Role of Social Networks in Diversification of Income Sources in Rural India

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Abstract

Rural households in developing countries adopt diversification of income sources as a common strategy to stabilize their income throughout the year. We view social networks as an important factor that influences diversification activities. Social interactions may help households to gain ideas, skills, services and information which could influence their decision to diversify their income sources.This paper examines whether household's social networks influence income diversification in Wayanad District of South India. We develop a network econometric model based on a Spatial Autoregressive econometric approach by replacing the spatial matrix with a network matrix. Our results indicate that the diversification of a household's social network has a statistically significant positive effect on its income diversification.

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Introduction

Rural livelihoods in developing countries primarily rely on rain-fed agriculture and are characterized by poverty, instability and inequality. Rural populations in these countries face several problems and challenges in terms of low prices, fragmented landholdings, seasonality of weather, poor infrastructure, unavailability of credit and segmented labor markets, which make it difficult for them to secure stable income from one source throughout the year. Given this context of rural survival, households tend to diversify their income sources. In other words households engage in multiple income earning activities as a strategy to stabilize or increase their income (Ellis, 1998). Households generally diversify either to minimize and cope with risks or to exploit new opportunities (Ellis, 1998). On one hand diversification is primarily driven by the households' poverty status where diversity acts as a safety valve for the rural poor. On the other hand, household income diversification can be a matter of choice and opportunity involving deliberate household strategies for improving living standards and accumulating wealth (Ellis, 1998; Reardon et al, 1992).

One of the factors that can play a role in income diversification is the social networks of the households. A household's social network may help it gain ideas, skills, information and services which could influence their decision to start a new initiative or maintain an existing one. We view social networks as connections and links among individual households (nodes) through which information, money, goods or services flow (Maertens and Barrett, 2012). These links or connections can be formed through various interactions and relationships. Jackson (2009) argues that "Many economic interactions are embedded in networks of relationships and the structure of the network plays an important role in governing the outcome." More generally an individual's

choices can be influenced by the people they are connected to through various relationships or interactions. For instance, lack of access to credit and collateral restrictions often prevent the rural poor from getting a commercial loan which can act as barrier to diversification. In such cases informal kinship and connections within the community can serve as an alternative by facilitating access to credit through mutual lending among households (Kim, 2011). Further, the Self Help Group (SHG) model which is one of the most important networks found among women in rural India, is a good example of how connections made through networks can promote a favourable atmosphere for diversification. The SHG provides opportunities for collectve action and risk sharing along with a platform to share information, knowledge, skills and develop more contacts within the community. Social networks can also help people to access inputs from trusted providers or markets for outputs which inturn may faciliate diversiifcation into new activities.

Although there has been a rapid expansion in network studies in the economics discipline over the last decade, social network effects have been an area of interest across social science disciplines for a long time. In recent years, economists have explored social network effects on outcomes such as agricultural technology adoption (Maertens and Barrett, 2012), labor market function (Armengol and Jackson, 2004, 2007), diffusion of microfinance (Banerjee et al, 2012), academic achievement (Lin, 2010) and participation in retirement plans (Saez and Duflo, 2003). There are very few studies that have focused on the role of social network or other forms of social capital on rural income diversification (Schwarze and Zeller, 2005; Smith et al., 2001; Baird and Gray, 2014).The few studies that been done have mainly looked at one or more specific social intercation and its possible links to diversification, for example involvement in community groups and exchange of material goods between communities. Much of the

diversification literature is focused on determinants, patterns and links to household welfare through income and consumption (Ellis, 1998, 2000; Barret et al., 2001; Ersado, 2003; Abdulai and Crolerees, 2001). Our focus is to depict social networks as connections or links between the households within a village formed through various interactions and examine its role in diversification activities using a network econometric model. The primary objective of this paper is to examine whether household's social networks influence income diversification in Wayanad District of South India. We develop a network econometric model based on a Spatial Autoregressive econometric approach by replacing the spatial matrix with a network matrix.

Background

India, being the world's second most populous country, is also home to a large number of poor and malnourished people. Poverty is engrained in many areas, particularly in remote villages with high proportions of tribal communities and rural poor. Seventy percent of the nation's population lives in rural India and sixty percent of the rural workforce remains primarily involved in agriculture (Himanshu et al., 2013). In recent years, there has been a continuous decline in the share of agriculture and allied sectors to the overall Gross Domestic Product (GDP) of the country from 30 percent in 1990-91to 13.7 percent in 2012-13 (Government of India, 2013). However, this decline has not been accompanied by a matching reduction in the percentage of population dependent on agriculture. With the slow growth of the agricultural sector, rural employment challenges are increasing fast. It is seen that the rural non-farm economy and migration to urban areas serve as key alternative sources of new jobs. Based on the National Sample Survey Organization (NSSO) statistics between 1983 and 2009/10, Himanshu et al, (2013) find evidence indicating a process of diversification out of agriculture that is slow but accelerating. Further, village based studies on income diversification in India indicate that

majority of households have diversified incomes and non- farm income is an important component (Lanjouw and Shariff, 2002; Walker and Ryan, 1990; Deb, et al., 2002; Vatta and Sidhu, 2007; Anderson et al., 2005., Rawal et al., 2008.).

Study Location

The study was conducted in Meenangadi panchayat in Wayanad district of Kerala, situated in southern India. Wayanad is primarily a rural district, in which 96.2 per cent of the total population lives in villages. The district has presence of tribal population of around 17.4 per cent, which is the highest in Kerala (Institute for Human development, 2008). They are the most backward and disadvantaged sections of the society and are found in remote and inaccessible areas. Tribal groups are mainly dependent on casual labor in agriculture, plantations and forestry for survival since they have little or no land. The absence of land holdings, education and health facilities is critical amongst the tribal community. Although Kerala is known for its achievement of high human development within India, the gap between tribal and non-tribal populations with respect to socio economic development indicators is significantly high (Chandran, 2012).

This study is part of a larger project, the "Alleviating Poverty and Malnutrition in Agrobiodiversity hotspots in India (APM)". The study location is one of the sites included in the APM project. It is recognized as one of the world's 35 biodiversity hotspots due to the many endemic floral and faunal species, as well as the threats to those species. The majority of the population in the study area identify themselves as belonging to either Scheduled Castes or Scheduled Tribes. The average landholding of the area is 1.05 acres with 84.5 % of the households being male headed. The primary occupation of household heads in the study area is agriculture with 60.5 percent involved in crop farming (APM Baseline report, 2012). The main

agricultural economy of the region includes plantation crops such as coffee, tea, cocoa, pepper and rubber, while seasonal crops such as rice, banana, tubers and fruits serve as the local food sources. It is interesting to note that while primary occupation of the household heads is agriculture, the major share of income comes from non-farm wage sources at 24.8% and salaried employment/ pension at 21.8%, followed by crop production at 17.7% (APM Baseline report, 2012). The different types of non-farm activities include teaching, government jobs, shop keeping, small scale retail ventures, rickshaw drivers, renting of trucks/tractors, employment offered by government employment programs, and construction work. Majority of the people in this sector are involved in informal activities and do not rely on single source of income.

Conceptual Framework

In this paper we offer a conceptual framework which views diversification as an important strategy for poor rural households in developing countries to stabilize and increase their incomes. Although there are arguments about possible negative effects of rural income diversification, there is overall consensus in the literature that diversification is positively correlated with household welfare (Ellis, 1998; Barret et al., 2001; Ersado, 2003).There are various factors that could influence a household's ability to diversify. The common factors identified in the literature are household demographics (age of the head, gender of the head, number of adult, numbers, ethnicity), income, access to credit and infrastructure, household risks, access to information on various services (Minot et al., 2006; Ellis, 2000; Barett et l., 2001; Block and Webb, 2001).

Along with the above mentioned, we view social networks as one of the important factors that can influence diversification. Networks are particularly important for information dissemination,

facilitating collective action, exchange of material goods, services, skills and ideas that can be critical for diversifying incomes. Jackson (2008) mentions that social relationships play a critical role in individual behavior, they affect people's opinions, the information they obtain, and are also key in accessing resources. The amount of information, trust in the information and information dissemination are key factors in influencing behavior. In rural areas, it is observed that farmers often rely on their social connections as their most trusted and reliable source of information regarding the suitability, profitability, and use of new technologies (Anderson and Feder 2007). Social networks can facilitate access to key resources and thereby influence diversification. For example, in cases where collateral restrictions prevent the poor from getting a commercial loan, community networks act as alternative sources of credit through mutual lending. Further, problems of mobility and lack of proper infrastructure might limit market access and this can act as a strong hindrance to income diversification. Social networks through shared goal and collective action can overcome these limitations (Kim, 2011). The significance of non-farm sector in rural areas has been growing over the past few years and households increasingly diversify into various non-farm activities. For people who generate income from the non - farm sector, social contacts outside the farm are often a primary reason to enter into the sector and maintain these off-farm activities (Meert et al., 2005).

Methods

Data

Data for this study was collected from 301 households in nine villages. The unit of analysis is a household. Households were selected from a census of 1000 in 31 villages that were previously included in the related study, "Alleviating Poverty and Malnutrition in Agrobiodiversity

Hotspots." Out of the thousand households we excluded households living in all small villages (<20 households) and all large villages (>100 households). Of the villages remaining, we purposely selected nine villages of intermediate size (between 20 and hundred households). This focus on intermediate-sized villages was done to ensure a reasonable sample of villages and to ensure that households within the villages are properly connected. All households in each of the 9 villages chosen were included in the study.

To measure a household's important social networks we drafted a questionnaire based on the social network survey which was previously developed by Duflo et al., (2012) in their study on diffusion of microfinance in villages of rural Karnataka, India. The survey included " thirteen dimensions, including names of friends or relatives who visit the respondent's home, names of those friends or relatives the respondent visits, who the respondent goes to pray with (at a temple, church, or mosque), from whom the respondent would borrow money, to whom the respondent would lend money, from whom the respondent would borrow or to whom the respondent would lend material goods, (kerosene, rice), from whom the respondent gets advice, and to whom the respondent gives advice" (Duflo et al., 2012, pp.5). For our purpose we used similar questions with some changes in order to suit the study location. The survey was administered to a member of the household who is above 18 years of age. In most cases the head of the household or spouse of head answered the questions and in some cases both answered.

In order to measure household income diversification, information on incomes was obtained from a survey conducted as part of the APM project. Household incomes in the survey are categorized into different sources namely, sale of surplus staple crops, fruit and vegetables, livestock products, crop by products, income from services by livestock, agricultural wages, off-

farm activities, migration and salaried employment. Annual income in rupees earned from each of these sources was obtained from the households. The survey also collected data on household demographics and other background information.

Following Duflo et al, (2012) there are a few important things to be mentioned about the social network data. The networks derived from this data are unidirectional. In other words, two households are considered to be connected if any member in the household mentions the other as a contact in response to some network question. This is appropriate since we are interested in links between households through which information, services and skills could flow. For example the fact that one household borrows money from the other is enough to create a link. Further two households are considered to be linked if they are connected through any of the interactions or relationships. Lastly we only take into consideration links within the villages although there may exist links across villages.

Descriptive Statistics

Table 1, 2 and 3[1] provide some descriptive statistics. The major share of income comes from off-farm activities (business, trade, non - agriculture wages) at 52.8%, followed by income from salaried employment at 13.8% and crop production at 10.9%. The average annual income of the households is Rs.155992. Average annual income for households who have diversified is greater than for households who have not diversified. Based on the descriptive statistics we can classify households into two main categories, those who receive their main share of income from agriculture and those who receive their main share of income from non-agriculture. Out of 301 households sampled, 247 households receive their main share of income from non- agricultural

[1] Tables 1, 2 and 3 are included in the appendix

sources and 54 households receive their main share of income from agriculture. It is interesting to note that almost all agricultural households are diversified, while 20 percent of the non-agricultural households are not diversified.

Econometric Model

Based on the Spatial Auto regressive model, we develop a network econometric model given by

$$Y_i = \beta_0 + \beta_1 AY_i + \beta_2 X_i + \varepsilon_i \qquad (1)$$

where, households or nodes are indexed by i = 1…..n. Y_i is an n x 1 vector of the outcome variable, income diversification. X_i represents exogenous factors that affect diversification. A is an n x n row normalized network matrix. $\beta_1$and β_2 are the parameters we would like to estimate and ε_i is the error term.

The links between the households or social networks are captured by an n x n matrix W where element $w_{ij} = 1$ if household j is connected to household i and zero otherwise. It is assumed that $w_{ii} = 0$, in other words that household i is not connected to itself and that every household has at least one connection. Given this, then matrix A is a row normalization of W such that element $a_{ij} = w_{ij} / \sum_j w_{ij}$. The element a_{ij} in the row normalized network A can be interpreted as the fraction of all network weight on household i that can be attributed to j. The term AY in the model represents the average outcome (diversification) of household i's network and β_1 is the network effect parameter. AY in this model suffers from endogenity problem caused due to reverse causality. In other words, it suffers from the reflection problem discussed by Manski (1993) due to the fact that a household's outcome is influenced by the average outcome of the network which in turn is influenced by the household's outcome (Lin, 2010; Wichmann, 2014).

The influence of network's diversification behavior on household's behavior can amplify the effect of other exogenous factors on diversification. This amplification is known as social multiplier effects (Sacerdote and Scheinkman, 2003). The social multiplier (η) can be measured as η= 1/ 1- β_1 and is interpreted as how much on average the network interactions intensify the effect of exogenous variation on outcome (Wichmann, 2014). For example facilitating income diversification activities for a group of women by providing training opportunities and initial support may lead their neighbors to do the same. This could take place as a result of information transmission, so that the choices of any single household modify the information available to the rest of the agents in her network (Maurin and Moschion, 2006).

The outcome variable, income diversification, is commonly measured in the literature using indices such as Simpson Index, Herfindahl Index or Shannon Index, which takes account of both the number of sources and the balance among them (Ersado, 2003; Joshi et al. 2003; Minot et al., 2006; Babatunde and Qaim, 2009). We use the Simpson Index of diversity which is defined as $SID = 1 - \sum P_i^{\,2}$ where Pi is the proportion of income coming from source i. The value of SID always falls between 0 and 1. If there is just one source of income, Pi = 1, so SID = 0. As the number of sources increases, the shares (Pi) decline, as does the sum of the squared shares, so that SID approaches 1. If there are k sources of income, then SID falls between zero and 1 – 1/k (Minot et al., 2006). The Simpson Index is closely related to the Hirschman–Herfindahl index of concentration (HH), specifically, SID = 1 – HH/10,000 (Minot et al., 2006).

The exogenous factors (X_i) in the model are household demographics including age of the head, gender of the head (male =1), whether the head has completed primary education (yes=1), caste

or social category of the household (schedule tribe=1) and number of adult members in the household. The other variables are agricultural and non-agricultural income, access to credit measured by whether the household has accessed formal or informal loans in the past year, access to infrastructure represented by use of electricity (=1), access to information on agricultural extension services, weather, market prices, crop insurance services and whether the housheold has faced any shocks in the form of crop failure in the past year.

There are two main issues to be dealt with in the given model. First, as observed in other diversification studies, we suspect that income variables used in the model is endogenous due to reverse causality, i.e. it could be influenced by diversification (Dimova and Sen, 2010). We use the Instrumental variable (IV) method to address this problem. The IV approach with endogenous variables requires an observable variable (Zi) not in equation (1), and satisfies two conditions: (a) Zi must be uncorrelated with the error term ε_i and (b) Zi must be correlated with income. Wooldridge (2002) notes that there is no credible econometric way of testing the correlation between Zi and ε_i. In practice, instruments that are conceptually appropriate and consistent with economic theory are chosen. In diversification studies, assets are commonly used as a proxy for income (Dimova and Sen, 2010; Ersado, 2003). We use ownership of agricultural assets (spades, shovel, sprayer pumps) and other household assets (computer, fridge) as instruments for agricultural and non- agricultural income based on the logic this can influence household income directly but can only affect diversification activities indirectly through income. The correlation between income and instruments Zi can be tested by estimating simple regressions of income on instruments (Sokcheng and Kimsun, 2013). Diversification index was

also regressed on these instruments to make sure that they are not directly correlated. Our final set of instruments passed the Sargan over-identification test.

Second, as stated before the diversification of the social network is endogenous due to the reflection problem. Following Bramoulle et al. (2009), we use the average exogenous characteristics of a household's network (AX), average exogenous characteristics of household's network's network (A^2X), and the third degree connection, that is the average exogenous characteristics of a household's network's network's network (A^3X) as instruments for the endogenous variable. The intuition behind this is that the exogenous factors of the network are correlated to the diversification behavior of the network (endogenous variable AY) but are not correlated with unobservable factors of household's diversification. In other words, our identifying assumption is that X is exogenous, which would make AX a valid instrument.

Results and Discussion

For the purpose of analysis, we have classified the households into two categories, households who receive their main share of income from agricultural sources and households who receive their main share of income from non-agricultural sources. In each of these categories we focus on the social network effects captured by the average diversification of a household's network on its diversification behavior. Results are presented in Table 4.

Table 4

Variables	Non- Agriculture	Agriculture
Agriculture Income	0.031***	-0.002**
	(0.01)	(0.00)
Non- Agriculture Income	-0.006***	0.019***
	(0.00)	(0.00)

Average diversification of the network	0.241**	0.271***
	(0.12)	(0.06)
Age of household head	0.004	-0.004***
	(0.00)	(0.00)
Gender of household head(male=1)	-0.012	-0.064***
	(0.03)	(0.02)
Education level of household head (primary=1)	-0.024	0.121***
	(0.02)	(0.01)
Number of adult members in the household	0.025**	-0.013
	(0.01)	(0.01)
Social category (Scheduled tribe=1)	0.057**	0.043**
	(0.02)	(0.02)
Access to electricity	0.022	-0.034
	(0.03)	(0.04)
Access to information	0.010	0.056 **
	(0.02)	(0.02)
Access to credit	0.009	-0.014
	(0.02)	(0.02)
Crop failure	0.170***	-0.090***
	(0.04)	(0.02)
Constant	0.034	0.601***
	(0.06)	(0.06)

*,**, *** represents statistical significance at 10%, 5% and 1% respectively

The results show that the average diversification of the household's network has a positive effect on diversification of the household in both categories. This is consistent with our proposition that social networks play an important role in income diversification. As mentioned before, positive effects of network's diversification on household's diversification can create social multiplier effects by amplifying the influence of exogenous variation on diversification. Social multiplier can be calculated using the network effect parameter (1/ 1- β_1). A social multiplier of 1.37 is estimated in the case of agriculture households and 1.31 in the case of non-agriculture

households. Thus the network effects intensify the exogenous effects on diversification by 37% in the case of agricultural households and by 31% in the case of non-agricultural households.

While social multiplier effects are present in both categories, it is interesting to note that the effects are slightly greater in the case of agricultural households. There could be two factors that explain why social network effects are slightly lower in the case of non-agricultural households. For households who receive their main source of income from the non-farm sector, the largest share of income comes from off-farm activities followed by salaried employment. In India, with 75 percent of nation's population living in rural areas, poverty and employment challenges seen in the study location are common. In order to address these issues, the government has initiated various programs and policies for rural employment, including the Mahatma Gandhi Rural Employment Guarantee Act (MGNREGA) which offers minimum 100 days of employment per year per household for eligible persons. Within the off-farm activities MGNREGA employment is one of the main source of jobs and a large majority of the households included in the study benefit from this policy. Further, many of the people who obtain formal wages are engaged in government jobs. In both of these scenarios there are certain fixed conditions based on education, social category and poverty status that need to be met to be eligible. This being the case, a person's social interactions or connections may not have a large impact.

We have mixed results with respect to the effects of other explanatory variables used in the study. We first discuss the explanatory variables that have statistically significant effects on diversification activities of both agriculture and non-agriculture households, followed by variables that affect agriculture households and finally variables that matter for non- agriculture households.

Income of the household is an important factor and has a statistically significant effect on diversification activities. In our model, income is entered as agricultural income and non-agricultural income. For agricultural households, as their main source of income increases there is a negative effect on diversification and as their non-agricultural income increases there is a positive effect. As discussed in Dimova and Sen (2010), a negative effect on diversification indicates that diversification activities are motivated by risk minimization or survival strategies and a positive effect of income indicates that diversification is motivated by accumulation strategies. In our case, households initially diversify for survival and as their additional source of income increases they diversify in order to accumulate wealth or to exploit opportunities. This pattern is observed in the case of non-agriculture households as well. It is interesting to note that diversification among households in Wayanad is motivated by both risk minimization and accumulation strategies. The social category of the household, in other words, whether it belongs to a schedule tribe has a negative effect on diversification in both categories. As mentioned above schedule tribes are the most vulnerable and disadvantaged sections of the society. Thus diversification is particularly necessary for these people to maintain stable incomes. Effects of crop failure on diversification are different in both categories. For agricultural households, crop failure has a negative effect. This might be due to the fact that these households are involved in agriculture for a long time and facing a crop failure might not push them to immediately diversify away from their primary activity. This is very commonly observed among farmers in Wayanad. Farmers who face crop loss do not stop farming in the next season even if they are in debt. However, it is reasonable to expect that non-agricultural households who undertake farming as an additional activity will want to diversify and avoid risk if the face a crop-failure.

For households who receive their main source of income from agriculture and related activities, household demographics like age, gender (male=1) and education (primary level=1) of the household head have statistically significant effects on diversification. In our model, age has a negative effect on diversification. It is difficult to anticipate how age might affect diversification and there are mixed explanations in the literature. On one hand, as a person gets older, he or she may accumulate the skills that lead to greater specialization. On the other hand, more experience and accumulation of assets may allow households to diversify into alternative enterprises (Minot et al., 2006; Block and Webb, 200). Gender of the head has a negative effect indicating that male-headed households are less diversified compared to female-headed households. This might be because female-headed households are more risk averse and are generally perceived to be more vulnerable. As a result, they might feel that it is important to have alternate sources of income to ensure stability. Education of the head has a positive effect on diversification. Education might facilitate entry into other economic activities within the non-farm sector (Barrett, Reardon and Webb, 2001; Minot et al., 2006). Household's access to information on agricultural and related extension services, weather, market prices and crop insurance services are particularly important for diversification. Results from the study are consistent with this indicating a positive effect of access to information on diversification activities.

None of the above discussed variables are found to be significant for households who receive their main source of income from non-agriculture. The number of adult members in the household has a positive and significant effect on diversification. Households with large number of adult members will have more skills and inclinations even if individuals are specialized resulting in diversified income sources (Minot et al., 2006).

Conclusion

In developing countries, diversification of income sources is a norm and specialization in one activity is an exception (Reardon, 1997). Given the relevance of diversification among rural households, it is important to recognize that social network effects can be critical in promoting diversification activities. By capturing social networks as the links between households within a village, our study provide empirical evidence indicating that social network effects play an important role on income diversification activities among rural households in Wayanad. We find the existence of social multiplier effects which can create a favorable atmosphere and facilitate diversification activities. The link between social networks and diversification is a relatively unexplored area and there are different ways (information dissemination, collective action) through which networks can promote diversification. Further empirical investigation and experiments on different ways through which social networks can be used to facilitate income diversification might open up a new range of possibilities for design and implementation of development programs. For instance, if NGO's and development programs while initiating extension and training programs can facilitate interactions between diversified and non-diversified people, this will create network effects and influence behavior. Further, network position might play an important role in diversification through information dissemination. It is generally observed in rural areas that even though information on extension services and training programs are available, people fail to receive them due to poor dissemination. If NGO's or development projects can identify people within a village or network who are critical in information dissemination, then this can further facilitate diversification.

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Appendix

Table 1: Sources of Income

S.No	Sources of Income	Percentage share of Income (on average)
1.	Sale of market surplus staple crops	10.87
2.	Sale of surplus fruits and vegetables	0.08
3.	Sale of crop by-products	0.33
4.	Sale of livestock, birds	0.86
5.	Sale of livestock products	5.32
6	Income from services by livestock	0.02
7.	Income from agricultural wages	4.72
8.	Income from off-farm activities (business, trade, non - ag wages).	52.81
9.	Income from migration	6.97
10.	Salaried employment	13.82
11.	Income from other activities	3.88

Source: Monitoring and Evaluation Survey, APM 2013

Table 2: Average Income

	All Households	**Diversified**	**Non-diversified**
Total Income(Rs)	155991.7	161656.5	127554.2
Agriculture Income(Rs)	37091.1	43733.16	3748
Non-agriculture Income(Rs)	118900.6	117923.4	123806.2

Source: Monitoring and Evaluation Survey, APM 2013
1 USD = Rs.59

Table 3: Number of diversified households in each category.

Main source of income	**Total number of households**	**Number of households who do not diversify**	**Number of households who diversify**
Agriculture	54	2	52
Non-agriculture	247	48	199

Source: Monitoring and Evaluation Survey, APM 2013