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# COPING MECHANISMS OF PEOPLE IN DROUGHT-PRONE AREAS OF RURAL ORISSA

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**ABSTRACT**

*This paper is an attempt to study various coping strategies employed by people during drought. It also looks at the sustainability about the coping mechanisms, which the communities adapt to counter the erratic behaviour of rainfall. This study tests for ex-ante and ex-post adaptation responses to weather risk in rural farm households of Orissa and also examines how poor rural families adapt with the changing patterns of livelihood. The study critically analyses different safety-nets available for the people and examines the gaps between policy and practice. The coping mechanisms of poor agricultural households during the drought period reveal several problems relating to diversification of crop and livelihood, capacity to migrate and the role of government institutions and policies. Based on the findings, this paper puts forth several suggestions and the role of different stakeholders and institutions, which have bearing on policy.*

## Introduction

Livelihoods and welfare of households can be adversely affected by the destruction of physical and human capital stock. One such factor which negatively impacts household welfare is climate induced natural disasters. The livelihood of most of the farmers in the disaster-prone regions is highly fragile and thinly balanced, even a minor shock can endanger the security of farm households (Subbiah, 2004). Adaptation[1] to climate change is a critical issue for India. It has become common knowledge that the poor are likely to be hit hardest by these events as the capacity to respond to such situations is also the lowest among the poor (IPCC, 2001; Olmos, 2001). Recent research on climate change predicts that there will be changes in the pattern of precipitation and temperature, occurrence of extreme events like droughts, floods, and typhoons, fluctuations in agricultural activities, availability and accessibility of water, nutrition and health

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status (Hetberg *et. al.,* 2009). In this context, the developing countries are predicted as more vulnerable to the climate change damages. In addition, poverty and other factors create conditions of low adaptive capacities in most developing countries. The impacts of climate change are already evident in India. Hence adaptation, which is nothing but a process to enhance the coping capacities of the affected people, is essentially a necessary and sufficient condition to overcome the impact of climate change. The fourth assessment report of the Inter-governmental Panel on Climate Change (IPCC AR4) states that while neither adaptation nor mitigation actions alone can prevent significant climate change impact, taken together they can significantly reduce risks. Mitigation is necessary to reduce the rate and magnitude of climate change, while adaptation is essential to reduce the damages from climate change that cannot be avoided (IPCC 2007; Lemmen *et. al.,* 2008).

**Research Questions**

Keeping these issues in view, the present paper addresses the following important research question: (i) What are the factors influencing successful adaptation? To address this research question, the present paper aims to study the different factors and steps influencing the success of an adaptation process. The specific objectives of this paper are : (i) to study the individual and community adaptive and planning strategies responding to the crucial impact of climate change i.e. drought; (ii) to study the different stages and factors influencing the success of an adaptation process; (iii) to analyse critically the different safety-nets available for the people and examine what went wrong in putting this policy into practice; (iv) to study the key factors that determine the differences in outcome; and (v) to suggest appropriate policy measures to enhance people's adaptive capacity in a sustainable manner.

**The Issue of Adaptation : An Overview**

A growing body of literature on the issue of adaptation has evolved over time, which put into practice anticipatory adaptation strategies as well as response strategies to manage the impact of climate risk (IPCC, 2007; Smit and Wandel, 2006; TERI, 2007; UNDP, 2007). The importance of climate change is increasingly emphasised (Pielke *et. al.,* 2007). This is because helpless and ignorant households find their own way of survival strategy even in adverse terms and conditions. Though state intervention is there, people have to fight for their livelihood independently as state intervention is limited in terms of time, area and dimensions (Mahamallik, 2008). The approach to adaptation needs to be dealt with differently from the way the mitigation issues have been handled (TERI, 2005). Mitigation represents activities to protect nature from society, while adaptation constitutes ways of protecting society from nature.

In different circumstances people adopt a variety of strategies within their hand-reach. Therefore, households adopt strategies as per the need of the time. They think of their livelihood in a very narrow perspective, i.e. for "survival" only. Livelihood means some sources for bare needs and/or a little more than survival for resources-poor or vulnerable households (Mahamallik, 2008). On the other hand, livelihood is not merely a source of survival for the better-off households, but something indirectly holding power relation and more income. In other words, the resource-rich households directly or indirectly make control over different social and economic institutions, market conditions etc. and try to make the situation in favour of them to gear up their strategies. Many times resource-rich households use the shoulders of poor households to reach the peak by controlling institutions, which, in turn flow resources in their favour. However, whenever there is a change (which is basically climatic),

there will be an impact. Our interest here is to minimise the vulnerability and this can be achieved through a proper adaptation process, which is of two types: ex- ante and ex- post. Such mechanisms involve both activities undertaken in anticipation of rainfall variability; called ex- ante based on the expectation of the event whereas activities that take place after the realisation of the event is an ex- post measure. The details are shown in Table 1.

**Table 1: People's Strategies to Cope with Climate Variations**

| Ex- ante (Based on Expectation) | Ex-post (Based on Event Realisation) |
|---|---|
| * Diversify crops, livestock | * Reduce or intensify inputs |
| * Occupational diversity | * Change crops |
| * Invest or disinvest in irrigation, fertiliser etc. | * Depend on irrigation sources |
| * Accumulate assets | * Buy or sell assets |
| * Purchase crop or weather insurance | * Receive or provide transfers |
| * Make sharecropping contract | * Seek non-agricultural employment |
| * Arrange to share with family, community | * Migration |
| * Diversify income sources | |

Source : Subbiah, 2004.

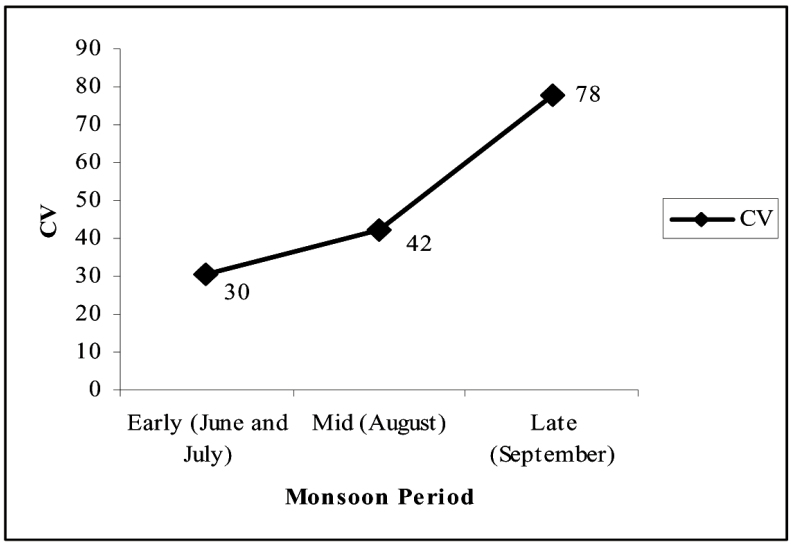
Ex-post adaptation measures aim at sustenance in the immediate present rather than to minimise loss whereas ex-ante process always aims at minimisation of the loss, which has a long-run perspective. Ex- ante process is backed by sufficient time period, which is completely absent for the ex-post process. Ex-post process is just a curative measure for any type of crucial situation. Of these two measures, the ex- ante measure is preferable as preventive measure is always better than curative measure. Through the preventive measure loss to a particular event can be minimised to a larger extent.

## Methodology

*Study Area - Nuapada District in Orissa: A Challenging Hydro Climate :* The present study has been concentrated on Nuapada district of Orissa where drought is the most frequent and the most devastating disaster. Nuapada district was chosen as the representative survey area because it truly represented the climate variation which took place in the State. Erratic rainfall and other geographic condition of the district further aggravate the drought situation. According to the official data, the South West Monsoon forms about more than 80 per cent[2] of the total rainfall for the year. South West monsoon usually commences in the meteorological week 23-25 (June 4–24) in this region and cessation takes place during 4-42 week (October 7–21). The distribution of rainfall during meteorological week 23–42 ultimately decides the fate of Kharif rainfed crops in this district. The rainfall for North East monsoon period is around 10 per cent on the average of the annual rainfall (October to December). Since, agriculture production is solely dependent on the arrival of monsoon in appropriate quantity, due to lack of alternate irrigation facilities, failure of monsoon is often associated with high degree of risk for agricultural production and high incidence of

crop failure. Despite large number of drought mitigation programmes like Medium Irrigation Project, the up-land dominated rainfed areas are most vulnerable to water stress condition and face drought with canny regularity. The temporal variability of rainfall in Nuapada district is explained in Figure 1.

**Figure 1: Average Rainfall (mm) in Nuapada District: 1988- 2008***




* The monsoon (SW) is defined as early : June- July; mid: August; late: September and monsoon: June- September

Source : http://www.ori.nic.in/rainfall

To understand the rainfall picture in a better way in the study district, the South-West monsoon is divided into three different divisions as; early (June- July), mid (August) and late (September). The early period is generally the preparatory stage for agriculture. The second stage corresponds to sowing and subsequently the third stage is growing of the crop. All the three stages are crucial for agricultural operation. Depending upon the three different stages of monsoon, the investment made by the people are also different. Each and every stage has their own investment. Closer observation of Figure 1 reveals that the inconsistency[1] of rainfall is found to be more in the late period (as the coefficient of variation (CV) value is more (78) compared to other two periods) in Nuapada district. It implies that a farmer reaches the third stage only after investing in the first two stages. Because of this, the vulnerability of the farmers in Nuapada district is more as the return of investment from the first two periods is almost nil. Neither can they leave the operation nor can they get anything from it. Hence these people have started diversifying their income strategies which are importantly dependent upon the generation of purchasing power in non- cropping occupation.

*Data and Techniques :* The study required a three-pronged approach while collecting information: (a) conducting a field survey; (b) collection of data from secondary sources and

discussions with officials in government, non-officials and local leaders in the sampled area; and (c) Focus Group Discussions (FGD) with various stakeholders.

The study has been carried out in Orissa but within the State, the selection of the district for detailed analysis was based on the criteria of maximum loss during the last drought. Hence based on the loss, Nuapada district was identified for detailed case study analysis. Further, villages were selected for field visits based on a composite index purely based on the basis of infrastructure, classified as developed (IU Village) and underdeveloped (ID Village). The indicators that are considered to construct the infrastructure index are (i) power supply; (ii) communication; (iii) bank facility; (iv) agricultural society; (v) medical facility; (vi) drinking water; and (vii) education facility. Here the conventional approach[4] has been adopted to determine weight for different indicators for the infrastructure index.

**Construction of Infrastructure Index**

In order to construct the infrastructure index, information about the 7-indicators of the concerned villages were collected from 2001 census report. Then they were arranged in accordance with a binary response (If the facility is available in the village then YES = 1. Non-availability of the infrastructure facilities led to a NO = 0 answer). Here in the present context, instead of taking a NO = 0 response, this particular survey has standardised this NO answer in terms of nearest distance where this facility is available. For example, if medical facility is not available in a particular village, but the nearest distance where the facility is available is 10 km, then in that particular place instead of taking a zero, we have taken 1/10. In this way the standardised value of all indicators were found out for all the villages. After this a simple average of all the standardised indicators gave the composite index purely based on infrastructure.

One village from each category was reflected in the study. From these two villages, a total of 257 households were selected on the basis of circular systematic random sampling. Of the total 257 households covered under this study, 107 households are from IU village and 150 are from ID village. The households are classified into five distinct categories on the basis of their landholdings in standard acres. They are (i) large farmers (10.01 acres and above); (ii) medium farmers (5.01 to 10.0 acres); (iii) small farmers (2.01 to 5.0 acres); (iv) marginal farmers (up to 2.0 acres) and (v) landless (no land). In the study, out of the total sample of 257 in both the villages, 36 landless, 25 marginal, 55 small, 33 medium and 108 are large farmers.

Three sets of instruments were used to collate information for this study : (i) household schedule; (ii) check list for secondary data collection, which reflects, different reports on drought impact, disaster management, information on crop yield, rainfall, temperature etc; (iii) Schedule (basically open-ended) for FGDs. The content areas in- terms of variables covered are described in Table 4. The narrations of the people with respect to drought, found from the FGDs through these open-ended questions were later incorporated in the analysis in order to enrich the outcome. The instruments were piloted and enriched subsequently before the data collection procedure.

From each sample village, three FGDs were performed, consisting of 15 villagers at different levels. In the first level, the FGD included members, such as sarpanch, ward member, knowledgeable person, school teacher, village post master, individuals from SC & ST community. At this village meeting, issues related to loss, different coping mechanisms both ex-ante and ex-post, perception about the people on the factors affecting the coping mechanisms, etc. were discussed. In the second level, the FGD was with the women folk. During the FGD with the women, various important issues such as fetching of water, time trend analysis, maintenance of family during the migration period of the spouse, wage rate during the disaster period, exploitation in terms of wage rate and working hour were discussed. Lastly, the study also focused on the elderly people to gather information (through PRA techniques) since they are vulnerable to disaster to a larger extent. The main purpose of generating information through qualitative method was to find out the problems faced by the affected people during the process of disaster. The process of interaction, in nature, was spread over extended and leisurely conversation mode to elicit their needs and demands. The structure followed was more or less similar for both the villages: village meetings, followed by group meetings, and then individual household surveys by administering interview schedules.

The interviews aimed to capture the effects of drought on the studied community, strategies employed by local farmers to deal with the situation. For this analysis, qualitative answers were coded into a set of defining variables[5]. For example, answers to questions concerning the household's current income, number of working days, wage rate, different sources of livelihood (e.g. a household may earn income from agriculture, agricultural wage labour, petty business, daily wage labour etc.), which for each household was set. All variables were cross-checked against each other to search for potential trends in the material. Having done that, another layer of analysis was added, where the defining variables were grouped into a few broader categories (Table 2). In this paper it is primarily used as a complement to the qualitative data.

*Method Used to Define Household Vulnerability :* A number of factors affect the disaster vulnerability and they are: income, occupation, family structure, gender, social class, caste, cultural factors, and health. In order to identify the vulnerability of a household, various approaches have been suggested in the past literature, which focus mainly on poverty and disaster (Bhandari et al., 2007; Brooks *et al.,* 2005; Christiaensen and Subbarao, 2005; WB, 2001, 2005). In order to identify the vulnerable groups of households, the study used the coefficient of variation measures of income between the normal year and the calamity year. Here the advantage is that it accounts for both the normal year income vis-a-vis the calamity (impact) year income. Therefore, the households with greater variation in the two income years will come out as more vulnerable, whatever be their initial (normal) year incomes. It is generally assumed that the income of the people is adversely impacted because of a particular calamity (drought). Hence the pattern of income will show variation responding to the event. More the variation in terms of income, more is the vulnerability due to a particular event. The study fixed a cut-off point to identify vulnerability. That household will be called as vulnerable whose income will show more than 33 per cent of variability and less than 33 per cent variability will be called as less vulnerable people.

*Method Used to Define Diversification :* In economics, the Herfindahl Index[6] is a measure of the size of firms in relationship to the

**Table 2 : Examples of Variables and Categories Used in the Analysis**

| Category | Defining Variables | Original Questions/ Discussion Topic |
|---|---|---|
| Adaptive Capacity | Diversification of Livelihood | Based on questions about perception on alternative non-cropping livelihood sources, accessibility to these livelihoods. |
| | Distress Sale | Number of livestock, their sale, normal price and distress price at sale, availability of jewellery and its price. |
| | Credit | Loan from bank, moneylenders, relatives and friends, rate of interest and repayment mode. |
| | Migration | Landholding pattern, person migrate, type of family, capacity to migrate, other earning members in the family. |
| | Agri-Insurance | General insurance, agri-insurance, premium details, facilities details. |
| Vulnerability | Income level | Based on questions about income sources, household expenditures, and assessment of asset holdings. |
| | Education level | Based on questions regarding the respondent's formal and informal education. |
| | No. of members in household | Defined as people living at the same homestead, sharing income sources. |
| | Active Earners | Number of male and female earners, wage rate, availability of work, type of work, distance from their home. |
| Access to networks and information | Membership of the local groups | Household/individual membership in local groups and level of engagement in them. |
| | Access to information | Perceptions of access to information about options for farming systems, extension service system. |

Source : Author's Own.

industry, and an indicator of the amount of competition among them. It is defined as the sum of the squares of the market shares of each individual firm. Formula: $H = \Sigma(Si^2)$, where Si is the market share of firm i in market. The Herfindahl Index (H), also known as Herfindahl-Hirschman Index (HHI), has a value that is always smaller than one. A decrease in the Herfindahl Index generally indicates a loss of pricing power and an increase in competition, while an increase implies monopoly. This Herfindahl Index can be used in the diversification measurement issues. The Diversification Index is calculated as: $D_1 = 1 - H$, where, H is Herfindahl Index.

**Results and Discussion**

*General Characteristics of the Study Households :* More vulnerable households in these study villages have a larger average

household size of 4.2 in comparison with 3.9 in the less vulnerable households. The total household income of the more vulnerable group is lesser than that of the less-vulnerable group. So far as landholding is concerned, the more- vulnerable groups possess more land than that of the less-vulnerable groups. In other words, there is a proportional relationship between disaster vulnerability and possession of landholding (Table 3).

**Table 3 : General Characteristics of the Households in the Study Villages**

| S. No. | Village | Vulnerability | Sample HH | Family Size | Age of Head of HH | Female Depen-dency | Active earners | Land (Acres) | Education | Income (₹) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Katingapani (IU Village) | Less Vulnerable | 27 | 4.8 | 50.0 | 42.3 | 1.6 | 10.1 | 0.4 | 22,681 |
| | | More Vulnerable | 80 | 3.9 | 51.2 | 44.2 | 1.4 | 11.5 | 0.1 | 19,688 |
| | | Total | 107 | 4.1 | 50.9 | 44.2 | 1.5 | 11.1 | 0.2 | 20,443 |
| 2 | Amalpani (ID Village) | Less Vulnerable | 69 | 4.0 | 45.1 | 39.9 | 1.7 | 1.8 | 0.9 | 23,863 |
| | | More Vulnerable | 81 | 4.0 | 45.1 | 39.9 | 1.7 | 1.8 | 0.9 | 20,625 |
| | | Total | 150 | 3.8 | 46.0 | 40.6 | 1.8 | 1.8 | 0.6 | 22,115 |
| | Total | Less Vulnerable | 96 | 3.9 | 45.6 | 40.3 | 1.8 | 1.8 | 0.8 | 23,531 |
| | | More Vulnerable | 161 | 4.2 | 46.5 | 40.6 | 1.7 | 4.2 | 0.8 | 20,160 |
| | | Total | 257 | 4.0 | 47.8 | 41.9 | 1.7 | 5.7 | 0.5 | 21,419 |

Source : Field Survey.

*Livestock and Animal Husbandry Possession :* Table 4 shows the livestock possession by the sample households in both the study villages. Overall the cattle holding position increased with the landholding size. Compared to large animals like cows and buffaloes, small ruminants are more convenient for these people as can be seen from the Table, because their number can be adjusted quickly by sale or purchase (Rathore, 2004). The dependence of landless, marginal and to a certain extent the small households on animals like goat, sheep and poultry for supporting their livelihood in the vital stage is evident from the composition of the livestock.

**Table 4 : Livestock Possession of Sample Households in the Study Villages**

| Village | Size of Holding | Livestock Ownership (% of HH) | | | | | Total sample households |
|---|---|---|---|---|---|---|---|
| | | Cow | Buffalo | Goat | Sheep | Poultry | |
| Katingipani (IU Village) | Landless | 50 | 0 | 50 | 0 | 100 | 4 |
| | Marginal | 0 | 0 | 0 | 0 | 0 | 0 |
| | Small | 0 | 0 | 0 | 0 | 0 | 0 |
| | Medium | 75 | 0 | 25 | 0 | 50 | 4 |
| | Large | 64 | 0 | 47 | 22 | 48 | 99 |
| | Total | 58 | 0 | 38 | 7 | 61 | 107 |
| Amlapali(ID Village) | Landless | 2 | 0 | 11 | 13 | 9 | 32 |
| | Marginal | 11 | 2 | 5 | 8 | 9 | 25 |
| | Small | 52 | 26 | 17 | 13 | 6 | 55 |
| | Medium | 66 | 42 | 23 | 10 | 12 | 29 |
| | Large | 100 | 85 | 40 | 20 | 10 | 9 |
| | Total | 51 | 34 | 21 | 14 | 10 | 150 |

Source : Field Survey.

*Impact of Drought on Agriculture Production :* Rice is the dominant crop in both the surveyed villages. The area under rice crop constitutes nearly 84.8 to 69.2 per cent in these villages. The production of paddy per acre of land as per last year's production is 5.3 quintals in Amlapali and 2.4 quintals in Katangipani. In both the villages one notices significant decline in production of paddy. Current year production is 3.7 and 7.6 per cent, respectively of last year production of these two surveyed villages, showing more than 90 per cent production loss in these surveyed villages. At the level of cultivating households, the loss of production is 100 per cent for more than 80 per cent cultivators in Amalapali village whereas in Katangipani, it is 38.4 per cent (Table 5).

**Table 5 : Extent of Production in the Study Villages**

| S.No. | Details | Villages | |
|---|---|---|---|
| | | Katangipani (IU Village) | Amlapali (ID Village) |
| 1 | % of Paddy area | 69.2 | 84.8 |
| 2 | Average production of paddy per acre | 2.4 | 5.3 |
| 3 | % current year production to last year production | 7.6 | 3.7 |
| 4 | % of households with 100% loss | 38.4 | 81.1 |

Source : Field Survey.

The other important crops produced in the surveyed villages have been horsegram, blackgram, greengram, raggi, cereal, gram and *Gunji* (an inferior variety of paddy). One also notices significant decline in the production of these crops which can be observed from Table 6.

**Table 6 : Production of Other Crops in the Study Villages**

| S.No. | Crops | Villages | | |
|---|---|---|---|---|
| | | Katangipani (IU Village) | Amlapali (ID Village) | Total |
| 1 | Horsegram | 18.4 | 13.3 | 15.8 |
| 2 | Blackgram | 15.1 | 10.1 | 12.5 |
| 3 | Greengram | - | 42.4 | 42.1 |
| 4 | *Gunji* | 23.9 | - | 23.9 |
| 5 | Gram | 33.7 | 64.9 | 49.3 |

Source : Field Survey.

It is noticed that horsegram, blackgram and yellowgram are produced in both the surveyed villages. One finds some production of *Gunji* only in Katangipani and greengram only in Amlapali. The current year production in all the surveyed villages together constitutes highest proportion of 64.9 per cent for gram and lowest of 10.1 per cent for blackgram. The crop loss for greengram is around 60 per cent. The two crops (horsegram and blackgram) which are produced in both the villages show a proportion of 15.8 and 12.5 per cent, respectively suggesting a crop loss of more than 80 per cent.

*Impact of Drought on Farm Wage Earners:* Agriculture employment in India fluctuates seasonally both in terms of labour force participation rates and the number of work days available during particular season. This is also associated with high levels of involuntary unemployment (Table 7) among the agriculture wage labourers. Seasonal fluctuation in wage earnings affects the purchasing power of the daily wage labourers in full or part, particularly those who are working as agricultural labourers (Agrawal, 1990).

**Table 7 : Impact of Drought on Farm Wage Earners in the Study Villages**

| Villages | Event | Annual full days of employment | | No. of days of not working due to drought | | Annual real[7] earnings per person | |
|---|---|---|---|---|---|---|---|
| | | Women | Men | Women | Men | Women | Men |
| Katangipani (IU Village) | Normal | 190 | 280 | 155 | 55 | 680 | 1867 |
| | Drought | 100 | 190 | 235 | 145 | 433 | 1266 |
| Amlapali (ID Village) | Normal | 180 | 290 | 175 | 65 | 533 | 1900 |
| | Drought | 95 | 200 | 255 | 140 | 367 | 1400 |

Source : Informal discussion, Field work, Observation and FGD.

For Amlapali village, the normal period's annual earnings are ₹1900 and ₹1400 for drought period and ₹1867 and ₹1266 are normal and drought period income in Katangipani village (for men). Huge variation is found with regard to the annual real earning

per person. The impact of drought on wage earners in an adverse manner is very much visible from the above discussion. Under this situation, people are forced to work for low level of wage. Women in agriculture labour are much more dependent on wage labour than men, with lower average days of annual employment (and more days of involuntary unemployment), lower daily wages (often from the similar tasks), which makes for the considerable gender differences in annual real earnings (as shown in the Table 7).

**Coping Mechanisms of the Drought-Prone Areas of Nuapada District**

*Migration :* In typically un-irrigated villages with little employment opportunities inside the villages, the option under scarcity conditions for a small land size cultivating family is to move out of the village in search of employment. Sometimes people migrate with their livestock also. In the present study migrations found among the people in both the villages, are seasonal[8] in nature. In the study area, the period of migration varies from 3 months to 9 months. Migration depends on a person's capacity to migrate. Otherwise forced migration or distress migration helping households cope with disaster, can result in long-term adverse consequences, socially and economically. Sometimes, migrant families that migrate to distant places do not return in time to resume their normal agricultural activities even when the drought is over.

Migration also depends on the social network process of the rural people. However, some people are forced to migrate without having any objective other than to find a livelihood. They migrate in order to cope with the vulnerable situation. As these types of people do not have any link in the cities or towns, they do not get job immediately. The frictional unemployment period is very much painful for them as well as to their family members. Table 9 shows the nature of migration in the study villages. 11.2 and 59.3 per cent from Katangipani and Amlapali, respectively adopted migration as strategy to cope with drought.

**Case of Distress Migration in Katingipani**

Mr. Benudhar Majhi, a 25 years old man migrated with his newly married wife to Hyderabad for brick making. He has 3 acres of land. Category-wise he is a small farmer. In the years of good rainfall, these 3 acres of land is more than enough for them. However due to lack of rainfall, he could not produce anything and mortgaged his land at a distress price. Then without having any alternative both of them migrated in 2007 and worked for 10 months and earned ₹ 7000 apart from free accommodation and food. They retuned back to the village in June 2008.

Source : Field Survey.

Here Katangipani reported very less percentage of migration because this particular village is a hilltop village. Here extension service is found to be very poor. It is mostly the landless, marginal and small categories people who look for jobs in casual labour market (Table 8). However, the team observed a growing tendency as well as preparedness among the inhabitants of these villages to move out of the villages in near future if no relief measures and work are forthcoming from the government and other organisations.

**Table 8 : Migration of Sample Households in the Study Villages**

| Village | Size of Holding | Person Migrate | | | Total sample households | % of migration |
|---|---|---|---|---|---|---|
| | | Head of the HH | Other Members | Total | | |
| Katingipani (IU Village) | Landless | 04 | - | 04 | 04 | 100.0 |
| | Marginal | - | - | - | - | - |
| | Small | - | - | - | - | - |
| | Medium | 01 | 01 | 02 | 04 | 50.0 |
| | Large | 03 | 03 | 06 | 99 | 6.1 |
| | Total | 08 | 04 | 12 | 107 | 11.2 |
| Amlapali (ID Village) | Landless | 16 | 11 | 27 | 32 | 84.3 |
| | Marginal | 11 | 10 | 21 | 25 | 84.0 |
| | Small | 25 | 23 | 28 | 55 | 50.9 |
| | Medium | 09 | 04 | 13 | 29 | 44.8 |
| | Large | - | 01 | - | 09 | 11.1 |
| | Total | 61 | 49 | 89 | 150 | 59.3 |

Source : Field Survey.

*Occupational Diversification :* Nuapada district is primarily an agrarian economy. Though 70 per cent of the land is rainfed, people still derive their livelihood from agriculture. The diversification of livelihoods through the Herfindahl index is shown in Table 9.

**Table 9 : The Herfindahl Index for Livelihoods Diversification in the Study Villages**

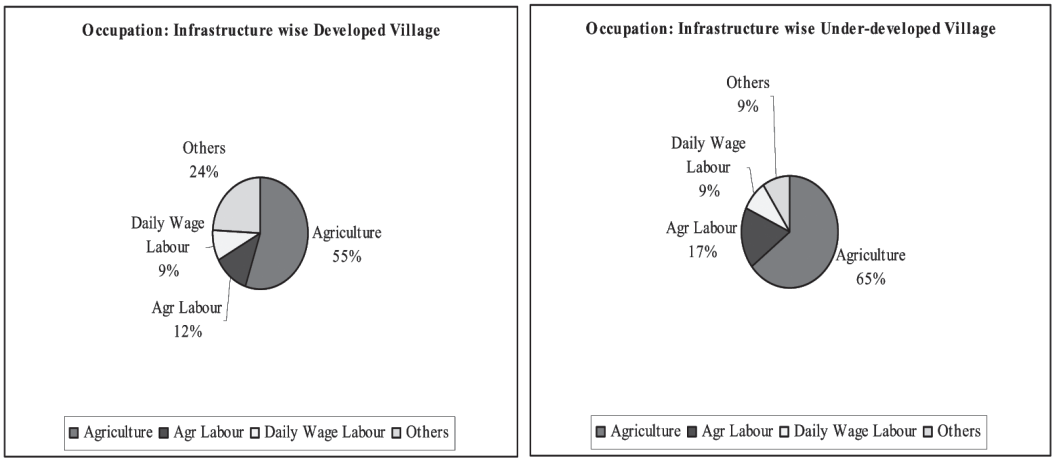
| Villages | No. of Households | Diversification |
|---|---|---|
| Katingapani (IU Village) | 107 | 0.14 |
| Amalpali (IU Village) | 150 | 0.39 |

Source : Field Survey.

Among the two villages (Katangipani and Amlapali) in Nuapada district, diversification was found to be more in Amlapali (0.39) than that of Katangipani (0.14).

There were so many "other activities" found in Amlapali (ID village) (14 per cent) which is found to be less in Katangipani (the IUD village) (9 per cent). The other activities are: non-agricultural wage work such as rickshaw drivers, gardener, mason etc. In ID village, migration is prevalent and at the village level through SHG, women have taken note-worthy steps to help their family (Chart 1).

**Chart 1: Occupational Pattern in the Study Villages of Nuapada District**




Source : Field Survey.

**Income Diversification by Women**

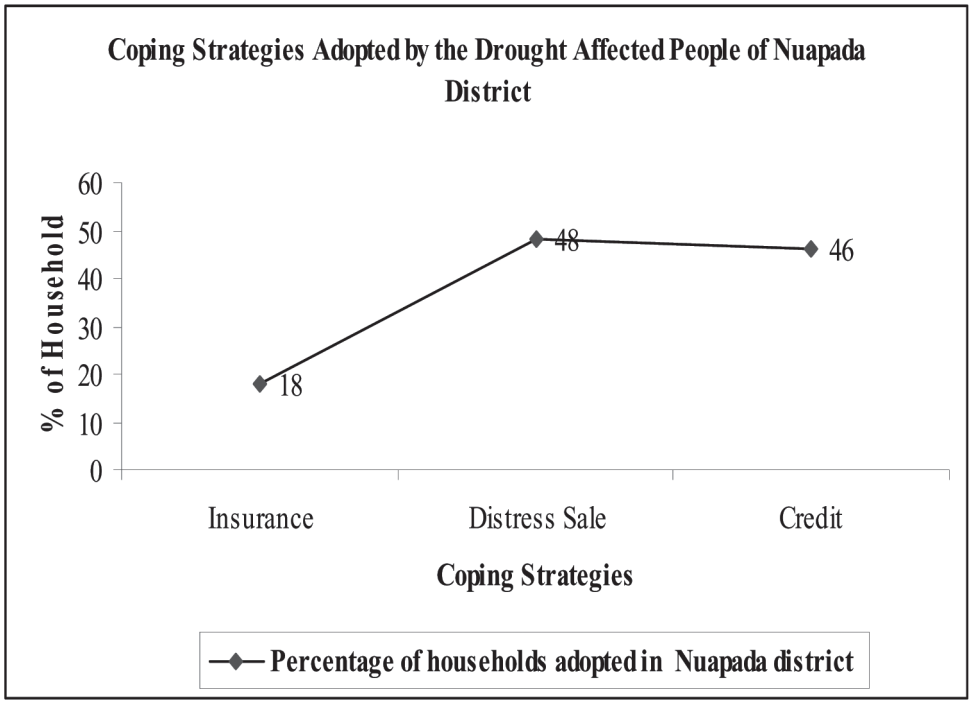
There are six SHG groups in Amlapali village, which are (i) Mother Teresa (Activity: selling of goat and sheep); (ii) Maa Durga (Activity: Brick making); (iii) Annapurna (Activity: selling of clothes by ICDS); (iv) Narisakti (Activity: Agriculture activities); (v) Bishnupriya (Activity: managing mid-day meal); and (vi) Maa Brundabati (Activity: Brick making). The village Amlapali is chronically affected by drought. These women have adopted these activities as livelihood reconstruction measures in order to help their family members.

Source : Field Survey.

Katangipani is situated in the hill top. There is no approach road from the village to the nearest town. Out-migration is not an option for these villagers in times of crises due to its location. As a result, people are completely dependent on either agriculture or on forest products. Very few migration cases are found in this village. On the other hand, Amlapali is situated nearer to the road and one of the reasons for diversification among the people is availability of good infrastructure such as power supply, communication, bank facility, medical facility, education facility, etc.

*Other Adaptation Measures :* The rural households in the study area to reduce the impact of drought have adopted various coping mechanisms and adaptive strategies. It is a combination of individual measures and community based activities. The adopted strategies and coping mechanisms depended on households' perception on extreme events and the problem associated with it. Apart from the occupational diversification, the detailed strategies adopted by the people (Figure 2) are: (i) Insurance; (ii) Distress sale; and (iii) Credit.

**Figure 2: Other Coping Strategies Adopted in the Study Villages**




Source : Field Survey.

*Insurance :* The scenario of insurance sector is not popular among the rural households (18 per cent in the two study villages of Nuapada district). The people who take agricultural loan are bound to insure their crop. Insuring a crop by non-loan holders is found to be very rare. The factor, which creates confusion among the people, is the definition of a unit, which declares a particular year as a calamity year. During the FGDs in those villages, people showed their dissatisfaction regarding this definition. In this scenario, information plays a major role between the planners and the affected communities. From the study, lack of a proper extension service in the two study villages is evident. This leads to lack of information among population about various government programmes and schemes.

*Distress Sale and Credit :* The most important way of responding to drought is distress sale and credit. In the study villages, sale of cattle was found to be very much prominent during calamities. Also during distress, people invariably depend on credit. In the present study, it was found that 46 per cent of the people took credit from different sources to cope with the situation. They usually depend on banks, relatives, friends and most importantly village moneylenders. Due to the procedural delay and lack of collateral, people are more often trapped by the village moneylenders who lend at very high rates of interest. In the study villages, the interest payable to private moneylender varies between 36 and 60 per cent.

**Status of Insurance Sector**

So far as insurance is concerned, there are two types of farmers - borrower farmers and non-borrower farmers. For borrower farmers, minimum 2.5 per cent of the disbursed crop loan is to be insured by the farmers. The percentage is inbuilt with the scale of finance. The District Consultation Committee (DCC) generally decides the scale of finance. The DCC decides the kind and quantity of crop to be financed in the kharif season. If a farmer wants to cultivate efficiently through increased use of fertiliser, water and input, he can go beyond the threshold yield (i.e. 6.25 per cent). There is no pressure from the bank side in this regard. In Nuapada district of Orissa, the three main crops for which loans are disbursed include paddy, groundnut and cotton. In case of small and marginal farmers, there is a rebate of 10 per cent in the premium amount (information collected through informal discussion with field officer of a regional rural bank.

Source : Informal Discussion with Field Officer, Kalahandi Anchlika Gramya Bank.

*Factors Influencing Adaptation Options :* The different factors that influence the coping mechanism of the people which will increase the adaptive capacity are explained in Table 10.

Drought forecasting is the most important factor influencing the coping measures among both the study villages (Table 10). Efficient and timely forecasting will reduce the vulnerability to a larger extent. Effective leadership has been suggested in both the villages. Equitable distribution of relief and reconstruction measures is one of the top priorities for all the people in all the study villages. Use of drought resistance variety and extension services are emerging as the efficient factors influencing coping mechanisms. Presence of community organisation, health facilities and strong NGO intervention are suggested by the people. Extension service is found as one of the important factors influencing the coping capacities of people.

*Understanding of Adaptation Decision Making :* A striking feature inherent in the present study of adaptive behaviour is that not only do households plan their response, but there is also a distinct sequence in the

**Table 10 : Factors Influencing Implementation of Coping Mechanism in Nuapada District**

| S.No. | Factors | % of Households | | |
|---|---|---|---|---|
| | | Katangipani (IU Village) | Amlapali (IU Village) | Total |
| 1 | Leadership | 55 | 68 | 60 |
| 2 | Drought forecasting | 100 | 97 | 93 |
| 3 | Community Organisation | 38 | 47 | 41 |
| 4 | Relief and reconstruction measures | 100 | 95 | 92 |
| 5 | Education | 09 | 02 | 04 |
| 6 | Health facilities | 41 | 45 | 41 |
| 7 | Land ownership | 17 | 23 | 20 |
| 8 | Strong NGO intervention | 32 | 46 | 38 |
| 9 | Insurance | 10 | 22 | 16 |
| 10 | Extension service | 76 | 55 | 60 |
| 11 | Drought resistant variety | 65 | 71 | 65 |

Source : Field Survey.

response. The significance of these sequences[9] in relation to household objectives, the way in which strategies are planned to meet these objectives and the factors which determine the effectiveness of these strategies is the primary cause of concern for this study. In order to examine this idea more carefully, this study has recorded household responses to drought. On the basis of strategic and focused interviews, the most important and commonly observed adopted responses, which the affected people had adopted serially with the intensity of the event, are explained in Table 11.

**Table 11: Sequencing of Adaptation Options in the Study Villages**

| S.No. | Sequencing of Coping | Mechanisms Factors Affecting the Coping Mechanisms | Point of Intervention | Level of Intervention |
|---|---|---|---|---|
| 1. | Credit | Availability and accessibility to formal financial institutions; presence of private moneylenders in the village; *ex-ante* decision-makers; availability of friends and relatives | Legal procedure of the formal financial institutions should be more liberal so that all the affected people can access to it | Bank |
| | | | Chances are always there for interlocking with the people who take *ex-ante* decisions. Poor people always take *ex-post* decisions after realisation of the event. Always *ex-ante* decisions are better than the *ex-post* decisions. So intervention should aim at converting the *ex-post* decisions of the people into *ex-ante* decisions | Government, NGOs, Civil society, Panchayats, leaders, community |
| 2. | Insurance | Extension services, community participation, agriculture loans | Proper and efficient extension staffing facility, monitoring by the extension staff, discrimination of different government schemes | Government extension staff |
| | | | Demonstration of benefit and cost of insurance schemes | Insurance companies, NGOs |
| | | | Regular contact of the banking staff with the people at bottom level | Bank |
| | | | Proper dissemination of benefits to the people once realised | Bank |

*(Contd.)*

**Table 11:** *(Contd.)*

| S.No. | Sequencing of Coping | Mechanisms Factors Affecting the Coping Mechanisms | Point of Intervention | Level of Intervention |
|---|---|---|---|---|
| 3. | Diversification of Crops | Extension services, availability of input, community participation | Proper and efficient extension staffing facility, monitoring by the extension staff, dissemination of different government schemes | Government extension staff |
| | | | Facilities of subsidies towards agricultural input at village level | Government, Panchayats, leaders, NGOs |
| | | | Strong participation of the community at all levels of the decision-making process | Community |
| 4. | Adjustment in Food Habits | Availability of food stock, family size, availability of Food for Work Programme (FWP) | Through the system of redistribution (Meert, *et al*., 2005). It means that everyone contributes to common stocks of resources that are then redistributed according to agreed rules. This can be done by creating foodgrain storage at the village level | Community level, Panchayats |
| | | | Proper and equitable distribution of safety-net programmes like FWP | Government, NGOs, Community |
| | | | Strong association of the community at the grassroot level | Community |
| | Diversification of Livelihood | Risk-bearing capacity, availability of livelihood options, family size, education, investment capacity, extension services | Helping people by providing non-agricultural livelihood option. It should be accompanied by proper marketing facilities. Also to sensitise them about the other sub-support systems of the main livelihood systems | Government and NGOs |
| | | | Encouragement for education | Government, NGO, Leaders |
| | | | Provision of subsidised credit for different livelihood options | Bank |

*(Contd.)*

**Table 11:** *(Contd.)*

| S.No. | Sequencing of Coping | Mechanisms Factors Affecting the Coping Mechanisms | Point of Intervention | Level of Intervention |
|---|---|---|---|---|
| 5. | Distress Sale | Asset holding capacity, wage rate, family size | Assurance of work through NREGS in order to protect the people from distress wage | Government |
| 6. | Migration | Social networking, capacity to migrate, type of family, family size, family composition | Infrastructure development, road connectivity, support services to the immediate family members of the migrated person for a temporary period | Government, NGOs, Panchayats, Community |

Source : Field Survey.

Thus, a clear understanding of household behaviour in response to drought will have a number of important practical implications for its proper design and management in a sustainable manner.

*Role of Government :* Throughout India, Government has assumed one of the most important post-disaster roles : provision of support to those persons who are least able to cope. However, in a country like India, Government often has insufficient funds to provide assistance after major disasters. This section of the paper summarises the role of the government in reducing the vulnerability. To facilitate easier understanding, the contents are categorised under three major areas: (i) successful adaptation vs. mal-adaptation; (ii) policy intention vs. policy practice; and (iii) financing adaptation.

*Successful Adaptation vs. Mal-Adaptation :* By observing the adaptation measures adopted in the two study villages, it was found that the adaptive capacity of the infrastructure-wise developed village is better than that of the underdeveloped village. From the very beginning, these two villages are distinguished on the basis of infrastructure. It is obvious that infrastructure is certainly a factor which makes difference in outcome. However, some other factors such as planned adaptation measures implemented by the government also make the difference in outcomes. These factors are : (i) existence of the facility of lift irrigation (ii) availability of active SHG groups linked with the banks. (iii) livelihood diversification (iv) emphasis on crop substitution and diversification with better crops like cotton, pulses, groundnut, vegetables, yam etc. endowed with deep root system and adaptability to withstand moisture stress much better than rice through Western Orissa Rural Livelihood Project (WORLP), (v) availability of foodgrains at subsidised rate through the public distribution system (PDS); (vi) availability of different schemes like old age pensions; (vii) repeated government training programme for primary and secondary stakeholders.

*Policy Intention vs. Policy Practice :* As of now India lacks a definite policy on disaster management like drought mitigation. A large number of specific schemes and proposals have been debated but there is absence of consensus on the merits of alternative schemes. The important policy instruments seen by many as a promising safety-net

instrument in Orissa, however, are Food for Work Programme, National Rural Employment Programme, Integrated Rural Development Programme and Rural Landless Employment Guarantee Programme. Some of these programmes are, however, *ad-hoc* in nature and do not have a long-term perspective (Government of Orissa, 2004). These are all ex-post mechanisms adapted by the people after realisation of the event. These measures sustain the vulnerable people in the immediate distress situation. However, these programmes do not have long run sustainability. For example, the implementation of watershed in different parts in order to reduce vulnerability is partially successful. The crop yield has increased, the groundwater table has increased and soil erosion has decreased to a larger extent where watershed implementation was successful. Furthermore, field survey in one of the watershed villages of Khariar block of Nuapada district points out that the success of this planned adaptation are completely dependent on the consensual effort of government, NGO and communities. Sometimes, it is found that lack of proper collective action among the communities leads to mal-adaptation.

*Financing Adaptation :* Financing adaptation can be achieved through the financial intervention, which is required for the sustainability of the activities. Activities like proper maintenance of all watershed structures including check dams, percolation tanks etc. are cost intensive. Financial support from the government is required on a continuous basis for such types of activities. An alternate way to converge the funds instead of creation of new funds for adaptation activities is required. For example, various developmental works need to be channelised through the NREGS (National Rural Employment Guarantee Scheme). As a result, generation of employment as well as maintenance of assets such as watersheds can be maintained and monitored properly in a sustainable way. Also, SHGs can be empowered through soft loans at subsidised rates of interest for income-generating activities. Further, funds should be provided for the primary and secondary stakeholders' training programmes. However, for activities such as construction of dams, artificial recharge of groundwater aquifers, integrated watershed management, promotion of drought-tolerant seeds, soil conservation, improved agronomic practices and infrastructure development (like approach road, schools, hospital, financial institutions, agriculture credit societies, etc.), huge investment is required. This needs to be provided by the government.

**Conclusions and Recommendations**

This article argues that drought-affected households suffered production losses up to 100 per cent in the case of paddy in the study villages. Drought had induced farmers to think of innovations in the cropping pattern and accordingly farming practices are adapted to suit the harsh moment. For instance, change in cropping intensity and shift to tolerant varieties (though very insignificant in the study villages) are helpful to cope with drought.

Adjusting consumption of food was an important coping strategy during drought years. But the adaptation among the rich and poor were different from each other. In case of the latter, adjustment involved a reduction in the number of meals taken in a day (from three times to two times). However, in case of rich group, the scenario was different. They reduced the consumption of milk, pulse, sugar and vegetables.

Depending upon the severity of drought, people moved from place to place in search of employment. The role of seasonal migration had impacted positively in one of the study villages (Amlapali village). A closer observation from the FGD into the inner dynamics revealed

that the advantaged and disadvantaged groups of society have differential impact in the short term and long term. In the short term, disadvantaged groups are pushed out in search of employment. Apart from this, livelihood diversification, distress sale and insurance were the other important coping strategies found in the study villages. Infrastructure available was an important factor in influencing coping strategies. Developed village in terms of infrastructure had fared better than the less developed one.

It is suggested in this paper that coping strategies typically fall into different stages. First they try to manage by consuming lesser from the existing food stock. Generally, whatever the poor people earn they consume it. Failure of agricultural practices due to the extreme climate situation leads to diversification of livelihood. However, people hardly get enough time intervals to take proper decision regarding their livelihood. When these mechanisms prove ineffective, people gradually dispose the key productive assets (like selling of cattle, mortgaging of asset for credit), which slowly culminate in migration. However, migration completely depends upon the capacity to migrate, networking and availability of physical infrastructure. Examination of the sequences of the strategies required a proper understanding about the importance of adaptation mechanisms. A proper understanding can only come from the current sequencing of the strategies. Then the current strategies can be rearranged according to the economy of that area which is subject to that particular event. This rearrangement can be done with proper consultation with the climate specialist, government officials and representatives from NGOs, community organisations and the PRI. However, these are the depiction of autonomous adaptation processes, which poor and vulnerable people generally adapt. These processes need to be complemented with and intervened at different levels (Government, NGO, Bank, etc.) along with planned adaptation processes like proper facilities of credit, insurance and benefit from crop diversification. This will enable the adaptation process to be a successful and sustainable one.

On the basis of empirical findings, the following strategies can be useful in future in order to reduce the vulnerability of the people :

(i) Rainfall in the study area is highly skewed in nature and most of the time rainwater runs off and little percolates down. This leads to poor recharge of groundwater and the water table continues to decline. Through drought-prone area programme, laying of contour bunds, wasteland development, construction of check dams and establishment of percolation ponds it is possible to arrest the run away rainwater. So watershed management is a crucial intervention that needs immediate attention in the present context of Orissa;

(ii) Effective planning mechanism should be encouraged to streamline the existing water base of the village economy;

(iii) Community based organisation initiatives like self-help group (SHG) formation should be given priority in order to tackle climate induced natural disaster vulnerability effectively;

(iv) Infrastructure development should be promoted by interlinking the villages with the market places;

(v) Insurance to be popularised through sensitising the community;

(vi) Landless people should be given utmost importance in the context of financial

support from government for sustainable reconstruction of their livelihood. The production base of the poor agricultural labour should be strengthened by the provision of surplus private and government land in order to generate resource base of these households, in the absence of which they are completely thrown into miseries;

(vii) Giving reliefs during the drought time is a short run solution to the local community and hence does not contribute substantially to the livelihood of the local community in the long run. Therefore, the focus should be at creating such livelihood assets, which would enhance the capacity of the people to cope with drought in future. Moreover, the block officials, while dispersing any agricultural inputs like seeds, fertilisers, post-reliefs etc. should monitor equity;

(viii) Traditional knowledge on coping mechanisms of the farmers is also efficient in reducing vulnerability of the people. These coping strategies should be supported by scientific and technical methods so that the losses due to climatic extreme events can be minimised to a greater extent.

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## Note

1 Adaptations undertaken by individuals/ communities can be classified as: (i) Reactive or Anticipatory; (ii) Private or Public; and (iii) Planned and Autonomous (IPCC, 2001).

2 http://www.ori.nic.in/rainfal (Assessed on 4 November 2009).

3 To measure the inconsistency of rainfall, a coefficient of variation (CV) measure has been used in the study.

4 There are various approaches to determine weights. The conventional method involves the discretion of the investigator. The investigator uses his or her judgment to determine the importance of the component variable in the composite index.

5 The defining variables selected for the study are: diversification of livelihood, distress sale, credit, migration, agriculture insurance, income level, education level, number of members in the household, active earners, membership of the local groups, and access to information. Also see Enfors and Gordon (2008).

6 Mishra (2009).

7 Annual Real Earning per person = (Number of Days * Wage Rate)/ 12.
Wage Rate : Average (women) = ₹ 40, Average (men) = ₹ 80

8 It involves neither change of place of residence nor permanent movement away from the place of birth, but a temporary change of place for the purpose of work (Prasad, 1998).

9 Corbett (1988).