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## STUDY ON LIVELIHOOD THROUGH ADAPTATION AND DIVERSIFICATION IN FLOOD PRONE AREAS IN WEST BENGAL

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### Abstract

The study points out the need for third party intervention in promoting the livelihood patterns which are less exposed to the damaging effects of flood. Self-employment in small business or trading is a good option for households to supplement their streams of income. But such business even though required small capital, required at least some degree of training and skills development. Therefore, the financing and consultancy agencies can intervene. Promotion of ancestral occupation based on traditional skills and local level resources may be considered. Once again intervention of government and non-government organizations is highly required. Similarly, non-farm wage employment can also be promoted by introduction of "year round" public projects and employment guarantee schemes. Promotion of activity-wise micro financing, self-help groups may be involved. However, none of the areas as identified can be taken sufficient to substitute the flood risk prone livelihoods as most of them are directly or indirectly dependent on agriculture in the context of a farming community.

**Key Words:** Livelihood pattern; Flood damage; Occupations; Employment; West Bengal

### Introduction

Floods are considered to be the most highly discussed natural calamities of all, as it affects our lives and economy in highest magnitude. It has been argued by several authors that floods are not caused by rainfall alone (Sarkar, 2005; Biswas & Chatterjee, 1971; Khan, 1969; Sarkar, 2002). Floods are most often caused by technological and engineering failures which immediately points to the urgency of flood risk management. In particular the flood conditions during the year 2000 in West Bengal and Jharkhand posed a warning to the existing flood control measures.

A livelihood calls sustainable if it can cope with and recover from any shocks and stresses and maintain or enhance its capabilities and assets both now and in the future. The sustainable livelihoods framework calls for such considerations as people's capitals, their vulnerabilities, the policies, institutions, process and organizations. These affect people, the desired outcome, the livelihood strategies adopted by the people and the opportunities.

Human capabilities are central to achieve sustainability. Further sustainable livelihood principle must be people-centered, participatory and multi-level. In the context of vulnerability in farming-community within a rural area the information on crops grown, revenues from a given crop, the proportion of output marketed and seasonal price fluctuation remain important. All types of capital unavailability seem to be the most binding constraints. Also,

a suitable matting of natural resources or capital remains equally important. However to built financial capital for the poor there must be organizational, institutional, and legislative support. Institution can restrict people's choice of livelihood strategies. The importance of the non-farm sector cannot be denied in the development process. However, this sector confronts several problems which are (a) dominance of a highly traditional occupation structure, (b) raw material constraints, (c) limited or no access to information system, (d) inappropriate technology, knowhow and training, (e) marketing constraints and (f) lack of entrepreneurial skills (Rahim *et al.*, 1998).

In this background, an attempt has been made in this paper to examine the livelihood adjustment process evolved by the households through experience of generations. It helps us to capture the efforts of households to explore the livelihood diversification within the existing constraints and also it may help to implicate such efforts in the context of durable salutation to the flood adversities.

### Data Base and Methodology

The study has been conducted based on primary data. Primary data has been collected from twelve (12) most vulnerable floods prone blocks selected purposively i.e. five blocks from Birbhum district and seven blocks from Bardhaman district in West Bengal. These blocks are extended over ten police stations of the lower Ajoy basin. In the second stage following the same criteria, twelve flood prone villages i.e.

one village from each block has been selected purposively. In the next stage, the list of households of each village has been collected, and 25 households from each village have been selected randomly. Thus, finally 300 households of different categories have been selected as the ultimate sample unit of the study. Standard deviation (S.D) has been computed by employing the following formula to estimate the extent of absolute dispersion in data.

$$S.D = \sqrt{\left(\frac{1}{n}\right) \sum_{i=1}^n (x_i - \bar{x})^2}$$

Where, Xi = the value of the <sup>i</sup>th observations,  $\bar{x}$  = simple arithmetic mean (AM) of observations, n = total number of observations.

Co-efficient of variation (CV) has been computed as a relative measure of dispersion which can be written as

$$CV (\%) = \frac{SD}{\bar{x}} \times 100$$

As a measure of livelihood diversification, two livelihood diversification indices have been worked out. Herfindahl index (H.I) for livelihood diversification has been constructed by considering the sum of squares of the share of each livelihood in the total number of cases in all reported livelihoods. It can be written as  $H.I = \sum_{i=1}^N Pi^2$ . Where N = total number of cases (earners) in all livelihood pattern, Pi = relative share of the <sup>i</sup>th case description of livelihood. We must have  $0 \leq HI \leq 1$ . It means that as diversification increases the value of H.I decreases and vice-versa. When H.I approaches 0, then diversification trends to be perfect and when H.I equal unit there will be complete specialization. Since H.I is primarily a measure

the Simpson Index (S.I) and measures diversification. Hence  $S.I = 1 - \sum_{i=1}^2$ . Its value also lies between 0 and 1.

### Findings and Discussion

It has been found that apart from farming which is inherently vulnerable to floods, most of the households have to engage themselves in self-employed enterprises even though these are not full proof occupations against the risk of flood. Loss due to floods comes to be more pronounced in the case of farming and other self-employed avenues. The dispersion of losses varies remarkable on an inter-occupation basis. Efforts have been made to estimate the coefficient of variation on account of the degree of heterogeneity in losses for each of the livelihood pattern separately. A higher value of the coefficient of variation indicates a relatively unequal spread of losses among households while a lower value stands for a relatively uniform and stable pattern of flood losses. The most affected areas appear to be fishing, livestock, poultry/duckery, income from hiring assets, handicrafts and caste occupation.

The scenario of losses and their variability is reported in Table 1. It can be seen that the maximum losses are in case of farming, fishing, and livestock rearing. In the case of fishing, the loss is as high as about 93 percent. The other areas suffering perceptible damages include non-farm wages, caste occupation and handicrafts. It is seen that the average income contributed by livelihood patterns such as fishing, livestock rearing, poultry/duckery, and private jobs are quite significant. Although farming is the main source of income in the study area, on an average it is found to contribute around 7 per cent of the total income.

**Table 1:** Loss of livelihood due to flood

Sl. No	Pattern of livelihood	No. of cases	Loss due to flood		
			Mean	Standard deviation (S.D.)	Co-efficient of variations (%)
1.	Farming	300	86.78	16.11	18.57
2.	Fishing	2	92.50	3.53	3.82
3.	Livestock rearing (Dairy)	8	59.75	6.01	10.07
4.	Poultry/Duckery	4	85.25	4.11	4.82
5.	Non-farm wages	28	29.92	6.84	22.86
6.	Govt. Employment	43	11.83	4.44	37.55
7.	Pvt. Jobs	49	11.32	3.59	31.69
8.	Business/Trading	77	24.31	5.19	21.36
9.	Hiring Assets	4	30.00	5.77	19.24
10.	Caste occupation	13	32.30	5.20	16.10
11.	Handicrafts	24	34.25	5.46	15.95
12.	Remittances (pension/gifts)	6	6.83	2.48	36.34
13.	VAN rickshaw	3	25.00	5.00	20.00
14.	Helper	3	20.00	5.00	25.00
15.	Tuition	1	10.00	-	-
16.	S.H.G	1	5.00	-	-

Source: Field Survey

**Table 2:** Crop pattern by size-class

Crop	Marginal		Small		Medium		Large		Overall	
	Area (ac.)	%	Area (ac.)	%	Area (ac.)	%	Area (ac.)	%	Area (ac.)	%
Net cropped area	1.36		3.61		6.44		12.04		2.82	
Kharif paddy	1.36	42.90	3.61	43.23	6.44	42.90	12.04	42.30	2.82	43.52
Summer paddy	0.69	21.77	2.00	23.95	3.60	23.98	4.70	16.51	1.48	22.84
Potato	0.82	25.87	1.90	22.75	3.58	23.85	5.66	19.89	1.55	23.92
Mustard	0.22	6.94	0.67	8.02	0.89	5.93	1.41	4.95	0.45	6.94
Til	0.05	1.58	0.05	0.60	0.24	1.60	0.50	1.76	0.09	1.39
Vegetables	0.03	0.95	0.12	1.44	0.26	1.73	4.15	14.58	0.09	1.39
Gross cropped area	3.17	100.00	8.35	100.00	15.01	100.00	28.46	100.00	6.48	100.00
Cropping Intensity (%)	233.09		231.30		233.08		236.38		229.79	

Source: Field Survey

**Table 3:** Impact of flood on income

Livelihood pattern	Without flood		With flood			
	Average income		Income		Loss	
			Average	%	Average	%
Farming	82853.95		10953.29	13.22	71900.66 (86.78)	86.78
Fishing	91250.00		6843.75	7.50	84406.25 (92.50)	92.50
Livestock rearing (Dairy)	75475.00		30378.69	40.25	45096.31 (59.75)	59.75
Poultry/Duckery	89600.00		13216.00	14.75	76384.00 (85.25)	85.25
Non-farm wages	31507.14		22080.20	70.08	9426.94 (29.92)	29.92
Govt. Employment	202169.30		178252.68	88.17	23916.63 (11.83)	11.83
Pvt. Jobs	114734.70		101746.72	88.68	12987.97 (11.32)	11.32
Business/Trading	69778.57		52815.40	75.69	16963.17 (24.31)	24.31
Hiring Assets	111100.00		77770.00	70.00	33330.00 (30.00)	30.00
Caste occupation	46830.77		31704.43	67.70	15126.34 (32.3)	32.30
Handicrafts	28979.17		19053.80	65.75	9925.37 (34.25)	34.25
Remittances (pension/gifts)	156000.00		145345.20	93.17	10654.80 (6.83)	6.83
VAN rickshaw	34833.34		26125.01	75.00	8708.34 (25.00)	25.00
Helper	46666.67		37333.34	80.00	9333.33 (20.00)	20.00
Tuition	24000.00		21600.00	90.00	2400.00 (10.00)	10.00
S.H.G	12000.00		11400.00	95.00	600.00 (5.00)	5.00

Source: Field Survey

**Table 4:** Income diversification indices

Livelihood pattern	Average income contribution	Relative share to total	Squared value of relative share
Farming	82853.95	0.068	0.0046
Fishing	91250.00	0.075	0.0056
Livestock rearing	75475.00	0.062	0.0038
Poultry/Duckery	89600.00	0.074	0.0054
Wage employment (non-farm)	31507.14	0.026	0.0007
Govt. employment	202169.31	0.166	0.0276
Jobs in private sector	114734.69	0.094	0.0089
Business/Trading	69778.57	0.057	0.0033
Hiring of assets	111100.00	0.091	0.0083
Ancestral occupation	46830.77	0.038	0.0015
Handicrafts	28979.17	0.024	0.0006
Pension holder	156000.00	0.128	0.0164
Rickshaw puller	34833.34	0.029	0.0008
Helper in logistic service	46666.67	0.038	0.0015
Private teaching	24000.00	0.020	0.0004
S.H.G	12000.00	0.010	0.0001
Total	1217778.61	1.000	0.089
Herfindahl Index (H.I)	0.08		
Simpson Index (S.I)	$(1 - 0.08) = 0.92$		

paddy to be the most dominant crop in the study area (Table 2). This crop is also the most affected crop as flood has a close positive association with the kharif season. Next to kharif paddy, the other crops in order of importance are summer paddy, potato, mustard, til and vegetables. All these crops are directly or indirectly vulnerable to floods. The decline in the quality of soil in the post flood period also causes a negative impact on the productivity of these crops. In this situation, it calls for the urgency of exploring higher levels of diversification of livelihoods. Crop pattern by different size-classes of farming in the study area indicates that the farmers in all size-groups have a clear bias in favour of kharif paddy. Even the fact remains that the cropping intensity is slightly higher and varies from 231.30 per cent to 236.38 per cent. The percentage of area allocated to other high valued crops is relatively low. The implication of this is very clear as the kharif season paddy remains prone to the risk of flood inundation that means the most significant crop in farmer's basket remains prone to damage due to floods.

The average loss of income due to flood is about 93 per cent in the case of fishing. The average income in fishing is Rs. 91250/- in case of without flood, and the average loss is Rs. 84406.25/- in case of with flood (Table 3). The average income at the event of the flood in fishing, farming, poultry/duckery and livestock rearing are Rs. 6843.75/-, Rs. 10953.29/-, Rs. 13216.00/- and Rs. 30378.69/-, respectively. The losses are relatively low and vary from 5 per cent to 34 per cent in case of other livelihoods.

In this study, two types of indices have been computed to capture the livelihood diversification (Table 4). These are Herfindahl Index (H.I) and Simpson Index (S.I). The H.I and S.I are found to be 0.08 and 0.92, respectively. The values of H.I. and S.I also point out a very high level of diversification as it is closed to 0 (H.I = 0.08) and (S.I. = 0.92) in lower Ajay basin. Unfortunately, this diversification cannot be regarded very much encouraging as it indicates only a desperate attempt to cope-up with irregular and fluctuating events. The prevailing diversification does not fulfil, and it is not based on any systematic agricultural growth path. Neither is it based on any planned and managed the diversification behaviour being consistence with the available skills nor the viability estimates or third party intervention. Hence, a serious attempt should be made to explore the opportunities and possibilities for diversifying the present pattern of livelihoods in such a way that suitable strategy framework can be developed at the event of floods.

The adjusted average income can be calculated to get an idea about the adverse impact of flood. It is done by subtracting the average income due to flood under each

livelihood from the average income earned without flood. It is seen from the Table 4 that the average flood adjusted income is frustratingly lower than average income without flood in case of almost all the livelihoods. It has been found that the most adversely affected areas are fishing, farming, poultry/duckery, and livestock rearing (dairy). The top five least affected areas are micro-finance (SHG), government jobs, full-time private sector jobs, self-employed profession and non-farm wage employment.

In order to explore the livelihood patterns and opportunities, attempt has been made to make a qualitative analysis on the basis of the values of co-efficient of variations in percentage loss and average loss of income due to flood. The flood adjusted average income in a particular livelihood can be calculated as the difference between the average incomes under that livelihood without flood damages and the average loss in income due to flood. Flood adjusted average income as a ratio to average income without flood gives a more or less acceptable measure of intensity of flood vulnerability of income. The lower the ratio, the higher will be the level of vulnerability and vice-versa.

Tables 5 and 6 provide us with a clue to explore the livelihood patterns in the study area. In the study area, farming and livestock rearing are the most vulnerable among all livelihoods. Additionally fishing and poultry are the other most affected area. Non-farm wage employment, ancestral occupation such as pottery, weaving, masonry, drum-biting (Dhak), handicrafts, etc. are the moderately vulnerable occupations. The less vulnerable sectors are hiring out assets (paddy husking machine, car, tractor, power-tiller business etc.), small business or trade (grocery, tailoring, medical stores etc.), transport business (van rickshaw pulling, car, auto rickshaw etc.), professions (government and private jobs) and micro-finance activities (SHG). Similar finding was observed by Ellis (2000) and stated that rural livelihoods in developing countries are highly correlated with risks (market, climate variability, floods, and drought). Specialization in the agricultural sector makes it more vulnerable to droughts and floods (Cutter *et al.*, 2003). If there is a flood or drought in a particular locality, most farm income streams are adversely affected or disrupted. Therefore, at this event non-farm income, such as remittances, may provide more advantages than farm income if adverse natural events disrupt farm income streams.

**Table 5:** In the context of vulnerability

Sl. No	Range of average percentage loss income due to flood	Level of Vulnerability
1.	Less than equal to 45% ( $\leq 45\%$ ).	Most Vulnerable.
2.	Greater than 45% to less than equal to 70% ( $>45\%$ to $\leq 70\%$ ).	Moderate vulnerable or vulnerable.
3.	Greater than 70% to less than equal to 100% ( $>70\%$ to $\leq 100\%$ ).	Less vulnerable.

Source: Field Survey

**Table 6:** Exploration of livelihood patterns

Most vulnerable in flood	Vulnerable livelihood pattern due to flood	Less affected livelihood pattern due to flood
Fishing	Ancestral occupation (pottery, weaver, mason, dhaki etc.)	Hiring assets (paddy husking, car and tractor business)
Farming	Handicrafts	Wage employment (non-farm)
Poultry/duckery		Rickshaw puller
Livestock rearing		Business or trading (grocery, tailoring, medicine shop etc.)
		Helper in logistic service
		Private teaching (Home-tutor)
		Government and private jobs.
	Different self-help group (activity-wise)	

Source: Field Survey

## Conclusions

The discussion clearly points out the need for third party intervention in promoting the livelihood patterns which are less exposed to the damaging effects of flood. Self-employment in small business or trading is a good option for households to supplement their stream of incomes. Such business even though required small capital, required at least perceptible training and skills. Therefore, the financial agencies can intervene. Promotion of ancestral occupation based on traditional skills and local level resources may be considered. Once again intervention of government and non-government organizations is highly required. Side by side non-farm wage employment can be promoted by introduction of the year-round public projects and employment guarantee schemes. Self-help groups can be involved for the provision of activity-wise micro-finance. However, none of the areas as identified can be taken sufficient to substitute the flood risk fully prone livelihoods as most of them are directly or indirectly dependent on agriculture in the context of a farming community.

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