



Diversification Strategies among Rural Farm Family Households in Different Agro-climatic Zones of J&K Union Territory, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author RN designed the study. Authors RP, LKS and PS performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AKS helped to draw the funds for the project. Author RP managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The diversification of a portfolio is an alternative strategy for households to minimize their income variability and to ensure a minimum level of income.

Study Design: Multi-stage sampling, binary logistic regression and logit regression design were used for the study.

Place and Duration of Study: The study was conducted in Jammu & Kashmir State (Union Territory) in the year of 2016-17 with a total sample size of 630 farming families drawn from the four agro-ecological zones.

Methodology: From each selected villages, 15 farming families were drawn randomly without replacement and out of 15 farm families only 10 families were retained for analysis.

Results: An average gross income from on-farm enterprise was Rs. 77,623 per annum and from off-farm activities the average income was Rs. 1,17,643 per annum. Education, size of family

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members and fragmented land holdings were the push factors which motivated the farming family households to diversify towards other activities.

Conclusion: The study further suggested that there is a need to develop education and skill development training among the farm family households, as it will surely provide a positive impact on the ability to diversify their other livelihood options.

Keywords: Diversification; livelihood determinants; on-farm; off-farm activities.

1. INTRODUCTION

A plethora of studies from developing countries have underscored the importance of diversification strategies from farm to non-farm activities which have immense potential to enhance farmers' income and mitigate conditions of poverty and inequality [1,2,3,4,5]. Evidence has been reported regarding a substantial increase in the share of off-farm and/or non-farm income in rural households' total income in several developing countries [6]. It becomes imperative to target the farmers' distress by mitigating the risks and uncertainties that suddenly culminated after 2011-12. Therefore, this study has identified the determinants of sources of diversification of farmers' income so that it could provide a sustainable growth in farmers' income. Several factors are known to affect income diversification in one or the other way. Factors such as education, leadership, livestock ownership, oxen ownership, farm size, gender, annual cash income and market distance are the key determinants that affect farmers' participation in income diversification, as reported by Gecho [6]. Some other empirical researches [7,8,9,10,11] have included household asset endowments like financial, physical, human and social factors, local advantages, agro-climate and relative prices, access to infrastructure and risks. Babatunde and Qaim [12] have reported mixed results as far as the significance of few of these variables are concerned, especially land and agricultural assets. Livelihood diversification can address many constraints to income growth, conditions like crop failures and builds capacity for investment [13]. It is reported to be associated with providing growth and stability in income and consumption in a period of time [14,15,16,10,17]. Brithal et al. (2014) have stated that fostering farm-nonfarm linkages, absorption of surplus labour, reduction in rural-urban disparities and migration can be all addressed by growth of rural non-farm sector. Therefore, mostly in the developing countries, researchers have probed into the factors that affect nonfarm income diversification (Ellis, 2000; [5,16,11]) which has been grouped into barriers to income

diversification, individual and household characteristics, farm characteristics, location factors and risk factors [18]. While inaccessibility to credit and market information may demotivate farmers to non-farm diversification, risk factors are found to take control of the variability of returns from several non-farm activities [19,20,11].

Hence, the study main objectives was to documents the changes in livelihood sources, quantifies levels and trends in livelihood diversification and investigates the factors responsible for changing livelihoods. Since it is not always clear whether diversification is a coping strategy that enables poor households to deal with contingencies (for example when the rains fail or market prices for agricultural crops fall) or an opportunity to accumulate wealth and capital and thereby exit poverty, changing levels of poverty and inequality are also explored. By simultaneously developing a clear picture of changing poverty and inequality, it is possible to understand the prospects for livelihood diversification as a strategy that leads to a positive exit from poverty. If inequality is increasing, it may be that richer households are involved in diversification in order to accumulate wealth rather than exit poverty.

2. METHODOLOGY

2.1 State Profile

The study was carried out in Jammu & Kashmir Union Territory, a hill state having a varied topography, diversified cultural-diversity, social and economic practices of its different regions where agriculture remains the backbone of the economy as more than 65 percent of its population depends on agriculture and allied sectors. The entire state lies between 32°17' N and 36°58' N latitudes and 73°26' E and 80°30' E longitudes, constitutes the northernmost extremity of India. The total area of J&K is 2, 22,236 sq. Km which is 6.76 percent of the country's geographical area. The diversity in the physiographic features of the agro-climatic zones, i.e. sub-tropical, intermediate, temperate

and cold-arid zone speaks volumes about the vast agricultural potential in the state. Over the years, farmers have adopted several area specific and time specific cultivation practices to meet the requirement of their staple food crops. Rice, maize, wheat, pulses, fodder, oil seeds, potato and barley are the main crops of the state. The farmers are now diversifying to cash crops such as flowers, vegetables, aromatic and medicinal plants and mushrooms etc. Honey-bee keeping, fodder intensification, production of quality saffron, Basmati rice, rajmash, off-season vegetables, potatoes etc. are also practiced in specific areas, belts and clusters depending upon their agro-climatic suitability. However, state is still having low productivity of all agricultural crops and there is massive deficit in its own production of food grains (40%), oil seeds (70%) and vegetables (30%). The net sown area of 7.52 lakh hectares is 35 percent of the total geographical area as against national average of 46 percent. Over 70 percent of the net sown area is under food crops and the area under fruits is a little over 13 percent (DES, 2014). Viability of agriculture as a profession is presently affected by capital inadequacy, lack of infrastructural support, storage and sale of agricultural produce. Water resources too is a major challenge as only 42 percent of the cultivated area is under irrigation. Hilly terrain puts limits to mechanical farming and transportation of products, especially horticulture produce. Fragile soil in hilly areas is susceptible to soil erosion and a single cropping season is being practiced in temperate and high altitude areas. Within the state, Jammu division itself is a home for large diversity in physiographic features; cultural richness, agro-climatic variations etc again underline the vast agricultural potential in the division. Net irrigated area in the region is just 24 percent, double and multiple cropping are followed on a larger scale in the intermediate and warmer plain of sub-tropical areas. About 2,50,000 hectares, 2,10,000 hectares and 1,10,000 hectares of land is under wheat, maize and rice crops respectively. Basmati rice and rajmash (pulses) are valuable cash crops of the region. Vegetables, oil seeds, spices and condiments, aromatic and medicinal plants and fodder are also grown in specific areas of the region (DES, 2014).

2.2 Data Collection and Analysis

The study was based on a survey using a structured questionnaire. A total sample of 630 farm families households selected randomly were interviewed personally to collect data

regarding their socio-demographic profile, farming characteristics, institutional availability, expenditure profile and other information. In the study, the socio-economic profile was calculated by simple percentage and income of the farm family household was calculated by average. The level of diversification from off-farm activities was calculated by Simpson's Index of Diversity (SID) which was computed from the different sources of income and for crop diversification Gibb's Index was used.

The general form of Simpson Index of Diversification (SID) is given by:

$$S.I = 1 - \sum_{i=1}^N P_i^2$$

where, n is the number of income sources, and P_i is the share of income from the source i .

The general form of Gibbs-Martin index is given by:

$$1 - \frac{\sum x^2}{(\sum x)^2}$$

Where X is the percentage of total cropped area under an individual crop.

The on-farm and off-farm activities were considered as dependent variables. Age(AGE), formal years of education(EDU), Agriculture experience(AGREX), land fragments (LANDFRAG), farm size(FARMSIZ), productivity of land (PRODLAND) and institutional loan (INLOAN) were considered as independent variables. Based on these dependent and independent variables logit model was applied to determine the factors responsible for diversification.

3. RESULTS AND DISCUSSION

The data collected was based on the on-farm and off-farm activities performed by the farm family households. Majority of the farm family households were involved in crop production, dairy activities and from the list of off-farm activities majority were involved in labor, government and private job which counted as push factors towards diversification.

3.1 Socio-profile of the Farm Households Heads

The Socio-profile, includes various parameters like age, educational status and farming

experience of the farm-households. Under Table 1 the overall mean age of the sampled households' head was 50.13 years with standard deviation (SD) of 14.04. The mean age of the respondents in the sub-tropical, intermediate, temperate and cold-arid zone was 53.29, 50.23, 46.56 and 50.74 years, respectively. On the basis of age-group classification 61.10 percent of the sampled farming household heads from the intermediate zone were adults followed by sub-tropical zone (57.80%), temperate zone (52.80%) and cold-arid (48.90%). From the total sample size of 630 farming families household 56.04 percent of the farming household heads were adults ranging from 41 to 65 years. The results were in contrast with Ahmed and Fausat [21] who stated that farming family households belong to the age-group of 35-40 years in their study. In context to education one third (31.40%) of the sampled heads of farm household was illiterate. In respect to zones 38.90 percent of the

household heads in the temperate zone were illiterate followed by cold-arid zone (34.50%), intermediate zone (28.60%) and sub-tropical zone (25.60%). The educational level of middle pass was 24.40 percent from the total sample size of 630. Talking about farming experience, the average farming experience of the sample farming households was 30.02 years with a standard deviation of 14.60. The further insight of the data revealed that majority of the farm household heads (72.20%) in the intermediate zone had an agriculture experience between 15-44 years; equal percent (70%) was shared by sub-tropical and cold-arid zone followed by (68.90%) temperate zone. In the temperate zone, 15.60 percent of the sample farm households had an agriculture experience of less than 14 years followed by 12.80 percent in the sub-tropical zone, 11.70 percent in intermediate zone and 5.60 percent in cold-arid zone. Overall, 12.20 percent of the farm household heads had

Table 1. Socio-profile of the sample households' head

Parameters	Agro-climatic zones				
	Sub-tropical (n=180)	Intermediate (n=180)	Temperate (n=180)	Cold-arid (n=90)	Total
Mean age (in years)	53.29±13.97	50.23 ±13.70	46.56 ±13.48	50.74 ±14.53	50.13 ±14.04
Age-group (in percentage)					
Adolescent (11 to 17 years)	0.00	0.00	0.50	0.00	0.15
Young adults (18 to 40 years)	21.60	27.20	38.90	34.40	30.00
Adults (41 to 65 years)	57.80	61.10	52.80	48.90	56.04
Old age (Above 66 years)	20.60	11.70	7.80	16.70	13.81
Educational status					
Average formal schooling (in years)	7.03 ± 4.64	6.36 ± 4.95	5.53 ± 4.97	5.99 ± 4.97	6.25 ± 4.89
Level of education (in percent)					
Illiterate	25.60	28.60	38.90	34.50	31.40
Below Primary	1.70	5.80	3.30	5.70	3.80
Primary	7.80	12.80	6.70	4.40	8.40
Middle	25.60	25.60	23.90	21.10	24.40
Matriculate	28.90	12.80	15.60	21.10	19.70
Higher Secondary	3.80	6.70	3.90	4.40	4.70
Graduate and above	3.80	6.70	3.90	4.40	4.70
Farming experience					
Average farming experience (in years)	30.02 ±14.21	30.52 ±14.32	27.99 ±14.43	34.51 ±15.47	30.22 ±14.6
Less than 14 years	12.80	11.70	15.60	5.60	12.20
15-44 years	70.00	72.20	68.80	70.00	70.31
More than 45 years	17.20	16.10	15.60	23.30	17.30

* SC= Schedule Caste, ** ST= Schedule Tribe, ***OBC= Other Backward Categories

farming experience of less than 14 years. The study conducted by Waseem Khan et al. [22] stated that majority of respondents were from the mature group and 68% of the farm family households had a secondary education. As far as social category is concerned, the majority of respondents were from the backward Classes (OBC).

3.2 Percent Share of Income from Different Economic Activities

The percent share of income from different off-farm and on-farm activities have been presented in Table 2. Both off-farm and on-farm activities were essential sources of income for all farm households. Among off-farm activities, government employment, and labor contributed the highest percentage share towards total income followed by business, private employment, and others. In the case of percent share from on-farm activities, crop and livestock production were the most crucial contributor, followed by the horticulture and subsidiary (beekeeping, sericulture) enterprises. The Government employment remains the highest contributor towards total income in all the four zones; 66.54 percent in the subtropical zone, followed by 66.29 percent in intermediate, 51.22 percent in temperate and 42.12 percent in cold arid zone.

In the subtropical zone, after the government employment, the major contributors towards total income were labor (16.25%) followed by private employment (13.47%). From on-farm activities, crop production (49.90%) contributes the highest

percent followed by livestock production (49.50%). However, in the intermediate zone, the major contributors towards total income after the government job was labor (16.46%) followed by business (5.98%). From on-farm activity livestock production contributes the high-income share (65.10%) followed by crop production (32.40%). Similarly, in the temperate zone, the major contributors towards total income after the government employment was labor (26.18%) followed by private job (10.99%). From on-farm activities, livestock production contributes the highest (58.20%) followed by crop production 24.80 percent. In the cold arid zone, the major contributors towards total income after the government job was business (2.88%). From on-farm activities, livestock production contributes the income percent of 51.20% followed by crop production (17.80%).

On the contrary, Abdissa [23] showed that out of the total sample household heads, about 39 percent of the total household income derived from agriculture only, 25.00 percent from a combination of on-farm and nonfarm.

3.3 Determinants of Off-Farm Income

The results of the bivariate logit estimation (preferred over the Probit estimation, based on the criteria like AIC (Akaike information criterion) and Bayesian information criterion (BIC) of the off-farm participation of farm households has been presented in the Table 3. The value of the likelihood ratio test statistic found statistically significant, which reveals the validity of the logit model for the selected independent variables.

Table 2. Contribution of percent share of income from different components towards total income (in percent)

Components	Agro-climatic zones				Total (n=630)
	Sub-tropical (n=180)	Intermediate (n=180)	Temperate (n=180)	Cold Arid (n=90)	
Off-farm income					
Labour	16.25	16.46	26.18	1.85	15.94
Govt. job	66.54	66.30	51.22	42.12	66.98
Private job	13.47	4.54	10.99	1.48	8.63
Business	2.58	5.98	6.90	2.88	4.82
Skilled labor	1.08	3.75	2.82	1.15	1.92
Daily wager	0.08	0.80	0.82	0.10	0.47
Paying Guest	0	0	0	0.18	0.09
Other	0	2.16	1.07	50.24	1.15
On-farm income					
Crop production	49.9	32.3	24.8	17.8	36.7
Livestock	49.5	65.1	58.2	51.2	54.1
Horticulture	0.58	2.6	11.8	31.0	7.9
Subsidiary	0.02	0	5.2	0	1.3

The variables namely education of farm house hold head, farm size, productivity of land and loan from institutional sources had statistically significant effect on probability of adoption of off-farm income. The productivity of land and education had negative effect on the probability of adopting off-farm sources of income whereas; the education and loan from institutional source had positive effect on the probability of adopting off-farm sources of income.

The odd ratio for different significant variables revealed that with increase in one year of education and one unit increase in productivity of land, the probability of engagement in off-farm sources of income increased by 1.08 and 1.81 times, respectively. Similarly, an increase in size of operational holding by one hectare and increased access to institutional loan by one rupee decrease the probability of engagement in off-farm sources of income by 0.52 and 0.43 times. Several studies have identified the determinants of income diversification across rural households [13,24,25,26,27,28,29]. The study conducted by Waseem et al. [22] depicts farm size, education, access to credit, age, possession of productive assets, work experience and social category were the important determinants of livelihood diversification of farm households.

3.4 Income Diversification by Simson's Index of Off-Farm Activities

Simpson's index of diversity was selected for measuring livelihood diversity. The index considers the number of income sources and the distribution of income among the different sources. The data regarding income diversification was presented in Table 4. The

income diversification index was classified into four categories i.e. No diversification (0.-0.01), low diversification (0.02-0.25), medium diversification (0.26-0.50) and high diversification (0.51-0.75). In case from individual zone, 73.80 percent households from sub-tropical zone did not diversify into other activities. This may be due to the sufficient income source from single activity. Only, 1.20 percent of the households from sub-tropical had high level of income diversification, as they were not getting the sufficient income from single activity. In intermediate zone, majority of the households (79.54%) had no diversification while 2.30 percent of the households had high level of income diversification. The same case was also followed in temperate (82.50%) and cold-arid zone (76.53%) where the households had income no-diversification.

The overall data from J&K, depicts that the majority of the household (78.40%) did not diversify their off-farm activities and as such a very least percent had high level of income diversification (1.90%) from off-farm activities.

3.5 Gibb's Index for Crop Diversification

Gibb's method of crop diversification was used to study the crop diversification among the rural farm households. The Gibb's index was categorized into three i.e. High (above 0.65), Medium (0.55-0.65) and low (0.45-0.55).

Regarding zone wise, about one-third of the households (36%) from subtropical zone had medium level of cropping diversification followed by the low-level of the diversification (30.30%). But equal percent was share by high and low level of cropping diversification (36.70%) in intermediate zone.

Table 3. Logit model for adoption of off-farm sources of income

Parameters	Coefficient (β)	Std. error	Z	p-value	Exp (β)
Const	0.81	1.11	0.73	0.47	2.24
Internet	0.71	0.69	1.03	0.30	2.04
Age	-0.006	0.02	-0.2881	0.77	0.99
Education	0.08	0.04	1.80	0.072*	1.08
Agriculture experience	0.03	0.02	1.38	0.17	1.03
Land fragments	0.51	0.63	0.81	0.42	1.66
Farm size	-0.66	0.22	-2.9715	0.003***	0.52
Productivity of land	0.59	0.29	2.05	0.04**	1.81
Loan availed	-0.84	0.42	-1.9748	0.048**	0.43
Intermediate zone	0.49	0.56	0.88	0.38	1.63
Temperate zone	0.38	0.55	0.70	0.49	1.46
Coldarid zone	-0.557	0.60	-0.9265	0.35	0.57
Log-likelihood: -114.9406; Akaike criterion: 253.8813					

Table 4. Simson's index of Income diversification of sampled farm households for off-farm activities

Parameter	Agro-climatic zones				
	Sub-tropical (n=164)	Intermediate (n=171)	Temperate (n=171)	Cold arid (n=81)	Total (n=587)
No diversification (0-0.01)	73.80	79.54	82.50	76.53	78.40
Low diversification (0.02-0.25)	4.90	4.11	3.50	7.43	4.60
Medium diversification (0.26-0.50)	20.10	14.04	11.70	14.82	15.10
High diversification (0.51-0.75)	1.20	2.31	2.30	1.22	1.90

Table 5. Gibb's Crop diversification index of sampled farm households for on-farm activities

Range of Category	Agro-climatic zones				
	Sub-tropical (n=175)	Intermediate (n=173)	Temperate (n=180)	Cold arid (n=90)	Total (n=618)
High (Above 0.65)	33.70	36.70	51.70	76.70	46.40
Medium (0.55-0.65)	36.00	22.80	10.00	6.70	20.70
Low (0.45-0.55)	30.30	36.70	38.30	16.60	32.80

In temperate zone 51.70 percent of the households had high level of cropping diversification followed by 10.00 percent of the households who had medium level of cropping diversification. While in cold arid zone 76.70 percent of the household had high level of cropping diversification followed by low level of diversification (16.60%). From overall zone of J&K 46.40 percent of the households had high level of cropping diversification followed by the low-level of diversification (32.80%).

4. CONCLUSION

In a country like India, where 63.5 per cent of the rural workforce is engaged in agriculture (NSSO, 70th round), farmers' well being should be a major issue of concern as they are in debt from formal and informal sources. According to National Sample Survey Organization (NSSO, 70th round), about 52 per cent of the agricultural households were indebted. Chand et al. [30] have reported that the growth of farm income has plummeted to around 1 per cent after 2011-12. The empirical studies have argued that diversification from farm to non-farm sector has immense potential and findings of the study revealed that diversification across income sources helps households to combat instability in income. This study has empirically analyzed the

determinants of diversification of income sources through logit regression model. It has clearly indicated that diversification of farm households is determined by sociodemographic, farm and market related variables. The extent of livelihood diversification is significantly influenced by the factors like age of farmers, education level, use of ICTs, access to financial services, availability of organized input supply and access to market. Thereby, increase the probability of sustainable livelihood security, especially among the marginal and small farm households. Policy-makers need to reflect on the most suitable ways of supporting diversification. Only more appropriate policies will make people recognize the importance of diversity that will make a positive impact on the food security of farmers. From the list of on-farm activities crop production plays an important role and most of the area in J&K is unirrigated, so drought-prone crops should be introduced, the farm families should also diversify towards the other cash crops depending upon the suitability of climate and soil texture along with livestock improvement. Livestock sub-sector plays an vital role to eliminate the problem of food insecurity. Contribution of livestock plays a vital role in the household income security; therefore; necessary effort should be made to improve the production and productivity of the livestock. This can be

done through the provision of adequate veterinary services, improved water supply points, up-grade the already existing breeds, launching sustainable and effective development program, provision of training for the livestock holders to improve their production and productivity, improving the marketing conditions, etc.

Moreover, the training regarding the value addition of the dairy products should be imparted among the farm family households for doubling the income. The substantial effect of education on household livelihood strategy is also one of the factors towards diversification. However, the fact says in J&K state the educational status of the farm families households were illiterate and the average years of education achieved by sample households heads were below primary level. To eradicate the illiteracy rate and to increase the average formal years of schooling both formal and informal education, vocational or skill training should be promoted to increase rural households awareness of more viable livelihood options and to improve decision making the skill. Agriculture is not sustainable and few percent of the farm family households in J&K state practice agriculture as a single source of income. The government should help such kind of farm families by setting up a small enterprise or by giving financial aid to such families. The result showed that incomes from off-farm activities make an essential contribution to household cash incomes. In this regard, interventions that enhance off-farm activities sustainably need to be designed. Therefore, the rural development strategy should not only emphasis on increasing agricultural production, but alternative actions should also be given attention in promoting such activities in rural areas.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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