

## FARM-BASED FACTORS SHAPING CROP ENTERPRISE DIVERSIFICATION AMONG MAIZE SMALL-HOLDER FARMERS IN KALULUSHI DISTRICT OF ZAMBIA

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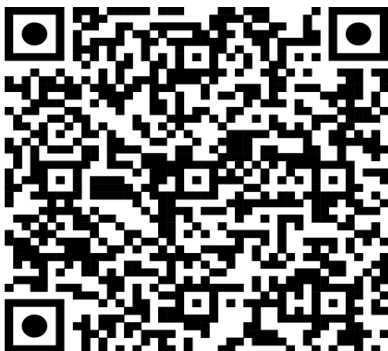
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### Abstract

This study examined the factors shaping crop enterprise diversification among small-holder maize farmers in the Kalulushi District of Zambia. Having high crop enterprise diversification promotion among small-holder maize recently as a household food security and farm enterprise risk absorption strategy across Zambia, questions have arisen on factors encouraging or negating farmer responses since maize production has remained dominant, particularly under rain-fed systems. The study used primary data from a sample of 150 farmers. Data included the crop enterprise diversification index as the dependent variable, whereas the farming practice, farm size, the maize subsistence index, cooperative dependence, distance to the central market, weighted maize selling price, dependence on government purchases, planting period and source of financing for farming are the independent variables. Empirical results revealed that crop enterprise diversification increased with an increase in distance from the market, conservation farming practice, subsistence level, weighted maize selling price, and alternative financing. However, it decreased with an increase in farm size and dependence on government purchases. Cooperative dependence and planting period were not found to affect crop enterprise diversification. The study recommends streamlining crop enterprise diversification with distance from the market, farming practice, level of subsistence, weighted maize selling price, alternative financing, farm size and dependence on government purchases.

**Key terms:** Dependence, Diversification, Neutral, Subsistence.

## 1.0 INTRODUCTION

Crop enterprises are major economic activities supporting the majority of Zambia's population (Sichoongwe, 2014), with maize being the dominant crop (Government of Zambia, 2016). With diversification being entry into new crop production lines (Githira, 2008) and the practice of cultivating more than one crop variety on the same farm (Dube et al., 2016). This implies the low contribution of crops other than maize, low diversification, low price risk management and low food security (McCord et al., 2015) but increased returns to maize specialisation for households with limited resources (Ignaciuk et al., 2017). Moreover, the gender of farmers, education and trade experience, membership in cooperatives, resource ownership, features of the land owned, access to extension services and transaction costs reported to affect crop enterprise diversification (Rehima et al., 2013) do not seem to have a consistent direction of effect on it.

Generally, crop combinations are dynamic from year to year (Hichaambwa et al., 2016), but maize still remains dominant, leading to a low transition from subsistence to commercial agriculture (Rehima et al., 2013), low food security and farm incomes, high depletion of soil nutrients (Sitko et al., 2011), low composite yields and increased biological risks (Smith et al., 2008). In spite of various government policy pronouncements on diversification into other crops, maize production is still dominant in Zambia at around 70 per cent of total production (Government of Zambia, 2016). Thus, the study sought to understand factors shaping crop enterprise diversification among maize farmers.

The study tested the null hypotheses that (a) the regression coefficients in the relationship were not significantly different from 0 ( $H_0: \beta_i = 0$ ) against the alternative that they were significantly different ( $H_1: \beta_i \neq 0$ ) so that accepting it implied the non-existence of a relationship, whereas rejecting it implied its existence; (b) the coefficients identified to be significantly different from 0 were either greater than 0 ( $H_1: \beta_i > 0$ ) or less than 0 ( $H_1: \beta_i < 0$ ) to give the direction of effect on the diversification. Thus, results would guide crop enterprise diversification to meet food and income security (Makate et al., 2016), risk management (Culas & Mahendrarajah, 2005), sectoral development (Githira, 2008) and complementing other studies (Sichoongwe, 2014).

## 2.0 LITERATURE REVIEW

Sichoongwe (2014) in a study on determining the extent of crop enterprise diversification and identifying the major factors, which influencing farmers' decisions to diversify in crop production using the Tobit model, observed the extent of crop enterprise diversification among the small-holder farmers as being relatively low. Moreover, the size of landholding, quantities of fertiliser, distance to the market, tillage time and use of a plough were found to significantly determine crop enterprise diversification. Based on the findings, the important recommendations included the government's need to implement policies that improve farmers' access to and control over land, encourage mechanisation and bring trading markets closer to the farmers. However, this approach is appropriate when the dependent variable is censored between diversification and specialisation. Thus, it fails to work when the dependent variable is of the same category.

Rehima et al. (2013) established that crop enterprise diversification under a small-scale production system was a risk management strategy and an important step for transitioning from subsistence to commercial

agriculture. The study investigated the determinants of crop enterprise diversification using data on the three-stage randomly selected sample of 393 farm households in Ethiopia. The Heckman two-stage model was used to separately estimate the farmers' decisions and the level of diversification. Empirical results revealed gender, education and trade experience, membership in cooperatives, resource ownership, features of the land owned, access to extension services and transaction costs as the major determinants of crop enterprise diversification. Based on its findings, the study recommended the promotion of female participation, investment in formal and informal education of the farmers, provision of incentives for extension workers, input support, and streamlining technology by ecological region.

Makate et al. (2016) found how crop enterprise diversification impacted two outcomes of climate-smart agriculture. The study found increased productivity of legumes and cereals and enhanced resilience of household income, food security and nutrition in rural Zimbabwe. Data analysed from over 500 small-holder farmers revealed that crop enterprise diversification depended on the land size, farming experience, asset wealth, location, access to agricultural extension services, information on output prices, low transportation costs and access to farming information. Thus, crop enterprise diversification was found to be a viable climate-smart agriculture practice for enhancing crop productivity and, consequently, resilience in rural small-holder farming systems.

Chiputwa (2011) noted that conventional agricultural practices were unsustainable due to their extensive soil degradation effects. Although several conservation technologies had been promoted, adoption of these technologies was reported to have been resisted by small-holder farmers, and understanding the causes of the low adoption rates remained a challenge to development practitioners. A study on 100 farmers using a Tobit model to assess the underlying factors of low adoption pointed to farm size and crop enterprise diversification as major determinants.

A common literature finding on farm diversification is the high correlation between farm size and diversification. Findings by some researchers indicate large farms are more likely to be diversified (Pope & Prescott, 1980) due to increased flexibility in exploiting capital more effectively and employing available labour more efficiently. This study considers diversification among maize farmers and how it is driven by farm-based factors.

### 3.0 METHODOLOGY

The study was conducted in Kalulushi District, which is located in the high rainfall and long growing season region of Zambia, for two main reasons. Firstly, it was recognised to be receiving settler small-holder farmers from low rainfall areas of Zambia. Secondly, it was identified as having been targeted for diversification programmes by the government. Purposive sampling using a stratified Snowball sampling design was followed in the study to select small-holder farmers, and data were collected using self-administered questionnaires. The crop enterprise diversification index (CDI), which served as the dependent variable, was estimated from different individual crop area sizes using the equation  $CDI = 1 - \sum \left( \frac{A_i}{A_T} \right)^2$ , where  $\sum \left( \frac{A_i}{A_T} \right)^2$  is the Herfindahl and Hirschman Index, which measures levels of enterprise concentration. In this equation,  $A_i$  is the area for an individual crop, including maize, and  $A_T$  is the total area, including maize, grown by each farmer. Independent variables included a number of farmer factors. The farm size for cropping activities (FRMSZ), which was measured in limas or  $\frac{1}{4}$  a hectare, was

included based on observations by Weiss and Briglauer (2002) that crop enterprise diversification may depend on it. Cooperative dependence (COOPD) was measured as a proportion of an individual farmer's fertiliser sourced from cooperative structures to total fertiliser used.

Levels of subsistence (SUBL) were measured as proportions of maize output reserved for consumption, and the weighted maize selling price (WGTP) of maize was captured as 1 for values greater than FRA prices and 0 for values equal to or less than FRA prices. The dependence on government purchases of maize (DGP) was captured as 1 for farmers who supplied maize to the FRA and 0 for those who did not. The planting period (PLP) was captured as 1, 2, and 3, with 1 being the first and second dekads of November for early planting, 2 being the third dekad of November and first dekad of December medium planting, and 3 being the second and third dekads of December for late planting to capture the effect of rainy season onset. Sources of financing other than cooperative dependence (FINSO) were captured as 1 if present and 0 if absent. The distance of cooperatives (DIST) from the main market in town was captured as 1, 2, 3, .....6 where 1 was the nearest cooperative to the market, 2 was the second nearest, and so on such that 6 was the furthest from the market. Thus, farmers in the 1-3 categories were considered to be nearer to the main market, and those in the 4-6 category were considered to be farther away from it. The farming practice (FRMP) was captured as 0 for conventional and 1 for conservation farming since the farming practice was hypothesised to be affected by other farmer characteristics, as argued by Rahm and Huffman (1984).

A sample of 150 farmers was targeted for the research using a stratified Snowball sampling design, with cooperatives being the strata because they grew maize and other crops under these cooperatives. However, only 133 availed themselves for the study through their willingness to participate in the interviews. Data analysis involved the use of an OLS regression model postulated as given in the equation below.

$$CDI_i = c + \beta_i X_i + e_i$$

In this equation,  $CDI_i$  is the diversification index,  $c$  is the constant,  $\beta_i$  is the set of coefficients explaining the effects of listed independent factors represented by  $X_i$  on the  $CDI$ , and  $e_i$  is the error term. The first tested hypothesis was that  $H_0: \beta_i = 0$  against  $H_1: \beta_i \neq 0$  for isolating factors affecting crop enterprise diversification among maize farmers from those not affecting it by using a t-test. The second hypothesis tested was  $H_0: \beta_i = 0$  against  $H_1: \beta_i > 0$  or  $H_1: \beta_i < 0$  to isolate factors enhancing diversification among maize farmers from those discouraging it by using a t-test. The results explained by  $\beta_i$  depend largely on the characteristics of the function, which included whether or not it should be estimated with a constant  $c$ . To make this choice, a null hypothesis t-test that  $H_0: c = 0$  against the alternative  $H_1: c \neq 0$  was conducted. If the test indicated that  $H_0: c = 0$ , it implied that the regression function had a zero constant and that it could be re-estimated without a constant. However, if the t-test indicated the alternative hypothesis that  $H_1: c \neq 0$ , it implied that the function had a non-zero constant and that the estimated constant needed to be maintained.

## 4.0 RESULTS AND FINDINGS

### Demographic Characteristics of Respondents

Of the 133 farmers, 60 (45%) farmers were near the centres of the market, whereas 73 (54.9%) were far away from marketplaces. On Farming practice, 21 (15.8%) farmers practised conservation farming, whereas 112 (84%) farmers practised conventional farming. For farm size, 122 (91.7%) farmers had small or moderate farms of up to 80 limas, whereas 11 (8.3%) farmers had large farms of beyond 80 limas. On cooperative dependence, 99 (74%) farmers depended on the cooperative, whereas 34 (25.6%) farmers had no cooperative dependence. On the subsistence level, 53 (39.8%) farmers were above the subsistence level, whereas 80 (60.2%) farmers were below. On weighted maize selling price, 83 (62.4%) farmers received equal to or below FRA price, whereas only 50 (37.6%) farmers received higher than FRA prices during produce sales. On dependence on government purchases for maize sales, 124 (93.2%) farmers depended on FRA, whereas 9 (6.6%) farmers did not depend on FRA for their maize sales. On the planting period, 94 (70.7%) farmers planted late, whereas 39 (29.3%) farmers planted early. On financing source, 68 (51%) farmers of them, financed production from previous maize sales, whereas 65 (49%) farmers had their additional personal savings from off-farm activities.

### Assessment of the Farmer Factors Shaping Crop Enterprise Diversification

The assessment of farmer factors shaping crop enterprise diversification was based on the response of the crop enterprise diversification index to these factors as indicated by the outputs of the OLS regression model presented in Table 1.

**Table 1: Regression Outputs of Crop Enterprise Diversification Index against Farmer Factors**

Farmer factors	Coefficients	P-value and statistical significance	
DIST	2.282	0.032	**
FRMP	16.118	0.001	***
FRMSZ	-0.036	0.006	***
COOPD	0.048	0.295	ns
SUBSL	0.165	0.003	***
WGTP	13.230	0.001	***
DGP	-21.700	0.002	***
PLP	1.527	0.603	ns
FINSO	7.186	0.046	**
R <sup>2</sup>	0.751		
Adjusted R <sup>2</sup>	0.726		
F test	41.467	0.000	***
Observations	133		

Note: \*\*\* means  $p < 1\%$ ; \*\* means  $p < 5\%$ ; \* means  $p < 10\%$ ; ns means  $p > 10\%$

The table shows that the R<sup>2</sup> of about 0.751 indicates 75.1 per cent of the variation in the crop enterprise diversification as being attributed to the hypothesised factors. Only 24.9 per cent was attributed to the unknown factors represented by the error term. In addition, the F-value of 41.467, together with its probability outcome of almost 0.000, suggests that the estimated regression function was significantly explained by the hypothesised factors.

The coefficient of distance from the market was found to be 2.282, which indicates that the crop enterprise diversification index increased by 2.282 times per movement from one cooperative to another in the direction away from the main market in Kalulushi District. This increase was found to be significantly different from 0 at 5 per cent level of significance. In the case of farm size, the coefficient was found to be -0.023, which indicated that a 1 lima increase in farm size caused a decrease of 0.023 times in the crop enterprise diversification index among maize farmers. This decrease was also found to be significantly different from 0 at 1 per cent level of significance. On the type of farming practice followed by individual farmers, the coefficient was found to be 16.118, which was also found to be significantly larger than 0 at 1 per cent level of significance. This indicates that crop enterprise diversification was found to be 16.118 times higher among farmers practising conservation farming as compared to those practising conventional farming in the district.

The effect of cooperative dependence on crop enterprise diversification among maize farmers was found to have a coefficient of 0.048. However, since the coefficient was not found to be significantly different from 0, the crop enterprise diversification increase of 0.048 times could not be said to have been significantly affecting crop enterprise diversification in Kalulushi District. The effect of subsistence level on crop enterprise diversification among maize was found to have a value of 0.165, and it was found to be significantly different from 0 at 1 per cent level of significance. This indicates that diversification increased by 0.165 times for every one-time increase in the subsistence level. The weighted maize selling price was found to have a coefficient of 13.230, and it was found to be significantly different from 0 at 1 per cent level of significance. This crop enterprise diversification was found to be higher by 13.230 times among farmers who had planned for the higher maize prices on the market as compared to those who planned for low prices. In the case of dependence on government purchases through FRA, the coefficient was found to be -21.700. Thus, farmers who depended on FRA for maize supply tended to have lower crop enterprise diversification by 21.700 times as compared to those who depended on alternative markets.

In the case of the planting period, the coefficient was found to be 1.527, but it was, however, not significantly different from 0. Thus, for every 2 dekad delays in planting after 01 November, diversification among maize farmers increased by 1.527 times, although the increase could not be said to significantly increase crop enterprise diversification. In the case of a source of financing, the coefficient was found to be 7.186 and significant at 5 per cent level of significance, which suggests that alternative financing to cooperative dependence tended to increase diversification among maize farmers as compared to those who solely depended on cooperative financing. Thus, off-farm income initiatives, especially those that occur in off-season months, could be important determinants of diversification by reducing dependence on government-supported programmes.

## Discussions

The increase in crop enterprise diversification with distance away from major markets was not peculiar to study in Kalulushi District but rather common. Mishra et al. (2004) in the USA observed high diversification on farms with close proximity to urban areas, which could also be linked to the need to specialise in high-value crops for urban markets. Chizuni (1994) also observed that the lack of market guarantees for maize in rural areas of Zambia tended to encourage crop enterprise diversification in such areas.

Low crop enterprise diversification with an increase in farm size in this study was found to be consistent (Ciaian et al., 2018), which is consistent with the argument based on the economies of scale. The other possible explanation is that farm size and wealth creation tend to be positively correlated, which implies that wealthy farms tend to be less risk-averse and, consequently, less diversified, as argued by Pope and Prescott (1980), who reported a negative but significant relationship between wealth creation and farm diversification. Moreover, observations by Pope and Prescott (1980) also affirm, indirectly, that small farms tend to be highly crop diversified and highly subsistence instead of being highly commercialised, as observed in this study, unless under irrigated horticulture (Waswa et al., 2009). However, the research findings contradict those by Basavaraja et al. (2016), who observed crop enterprise diversification to increase with farm size. Moreover, Pingali (1997) suggests that commercialisation increases with farm size, implying that subsistence, which is the opposite of commercialisation, increases with the decline in farm size.

The study results of a non-significant relationship between crop enterprise diversification and cooperative dependence contradict findings by Singh et al. (2006) in India and by Ndhlovu (2010) in Malawi, which found cooperative dependence for fertiliser access to be a significant determinant of crop enterprise diversification. The possible reason for the non-significant relationship could be that the quarter-a-hectare equivalent of fertiliser accessed by each farmer could be too low to induce crop specialisation in Kalulushi District of Zambia. The absence of any significant impact of the planting period during the rainy season on crop enterprise diversification among maize farmers is confirmed by Ngoma (2008). This could be attributed to limited variation in the planting rains, especially since Kalulushi District is in the high rainfall and long rainy season region of Zambia, which gives elasticity to planting different crops.

The decline in crop enterprise diversification with an increase in government dependence on maize marketing found in the study is confirmed in the findings by Mofya-Mukuka and Hichaambwa (2018) and Dube et al. (2016). Thus, the policy of increasing market support through FRA works against crop enterprise diversification in Kalulushi District.

## 5.0 CONCLUSION AND RECOMMENDATION

**Conclusion:** In Kalulushi District, farm distance away from markets tends to increase crop enterprise diversification among maize farmers. Thus, policies encouraging crop enterprise diversification may be more effective in outlying areas as opposed to those near major markets. Policies and initiatives that enable farmers to have alternative sources of financing to government input and market support also encourage crop enterprise diversification among maize farmers, and as such, they need to be encouraged. However, an increase in farm size and FRA dependence decrease crop enterprise diversification in the district. Therefore, policies favouring crop enterprise diversification may not be effective where these factors are prominent. Cooperative dependence and planting time have no effect on crop enterprise diversification, which allows for these interventions to be carried out without problems. Crop enterprise diversification is also encouraged by conservation farming, subsistence levels and high-weighted maize selling price in the district. Thus, policies encouraging crop enterprise diversification could be more effective among these categories of farmers in Kalulushi District.

**Recommendation:** The study recommends streamlining crop enterprise diversification with distance from the market, farming practice, level of subsistence, weighted maize selling price, alternative financing, farm size and dependence on government purchases.

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