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Determinants of household's choice of livelihood diversification strategies in Chobe district, Botswana

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ABSTRACT
To ensure reduced poverty levels and improved standard of living, the government of Botswana is aiming at diversifying its economy from mining to agriculture, industry, manufacturing, services and tourism. However, there is no quantitative empirical evidence to guide the development of policy strategies for livelihood diversification hence the need for research-based evidence on factors that influence households' choice of livelihood diversification strategies in the Chobe District. Primary data was collected from three villages in Chobe District and analyzed using multinomial logit model. The determinants of diversification are age, income, market access, land ownership, farm size and access to extension services. The diversification of rural livelihood strategies is important in reducing rural poverty and promoting asset and wealth diversification. Based on the results, there is need to improve households' market access and land ownership. In addition, younger members of the community should be educated and trained in tourism-based activities for profitable diversification.

Key words: Agriculture, diversification, livelihoods, and multinomial logit

RÉSUMÉ
Pour assurer une réduction des niveaux de pauvreté et une amélioration du niveau de vie, le Gouvernement du Botswana vise à diversifier son économie de l'exploitation minière à l'agriculture, l'industrie, la fabrication, les services et le tourisme. Cependant, il n'y a pas de données empiriques quantitatives pour guider l'élaboration de stratégies politiques pour la diversification des moyens de subsistance, d'où la nécessité de preuves fondées sur la recherche sur les facteurs qui influencent le choix des ménages en matière de stratégies de diversification des moyens de subsistance dans le district de Chobe. Les données primaires ont été recueillies dans trois villages du district de Chobe et analysées à l'aide d'un modèle logit multinomial. Les déterminants de la diversification sont l'âge, le revenu, l'accès au marché, la propriété foncière, la taille de l'exploitation et l'accès aux services de vulgarisation. La diversification des stratégies de subsistance en milieu rural est importante pour réduire la pauvreté rurale et promouvoir la diversification des actifs et des richesses. Sur la base des résultats, il est nécessaire d'améliorer l'accès des ménages au marché et à la propriété foncière. En outre, les jeunes membres de la communauté devraient être éduqués et formés aux activités touristiques pour une diversification rentable.

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Mots clés: Agriculture, diversification, moyens de subsistance et logit multinomial

INTRODUCTION

With a 5.2 percent real growth in the Gross Domestic Product (GDP) in 2014, Botswana has been considered the fastest growing economy among developing countries (Honde and Abraha, 2015) and has been heralded as Africa's success story. Even though there has been significant growth in the economy, poverty incidence in rural areas have marginally decreased from 24.3 percent in 2009/2010 to 24.2 percent 2015/2016 (Statistics Botswana, 2016). The agricultural sector, although the main livelihood for most rural households, has been performing poorly (Tlhalefang and Mangadi, 2013). However, agriculture is considered as the backbone of the economies, particularly in developing countries, (Richardson, 2005; Ahmad *et al*., 2011; Izuchukwu, 2011) as it contributes a high share to the GDP and serves as the primary source of employment, foreign revenue and food security.

Unlike in most developing countries, Botswana's economy mainly depends on natural resources, principally diamonds. Agriculture contributes about 2.2 percent of the GDP (Statistics Botswana, 2016) and public financing to the sector was merely 2.9 percent in the 2014/2015 fiscal year (Tlhalefang, 2014). This indicates a wide disparity between what was allocated to agriculture and the 10 percent budget allocation recommended by the Maputo declaration in 2003. The declaration, made by African leaders, was to reverse decades of underinvestment in the agricultural sector devoting at least 10% of their national budgets to agriculture and achieve at least 6% annual agriculture growth (Benin and Yu, 2012). In 2016, the agricultural budget allocation increased to 14.5 percent, due to government realization that investment in the agricultural sector reduces poverty by 2.5 times more compared to other sectors (Ministry of Finance and Development Planning, 2016). Consequently, the agricultural sector provides great potential for livelihoods diversification considering its significant contribution to rural poverty alleviation and the potential to reduce Botswana's reliance on food imports (Cervantes-Godoy and Dewbre, 2010). The benefits of diverse livelihoods for rural populations is well documented (Liao *et al*., 2015; Martin and Lorenzen, 2016).

This study was motivated by the diverse resources and associated investment opportunities that could still be exploited to create employment and reduce poverty in the Chobe district. According to Ellis (2000), livelihood diversification is the process by which rural households come up with various activities and assets in order to survive. Both distress and progressive livelihood diversification strategies can be employed to reduce vulnerability to economic shocks (as cited in Martin and Lorenzen, 2016) and/or to create greater opportunities for diverse assets accumulation and wealth expansion (Cinner *et al*., 2010). Diversification will not only help rural households avoid environmental, economic, trends and seasonality shocks but would also make them less vulnerable (UN and NEPAD-OECD, 2011).

The potential diversification strategies in the Chobe district include wildlife and tourism recreational strategies, agriculture hub, utilization of Chobe forest reserves and production of consumption goods from non-timber forest products such as Morula (*Sclerocarya birrea*) and Mmilo (*Vangueria infausta*) (Moswete and Dube 2014). Hence, it is important to study diversification as a way to reduce adverse poverty. However, quantitative empirical evidence on determinants of households' choice of livelihood diversification strategies in Chobe District is lacking and this study will address this knowledge gap for research-informed policy development to improve household welfare, and reduce poverty and vulnerability of the rural communities by suggesting sustainable development policies and programmes.

METHODOLOGY

Conceptual framework. The determinants of household choice of livelihoods diversification strategies can be divided into three channels namely: household attributes, farm level and institutional determinants as depicted in Figure 1 below.

According to (Ellis, 1998), household attributes are endogenous determinants of diversification. These include age, gender, education and income of the household head. Farm-level determinants are exogenous determinants of whether households diversify or not. The land ownership and farm size are external determinants that influence whether the households diversify or not. Institutional determinants include formal and informal rules and regulations affecting the household's decision to have diversified livelihood strategies. They determine the access to different types of compensation, extension services and exchange between households in various livelihood strategies which involves markets (Bingen, 2001). Diversification strategies available to the communities are Tourism Based Activities (TBA), crop farming, livestock farming, and mixed farming - crop and livestock farming. Livelihood outcomes from the choice of diversification strategies include benefits of increased income and food security in the region and improvement in welfare.

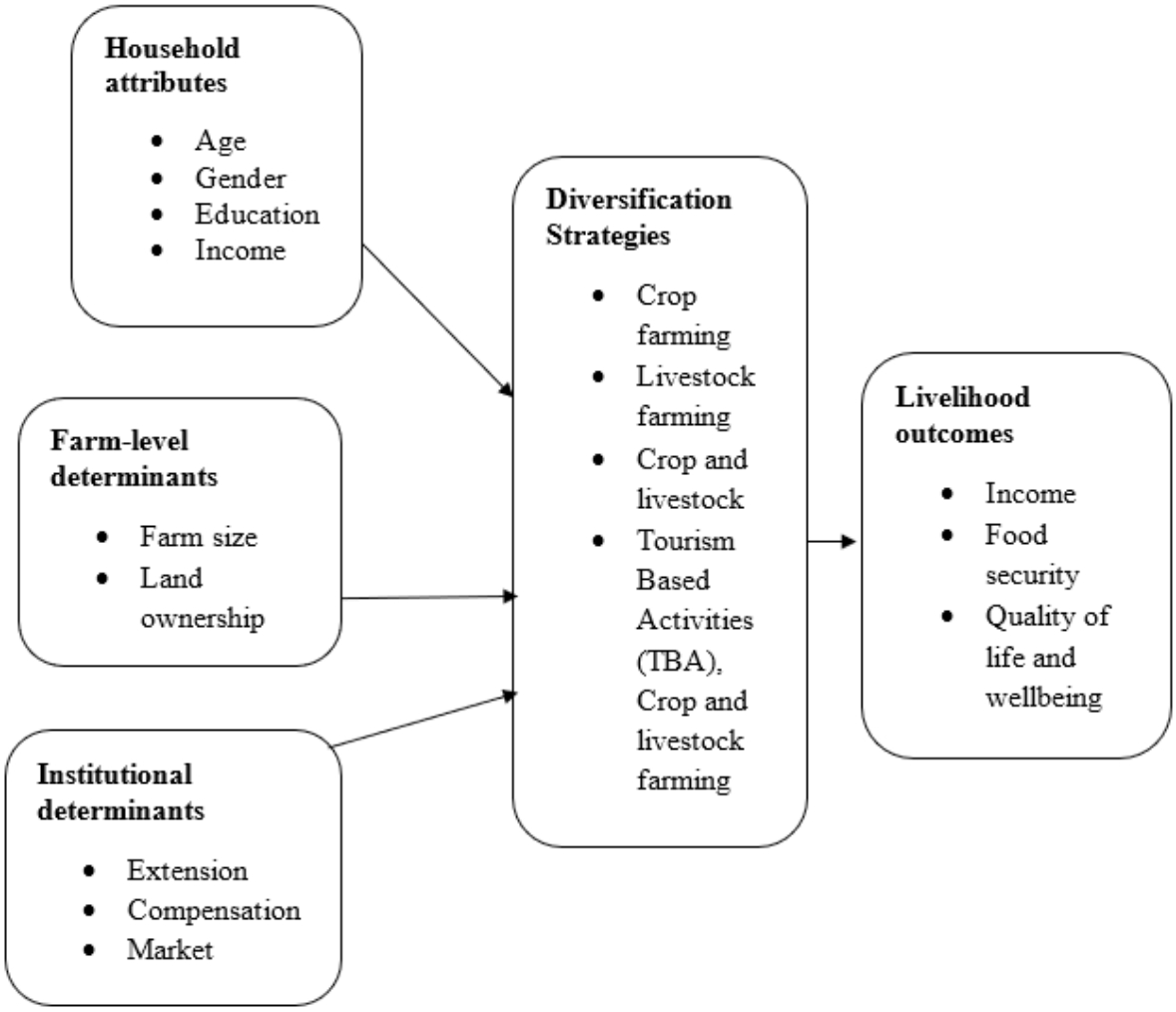

Figure 1. Conceptual framework for determinants of households' choice of livelihood diversification strategies
Source: Author (2015)

Theoretical Framework. The study is based on the random utility model (RUM), which states that individuals will make the choice that yields the highest utility (Kennedy, 2003). The study used multinomial logit (MNL) model which was introduced by McFadden (1977). MNL model is based on RUM in which it is assumed that the random parts of the utility functions are distributed as independent extreme values (Maddala, 1977). MNL model was used to analyze the determinants of household's livelihood diversification strategies because of its advantage of simplicity in calculating the choice probabilities that are expressible in analytical form (Tse, 1987), compared to the multinomial probit (MNP) model. The MNL model is efficient because it provides a closed form for underlying choice probabilities, thus there is no need for multivariate integration, hence simplifying computation of situations characterized by many alternatives. MNL model was used to identify the variables that determine a household's decision to diversify.

In the multinomial logit model, we assume that the log-odds of each response follow a linear model

$$\eta_{ij} = \log\frac{\pi_{ij}}{\pi_{iJ}} = \alpha_j + \mathbf{X}_j'\boldsymbol{\beta}_j$$

where α is a constant, β_j is a vector of regression coefficient, for $j=1,2,...,J-1$ and π_{ij} is the probability that the i-th response falls in the j-th livelihood strategyIn our case, since J=4 (four livelihood strategies), we will have 3 models (J-1).

Subsequently marginal effects must be computed for the MNL model to show the probability changes when the determinants of household livelihood diversification are altered by one unit (Greene, 2003). The necessity to compute marginal effects from MNL model rather than merely considering raw parameter estimates is one of the few problems of an otherwise extremely convenient modelling specification.

Empirical Framework. The dependent variable (diversification decision) in this study is a categorical variable, comprising of four livelihood strategies that household heads participated in. An assumption is made that each household head attaches a utility value to each strategy based on personal perception of the strategy-specific attributes, household determinants, institutional determinants and farm-level determinants. Livestock farming strategy was chosen as the base category as this is considered the traditionally practiced strategy among the households.

Study area. The study was conducted in Chobe district located in the north-west part of Botswana. Three villages were randomly selected which are Mabele, Kavimba and Kachikau. Chobe district covers an area of 129,930 km^2. The population size for each village were 773, 323 and 165 respectively in 2011 (Statistics Botswana, 2011) and the Yaman sample size equation was used to determine the sample size of each village using their population size because the error was taken to be homogenous (Yamane, 1967). The area was chosen because of its diverse economic strategies including livestock production, arable farming, tourism, handicrafts and to a lesser extent, fishery and forestry, although poverty, unemployment and inadequate infrastructure are still key challenges in the district.

Sampling and data collection procedures. A list of all the households in the three villages was accessed from the chief of each village. The sample population of household heads was selected using systematic random sampling technique. The first household head was randomly selected from the list to identify the starting point. From there, every 4th household head was selected for the interviews until the required sample size of 78, 60 and 57 respectively, per village was reached. A cross-sectional data of selection without replacement was done in 2015. The questionnaire was divided into four sections: farmers attributes, farm level factors, institutional factors and choice factors. Five enumerators were employed and were familiarized with the questionnaire through pilot training for two days prior to the interviews in Kasane.

Data analysis. To achieve the objective of assessing the determinants of households' choice of alternative livelihood diversification activities in Chobe district STATA 14 was employed to analyze the data using the multinomial logit (MNL) model. MNL model was used to analyze the factors that influence the households; choice of livelihood diversification strategies because of its advantage of simplicity to compute in calculating the choice probabilities that are expressible in analytical form. MNL was used to identify the main variables that influence the household decision to diversify. Then marginal effects were determined to assess how each variable singularly impacts the decision to diversify for the different strategies. The marginal effects calculate the probabilities of choosing the base category which is discretely compared to each of the strategies available. Therefore, with each determinant it will show whether it reduces or increases the chance of being in other strategies as compared to livestock farming– base category. To account for limitations of the model, tests were done which include variance of inflation factor, heteroskedasticity, goodness of fit and independence of relevance tests, and the model was found to be statistically sound.

RESULTS

Table 1 below shows the determinants of the different livelihood diversification strategies and the marginal effects. According to the results, the probability of engaging in crop farming was 0.07 which shows that 7 percent of the households were likely to engage in crop farming as compared to livestock farming. Crop and livestock farming had a 0.61 probability of the households engaging in it, this is 61 percent and TBA, crop and livestock farming (CLF) had 18 percent chance of having households engage in it instead of livestock farming. The variables were significant at the 10 percent level of significance. Education and income were expected to have a positive and significant influence on the type of livelihood diversification strategy selected by a household to sustain their lives. However, both unexpectedly had a negative and insignificant influence. This may be because people are private about their income and education, so it was difficult to attain the absolute value even using their employment status especially for the unemployed.

Table 1. Determinants of households' livelihood diversification strategies

Variable Probability to engage%	CF 0.07		CLF 0.61		TBA & CLF 0.18	
	dy/dx	P>|t|	dy/dx	P>|t|	dy/dx	P>|t|
Gender	0.09	0.753	-0.105	0.892	0.119	0.735
Age	-0.0009	0.695	0.007	0.053*	-0.006	0.043**
Education	-0.005	0.811	0.019	0.736	-0.012	0.812
Income	-0.011	0.878	0.086	0.055*	-0.062	0.833
Market access	-0.003	0.01***	-0.0003	0.333	0.003	0.024**
Land	0.035	0.045**	0.347	0.023**	0.025	0.077*
Farm size	-0.04	0.02**	0.254	0.041**	-0.122	0.888
CMP	0.028	0.924	-0.117	0.139	-0.017	0.968
Extension	0.253	0.811	0.785	0.072*	0.577	0.036**

Source: Author's survey data (2015)
***; **; *: significant at the1%, 5% and 10% level, respectively.
CF = Crop Farming; CLF = Crop and Livestock Farming; TBA & CLF = Tourism Based Activities and Livestock and Crop Farming.

DISCUSSION

According to the results, age of the household head increases the chances of choosing the crop and livestock farming (CLF) strategy by 0.7 percent, with all other variables held constant. However, it was evident that an increase in the household head age had a negative relationship with the decision of households to be involved in Tourism-based Activities, crop and livestock farming (TBA & CLF) by 0.6 percent. Correspondingly Zerai and Gebreegziabher (2011) found that age negatively affects individual's participation into non-farm strategies. For example, basket weaving would be a challenge with age because it needs virtuous eyesight and focus which diminish with age.

Income positively and significantly impacts the household's decision to diversify to crop and livestock farming. By the same token, Smith *et al*. (2001) found that income from crop production, livestock ownership enables rural households to divide their labour between farm and non-farm economic activities, therefore enabling them to diversify among strategies. Therefore, it is rational for households to diversify in this manner as the income at their disposal increases and they can afford modern technologies to be implemented.

Access to markets, measured in kilometers, gives the proximity of the markets to the households. Based on the results, there is a negative relationship between access to markets and households diversifying to crop farming (CF) with a marginal effect of 0.3 percent, while holding all other variables constant. This implies that as markets become less accessible households will prefer not to diversify to crop farming. A plausible reasoning would be that the less accessible the markets the higher the expected losses the households will incur from transaction costs, hence households will be willing to diversify to crop farming if and only if the markets are nearer. Similarly, Kankwamba *et al*. (2012) found that rural households do diversify in order to meet their subsistence needs.

Land ownership was found to significantly affect diversification to all the livelihood strategies, but at varying levels of significance. The highest was its influence on diversifying to crop and livestock farming at 34.7 percent followed by crop farming with 3.5 percent and TBA, crop and livestock farming at 2.5 percent. Contrary to these findings, Pham *et al*. 2010; Quang, 2013 found that farmland ownership has a negative effect on non-farm diversification.

The variable farm size decreases the influence of households to diversify to crop farming by 4 percent. Expectedly, farm size had a positive impact on households diversifying to crop and livestock farming with 25.4 percent at the 5 percent significance level. These findings are in accordance with Culas and Mahendrarajah (2005) who found that farm size has a positive effect on crop and livestock diversification. Homogeneously larger land sizes have largely been linked to increased involvement in agricultural strategies (Winters *et al*. 2009; Andersson, 2012).

Access to extension services has a positive effect on diversifying to crop and livestock farming with a marginal effect probability of 78.5 percent. The increase in access to extension services is also statistically significant for TBA, crop and livestock farming at ($p > |t|$ 0.036) with a positive marginal effect of 57.7 percent. These results are consistent with the findings by Masoud-Ali (2010) that in Tanzania extension services contacts are highly significant and positively related to the likelihood of household's diversification process for both farm and non-farm strategies.

CONCLUSIONS

Livelihood diversification has been defined in several ways and it considers both internal and external diversification enterprises. The analysis from this research reveals that the main determinants for households' choice of livelihood diversification strategies were age, income, market access, land ownership, farm size and extension services. These determinants impact the choice of the livelihood strategies in various ways. For instance the increase in the head of household's age positively influenced household diversification to crop and livestock farming but negatively influenced the household diversification to TBA,

crop and livestock farming. This shows that the determinants do not homogeneously impact households across the livelihood strategies. Therefore policies oriented towards household's diversification into the various strategies are needed.

Since age positively impacts diversifying to crop and livestock farming, all the age groups need to be encouraged to do crop and livestock farming. However, other livelihoods like TBA require younger people therefore, government and the rural inhabitants should educate and train younger members on lucrative diversification strategies. In addition, extra income sources need to be encouraged and strengthened to enhance skills and opportunities in crop and livestock farming.

Market access needs to be improved by opening subsidized or government oriented markets which are found in other areas. The existing ones in other parts of the country like Botswana Agricultural Marketing Board (BAMB) and Botswana Horticultural Market (BHM) could be effective. Transport facilities are important for market access, therefore the road network needs to be improved to increase access to opportunities both on the farm and outside the farm.

Citizens are freely allocated land through applications as a way of improving farm ownership and self-reliance. However, land use is not maximized as only about 20% of the land is being utilized and the rest is left barren. Therefore farm ownership should be controlled by careful management of land allocation and transfers. More effort should also be placed on extension services to improve diversification to TBA, crop and livestock. Once a week visit by extension service providers can be beneficial and also some short–term courses for the household's skills enhancement and competitiveness. It is increasingly becoming necessary to design evidence-based policies so that the government does not invest resources into strategies that do not effectively reduce poverty. With the information provided on the variables the rural communities can implement them to develop their economic strategies, generate maximum income and productivity for their households.

STATEMENT OF NO CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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