Smallholder farmer assets, extension and marketing in Uganda

by

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TABLE OF CONTENTS

ABSTRACT

The study was initiated to understand how asset building, combined with appropriate extension services, can enable smallholder farmers to address marketing problems. Interviews were conducted in 2009 with 317 farm households in Kamuli district, Eastern Uganda, who were participants in a sustainable rural livelihoods program, led by an indigenous non-governmental organization with support from Ugandan and U.S. universities. Training and support provided opportunities to improve production of crops and livestock, income, nutrition and well-being. Key research questions are: (i) How is the level of smallholders' assets associated with access to extension services? (ii) What influence do assets and extension services have on smallholders' market performance? The analytic model consists of three major concepts: assets, extension services, and market sales in 2009. We found no bias in provision of extension services according to the level of material assets of households participating in the development assistance program. The association of extension services with market sales (income from crop and livestock sales) is not statistically significant. The chi-square tests and the results of logistic regression revealed positive associations between income from sale of crops and livestock and assets but not extension service frequency.

CHAPTER 1: GENERAL INTRODUCTION

Background

Rural poverty reduction is an increasingly important issue in Africa and is central to achieving the Millennium Development Goals. More than one third of the world's extreme poor are in sub-Saharan Africa, living on less than one dollar a day (Liou 2013). Agriculture is the main source of livelihood for the poor, contributing 20% of GDP and 16% of export to sub-Saharan Africa (Butler and Mazur 2007). According to Millennium Development Goals Report, steady economic growth and improvements in poverty reduction continue to have a positive impact on Millennium Development Goals' progress in Africa (UNECA 2013). In recent years, the modernization of the global food market has raised concerns about the viability of smallholder farmers' livelihoods in Africa. The modernized market is fast growing, constantly attracts new sources of investment, and contains high value products (Ghanem 2008). In Africa, some smallholders have been able to sell the surplus produce such as maize, beans, sweet potatoes, cassava, and rice in traditional markets. However, many smallholders in Africa are excluded from large agricultural markets due to high transportation and transaction costs and competition from larger scale producers (Ghanem 2008). Many researchers have attached great interest in how to help smallholders to enhance market sales and thereby improve their livelihoods, especially in sub-Sahara Africa.

For smallholders in sub-Saharan Africa, access to modern markets can be demanding：farmers selling in modern market chains must be able to meet their more exacting quality and safety requirements which may require more investments in capital equipment, irrigation and waste water systems - elements that are beyond the means of most individual smallholder farmers (Norrod, et al. 2008). Moreover, evidence from Latin America and Africa

demonstrates that modern institutional buyers show a preference for procuring from large farmers where smallholders are part of a dualistic system with the presence of large land-holders (Berdegue, et al. 2005). Either because of farmers' incapability or because of buyer exclusion, smallholders' participation in modern markets is limited.

In Uganda, low and declining agricultural productivity is one of the key problems in much of sub-Saharan Africa (Nkonya, et al. 2004). Poverty is still severe, especially in rural areas (UPPAP 2002). At least 24% of Uganda's population lives in households with incomes under the poverty line (World Bank 2012). As crop productivity is stagnant or declining, food insecurity has increased since the early 1990s (Pender, et al. 2001). Insufficient food adds to the epidemic of AIDS, smallholders' work productivity is diminished, knowledge of crop production is being lost, and labor intensive farming activities are reduced (Butler and Mazur 2007). Under this situation, smallholders find it difficult to get access to modern markets, especially to meet the minimum production volumes required. This makes it difficult for them to negotiate and bargain for beneficial prices and non-price conditions from major retailers and processors on the output side and major manufacturers on the input side (Vorley 2003). Social institutions thus emerged to reduce transaction costs arising from the scale mismatch. McCullough et al. (2008) pointed out that to link smallholders with modern food markets, those social institutions can build farmers' capacity, provide information, help strengthen farmers' social networks, finance investments in assets, and monitor marginalized groups' progress as they transform to commercial-oriented production. Further, many non-governmental organizations (NGOs) and socially oriented businesses have been involved in market development through certification programs and direct trade in building niche markets for products whose supply chains are socially responsible, although their scope is

still limited (McCullough et al. 2008). NGOs also organize smallholders in groups and associations to market their products collectively. The advantages of marketing collectively compared with marketing individually are well documented. Kaganzi et al. (2008) indicated that collective action helps smallholders to meet basic market requirements for minimum quantities, quality and frequency of supply which they could not achieve as individuals. They are able to access new markets arising in the context of market reform, government policy, and globalization. Moreover, marketing in groups will reduce the transaction costs of accessing inputs and outputs for smallholders and enable them to obtain necessary market information and secure access to new technologies, which allow them to compete with larger farmers and agribusinesses (Ellis and Bahiigwa, Livelihoods and rural poverty reduction in Uganda 2003)|. Over several years, the development of partnerships with social institutions such as NGOs, community-based organizations and private sector business organizations has received increasing attention in recent years. These social institutions play a key role in supporting smallholders through the transformation when government policies fall short (McCullough et al. 2008).

With technical assistance, asset building, and the development of farmer groups through a NGO-led sustainable rural livelihoods support program initiated in 2004, African smallholder farmers in Eastern Uganda have opportunities to increase production and income with improved farming management practices, technologies and marketing information (ISU; MAK; NaCRRI; VEDCO; KIST 2008). In this study, we are interested in understanding how asset building, combined with effective extension services, can enable smallholder farmers to address marketing problems and contribute to achieving better livelihoods.

Thesis Organization

This thesis follows the journal paper format. Chapter 1 is the general introduction. Chapter 2 is the paper prepared for *Journal of Agricultural Education and Extension* with introduction, literature review regarding relevant study to research model, methods, results, discussions and conclusions. Chapter 3 contains general conclusions from the journal paper and how the results could apply to the research problem.

CHAPTER 2: SMALLHOLDER FARMER ASSETS, EXTENSION AND MARKETING IN UGANDA

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A paper to be submitted to *Journal of Agricultural Education and Extension*

Abstract

The study was initiated to understand how asset building, combined with appropriate extension services, can enable smallholder farmers to address marketing problems. Interviews were conducted in 2009 with 317 farm households in Kamuli district, Eastern Uganda, who were participants in a sustainable rural livelihoods program, led by an indigenous non-governmental organization with support from Ugandan and U.S. universities. Training and support provided opportunities to improve production of crops and livestock, income, nutrition and well-being. Key research questions are: (i) How is the level of smallholders' assets associated with access to extension services? (ii) What influence do assets and extension services have on smallholders' market performance? The analytic model consists of three major concepts: assets, extension services, and market sales in 2009. We found no bias in provision of extension services according to the level of material assets of households participating in the development assistance program. The association of extension services with market sales (income from crops and livestock sales) is not statistically significant. The chi-square tests and the results of logistic regression revealed positive associations between income from sale of crops and livestock and assets but not extension service frequency.

Problem Statement

Rural poverty reduction is an increasingly important issue in Africa and is central to achieving the Millennium Development Goals. More than one third of the world's extreme poor live in sub-Saharan Africa (SSA), a region where the number of poor people rose "steadily and dramatically" between 1981 and 2010 (Liou 2013). It is estimated that 48.5% of SSA's population lives on less than $1.25 a day (World Bank 2012). Smallholders, defined as those who cultivate land varying from less than one hectare to 10 hectares, contribute to 80% of food supply in SSA and are a central focus in poverty reduction for achieving the Millennium Development Goals (FAO 2012).

Though small-scale farming is the economic backbone in sub-Saharan Africa, smallholder farmers generally lack key resources to face challenges and opportunities brought by global food system restructuring (Halmen and Hyden 2011). One of the challenges is inadequate access to productive land due to poor land management and cropping practices, declining soil fertility, high population density, erratic rainfall patterns, and limited water storage capacity for irrigation, (Butler and Mazur 2007). With rudimentary technology and low yields, many smallholders produce food for self-consumption only (Halmen and Hyden 2011). Inadequate access to assets (land, agricultural equipment, inputs, technical information, and livestock), poor infrastructure, weak market information and institutions limit smallholders' access to emerging market opportunities (Farrington, et al. 2002). Ineffective governance is blamed for SSA's declining capacity to feed its growing population. However, development partnerships with social institutions such as non-governmental organizations, community-based organizations and private sector business organizations began to play key roles in supporting smallholders. McCullough et al. (2008) pointed out that to help link smallholders with modern market chains,

organizations could provide extension services, build market and transportation infrastructure, strengthen farmers' social networks, and mitigate information asymmetry. With technical assistance, asset building, and capacity development of farmer groups, African smallholder farmers in Kamuli district, Eastern Uganda have opportunities to increase production and income with improved farming management practices, technologies and marketing information.

Literature Review

Uganda is an 'agricultural based' country in which agriculture is dominated by smallholder farmers who had the majority of land and produce most of crops and livestock products (Salami, Kamara and Brixiova 2010). The growth projections of agriculture indicate that Uganda will exceed the Millennium Development Goal of halving poverty by 2015, yet will still have 10.15 million people living in absolute poverty (Ministry of Agriculture, Animal Industry and Fisheries 2010). With the population of 36.35 million (World Bank 2012), Uganda's widespread poverty is concentrated among its smallholder farmers. "Many farmers lack access to productivity enhancing inputs, suffer from heavy produce loss due to pests and diseases, lack knowledge and specialized skills, have low capital and no access to credit, face poorly functioning produce markets and lack efficient storage technology. Consequently, agricultural productivity across the country remains low, leading to low overall aggregate agricultural production" (Kraybill and Kidoido 2009).

Land degradation in Uganda is widespread and difficult to address (Ministry of Agriculture, Animal Industry and Fisheries 2010). Moreover, rapid population growth led to the land/labor ratio decline (Jayne, Mather and Mghenyi 2010). It is reported that with an annual

population growth rate of 3.2%, the arable land per person in 2011 was 0.2 hectares (0.5 acres) per person, about half as large as it was in the 1960s (World Bank 2012). Previous research indicated that the number of laborers has a positive relationship with productivity (Kraybill, Bashaasha and Betz 2012). In Uganda, the average life expectancy is 47 years; 40% of the population lacks reliable access to sufficient healthy food and 7% of the population suffers from AIDS (Butler and Mazur 2007). Malnutrition and AIDS undermine work productivity in that farmers with fewer laborers typically shift to less labor-intensive crops, reduce cultivated land, and even withdraw from marketing into subsistence (Harvey 2004). Many rural households cannot obtain sufficient food and income from farming alone, thus do off-farm work to compensate the low farming income (Butler and Mazur 2007).

Uganda's food markets are relatively isolated and relatively shielded from global markets, but also relatively inaccessible for smallholders to join modern market chains because many are net buyers of food (Ministry of Agriculture, Animal Industry and Fisheries 2010). Inadequate agricultural inputs, equipment, technical training, and roads have impeded smallholders' access to modern market chains. Kachooso village in Uganda, for example, was located close to the district center linked by good feeder roads and good community access roads, and had a wide range of services including microcredit, health, and agricultural extension services, water, primary and secondary education (Kwapong, et al. 2012). Livestock and livestock products also play a key role in raising incomes of households and providing a source of protein to many families. Those who hold livestock in their enterprise mix tend to be generally less poor. In Uganda, however, smallholders face some major constraints such as endemic livestock diseases, poor quality breeds and inadequate feed and water, insufficient infrastructure and

market information, and inadequate advisory and veterinary services (Ministry of Agriculture, Animal Industry and Fisheries 2010).

Extension service is an important way to address the problems that smallholders encounter in Uganda. In the early 1990s, the provision of extension services was broadened beyond the public domain to include a range of non-government organizations (NGOs). Previous studies demonstrate that to link smallholders with modern value chains, NGOs can build farmers' capacity, provide information, help strengthen farmers' social networks, finance investments in assets, and monitor marginalized groups' progress as they transform to commercial-oriented production (McCullough, Pingali and Stamoulis 2008). Kaganzi et al. (2008) indicated that smallholders are more capable of meeting basic market requirements for minimum quantities, quality and frequency of supply by marketing collectively rather than individually. Furthermore, smallholders can reduce transaction costs of accessing inputs and outputs and obtain necessary market information and secure access to new technologies as group members (Ellis and Bahiigwa, Livelihoods and rural poverty reduction in Uganda 2003). In the case study of Agiret village in Uganda, the decreasing levels of poverty was mainly because of the high level of extension services which focused on collective action and participation of the members of the village in self-help groups and cooperatives (Kwapong, et al. 2012).

The government of Uganda has implemented programs and policies to reduce poverty and promote economic growth. The Plan for Modernization of Agriculture (PMA) was initiated in 2005, aiming at achieving poverty reduction through agricultural commercialization (Ministry of Agriculture, Animal Industry and Fisheries 2010). However, the PMA suffered from some weaknesses and the government made the modifications in the five year Agricultural

Development Strategy and Investment Plan (DSIP) (Ministry of Agriculture, Animal Industry and Fisheries 2010). The latest DSIP (2010/11-2014/15) addresses "Enhancing production and productivity must be augmented by significant improvements in market performance" in order to encourage expanding network of rural market infrastructure and strengthen farmers' organizations in management.

The strategy in the Kamuli program has been to support local and national organizations to identify social and economic mechanisms to support local initiatives, human resource development and leadership capabilities (Butler and Mazur 2007). The study focuses on data regarding assets (land, labor, equipment, and livestock), extension services, and market sales. Market sales refer to income earned from sale of major crops (maize, beans, rice, cassava, and sweet potatoes) and livestock (chicken, pigs, cattle, and goats). In Uganda, maize is a staple food which yields an average of 1.5 metric tons per hectare (Agona and Muyinza 2001). Beans provide a cheap source of vegetable protein in the Ugandan diet and have export potential (Kapoor 1993). It was reported that almost 65% of bean seed producing farmers in Uganda have found seed business (production and sale) a viable enterprise (PABRA News Blog 2011). Uganda's annual per capita rice consumption is 8 kg for people living in rural areas and 15 kg for urban dwellers (Nakaweesi 2012). Furthermore, local and regional demand of rice is increasing. It is estimated that the local consumption of rice in 2008 is 224,000 tones (Ministry of Agriculture, Animal Industry and Fisheries 2010). Cassava and sweet potatoes are important staple crops in that they are drought and heat tolerant, rich in carbohydrate content and sustain communities throughout the year as the main source of calories, thus are effective for poverty reduction (START 2013). Among livestock, chicken, goats, cattle, and pigs are the most commonly raised and sold. This study was conducted to understand how asset building,

combined with appropriate extension services, can enable smallholder farmers to address marketing problems and contribute to achieving better livelihoods. Research questions are: (i) How is the level of smallholders' assets associated with access to extension services? (ii) What influence do assets and extension services have on smallholders' market performance?

Methods

Study Population

Active collaboration involving Iowa State University, Makerere University, and Volunteer Efforts for Development Concerns (VEDCO) was initiated in 2004 in six parishes in three sub-counties in Kamuli district (population 653,188 in 2005), Easter Uganda (Butansi, Namasagali, and Bugulumbya). Kamuli has been one of the poorer districts in the country with agricultural as the main activity (Sseguya, Mazur, and Masinde 2009). In 2005, 33.7% of the population in Butansi lived below the poverty line; rates were somewhat higher in Namasagali (36.9%) and Bugulumbya (36.5%) (UBOS 2005).

The program adopted a holistic approach to low external input sustainable agriculture and strengthening smallholder farmers' livelihood skills and resource base, and thereby to improve their food security, nutrition and health, and income (Sseguya and Masinde 2005). VEDCO extension staff train selected members of farmer groups to serve as community based trainers, CBTs (Sseguya 2006). CBTs are trained in a relatively comprehensive range of activities: farmer-to-farmer extension, communication skills, low external input sustainable agriculture, soil and water conservation, farm planning and layout, livestock production, animal health and disease management, farm records and accounts, post-harvest management, nutrition and health,

gender and development, group dynamics and leadership. The first phase of the program was completed in early 2009, and the second phase of the program was launched in mid-2009, increasing the scale to 1200 households in 11 parishes.

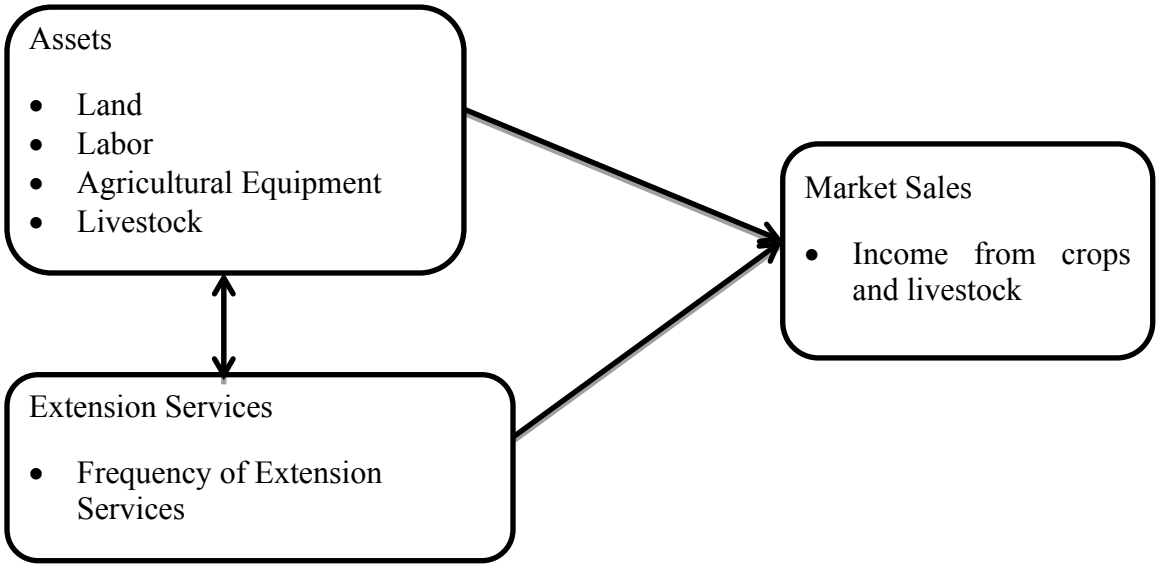
Data Collection

Program monitoring of phase two activities includes a longitudinal survey of 350 participating households that were selected using stratified random sampling. According to Sseguya (2011), 23 had migrated (either seasonally or permanently from the location), five were double households (two persons in the household were members of the same group), and four were in groups not currently working with the program. The questionnaire for 2009 contains information on participant particulars, household composition, farming practices, extension services, agricultural credit, food security, nutrition and health, sanitation and hygiene practice, natural resource management, agricultural trade, membership in marketing associations, and post-harvest handling practices and technologies. Relevant questions were selected based on our focal issues: assets, extension services and marketing success. Based on variables in our model, 317 households had complete data (one household's land information was missing). We used SPSS (Statistical Package for Social Sciences) for analysis.

Model and Operationalization

The analytic model consists of three major concepts: assets, extension services, and market sales. The model will guide testing of hypotheses using data from the 2009 survey. The following describes how we operationalized each variable.

Figure 1 Analytic Model



Assets

We operationalize assets through four indicators: 1) acres of land owned; 2) number of adults (age 18 years and older); 3) agricultural implements owned; and 4) livestock owned (using standardized units). The value of agricultural implements was calculated as unit price of agricultural implement * number of agricultural implements possessed (hoe, machete, axe, slasher, and spade). Standardized livestock units reflect an 'exchange ratio' among livestock species and are obtained by converting body weight into metabolic weight, i.e. body weight$^{0.75}$ (FAO 2005a); we applied livestock unit coefficients for Africa South of the Sahara from the table developed for international comparisons provided by the Food and Agriculture Organization in 2005 (P Chilonda 2006). The household's standardized livestock unit value is the sum of the weighted number of its cattle (weight 0.5), pigs (weight 0.2), goats (weight 0.1), and chickens (weight 0.01).

Extension Services

We combined information about the frequency of extension services provided by VEDCO staff and CBTs at group level and categorized households into three groups: 1) receiving extension services once a month or less; 2) receiving extension services from CBTs or VEDCO staff twice a month or more; 3) receiving extension services from both CBTs and VEDCO staff at least twice a month.

Market Sales

Households reported their market sales of crops and livestock, and incomes earned from them in the last six months. Livelihood was defined as "the assets (natural, physical, human, financial, and social relations), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household" (Ellis 2000). It is noteworthy that market sales of crops and livestock are important indicators of livelihood status - reflecting activities to expand asset base and linkages to different organizations. The most commonly produced crops (maize, beans, rice, sweet potatoes, and cassava) and livestock were chosen for sales calculation (chickens, cattle, goat, and pigs). The value of crop and livestock sales was recorded along with the quantity sold and price per unit sold.

Logistic regression was used to examine the effect of each predictor variable on the outcome of interest, taking into account all other variables in the model. It allows one to predict a discrete outcome such as group membership from a set of variables that may be continuous, discrete, dichotomous, or a mix, and thus requires no assumptions about the distribution of the predictor variables, i.e., they do not have to be normally distributed, linearly related to the

dependent variable, or of equal variance within each group (Tabachnick and Fidell 2013). The odds ratio refers to the probability of an event (response category in a dependent variable) occurring in one group to the probability of it occurring in another group (specifically the reference category), controlling for other independent variables. In this study, the variables we had were a mix of continuous and discrete variables and not all of them were normally distributed or linearly related to the dependent variable. It was thus appropriate to apply logistic regression.

Results

A total of 317 households have data for all variables in the model. The following description of the characteristics of the study population focuses on data from the 2009 household survey in Kamuli.

As shown in Table 1, 42% owned 2 acres of land or less, 33% had 2.01-4 acres, and 25% had more than 4 acres. More than half (55%) had three or more resident adults. The median value of agricultural equipment possessed by households was 45,000 UGX ($23.61) in 2009 (mean = 63,240 UGX, $33.18) with an interquartile range of 31500-68500 UGX ($16.53-$35.94)[1]. One-third had 0.30 standardized livestock units or less, 35% had 0.31-1.30 units, and 32% had more than 1.30 units. Extension services were relatively infrequent in 2009. At the group level, 53% received them once a month or less, 24% received extension services at least twice a month from CBTs or VEDCO staff, and 22% received them at least twice a month from both sources.

[1] Note: exchange rate used: $ 1 U.S. = 1906 Uganda Shillings in 2009. The exchange rate was calculated according to exchange rates of Uganda Shillings to U.S. dollars between March 14 and March 30 when the survey was conducted.

The cut-points in descriptive statistics are based on the two criteria: to ensure a large enough number of cases in each category for analyses and to facilitate meaningful explanation of variables in statistical analyses.

Among the smallholders involved in this study, 95% produced maize,62% produced beans,15% produced rice, 64% produced sweet potatoes, and 45% planted cassava. In terms of livestock, 70% had chickens, 50% owned goats, 45% had cattle, and 26% kept pigs.

Table 1 Descriptive Statistics of Household in 2009

Acres Owned	***Percentage***
≤ 2.0 acres	42.6
2.01–4.0 acres	32.5
> 4.0 acres	24.9
Adults	
1-2	61.2
3+	38.8
Equipment	
≤ 35,000 UGX	31.2
35,001-55,000 UGX	33.1
> 55,000 UGX	35.6
Livestock Units	
≤ 0.30	33.1
0.31-1.30	35.3
> 1.30	31.5
Extension—Group	
≤ 1x/month from either CBT or VEDCO	53.3
≥ 2x from either CBT or VEDCO	24.3
≥ 2x from both CBT and VEDCO	22.4
Income from Sales	
None	29.3
Some	70.7

We examined chi-square tests for association between extension services and each of the asset variables, and of extension services and assets with market sales. As shown in Table 2, only labor exhibited a significant association with extension services at $p< 0.05$; none of the material assets did so. This has two important implications. First, there appears to be no important bias in provision of extension services according to the asset level of households participating in the development assistance program. Second, this will allow us to determine the independent effects of each of the asset variables and extension in multivariate analysis without problems of multicollinearity, which was confirmed through checking the tolerance and variance inflation factor for each variable in the logistic regression analysis. The association between extension services and market sales was statistically significant, while the associations of assets and market sales were all significant at $p< 0.05$. The results indicated that those with more assets were more likely to earn income from crops and livestock.

Table 2 Chi-square p-values of assets, extension services, and market sales

	Assets and Extension Services			
	Land	Labor	Equipment	Standardized Livestock
Extension Services	.999	.041	.350	.201
	Extension Services and Market Sales			
		Extension Services		
Income		.104		
	Assets and Market Sales			
	Land	Labor	Equipment	Standardized Livestock
Income	0.000	.023	.001	0.000

In the logistic model, the dependent variable is income from crops and/or livestock sales; the independent variables are: household land cultivated (in acres), household adult laborers, value of equipment owned, livestock (measured in standardized units), and frequency of extension services at group level. The dependent variable is dichotomous: none or some; independent variables are grouped into either two or three categories.

The logistic regression table demonstrates the relationships among independent variables (household land, labor, equipment, livestock, and extension services at group level) and a dependent variable (income from sales of crops and livestock). The Nagelkerke R-square is a pseudo R square used in model fit test. The Nagelkerke R square is 0.181, indicating the proportion of variance accounted for in the dependent variable based on the predictive power of the independent variables in the model. Based on the logistic table, the following results were obtained.

Land - households cultivating medium sized landholdings (2.01-4 acres) were more than twice as likely to have income from sales of crops and livestock compared to the reference group, those with 2 acres or less. Those with larger landholdings appeared to also be more likely to have agricultural market sales, but the differences were not statistically significant. Labor - the reference group is those with 1 or 2 adults in household. Larger households appeared to be somewhat more likely to have income from sales of crops and livestock, but the differences were not statistically significant. Agricultural Equipment - those with the greatest value of agricultural equipment (>$50.18) were more than twice as likely as those in the reference group, those who owned no more than $31.93 worth agricultural equipment, to have income from sales of crops and livestock. Livestock - households with the highest number of livestock (in standardized units) were 3.4 times more likely to earn income from sales of crops and livestock than those have 0.3 or less standardized livestock units.

Extension Services at Group Level - households who received extension services less than once a month from either source were the reference group. Those who received extension services twice a month from either CBTs or VEDCO staff were more likely to have income from sales of crops and livestock than the reference group; those who received extension services

twice a month from both CBTs and VEDCO staff were also more likely to have had income from sales of crops and livestock than the reference group. The differences were not statistically significant.

Table 3: Multivariate Logistic Regression of Agricultural Market Sales

	Incomes from sales of crops and livestock	
Socioeconomic Factors	Exp (β)	S.E.
Household Land		
≤ 2.0 acres	1.000	
2.01–4.0 acres	2.568***	.324
> 4.0 acres	1.483	.352
Household Laborers		
1-2 adults	1.000	
3+ adults	1.169	.281
Household Equipment Value		
≤ $31.93	1.000	
$31.94-$50.18	1.299	.317
> $50.18	2.039**	.361
Standardized Livestock Units		
≤ 0.30	1.000	
0.31-1.31	1.512	.306
> 1.31	3.358***	.374
Extension Services at Group Level		
≤ 1x / Month from either source	1.000	
>2x / Month from either source	1.726	.343
>2x/Month from both source	1.444	.342
Nagelkerke R-square	0.181	

Note: * significant at p < 0.10 ** significant at p < 0.05 *** significant at p < 0.01

Discussion and Conclusion

Sub-Saharan Africa has the largest proportion of the world's people living on less than $1 a day, which is the focal of poverty reduction to achieve United Nations Millennium Development Goals (World Bank 2010). As smallholders in Africa face so many difficulties such as inadequate access to land and appropriate technology, lack of favorable government policies, and limited marketing information, appropriate extension services are necessary to strengthen farmers' technical and organizational skills in production and marketing. Based on the model presented and data analyzed in this study, we found that provision of extension services was not biased according to smallholders' assets (land, labor, equipment, and livestock); the associations of extension services with material assets and with market sales (income from crop and livestock sales) are not statistically significant. The chi-square test and the results of logistic regression indicated there are positive relations between assets and market sales.

In terms of limitations of this study, the beneficial impact of extension services is not fully realized within one year. We could only explore the association of extension services for smallholders at different levels of assets and incomes, not the impact of extension services among smallholders at the same level over time. Further, in the logistic model, the predicted effective of extension services was not statistically significant, suggesting that improved mesurement may be needed to better test the model.

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CHAPTER 3: GENERAL CONCLUSION

Sub-Saharan Africa has the largest proportion of the world's people living on less than $1 a day, which is the focal of poverty reduction to achieve United Nations Millennium Development Goals (World Bank 2010). As smallholders in Africa face so many difficulties such as inadequate access to land and appropriate technology, lack of favorable government policies, and limited marketing information, appropriate extension services are necessary to strengthen farmers' technical and organizational skills in production and marketing.

This study is based on a program aimed at improving the livelihood status of rural communities in developing countries that was jointly implemented by Iowa State University, Makerere University and Volunteer Efforts for Development Concerns (VEDCO). Data were collected in 2009 in Kamuli district, Eastern Uganda. Among households who benefited from the program in three sub-counties and 11 parishes, 318 households were randomly selected for interviews. In the questionnaire of 2009, data were selected parts of the questionnaire pertaining to household data, agricultural trade and market associations, market information, and access to extension services. Three major concepts were involved in analytical model for logistic regression analyses: assets (including land, labor, agricultural equipment, and number of standardized livestock), extension services (measured as frequencies of smallholders' receiving extension services at group level), and market sales (measured in terms of income from sales of crops and livestock in the past six months). Data processing and analyzing were done using the Statistical Package for Social Science (SPSS), v.17. Based on the model presented and data analyzed in this study, we found no bias in provision of extension services according to asset level of households participating in the development assistance program. The association of extension services with market sales (income from crop and livestock sales)

was not statistically significant. The chi-square tests and the results of logistic regression revealed positive associations between income from sale of crops and livestock and assets but not extension service frequency.

There are several explanations on statistical insignificance of extension services with two other concepts' variables. First, there was no bias in provision of extension services according to the level of material assets of households participating in the development assistance program. Second, the statistically insignificant relationship between extension services and market sales suggesting the extension services did not have much influence on market sales, or the extension services were not effective enough to have any impact on market sales. It might because the beneficial impact of extension services is difficult to be fully realized within one year. We could only explore the association of extension services for smallholders at different levels of assets and incomes, not the impact of extension services among smallholders at the same level over time. Or it might suggest that improved mesurement is needed to better test the model.

On the other hand, assets had a positive relationship with market sales in both chi-square tests and logistic regression. The results implied that a higher level of assets incresases the probablity of earning income from sale of crops and livestock.

The program is ongoing. Efforts to improve smallholders' livelihoods will attract more researchers to understand how to improve the quality of farming activites as well as market access for smallholders.

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