

Potential of Fragmented Landholding on Crop Diversification and Credit Worthiness to Smallholder Farmers in Tanzania

Aloyce Hepelwa[†]

Abstract

In most developing economies, agriculture sector is dominated by smallholder farmers who are faced with unstable crop output and income due to dependency on unpredictable weather and market conditions. Most farms in Tanzania are in fragmented landholdings which do not adequately provide appetite to financial institutions' financial support. Smallholder farming is perceived by most financial institutions in Tanzania as a risky business and hence receives inadequate financial support. This situation hampers the efficiency and sustainability of farming as business by smallholder farmers. The potential of fragmented landholdings on crop diversification and credit worthiness to smallholder farmers have not been explored in Tanzania. The current paper presents findings on the potential of crop diversification in promoting smallholder farmers' credit worthiness. Key findings are that, fragmented land holdings offer avenue for crop diversification which reduces variability of farm output and income given the changing climate and crop market dynamics. The policy implication is that, smallholder farming in fragmented landholdings is potentially credit worthwhile borrower. For effective support to smallholder farmers, financiers should consider crop diversification and yield status when assessing farmers' credit worthiness as alternative to collaterals and hence lowering interest rate charged to borrowing farmers with reduced credit default risks.

Key words: crop diversification; smallholder farmers' credit worthiness; fragmented land holding

JEL Classification Codes: Q120, Q140, Q180

[†] Department of Agricultural Economics and Business, University of Dar es Salaam, P. O. Box 35091, Dar es Salaam, Tanzania. Email: ahapelwa@yahoo.com or ahapelwa@udsm.ac.tz

1.0 Introduction

Agriculture sector has direct effects to economic development, food security and poverty alleviation in Tanzania and other developing countries (Rao et al., 2004; World Bank 2007; Kassie *et al.*, 2010). Smallholder farmers dominate agriculture in most developing countries and contribute significantly to livelihood and welfare of rural households and the economy (World Bank, 2010a; Kassie *et al.*, 2012; AGRA, 2013). In sub-Saharan Africa (SSA) agriculture accounts to about 32 % of gross domestic product (GDP) and employs about 65 % of labor force in the region (AGRA, 2013). The agriculture sector is among the priority sectors in Tanzania and identified to drive the economic transformation to achieve middle income status by 2025 (URT, 2015). The sector contributes 23% of GDP and 65% of inputs used in the manufacturing sector.

In Tanzania, Land fragmentation is a common phenomenon in agriculture and most smallholder farmers lack information on finance, market, grades and standards by consumers which hampers the efficiency and security of their operations. A major policy challenge with regard to agriculture sector is how to promote effective participation of smallholder farmers in the process of agriculture sector transformation and link with industrialization. As in most developing countries, agriculture sector in Tanzania is faced with challenges related with low productivity and high variability in output and income due to high dependency on uncertain rainfall and market conditions. As means to reduce crop out and income variability, crop diversification (CD) is frequently used as risk management strategy that involves participation in more than one activity (Pope and Prescott, 1980). CD broadly defined as a shift of resources from low value agriculture to high value agriculture (Vyas 1996) has the added advantage of mitigating price risk as well as fluctuations in outputs (Ashfaq et al 2008). CD is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops and thus provide provides farmers with viable options to grow different crops on their land. The diversification in agriculture is practiced with a view to avoid risk and uncertainty due to climatic and biological vagaries.

Agriculture is perceived as a risky business due to its direct interaction with weather and market conditions causing variability problem in returns to the decisions that farmers make (Ashfaq 2008). This calls for innovative thinking to transform agriculture from the usual subsistence to commercial farming and make it less risk undertaking venture by majority. This include exploring and establishing the extent to which diversification could mitigate credit risk and factors influencing diversification. The avenue through which crop diversification could promote credit risk mitigation by smallholder farmers is missing. Attempts have been to show how diversification can reduce output and income variability risk but no effort has been made to link with the credit finance to smallholder farmers. New way of agriculture financing is needed by considering the credit finance taking into account the existing fragmented landholding in the country. An indicator – diversification index of how creditworthy is the smallholder farmer is introduced. We hypothesize that, diversified farmer backed by fragmented landholding is a risk averse farmer and experiences stable output and income. This farmer could be in position to pay back the borrowed money invested in agriculture related venture.

The current paper is analyzing diversification by smallholder farmers and how the diversification could be used in reducing credit risks. The study is considering fragmented land holdings as an opportunity for crop diversification which in turn reduces farmers' output and income variability given the changing weather and market prices. With reduced output and income variability,

smallholder farmers could recoup back investment made in farm enterprises. Effort is made to link crop diversification and credit risk mitigation correlates at the farm level.

The rest of the paper is organized as follow: Section two presents the review of relevant literature on diversification as well as credit risk assessment. Section three presents conceptual framework governing the analysis of agricultural diversification. In section four we present methodology for measuring diversification and factors influencing diversification. Finally, we present estimation results and discussion of findings in section five.

2.0 Review of relevant literature on diversification and credit risk assessment

In this section we present the review of the existing research on the crop diversification and credit finance risks in agriculture. Okurut *et al.* (2004) indicates that credit is an important instrument for improving the welfare of the poor directly through consumption smoothing that reduces their vulnerability to short term income. The uncertain nature of farm incomes makes the probability of payment defaults high. Many smallholder farmers dependents on informal credit markets such as friends and relatives and co-operatives (Okurut *et al.*, 2004). The amount from these sources of credit is considerably small to run effective agricultural business.

Credit enhances productive capacity of the poor through financing investments in their human and physical capital. Since households cannot meet bank collateral requirements and that high transaction costs are involved in managing a large portfolio of small loans, this has made many formal banks to avoid lending to agricultural households (Komarek, 2010). While it is true that credit is indeed needed by smallholder farmers, the actual support has been declining in some parts of the developing countries (Machethe, 2004; Chauke *et al.*, 2013). Reforms by governments and donor community on financial sector reforms have been made with little success on reducing rural poverty and most farmers have remained with limited access formal financial services (Sebatta *et al.*, 2014).

In most developing countries, smallholder farmers' investment decisions are conditioned by their financial environment. Stringent credit conditions and incomplete insurance limit investment by smallholder farmers in activities with high expected profits. The avenue through which crop diversification could promote credit risk mitigation by smallholder farmers is missing. Attempts have been to show how diversification can reduce output and income. Also, literature is biased towards defective of land fragmentation in terms of high operation costs and diseconomies of scale being disincentive to financial institutions providing credit facilities (Kadigi *et al.*, 2017). There is a limited attempt to use household crop diversification models to explain credit risk mitigation. In most cases, smallholder farmers are viewed as risky and have limited access to credit. The reviewed studies have concentrated on addressing credit risk on the side of financier's point of view with limited attention on the side of risk reducing on the smallholder point of view. This means that when assessing credit risk, much attention is made on analysis of how risk is the borrower in terms of defaulting. But there no consideration on how risk is the farmer of not getting the credit facility. Farmers are required to have collaterals in order to qualify credit or have insurance or contract farming. All these they require addition finance by the farmer to acquire loan for investment in farming activities.

Crop diversification has not been considered by financier as an indicator for credit worthiness of the smallholder farmers. Crop diversification results to smallholder farmers' income enhancement, reduce significantly the variability in output and income all these conditions might favor smooth repayment of borrowed money without addition requirements such as collaterals that are none existence to many smallholder farmers. The current paper is exploring the role of diversification in promoting smallholder farming in fragmented land holding with reduced credit risk contrary to perceived risk by most financiers.

3.0 Conceptual framework

Household crop cultivation is for profit maximization. Farm production diversification involves farm choices about the number of activities carried out on the farm. The analytical thinking in this paper draws upon the theory of crop diversification among smallholder farmers. The fundamental assumption is that a farmer's decision on whether to diversify or not is based upon utility maximization (Rahm and Huffman, 1984). Crop cultivation by most smallholder farmers in Tanzania is done on fragmented plots and is heavily dependent on rainfall. Climate change and variability puts at risk many farmers from low and unreliable rainfall amount. Crop cultivation activities in the changing and varying climate necessitate farmers to innovatively change from the normal farming practices to new ways. Crop cultivation in fragmented land holding provides an avenue for crop diversification practices which enhances stable crop output and income and reduces farmers credit default risk exposure.

Farmers cultivate more than one crop in different plots of land holdings. Such practices provide an opportunity to farmers to allocate different crops per season and hence hedge against climate variability risks and other risks that are likely to prevail. Cultivation in fragmented land would enable farmers to operationalize cultivation plans and meet market requirement in terms of types and also quantity of output when cultivation is coupled with proper input mix in their production processes. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area to feed the growing agro processing subsector. In this study, the main hypothesis is that, fragmented land holding provides a better environment to farmers to practice crop diversification to be able to hedge against bad weather condition, feed the growing agro processing subsector and also increase their income from market participation and hence reduces credit default risks. Diversification provides rooms to smallholder farmers to participate in industrialization drive through provision of inputs to agro processing firms via crop market. Increased crop market participation gradually results to agricultural transformation and hence enable farmers to increase income and the ability to repay back loanable funds invested in crop production.

4.0 Methodology and data

Two indicators for diversification and fragmentations are established. Both descriptive and regression analyses are performed to ascertain the association and the extent to which land fragmentation, diversification and credit worthiness are related. At first, the study establishes the extent of diversification by estimating crop diversification index. There are several measures of diversification namely, the index of maximum proportion, number of enterprises, Herfindahl index (Herfindahl 1950), Entropy index and Composite entropy index (C.E.I) (Hart, 1971). Agricultural diversification is measured by using the Herfindahl Index (HI). To compute the Herfindahl index, the total cropped land (ha) of diversifiers and the proportion of land allocated for growing each

crop (ha) in year's harvested season. HI which is obtained by summing of squares of all n proportions) and the crop diversification index (CDI) is computed using the formula developed by (Hirschman 1964) in Eqs.1,2,3.

$$P_i = \frac{A_i}{\sum_{i=1}^n A_i} \quad (1)$$

Where A_i represent area harvested for crop i, P_i represent proportion of land allocated for growing each crop in each year.

$$HI = \sum_{i=1}^n P_i^2 \quad (2)$$

From (1) and (2), the CDI is estimated as

$$CDI = 1 - HI \quad (3)$$

Estimation of indices based on proportion of area of crop i in total area faces data limitation in cases where mixed cropping is dominant. With mixed cropping method, farmers cultivate more than one crop in a plot and complicate estimation of the actual land covered by each crop. The current paper attempts to overcome this problem and represent crop diversification by a standard variable defined by calculating the total number of crops produced by households. The number of land uses is used to represent crop diversification (Hung *et al.*, 2006).

$$Diversification_i = \sum_{j=1}^n crop_j \quad (4)$$

Where $Diversification_i$ represents diversification by household i, $crop_j$ represents type of crop and $j=1, \dots, n$ represents crops grown by household i

Second, the study establishes the Land fragmentation which is represented by the index estimated using the Simpson rule (Equation 5). The choice of the Simpson index is motivated by its strength in which it is able to take into account farm size unlike other method e.g., Januszewski index does not take farm size into account.

$$LF_i = \left[1 - \frac{\sum_i a_{ij}^2}{A_i^2} \right] \quad (5)$$

Where LF_i is land fragmentation by household i, a_{ij} is the amount of land area for j^{th} plot and A_i is total area cultivated by household i. The fragmentation index has the value between zero and one. A value of zero means that the farm household has only one parcel or plot of land, indicating complete land consolidation and the land is considered to be fragmented when the value of index is close to one.

Determinants of crop diversification

The study uses environmental and household socioeconomic related variables as determinants of the crop diversification. Environmental factors include soil type (loam, sand, clay), topography (sloping or gentle sloped land), weather (rainfall amount and temperature), area cultivated. On the other hand, the socioeconomic factors include the household income, asset ownership, remittances, education information, age, sex, household size, and other relevant economic and demographic information of the farm households are used as independent variables. The study makes use of market information such as prices, quantity harvested and sold, distance to main trading center, access and use of mobile financial services, access to credit facilities, membership in social organization or group, type of farm ownership, use of inputs such as improved seeds, pesticides etc.

In this paper, the regression analysis is performed on diversification index as dependent variable and independent variables grouped as socioeconomic, demographic, environmental, market orientation and land fragmentation factors. The study performs the Poisson regression analysis to ascertain factors influencing diversification. The Poisson regression model is employed to handle count dependent variable because of the non-negativity and the discrete character of the dependent variable. The advantage of Poisson model is that, Poisson model allows to relate well a skewed and discrete distribution non-negativity dependent variable with independent variables. In estimation, the Poisson regression assumes that the errors follow a Poisson and not a normal distribution. Rather than modeling dependent variable as a linear function of the explanatory variables, the Poisson regression models the natural log of the dependent variable as a linear function of the explanatory variables (Gardner, *et.al.*, 1995; Long 1997).

The relevant probability density function of the Poisson regression is defined as

$$f(y_i/x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!} \quad y_i = 0,1,2 \dots n \quad (6)$$

Where λ = shape parameter that indicates the average number of events in the given time interval, n = total number of events in the given time interval. From this density function, the study estimates the mean value of the diversification variable given explanatory variables, x_i and parameter vector, β as indicated in following equation

$$E(y_i/x_i) = \lambda_i = \exp(x_i' \beta) \quad (7)$$

For the given observations, model specification for estimating the factors influencing diversification is given as:

$$Diversification_i = e^{x' \beta} + \varepsilon_i = e^{(\beta_0 + \beta_1 x_{1i} + \dots + \beta_k x_{ki})} + \varepsilon_i \quad (8)$$

Where $Diversification_i$ is the crop diversification estimated in equation (4). There is close link between diversification, risk reduction and farm size. Large farm size owned by households is at high risk if there is no diversification.

The relationship between diversification and farm size is an indicator of tradeoff between risk reduction and possible economies of size in a particular activity and that there is negative relationship between diversification and farm size (Pope and Prescott, 1980). Large farm owned by households with no diversification possess higher risk to households (Pope and Prescott, 1980). Other variables influencing diversification include the farmers experience and net worth of the farmer.

Diversification may also be influenced by the skill requirement to manage diverse entrepreneurs (Jill and Erin, 2005). It is expected that wealthier farmer to be less risk averse and thus low diversification. Price and yield variability affect income from farming enterprise and therefore influences farmers and farm managers to select a combination of enterprises that reduce the variability of farm income (Mishra and El-Osta, 2002). In equation (10) Crop diversification is function of land fragmentation, market orientation, social economic factors, environmental factors and demographic factors

$$\text{Diversification}_i = f(\text{LF}_i, \text{SF}_i, \text{DF}_i, \text{EF}_i) \quad (9)$$

Where *Diversification_i* as define above; SF=socioeconomic factors; DF=demographic factors; EF=Environmental factors; and LF = Land fragmentation as measured in equation (5).

4.2 Data types and sources

The study uses National Panel survey (NPS) data collected by National Bureau of Statistics (NBS) in 2008, 2010, 2012, 2014 and 2019. The NPS is a national level longitudinal survey designed to provide data from the same households over time in an attempt to better track poverty reduction progress, understand poverty dynamics and to evaluate policy impacts in the country. To provide the status of agriculture diversification and its correlates and linkage with credit worthiness, NPS 2012 used.

5.0 Results and Discussion

Descriptive statistics

Frequency of farmers for food crops have increased between 2008 and 2019. Maize farmers increased from 35.5% to 42.5% in 2008 and 2019 respectively. Similarly, for paddy, sweet potatoes and beans. Some important crop for processing such as cotton, sunflower and groundnut found to have less farmers between 2008 and 2019. This is also entailing less participation of smallholder farmers in the value adding and hence marketing of the agricultural products. The increased number of farmers cultivating food crops above indicates less participation in processing as most of them are consumed and traded unprocessed. The market participation of smallholder farmers is still low as most farmers are cultivating less processed crops (Table1)

Table 1: Farmers and most crops grown for 2008 – 2019 (%)

CROP NAME	2008		2010		2012		2014		2019	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Maize	1,999	35.5	2,368.0	39.9	3,079.0	39.1	2,088.0	37.6	590.0	42.5
Paddy	539	9.6	659.0	11.1	805.0	10.2	491.0	8.8	141.0	10.2
Sorghum	297	5.3	314.0	5.3	324.0	4.1	202.0	3.6	55.0	4.0
Sweet										
Potatoes	228.0	4.0	223.0	3.8	364.0	4.6	331.0	6.0	76.0	5.5
Beans	609.0	10.8	654.0	11.0	871.0	11.0	626.0	11.3	162.0	11.7
Cowpeas	147.0	2.6	177.0	3.0	244.0	3.1	136.0	2.4	30.0	2.2
Pigeon pea	151.0	2.7	170.0	2.9	276.0	3.5	194.0	3.5	29.0	2.1
Sunflower	188.0	3.3	147.0	2.5	246.0	3.1	174.0	3.1	40.0	2.9
Simsim	72.0	1.3	91.0	1.5	114.0	1.4	127.0	2.3	18.0	1.3
Groundnut	363.0	6.4	319.0	5.4	472.0	6.0	378.0	6.8	63.0	4.5
Cotton	83.0	1.5	76.0	1.3	204.0	2.6	134.0	2.4	37.0	2.7
Tobacco	31.0	0.5	39.0	0.7	62.0	0.8	46.0	0.8	-	-

Source: NBS and own calculation

5.2 Estimated diversification and fragmentation

On average households cultivates 3 types of crops and the average farm size cultivated is 4.3 acres (1.7 ha). About 11% of households accessed credits and 41% reported to own mobile phones. The average household size is 5 people and the average age of the head of the household is 45 years old. Only 25% of these are female headed households. 46% of farmers are also engaged in other off farm income generating activities and 21% reported to receive income in the form of remittances (Table 2).

Table 2: Descriptive statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Diversification (number of crops)	5010	3.566	2.358	1	22
Household size (number of people)	5010	5.33	3.118	1	54
Credit accessibility (1=access; 0=otherwise)	5010	0.115	0.319	0	1
Use of mobile money service (1=use; 0=otherwise)	5010	0.413	0.492	0	1
Land fragmentation index (Simpson index)	5010	0.761	0.37	0	1
Total farm size owned (acres)	5010	4.274	14.157	0	447.5
Age of Household	5010	45.315	16.096	17	108
Gender of Household head (1=female; 0=male)	5010	0.246	0.431	0	1
Household head marital status (1=married; 0=single)	5010	0.712	0.453	0	1
Other occupation (1=off-farm activities; 0=otherwise)	5010	0.465	0.499	0	1
Education Level (1=primary; 0=otherwise)	5010	0.153	0.36	0	1
Education Level (1=secondary; 0=otherwise)	5010	0.28	0.449	0	1
Education Level (1=tertiary; 0=otherwise)	5010	0.023	0.15	0	1
Remittances (1=gets remittances; 0=otherwise)	5010	0.214	0.41	0	1

The average number of land uses is 3 with minimum of one and maximum of 22 implying low diversification. The results show that land fragmentation is the main characteristics of smallholder farmers. The estimated mean fragmentation index is 0.76. However, with large fragmentation index, this indicates that smallholders have opportunity to diversify. Most farmers are cultivating cereal related crops such as maize, beans, potatoes, groundnuts. Disaggregating fragmentation and diversification by region, it is found that, there is significant correlation between fragmentation and diversification. Regions with high land fragmentation index have also large diversification index (Table 3).

Table 3: Land fragmentation and crop diversification

Region	Mean fragmentation	Crop diversification
DODOMA	0.61	3.24
ARUSHA	0.75	3.42
KILIMANJARO	0.67	3.27
TANGA	0.65	3.13
MOROGORO	0.69	2.79
PWANI	0.75	3.32
DAR ES SALAAM	0.91	3.92
LINDI	0.7	3.02
MTWARA	0.76	3.24
RUVUMA	0.79	2.97
IRINGA	0.71	3.6
MBEYA	0.71	3.31
SINGIDA	0.61	3.13
TABORA	0.58	3.51
RUKWA	0.63	3.29
KIGOMA	0.85	3.78
SHINYANGA	0.74	3.93
KAGERA	0.63	3.58
MWANZA	0.81	3.94
MARA	0.66	3.09
MANYARA	0.64	3.27
KASKAZINI UNGUJA	0.73	2.81
KUSINI UNGUJA	0.78	3.5
MJINI/MAGHARIBI	0.98	5.18
KASKAZINI PEMBA	0.88	4.12
KUSNI PEMBA	0.9	3.53
Total	0.76	3.57

Source: Own calculation from NBS datasets

5.4 Determinants of crop diversification

Poisson Regression analysis using land uses as dependent variable was estimated together with independent variables such as land fragmentation, farm size, household size, credit access and credit amount, remittances, age of the head of household, off-farm occupation, use of mobile phone financial services, education level categories such as primary, secondary and tertiary. Also, the study includes gender and marital status of the head of household¹. The results show that fragmentation influences diversification (Table 4). For the estimated model the coefficients of

¹ It must be noted that the unit of analysis is farm level owned by households. This means that while socioeconomic and demographic information are at household level, the farm characteristics are at the farm level

household size, access to credit, age of the head of household, female headed household, married head of household, off- farm occupation land fragmentation was positive and statistically different from zero at 1%. The results imply that land fragmentation significantly influences crop diversification alternatively land fragmentation provides an avenue for crop diversification. In addition, age of the head of the household has significant and positive coefficient implying that experienced household in farming practice diversification. This is in line with risk averse theory where old people are more risk averse and thus crop diversification is done to mitigate risks.

Table 4: Poisson and OLS regression

VARIABLES	(1) Poisson	(2) OLS
Household size (number of people)	0.0729*** (0.00173)	0.413*** (0.00929)
Credit accessibility (1=access, 0=otherwise)	0.0741*** (0.0232)	0.166** (0.0813)
Use of mobile money services (1=use, 0=otherwise)	0.0245 (0.0170)	0.0501 (0.0577)
Land fragmentation (Simpson index)	0.699*** (0.0259)	1.992*** (0.0717)
Total farm size owned (acres)	-0.00391*** (0.000668)	-0.0137*** (0.00187)
age	0.00493*** (0.000546)	0.0115*** (0.00185)
female	0.175*** (0.0264)	0.438*** (0.0845)
married	0.293*** (0.0261)	0.612*** (0.0817)
Off farm	0.127*** (0.0173)	0.605*** (0.0590)
primary	0.0153 (0.0220)	0.0218 (0.0748)
secondary	-0.0132 (0.0203)	-0.00139 (0.0669)
tertiary	-0.0258 (0.0532)	-0.0254 (0.175)
remit	-0.0278 (0.0197)	-0.0436 (0.0654)
Constant	-0.253*** (0.0453)	-1.468*** (0.137)
Observations	5,008	5,008

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

5.3 Credit access by smallholder farmers and sources

Majority smallholder farmers (30%) borrowed from neighbors and the average amount borrowed is TZS 134,000 with average interest rate of 1.65%. This is the cheapest source of credit but the credit supply is very small. The financial institutions such as commercial banks and micro-finance provide relatively large credit amount of TZS 2 to 5 million at the average interest rate of 21% which is expensive loans. Important form of credit sources (banks and other financial institutions) which offers large credit amount are accessed by very few borrowers. Only 13.5% borrowed from commercial banks and 17.1% from micro-finance. Cheaper credit sources available to smallholder farmers are constrained with low credit supply and hence only fewer farmers access these sources. Majority (30.2%) borrowed from neighbors, 12% from shop(grocery) owners and 2% from employers. The expensive sources of credit such as money lenders, commercial banks and other financial institutions have accessed by fewer farmers.

Table 5 Credit supply and access by smallholder farmers

CODE SOURCE OF LOAN	Percent	Mean loan amount	repayment months	amount to be repaid	interest rate
COMMERCIAL BANKS	13.49	5,334,967	6.77	6,486,495	21.58
MICRO-FINANCE INST	13.64	1,805,032	6.45	2,113,658	17.10
OTHER FINANCIAL INST	3.52	2,257,917	6.00	2,744,658	21.56
NEIGHBOURS / FRIENDS	30.21	134,235	7.17	136,449	1.65
GROCERY/LOCAL MERCHANT	12.32	506,192	6.92	526,227	3.96
MONEY LENDER	2.93	302,750	6.15	379,170	25.24
EMPLOYER	2.05	2,030,000	4.30	2,060,714	1.51
RELIGIOUS INST	0.88	3,428,333	7.67	3,437,500	0.27
NGO	1.17	1,246,625	8.00	1,369,375	9.85
SELF-HELP GROUPS	13.2	334,444	7.15	407,716	21.91
OTHER (SPECIFY)	6.45	1,792,186	7.76	1,871,141	4.41
Total	100	1,403,302	6.85	1,640,145	16.88

5.5 Crop diversification and loan repayment

Results indicates that households with diversification have relatively higher income than those who have not diversified. The descriptive statistics and t-test performed indicates statistically significant differences (Table 6 and Figure 1). On average, farmers who diversified have more than double income than farmers without diversification.

Table 6: Average income, farm size and crop harvest by household with and without diversification

Indicators	Diversify	Non diversification	Ratio
Income (TZS)	626,732.22	209,814.21	0.33
Harvested area (acres)	4.44	1.41	0.32
Harvest amount (Kg)	4,707.47	700.44	0.15

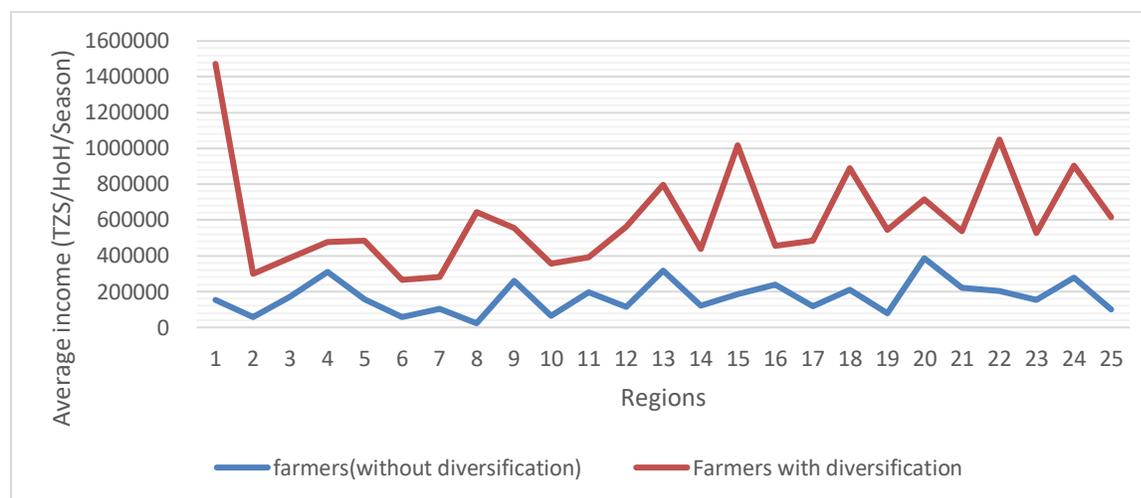


Figure 1: Household average income (with and without diversification)²

From these results, it is evident that, household with crop diversification have high chance of loan repayment from the income generated. Thus, is worth noting that, credit risk analysis should consider crop diversification indicator. Major sources of credit finances charges high interest since they consider farming as risk business. Such high interest rates an amplifying factor of credit default risk since it contributes significantly to loan burden to farmers. Considering divarication as additional factor for credit analysis to farmers would result to reduced interest rate and thus compounding the affordability to farmers.

6.0 Conclusion and policy implication

The study aims to suggest new way of addressing credit worthiness of smallholder farmers important for agricultural transformation. There is greater potential of fragmented landholdings to facilitate crop diversification and create credit worthiness to smallholder farmers. Fragmented land holdings offer avenue for crop diversification and thus reduces variability of farm output and income given the changing climate and crop market dynamics. For effective support to smallholder farmers, financiers should consider crop diversification and yield status when assessing farmers' credit worthiness as alternative to collaterals this lowers interest rate charged to borrowing farmers. Smallholder farmers in fragmented land holding have an opportunity for crop diversification and hence reduce credit default risks. To ensure effective transformation of agriculture sector, there is a need to encourage diversification by smallholder farmers given the fragmentation nature of

² Because of sensitivity of income variable analyzed, the names specific regions are not reported here

agricultural land in the country. Crop diversification could be considered when assessing credit worthiness and thus financial institutions should institute and use crop diversification as indicator for credit worthiness of the smallholder farmers.

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