The term ε was the *residual* or *error* and represents the deviation of the observed value of food security from that expected from the model. The error term was assumed to have a normal distribution with variance σ^2. $\beta_0, \beta_1, \beta_2, \cdots, \beta_q$, were coefficients to be determined.

6. Results and discussions

In this section, the results of the study are analyzed, interpreted, presented and discussed.

6.1Results

The contribution of capacity building interventions 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 training and food security were shown in table 3.

Table 3: ***Descriptive statistics for capacity building interventions 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
Training	351	4.12	.45	-.69	.13	1.82	.26
Networking	351	4.17	.38	-.13	.13	.42	.26
Gender Mainstreaming	351	4.39	.37	-.10	.13	-.37	.26

Key: 1.0 - 1.4- strongly disagree; **1.5 - 2.4-dis**agree; **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 mean and standard deviation for food security (M=4.30; SD=.36). The means and standard deviations for independent variables: training (M=4.12; SD= .45); networking (M=4.17; SD=.38); and gender mainstreaming (M=4.39; SD=.37) are also shown. Though table 3 showed capacity building interventions among smallholder farmers in Siaya County had improved food security, it could not show the proportion of contribution to food security. Moreover, the mean for food security was higher than those for training and networking but less than that of gender mainstreaming by some points. This exhibited doubt as to whether there was a correlation between them. Multiple linear regression model 1 was therefore sought. Preliminary tests on model 1 were satisfied. The hypothesis, 'there is no statistically significant contribution of capacity building interventions 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: ***Linear regression analysis for the contribution of capacity building interventions to food security***

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.916	.267		7.170	.000
	Training	.141	.041	.175	3.392	.001
	Networking	.110	.051	.115	2.170	.031
	Gender Mainstreaming	.307	.049	.316	6.313	.000
	Goodness of fit:					
	R = .439					
	R^2 = .193					
	Adj R^2 = .186					
	F_{ratio} = 27.628					
	P< .05					

a. Dependent Variable: Food Security

b. Predictors: (Constant), Training, Networking, Gender Mainstreaming

Source: Survey data (2017)

Table 4 showed a moderate degree of statistically significant positive correlation (R=.439; p<.05) between capacity building interventions and food security. R-square of .193 measures part of the food security, which was explained by capacity building interventions. It showed that approximately 19.3% of the variation in food security was attributed to capacity building interventions**.** Table 4 also showed standardized Beta coefficients used to compare contributions of capacity building interventions to food security. The largest Beta coefficient of .316 (p< .05) was for gender mainstreaming and was statistically significant. It made the strongest unique contribution in improving food security, when the variance explained by training and networking in the model was controlled. The Beta value for training of .175 (p<.05) was also statistically significant and made the second strongest unique contribution in improving food security, when the variance explained by networking and gender mainstreaming was controlled. Networking

with Beta value of .115 ($p<.05$) was also statistically significant. It made the least contribution in improving food security, when the variance explained by gender mainstreaming and training in the model was controlled. The optimum multiple linear regression model for the relationship between food security and capacity building interventions: training; networking; and gender mainstreaming was provided as

$$y = 1.916 + .141x_1 + .110x_1 + .307x_3 \quad (2)$$

The linear regression model (2) had a moderate degree of positive multi-correlation ($R = .439$; $p<.05$) between variation in food security and variation in capacity building interventions: training; networking and gender mainstreaming factored in the model. The linear model (2) was approximately 19.3% explained by variation in capacity building interventions and was statistically significant ($F_{ratio} = 27.628$; $p< .05$).

The un-standardized coefficients were also used to interpret model 2. The constant 1.916 was the predicted value of food security when there was no training, networking, and gender mainstreaming practices. The coefficients showed that for every unit increment in: training, food security improved by .141 units while networking and gender mainstreaming were controlled; networking, food security improved by .110 units keeping training and gender mainstreaming constant; and gender mainstreaming, food security improved by .307 units while training and networking were controlled.

6.2 Discussions

A study commissioned by Asian Development Bank (2013) recognized the instrumental value of gender equality and conditions for the society as factors leading to increased contribution of women to food security and adequate nutrition. This was in agreement with results of the current study which also showed that gender mainstreaming contributed significantly to food security. However, while the current study considered both gender in equal measures, Asian Development Bank (2013) investigation was more inclined to women.

While the current study revealed gender mainstreaming as contributing to food security, FAO (2010) office of knowledge exchange, research and extension reported gender inequalities along the entire food production chain, “from farm to plate” as impeding the attainment of food and

nutritional security. Also, while the current study revealed gender mainstreaming to be significantly contributing to food availability, stability and accessibility, FAO (2010) observed that relations between and among men and women are important in determining vulnerability to food insecurity and malnutrition.

While the current study revealed gender inclusiveness and equity to have increased food security, Bridge (2014) revealed thousands of women and girls as lacking food and nutrition security because of their low status compared to men and boys. Such inequalities were found to have been compounded by women and girls' who often have limited access to productive resources, education and decision-making.

Senay, Tim, Lucy and Agnes (2012) study in Africa showed that, if women farmers were given the same access to resources (such as land, finance and technology) as men, their agricultural yields could increase by 20 to 30 percent; national agricultural output could rise by 2.5 percent; and the number of malnourished people could be reduced by 12 to 17 percent. While this study was more confined strengthening women, the current study looked at gender parity and found that it contributed significantly to food security in Siaya County.

While the current study described training of smallholder farmers as: engagement in seminars; engagement in conferencing; continued professional development; coaching programs; mentorship programs; and literacy improvement programs, Anderson (2007) described training of farmers as teaching farmers new skills using top-down approach through extension services aimed at supporting and facilitating people to engage in agricultural production for food security management. Despite this, Waddington and Howard (2014) viewed training as participatory in nature and uses bottom-up approach to transfer knowledge identified as priorities by farmers, rather than issues and challenges determined by outsiders. Though the current study linked training to food security, studies conduct by Anderson (2007) and (Waddington & Howard, 2014) failed to link training to food security.

World Summit declaration on Food Security(2009) described food security to exist when all people, at all times, have physical and economic access to sufficient, safe, nutritious food that

meets their dietary needs and food preferences for an active life. In this perspective, food security was viewed as the availability of food and one's access to it (FAO, 2011). The description of food security by FAO (2011) was in concurrence with what was described in the current study. The current study described food security as availability of food, access to food, utilization of food and stability of food. However, while FAO (2011) report did not link food security to training, the current study advanced knowledge by linking training to food security. This was advanced by bringing the contribution of training to food security.

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 towards 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.

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 supported the current study where networking was seen to significantly contribute 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

Capacity building interventions had a moderate degree of positive correlation with food security. There was evidence that capacity building interventions contributed to improved food security though on a small scale. Gender mainstreaming made the strongest unique contribution in improving food security, when the variance explained by training and networking was controlled. Training made the second strongest unique contribution and networking made the least contribution in improving food security**.**

8. Recommendations

Capacity building contributed to improved food security in Siaya County. The study therefore recommends that field agricultural officers should intensify capacity building with a view to enhancing sustainable food security. Capacity building involves wide field with numerous operational interventions. Siaya County Department of Agriculture should therefore invest in research to identify other capacity building interventions for sustainable food security.

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