Crop diversification among smallholder farmers in Kapiri-Mposhi District

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1. INTRODUCTION

A broad-based economic growth has been the main objective throughout Zambia's post-independence years. To achieve this, five policy goals were set out just after independence: Economic diversification, employment creation, removal of regional and sectoral inequalities, sustainable internal and external balance and provision of social facilities. The financial base for achieving these goals was mineral assets and copper in particular (Chiwele, 1999). The major decline in copper prices in 1974 marked the beginning of Zambia's protracted economic decay. In the bid to offset the damage caused by the declining mining sector, the government directed its efforts to the development of agriculture sector (Saasa, 1996). Agricultural growth was to play an important role, especially with respect to the first two goals highlighted above. The three decades of experimenting with economic and agricultural policies, have failed to stimulate the expected outcome as many resources of the agricultural sector are not fully utilised. The reason for this idling of land as argued by Chiwele (1999) is not a shortage in the amount of financial resources spent by the government in the agriculture sector, but rather the allocation of the financial resources within the sector which also to a large extent is influenced by political setting.

The policy preference of maize has led service support to the agriculture discriminate against the growing of other equally rewarding crops. As a result, a biased and disproportionate agriculture emerged that was dominated by growing of maize, unfortunately encouraged even in areas that are not geographically suitable for its production (Saasa, 1996). The planting area and production volume of maize is far greater than that of other crops such as sorghum and millet which had been the mainstay of diets in Zambia for millenniums (Jayne *et al.,* 2007).

Following several drought cycles in 2004 the Government of Zambia, through the Ministry of Agriculture and Co-operatives, introduced a programme to promote crop diversification. Crop diversification is the growing of two or more crops on a piece of land by a farmer. Crops to be considered include; cassava, groundnut, sunflower, soya beans among others

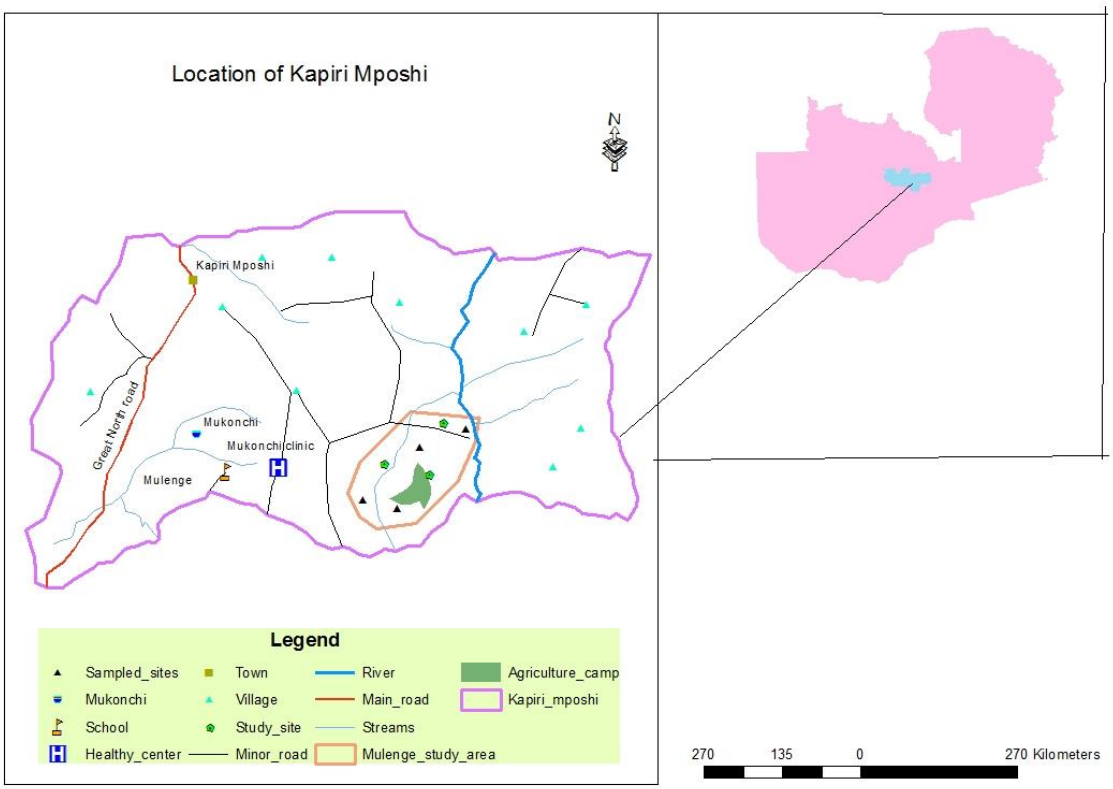
(MACO, 2004). Household crop diversification is often viewed as key for achieving food and nutrition security as well as for mitigating the risk of crop failure and market uncertainties. Crop diversification is marked as a strategy to stabilise, diversify and enhance household farm income. It is mostly considered a risk management strategy by cultivating more than one crop. Crop diversification not only has its added advantage of mitigating price risk, but also reduces the risk of crop yield fluctuations (Mukuka and Hichaambwe, 2016). In addition, there is strong evidence that diversification in agriculture has tremendous benefits on uplifting resource-poor household farmers (Singh, Squire and Strauss, 1986). If well implemented, crop diversification can be used as a tool to improve household income, alleviate poverty and conserve water and soil resources (Josh *et al.,* 2004). Also, low crop diversification tends to limit the economic multiplier effects of agriculture, by limiting the scope and scale of agro-processing trading and input supply. Furthermore, crop diversification improves food and nutritional diversity as it provides a broader choice in a given area and lessens the risk of crop failure. A lack of crop diversification and specifically, a focus on maize production limits the potential to use agriculture as a poverty reduction tool. As a low value cereal, maize production is more unlikely to serve as a means out of poverty (Chapoto, 2012).

Crop diversification adoption has not been remarkable as area allocation for other crops other than maize is still persistently low. Maize supremacy has continued among smallholder farmers in Zambia and in case of its failure, other crops cannot provide annual food sustenance. It is in this regard that the study sought to examine the factors influencing crop diversification among smallholder farmers. The study therefore, used the case of Kapiri Mposhi, a town located in the Central part of Zambia.

2. STUDY AREA

The study was conducted in Mulenge area of Chief Mukonchi of Kapiri-Mposhi district in the Central Province of Zambia; located on latitude 13°58′ S and longitude 28°40′ E. Kapiri-Mposhi district lies in the middle of Zambia. Kapiri-Mposhi town is at the southern end of TAZARA Railway from Dar es Salaam in Tanzania and at the fork on the roads to Lusaka, the Copper belt and Northern Zambia (Mwanza, 2015). Kapiri-Mposhi district is made up of land comprising hills, swamps and plains. It is in the agricultural ecological region11a with an average annual rainfall ranging between 800- 1000mm. The district has a total surface area of 17,219 km² and average population density of 14.7 per sq.km² (CSO, 2010).

Farming which is subsistence is largely the main economic activity for the people of Kapiri-Mposhi and the major crops grown are maize, cassava, sorghum and sweet potatoes. The district has few commercial farmers growing maize, tobacco and wheat. Livestock farming is not that pronounced and includes cattle, goat and pig rearing.



Source: UNZA Department of Geography and Environmental Studies Cartographic Unit (2017).

Figure 1: Location of Kapiri Mposhi District in Central Province, Zambia

3. METHODOLOGY

This study used a case study design. Data was collected using a mixed method approach. A mixed method refers to an emergent approach of research that advances the systematic integration or mixing of quantitative and qualitative data within a single investigation. To obtain qualitative, four focus group discussions were utilised. The first two groups were made up of diversifiers and non-diversifiers. The focus group discussion of the diversifiers comprised six members; three women and three men while the group of non-diversifiers was made up of eight members; four women and four men. In the last two focus group discussion gender was put into perspective where men and women discussants were in separate groups.

A group of men was composed of six members while that of women had eight participants; both had a mixture of diversifiers and non-diversifiers and of different age groups. Quantitative data was obtained using a structured interview schedule. Focus group discussions and an interview schedule were administered in an establishment of Mulenge area of Chief Mukonchi, Kapiri-Mposhi district. Mulenge has seven villages with a total number of 484 households. A simple random method of sampling was used to come up with the four villages (comprising 248 homesteads) out of the existing seven, representing a 57 per cent. Again a Simple random sampling was used to select households to be interviewed. Estimation of sample size was based on a proportion having the same confidence level of 95 per cent. The following formula was used;

nr- $4pq/d^2$ where;

nr- required sample

p- proportion of the population

q- 1-p

d- the degree of precision (d). The degree of precision is the marginal error that is accepted. Marginal error of 10 percent was used. This gave us a sample of 71 (Raghavendra, 2014).

Data was analysed using thematic analysis, descriptive statistics, Chi-square test and Simpson's Diversity Index (SDI).

4. FINDINGS AND DISCUSSION

4.1 Background characteristic of Respondents

The background characteristics of the respondents included the type of respondent, gender, marital status, age, household activity and number of years lived in the area. It is often necessary to ascertain information about the farmers and their families, for such information has often been crucial to good understanding of their farming systems and problems of their practices.

The majority of the respondents in the study area were household heads (78.4 percent). The mean age of the respondents was at 41 years. The marriage rate was at 83.8 per cent. The study also shows that male headed households dominated with 73.0 percent. Household size

ranged between 4 to 9 people, giving a mean household size of 7 people. The mean number of years respondents lived in the area was 26. Farming was the main occupation in the area. Table 1 shows the background characteristics of the respondents.

Table1: Background characteristics of Respondents

Respondent		**Frequency**	**Percentage**
Type of respondent	Household		78.4
	head	58	18.9
	Spouse	14	2.7
	Others	2	
Age	≤40	13	17.6
	41-50	55	74.3
	≥51	6	8.1
Marital status	Married	62	83.8
		12	16.2
	Unmarried		
Gender	Male	54	73
	Female	20	27
Household	size		14.9
	1-4	11	60.8
	5-9	45	24.3
	≥10	10	
Years lived in community			
	≤10	13	17.6
	11-20	8	10.8
	21-30	53	71.6
Household	Income		100
	Farming	74	39.2
	Business	29	
Total		74	100.0

Source: Field data (2017)

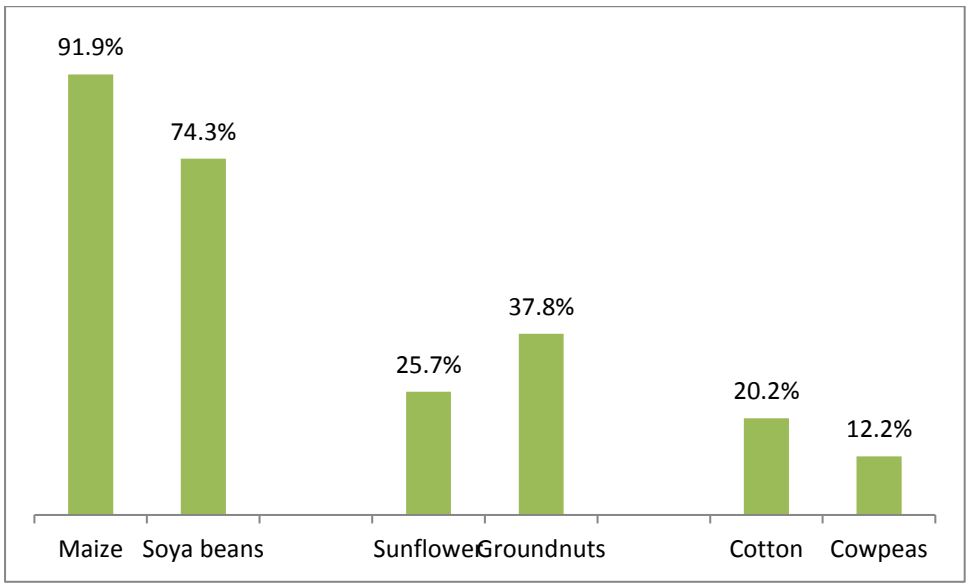
4.2 Types of crops grown

Figure 2 shows the main types of crops grown by smallholder farmers in Mulenge area. As can be seen from the table, maize is the major crop grown by smallholder farmer (91.9 percent). Apart from maize, 74.3 percent of the farmers also grew soya beans, 37.8 percent groundnuts, 25.7 percent sunflower, 20.2 percent cotton and 12.2 percent cowpeas.

The government and other stakeholders have emphasised the need by the smallholder farmers to diversify the crops; that is to grow other crops other than maize with equal land share or

more. However, results obtained from the ground show that farmers have not hid to this call. This gives a highlight that farmer's make decisions based on what they think would benefit them more otherwise, they would not take an endeavour or risk. Maize is a staple crop and according to farmers an easy crop to grow as well as less laborious than other crops such as soya beans and cotton. Growing other crops would imply sacrificing so much but less rewarding and compromising with food security. Availability of market for maize is an also another obvious factor put into consideration when choosing crops to grow. As long as there is no ready market for alternative crops, the scenario will remain unchanged. A farmer will make choice that will obviously bring a gain on their part.

Figure 2: Major crops grown



Source: Field data (2017)

4.3 Crops desired but were not grown

Respondents did also point out that there were some crops that farmers could have desired to grow but did not (Table 2). About 42 percent of the respondents expressed the desire to grow cotton; while 31.1 percent and 29.7 percent desired beans and soya beans respectively; followed by cowpeas (28.4 percent). Other crops desired included sunflower (18.9 percent), groundnuts (12.2 percent), maize (8.1percent), watermelon (8.1 percent) and popcorn (6.8 percent). Also, farmers desired to have grown bananas, wheat, figure millet, cassava, Irish potatoes and butternuts (24.3 percent). Farmers who did not grow maize said they could really have loved to grow the crop (being the staple food crop) but lacked seed and fertilizer inputs. This category of respondents said it was cheaper to grow other crops such as soya

beans and cowpeas and in turn were able to purchase maize for home consumption after selling their preferred crops.

Table 2: Crops desired but not grown

Desired crops	Frequency	Percentage
Maize	**6**	**8.1**
Soya beans	**22**	**29.7**
Sunflower	**14**	**18.9**
Cowpeas	**21**	**28.4**
Groundnuts	**9**	**12.2**
Popcorn	**5**	**6.8**
Cotton	**31**	**41.9**
Watermelon	**6**	**8.1**
Beans	**23**	**31.1**
Other crop (bananas, wheat, finger millet, cassava, Irish potatoes, butter nut)	**18**	**24.3**

Source: (Field, Data, 2017)

Other crops included bananas, wheat, finger millet, cassava, Irish potatoes and butternut.

4.4 Reason for not growing desired crops

The reasons forwarded by the respondents for not growing the desired crops are shown on Table 3. The most notable reasons advanced by the farmers included lack of seeds, lack of man power, poor market and low pricing as well as lack of equipment. Lack of knowledge and inadequate land were also reasons advanced by the farmers for not growing the desired crops.

Table 3: Reasons for not growing desired crops

Reasons	Frequency	Percentage
Lack of equipment	8	16..3
Inadequate land	5	10.2
Lack of man power	16	32.7
Lack of seed	26	35.1
Lack of fertilizer	4	5.4
Poor market, and low pricing	11	22.2
Lack of knowledge	6	12.2

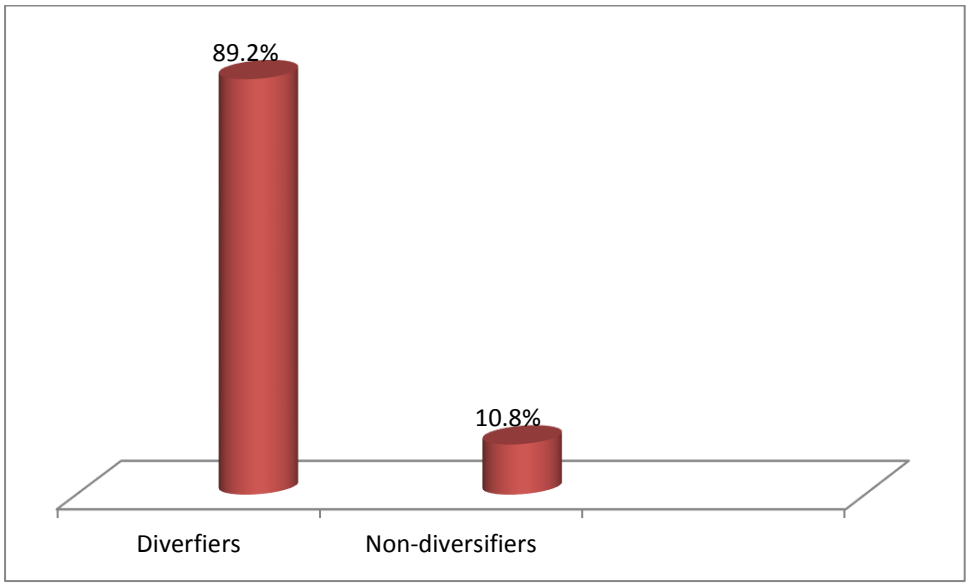
Others (lack of financed, water, preparation, unsuitable soils)	4	8.2

Source: (Field Data, 2017)

4.5 level of crop diversification.

Figure 3 shows the distribution of diversifiers and non-diversifiers. Only 8 out of the 74 farmers (10.8 percent) were non-diversifiers while 66 (89.2 percent) were diversifiers. Therefore, the diversification of crops can be described as high in the area. The reasons for high crop diversification highlighted in the study were varied. These included: lack of chemical fertilisers, which prompted others to grow crops such as soya beans, sunflower and cowpeas that did not require the use of chemical fertilisers. Attractive prices for crops such as soya beans in the 2015/16 farming season made others to include them in their crop portfolio. Some crops had ready market such as cotton (through contract with private companies) and soya beans. Certain crops were reported to be labour intensive such as cotton and soya beans which led others to shift to crops they thought were less laborious. Availability of recycled seeds which they thought would not affect their yields such as soya beans, sun flower and groundnuts prompted others to grow them.

Figure 3: Diversifiers and non-diversifiers



Source: (Field data, 2017)

The high level of crop diversification (89.2 percent) experienced in the area can be attributed to;

1. Gender of the household. The study revealed that the majority of the respondents were males (Table 2). Men in Zambia have more user rights to resources and other assets than

women. Female headed households in rural Zambia tend to face greater social barriers to income and asset accumulation (Mukuka and Hichaambwe, 2016). Therefore it is expected that many households diversified because they were dominated by men headed households who had user rights to land and other resources.

2. The majority of the respondents were married (Table 2). This means that households are expected to have more children thereby making larger household sizes than the single headed ones. It is therefore, assumed that marital status could have also encouraged crop diversification.

3. Age is also assumed to have contributed to crop diversity in the area. The majority of the respondents stood in the middle age; average of 41 years (Table, 2). This is a group which is more likely to be involved in a variety of farming activities because they are more energetic and active.

4. The average years lived in the area among respondents was high (see Table 2). This factor could have resulted into farmers' acquiring experience in farming activities of the area thus taking on crop diversification.

5. Household size was large; average of 7 people (Table 2). This also means that there was a large work force which could have in turn encouraged crop diversification.

Apart from just considering the distribution of diversifiers and non-diversifiers, the level of crop diversification was empirically measured using SDI. Though the percentage of diversifiers (89.2) and the SDI (0.6) were high, the proportionate (value) of individual cropped area in Mulenge was far less than that of maize. Likewise, total cropped area of other crops (47.2 percent) was equally smaller than that of maize (52.8 percent); giving a low status or 'quality' of crop diversification in the area. As seen from Table 4, maize occupies more than half of the total cropped area. Moreover, yields for other crops (alternative crops) other than maize were low to sustain food security in an event of maize failure due to unforeseen circumstances such as environmental distress.

Table 4: Cropped area

Crops	Cropped area (ha)	Percentage
Maize	57	52.8
Cotton	8	7.4
Sunflower	5	4.6

Cowpeas	4	3.7
Groundnuts	5	4.6
Soya beans	29	26.9
Total	108	100.0

Source: Field Data (2017)

4.8 Factors influencing crop diversification

4.8.1 Level of education

Table 5 shows that 58.1 percent and 39.2 percent of the respondents attained primary and secondary levels of education respectively, with 1.4 percent attaining tertiary level. Also, 1.4 percent did indicate of not having gone to school. In terms of crop diversification, farmers with primary and secondary levels of education had more diversifiers (53.0 percent and 45.4 percent respectively) while those that did not go to school and attended tertiary education ranked the least and were represented by 1.4 percent each. Chi-square test results (P-value = 0.091) showed no significant correlation between education level attained and crop diversification. The results of this study were inconsistent with the study conducted by Ibrahim *et al.,* (2009) who indicated a positive relationship between level of education and crop diversity. It is assumed that the higher the level of education a farmer attains, the more knowledge a farmer gains and more likely will be able to make sound decisions in this case, a choice to take up crop diversification. Also, it is presumed that a formal education determines the willingness of a farmer to accept new ideas. Our study results are showing that education level had no influence on crop diversification.

4.8.2 Distance to the market

The study showed that those that diversified more were located between 21-30km and over 31km (63.0 percent and 28.8 percent respectively) while farmers who lived 10 km or less and 11-20km from the market were the least (4.6 percent and 3.0 percent respectively). A statistical analysis carried out using chi-square (with P-value = 0.000) showed a significant relationship between market distance and crop diversification. This means that distance to the influenced crop diversification in the area.

Similarly, Kankwamba *et al.,* (2012) reported that households that are located away from markets or main roads tend to diversify their crop portfolio only for sustenance purposes

because their market involvement becomes difficult. What is expected then is that, the closer a farmer is to the market; the easier it becomes to take the produce to market, thus, encouraging farmers to diversify their crops. Benin *et al.,* (2004) highlighted the significance of proximity to main roads and markets for development of other farm enterprises.

4.8.3 Years of farming (Farming experience)

Table 5 shows that 17.6 percent of the respondents had been in farming for 10 or less years and diversified by 15.2 percent. Those with farming experience of 11-20 years had diversified by 13.6 percent. More diversifiers were among farmers whose farming experience ranged between 21-30 years (71.2 percent). Statistical analysis using chi-square (P-value = 0.202) showed no statistically significant relationship between farming experience and crop diversification.

4.8.4 Time of cultivation (Tillage time)

The study revealed that most of the farmers did their cultivation in November and December, represented by 83.9 percent. This means that cultivation in Mulenge was mainly done during the rainy season. In terms of crop diversification, farmers who cultivated their fields in November and December had diversified by 92.4 percent compared to 7.6 percent of those who cultivated their fields in August, September and October (early cultivation). Interestingly, the results indicated that farmers that did the cultivation later were more and had diversified more than those that cultivated earlier. Chi-square test (P-value = 0.875) showed no significant association between tillage time and crop diversification. However, Sichoongo *et al.,* (2014) has argued that tillage done during the rainy season gives a surety that the rains will be there for crops; as farmers are updated on the pattern of rains falling for that particular season. This could also have been one of the reasons farmers took cultivation later (November and December). Similarly, Bhattchayya (2008) reports that crop diversification is more important in rain fed areas than in irrigated parts. Our study shows that tillage time did not influence crop diversification.

4.8.5 Access to technologies

Table 5 indicates that only 9.5 percent of the respondents had access to information about new innovations recommended in crop production. All those that had access to technologies had diversified (10.6 percent) compared to 89.4 percent that did not have access to any. Statistical analysis using chi-square (P-value = 0.333) showed that access to technological information was not significant in influencing crop diversification.

Respondents had little access to technological information. Technology information that our study pursued included; ways of increasing crop yield such use of certified seed inputs,

rightful application of chemicals such as fertilizers, herbicides, fungicides and pesticides as these are associated with increased crop production. Assimilation of new farming methods such crop rotation, zero tillage, Post-harvest techniques was sought among others. Mango *et al*., (2015) highlighted that access to extension advice is important in supporting smallholder farmer production decisions since it can be a reliable source of technical advice on current knowledge and other relevant production information.

It was observed that most of the farmers were unpleasantly involved in their traditional farming systems such as growing the same type of crop on the same piece of land year in and out, undesirable methods of cultivating land among others. One of the male respondent interestingly mentioned that application of compound D and Urea fertilizers on maize crop was done at the same time when the crop reached the knee height. This is a popular practice in the area and is locally known as (*changanya*); regarded as a way of rationing chemicals fertilizers. A large area was brought under cultivation with minimal use of the fertilizers. From our observations, this was among the reasons as to why farmers had low crop yields.

Contrary to our findings; Rehima *et al.,* (2013) reported that extension service positively and significantly affected crop diversification in their study area. Their findings indicated that a household that had extension access increased their crop production choices by 89.85 percent. In their finding, extension services on technologies were associated with spread and adoption of new technologies, which may be directly relevant to crop diversification. Also, Makate *et al., (*2015) found that farmers with access to extension services had 38.4 percent more chance of adopting a diversified cropping system than their counterparts (those without access to extension). Extension workers have technical knowledge on how to grow and manage crops.

4.8.6 Access to marketing information

Findings also indicated that only 17.6 percent of the respondents had access to information about where to sell their crops whereas 83.4 percent did not. In terms of crop diversification, farmers who had access to marketing information (17.6 percent) diversified by 15.2 percent compared to 84.9 percent who did not have any, showing that access to market had no influence on crop diversification. Chi-square test (P-value = 0.117) showed no significant correlation between access to marketing information and crop diversification. The results of the study by Makate *et al.,* (2016) were different. They reported that farmers with access to output prices information had a 37.0 percent chance of adopting crop diversification than their counterparts who did not. The argument was that having knowledge about the output

prices of different crop can motivate farmers to grow other crops especially if the prices are good.

Mubanga *et al.,* (2015) considered market availability as well as accessibility as major determinants of crop production choices by smallholder farmers in Shibuyunji district. They said that telling farmers to grow certain type of crop varieties cannot result in household food security if the crop they are told to grow does not have ready market. The emphasis to adopt modern technologies involving crop diversification would be more effective if the crop promoted for diversification has ready market. Farmers will pick on a choice they anticipate will yield a gain on their part. In this case, farmers would only grow crops that they are sure of selling and make profit or gain. Otherwise, they cannot under take the risk or endeavour. From our observation, most of the smallholder farmers are risk averters. However, the debate is that farmers can only respond to growing certain crops if market is ready and accessible.

4.8.7 Access to weather information

Table 5 shows that only 23.0 percent of the respondents had access to weather information while 77.0 percent did not. Respondents with access to weather information had diversified by 21.2 percent compared to 78.8 percent who did not. This shows that farmers' decision to diversify the crops had nothing to do with whether a farmer had access to weather information or not. Equally, statistical analysis by chi-square (P-value = 0.302) showed no significant relationship between access to weather information and crop diversification.

It was mentioned in the focus group discussion that respondents who had access to weather information did access it mainly through the radio, television sets and through rumours in the community. Mubanga *et al.,* (2015) acknowledged the significance of the farmer knowing about when and how much rainfall or rainfall distribution an area will receive. They argued that such information might be useful as it highlights what types and how many crops a farmer can grow.

4.8.8 Membership to cooperative

The study showed that 27.0 percent of respondents belonged to a cooperative while 73.0 percent did not belong to one. Among those that were members of a cooperative 30.3 percent diversified compared to 69.7 percent who did not belong to any. Statistical test using chi-square (P-value = 0.068) showed no significant relationship between membership to cooperative and crop diversification.

The Zambian government resumed large-scale distribution of subsidised fertilizers in 2003 through farmers' cooperatives in the name of Farmers Support Programme and Farmers Input Support Programme. The resumption of fertilizer subsidies and large scale government maize

purchases has helped to stimulate resurgence in smallholder maize production (Chapoto, *et al,* 2012). Cooperatives are mainly involved in distribution of maize inputs and this has encouraged maize mono-cropping thus, defeating the objective of crop diversification Rehima *et al.,* (2013) reported similar results where membership to a co-operative makes a farmer less likely to diversify. The result suggests that co-operatives might have their particular objectives (mono-cropping) and focus on specific crops, which may narrow the probability of diversification.

4.8.9 Household annual income (ZMK)

Table 5 shows that farmers with annual income of K10, 000 or less (27.0 percent) had diversified by 25.8 percent. Those with income range of K11, 000-K20, 000 (2.7 percent) diversified by 3.0 percent. Respondents with annual income of K21, 000-K30, 000 (69.0 percent) had more diversifiers represented by 69.7percent. Only one (1.4 percent) respondent had an annual income of over K31, 000 and showed diversification of 1.5 percent. Chi-square test results (P-value = 0.854) showed no significant correlation between annual household income and crop diversification. This means that whether a farmer had more or less annual income, they diversified their crop portfolio. The scenario could possibly mean that farmers that did not have enough income diversified for subsistence purpose; they did not need a lot of money to grow for home consumption whereas those with much more income could have also diversified possibly for cash. However, Rehima *et al.,* (2013), found a significant relation between annual household income and crop diversification. The more the annual income a household had, the more the farmers had diversified which is generally expected and regarded as a normal situation.

4.8.10 Transport cost to market

Table 5 shows that farmers who spent K10 or less (13.5 percent) diversified by 9.1 percent compared to those who spent K11-K20 (86.5 percent) and had diversified by 91.0 percent. Chi-square results (P-value = 0.001) indicated a significant relationship between transport to the market and crop diversification. This could possibly mean that transport cost to the nearest market was affordable or was rather low for this area for most of the farmers. It could also mean that farmers had money to spend on transport especially that such activities occurred when they were selling their produce. Makate *et al.,* (2016) also had the similar results from the study conducted in Zimbabwe; low transportation costs were found to have a positive bearing on the decision to diversify. Farmers who experienced low transportation costs had a 25.8 percent chance of adopting a diversified cropping system than their counterparts (those experiencing higher transport costs).

4.8.11Type of access to land

Findings of the study showed that 91.9 percent of the farmers who owned land diversified by 91.1 percent. Those that did not own land, meaning they grew crops on borrowed land represented 8.1 and diversified by 6.6 percent. Chi-square result (P-value = 0.448) shows no significant relationship ship between type of access to land and crop diversification. This is contrary to the findings of Niehof (2004) who reported that land ownership positively and significantly affected crop diversification in the area. It was highlighted further that a farmer who owns land is expected to grow a varied range of crops as compared to those who accessed it through either rent or borrowing. One of the key informants said that,

> *Owning land inculcates a spirit of stewardship to the resource; the farmer has it that it is my land, which eventually drives the soul of the farmer into conserving the soils through practices such as multiple cropping or series of crop rotation. Also, owning land improves the farmers' expenditure by not spending on land rentals. A farmer who accesses land through rent or borrowing may be limited by financial resources or the size of land to grow crops and so may be restricted to growing only one crop*.

4.8.12 Land size

Respondents with land size of 21-30 hectares (71.6 percent) had more diversifiers (72.7 percent), followed by those with land of 10 hectares or less (6.1 percent). Only one respondent did indicate to have land in the range of 31-40 hectares and diversified by 1.5 percent. Chi-square test results (P-value = 0.448) shows no statistically significant association between land size and crop diversification. Rehima *et al.,* (2013) reported that with an increase of one hectare on land size, the level of crop diversification of the household decreased by 345.7 percent. Their argument was however, constructed on quasi-fixed factors (inputs, management, skills and others). This implies that sizable farm land demands more management skills, inputs and draft power which limit households from growing multiple crops.

4.8.13 Means of production

Table 5 also shows that 14.9 percent of the respondents used human labour compared to 39.2 percent who used oxen as their means of production. Those that used both oxen and human labour constituted 45.9 percent. In terms of crop diversification, farmers who used human labour diversified by 9.9 percent compared to 42.4 percent who had used oxen. The respondents who used both oxen and human labour for crop production had diversified by

48.5 percent. Chi-square (P-value = 0.00) test of association showed a significant relationship between the means of production and crop diversification.

These findings agree with the conclusion of Sichoongo *et al.*, (2014) who reported a positive association between tillage plough and crop diversification. The possible meaning for this state of affairs could be that tillage plough may enable farmers to do farm activities on time. When farmers have animals (oxen) they are more likely to finish land preparation and related issues earlier and on time before the onset of rainfall or during the rainy season than those who might not have oxen. This could result in improving on the time spent on different farm tasks or activities.

4.8.14 Access to Means of production

With regards to access to means of production; farmers who used human labour (4.1 percent) diversified by 3.0 percent compared to 51.4 percent who owned the means of production and had diversified by 46.9 percent. Chi-square (P- value = 0.049) testing of significance showed a slight significant relation between access to means of production and crop diversification.

5.6.15 Period of access to land

Respondents who owned land for 10 years or less (17.7 percent) had diversified by 15.6 percent; whereas those who were in access range of 21-30 years (70.3 percent) had 71.2 percent diversifiers. Chi-square test of association (P-value = 0.202) showed no significant relationship between period of access to land and crop diversification.

Table 5: Distribution of respondents selected Socio-economic variables and crop diversification status

	All		Diversifier	Non-diversifier	P-value
Selected characteristics	N	%	%	%	
Highest education					0.091
No education	1	1.4	1.52	0.0	
Primary	43	58.1	53.0	100.0	
Secondary	29	39.2	43.9	0.0	
Tertiary	1	1.4	1.5	0.0	
Market distance					0.000***
10 & below	5	6.8	4.6	25.0	
11-20	4	5.4	3.0	25.0	
21-30	44	59.5	63.6	25.0	
over 31	21	28.4	28.8	25.0	
Years of farming					0.202
10 & below	13	17.6	15.2	37.5	
11-20	9	12.2	13.6	0.0	
21-30	52	70.3	71.2	62.5	
Tillage time					0.875
August	1	1.4	1.5	0.0	
September	1	1.4	1.5	0.0	
October	4	5.4	4.6	12.5	
November	43	50.1	59.1	50.0	

December	25	33.8	33.3	37.5	
Access to technologies					0.333
No	67	90.5	89.4	100.0	
Yes	7	9.5	10.6	0.0	
Marketing information					0.117
No	61	83.4	84.9	62.5	
Yes	13	17.6	15.2	37.5	
Weather information					0.301
No	57	77.0	78.8	62.5	
Yes	17	23.0	21.2	37.5	
Membership to cooperative					0.068
No	54	73.0	69.7	100.0	
Yes	20	27.0	30.3	0.0	
Household annual income(000)					0.854
10 & below	20	27.0	25.8	37.5	
11-20	2	2.7	3.0	0.0	
21-30	51	69.0	69.7	62.5	
Over 31	1	1.4	1.5	0.0	
Transport cost to market					0.001***
10 & below	10	13.5	9.1	50.0	
11-20	64	86.5	91.0	50.0	
Type of access to land					0.064
Borrowed	6	8.1	6.6	25.0	
Owned	68	91.9	91.1	75.0	
Land size(ha)					0.448
10 & below	12	16.2	13.6	37.50	
11-20	4	5.4	6.1	0.0	
21-30	53	71.6	72.7	62.5	
31-40	1	1.4	1.5	0.0	
No response	4	5.4	6.1	0.0	
Means of production					0.00***
Human	11	14.9	9.1	62.5	
Oxen	29	39.2	42.4	12.5	
Oxen and Human	34	45.9	48.5	25.0	
Access to means of production					0.049 ***
Human & Partnership	9	12.2	13.6	0.0	
Human	3	4.1	3.0	12.5	
Own	38	51.4	46.9	87.5	
Own & Partnership	24	32.4	32.4	0.0	
Period of access to land (years)					0.202
10 and below	13	17.6	15.2	37.5	
11-20	9	12.2	13.6	0.0	
21-30	52	70.3	71.2	62.5	

Note: Significance level: *** (P≤0.05)

4.9 Barriers to crop diversification

Findings show that farmers had challenges as regards to the types of seeds used. Most of the farmers used certified seeds to grow maize which was purchased from certified seed dealers at a high price; making them not to realise much profits. In order to grow other crops, farmers used either recycled or local seeds from their community which again frustrated their efforts by getting very low yields. Methods of farming employed by farmers also posed a challenge to crop diversification. It was discovered that mostly, farmers employed the use of chemical fertilizers and weeding physically as a way of increasing the yields as opposed to using other methods. Use of fertilizers proved to be so expensive while the weeding was reported to be so tiresome and cumbersome to farmers. Extension services provided to the farmers at the time of study were very low or almost non-existent and this was also evidenced by poor farming methods used by farmers.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The aim of the study was to examine the factors influencing crop diversification among smallholder farmers. Specific objectives of the study were; to identify the types of crops grown by the smallholder farmers, to ascertain the level of crop diversification among smallholder farmers, to determine socio-economic factors influencing crop diversification and to identify the barriers to crop diversification among smallholder farmers. The study utilised data collected from 74 randomly sampled smallholder farmers using structured interviews. Field data was analysed using descriptive statistics, Chi-square, Simpson's diversity Index (SDI) and thematic analysis. The results show that maize *(Zea mays L.)* (91.9 percent) was a widely grown crop for the purposes of consumption and sale. Soya beans *(Glycine max)* (74.3 percent) were identified as the secondly widely grown crop as well as an emerging high value crop mainly produced for sale. Cotton *(Gossypium)* (20.2 percent) was another crop grown in the area mainly by contract farming with private companies for sale. Cowpeas *(Vigna ungulculata)* (12.2 percent) were another potential high value cash crop grown in the study area, although market was not well established. Groundnuts *(Arachis hypogaea)* (37.8 percent) and sunflower *(Helianthus)* (25.7 percent) were grown mainly for home consumption because of lack of ready market and low valuing. The level of crop diversification among smallholder farmers in the study area was high as the SDI score was 0.6 a movement towards one (which is more diversification), while diversifiers constituted 89.2 percent and non-diversifiers were 10.8 percent.

Further, the study revealed that market distance, transport cost to markets, means of production and access to means of production were statistically significantly associated with crop diversification in the study area. In addition, the study identified barriers to crop diversification as lack of certified seed for other crops other than maize, farmers employed the use of chemical fertilizers and weeding physically as a way of increasing yield as opposed to using other cheaper methods such as the use of animal manure such as cow dung and composed manure. Lack of extension services was another barrier identified by the study.

6. 2 Recommendations

6.2.1 Bringing trading market closer to the farmers

The study established that farmers further away from the main markets were able to diversify for food security purposes. However, food security is not the sole purpose of the farmer's existence; they also need income for other livelihood activities such as sending children to school, buying inputs and so forth. Farmers can only achieve this if they are able to sale what they produce to the nearest market. Bearing in mind that distance to the market is an indication-of access to the market and organised trade as well as proximity to economic resources, therefore, there is need for the government to bring markets closer to the farmers. This can be achieved by investing in reliable and adequate market infrastructure through encouraging private sector participation. Once the input and output markets are established, farmers will be encouraged to produce more food and increase their income.

6.2.2 Reducing cost of buying and transporting inputs

Since it has been established that the cost of transport to the market significantly influenced crop diversification in the study area, the government and other stakeholders should invest in road infrastructure. Road infrastructure will improve farmer's access to markets and this in turn will help reduce the cost of transporting farm produce thereby increasing their earnings and improving their livelihoods. Expansion of infrastructure like road networks is an important precondition for the diversification of crops and is crucial in ensuring that farmers take their produce to the market.

6.2.3 Making certified seed available to farmers

The study also identified lack of certified seed for crops other than maize as barriers to significant diversification of crops in the study area. High yielding varieties should be developed and made available to farmers at affordable prices. There is need for the

government to embark on researches of different seed types of different crops other than maize and should be made available to smallholder farmers. This of course should be supported by effective extension services to create awareness and ensuring adoption by farmers.

6.2.4 Encouraging farmers to use agricultural implement such as ploughs

Since means of production and access to means of production were found to significantly influencing crop diversification in the study are; there is need to encourage farmer to adopt new technologies thus, encouraging farmers to move away from the use of hand hoes to better tools to till their land so that time and energy they spend in their field is reduced. Ox-ploughs are a good example given that most of the farmers cannot have money to hire tractors since majority of smallholder farmers live in deprivation, have low level of agricultural production and are usually food insecure. The government and other stakeholders can in this instance work together and assist farmers where possible especially that the sole purpose of the government is to improve the welfare of its citizenry.

6.2.5 Encouraging farmers to use other methods of improving the soil instead of using chemical fertilizers.

The study revealed that farmers were using chemical fertilizers as a way of improving their yields. To the farmers applying chemical fertilizers to their crops especially maize was synonymous with increased yields. There is need for the government and other stakeholders to encourage farmers to consider using other methods of enriching their land, such as use of animal and composite manure apart from relying on chemical fertilizers considering that most of them as evidenced from the study are resource poor and may not afford buying significant quantities for their crops. The use of animal and composite manure is cheap and natural at the same time very effective in enriching the soils. Most of the smallholder farmers have depended so much on the fertilizer subsidy from the government which often times has not helped them so much and has not served much of its intended purposes. The fertilizer is delivered late and farmers struggle to access the fertilizer at the helm of their growing season such that farmers fail to use it at the right time. In this case there is need for the farmer to move away from this dependency syndrome. The facts on the ground are that very few farmers benefit from the subsidy and so the use of animal manure such as cow dung is cheap.

6.2.6 Reviving extension service

The study also established the significant role played by agricultural extension service in fostering agricultural technologies. The study has established that extension service provision in Mulenge was low due to various challenges experienced by the government such as lack of financial resources to engage adequate and active extension service provision. There is need for the government and other stakeholders to rejuvenate the extension service by sourcing for both human and financial resources. Extension system should be strengthened through recruitment; incentive provision and training of adequate extension workers for successful crop diversification.

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