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ASSESSMENT OF ECONOMIC LOSS OF LANDSLIDES DAMAGES: AN EXPERIENCE FROM THE HILLY VILLAGES OF SOUTH EASTERN KERALA

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ABSTRACT
Landslide is a natural disaster cause economic, social and environmental losses. The estimation of these losses is essential to provide the massive destructive power or of the disaster to the society. This study mainly aims at the estimation of economic losses of landslide disaster experienced by the people living in the rural areas of the Idukki district. Totally, 312 sample households were collected from the three villages of Idukki district which were hit massively by the landslide. The stratified proportionate random sampling technique were used for the selection of sample households from the three villages namely, Konnathady, Kanjikkuzhi and Rajakkad. For the estimation of the economic losses, Averting Behaviour Model (ABM) is used. The results showed that rupees 196816127.32 has accounted as the total loss met by the sample households and the average loss was 630820.92 rupees. Both the direct and the indirect losses were estimated on the basis of repair cost, costs of lost, revenue loss and the health cost finally, the total economic loss were carried out. The result of the study will be expected to use as a basis for a policy formation to reduce the impact of landslide in hilly rural villages.

1. INTRODUCTION

The district name Idukki was emerged from the word '*Idukku'* which means narrow. Idukki district is well known for tourism and the rich collection of different spices. But the alarming issue of the district is continuous natural disaster in the forms of heavy rain, wild fire, landslides and the flood. In 2018. 2019. 2020 and 2021 several landslides were damaged the major geographical portions of the Idukki district and it has gifted huge losses in the forms of socio-economic and the environment.

Landslide is one of the natural phenomena mainly transpire in the geographical areas characterised by the hilly terrains. The actual numbers of the socio-economic and the environmental impact of the landslide are very difficult to evaluate because the damages due to the landslides are instantaneously occurred with the other disaster like flood, earthquake and other meteorological events (Oddvar Kjekstad et all). It is one of the widest spread disasters in the world causing millions of deaths and damages of billions of dollars around the world (CRED). According to Lynn highland, the problems of deaths and injuries due to the landslide disaster was aggravated the mushrooming population in the vulnerable areas. Undeniably, this trend will continue in the 21st century. The vulnerability of the area is determined by the factors like social, economic and the environment. When the vulnerability conditions on these aspects increases, it led to the increase in the susceptibility of the community to the impact of the disaster (UNISDR 2004). Another alarming issue of the landslide is the population hike in the prone areas, it will increase more fatalities and the economic damages to the landslide experienced victims. One of the studies in Uganda based on mitigation of landslide risk through preventive resettlement proved that, the poorest people in the prone area are most likely to be adversely affected. The traditional methods of resettlement were failed to prevent the landslide because of the inefficiency of the long- term solution and high population density and the land shortage (Pieter Vlaminck et all).

Apart from the scientific impact of the landslides, the economic loss of the disaster is much concerned. The losses due to the house damage, loss of cultivated area, loss of vehicles, and other property losses can be headed as economic losses. In other way, the cost of landslide, the severity of the costs can be reviewed and must be compared (Juhani Alexa Horelli). Therefore, the costs derived from the landslide can be distinguished into naturally occurring landslide and the human induced landslide (Juhani Alexa Horelli). In the sense of natural causes to the landslides, it makes damages to the private and public and it makes huge loss to the owners. Another thing is that, landslide is considered as an externality when it becomes a human intervened landslide. As in the case of externality, the costs in the damages remain same. Generally, the cost due to the natural disasters can be headed into two ways, such as direct and the indirect costs. The

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damages to property, lives, replacing, repairing, and the reconstruction of the properties are measured under the direct costs. The indirect cost, otherwise the subsidiary cost, which are occurring not directly but as a subsidiary of the direct cost. Basically, the cost of repairs, cost of loss, income loss due to the loss of employment and the health cost can be identified as the major problems when considering the landslides and its impacts on the households. After the landslides, most of the houses and the shelters can be reshaped through the damages, they will be destroyed as fully and partially and cooperates with the other losses in terms of sanitation, water, livestock, agriculture and so on. In this case the role of government is an important factor to tackle the financial burden of the refugees. The government intervention in terms of resettlement policy, financial aids, self- employment programs and other mitigation activities must be carried out. The rehabilitation of the affected people is an important concern. The major challenges of successful resettlement policies are density of population, lack of land to resettlement and the shortage of financial aid.

In 2018, the Idukki district has perceived massive hit of landslide and heavy rain in the month of August. There was non-stop rain for sixty days in Idukki district made the landslide disaster more monstrous. The major losses were accounted as 6157 families were severely affected those who are resided in 25 villages. 60 people lost their life and 51 people found severely injured. More than 6000 people were homeless among them 1050 houses were fully washed out and rests were abandoned due to the heavy vulnerability. The most alarming damages were reported in the field of agriculture sector, that is 10500 hectares of land were contaminated and became useless for further sowing. The mass movement of debris and soil were completely reshaped the face of Idukki as well as the tragedy pushed the survivors into the socio-psycho and the economic dilemma. After 2018 there was numbers of landslides have been disturbing the district in 2019, 2020 and 2021.

Based on the above problems, this study tried to estimate how much the value of economic loss faced by the disaster experienced inhabitants in the Idukki district, three villages, using the Averting Behaviour Method with the help of primary data base.

2. METHODOLOGY

The research was conducted in the three villages of Idukki district, namely Konnathady, Kanjikkuzhi and Rajakkad. The selection was made on the basis of most affected villages due to the landslide in the past three years. Totally, 2086 household were affected in three villages, out of the total affected households, 312 samples were selected on the basis of multistage stratified proportionate random sampling technique. For the collection of data, the survey method was used with the help of interview schedule. The field survey for the study has taken the period of one month.

The main aim of the study is the estimation of economic loss due to the landslides in the three villages of Idukki district. The major parts of the study were divided into direct cost analysis, indirect cost analysis and finally the total economic loss estimation. The Averting Behaviour Model (ABM) was used for the estimation of these losses made by the disaster on the households.

2.1.1 Estimation of Economic Losses due to Landslides: Using Averting Behaviour Model

The value of economic loss has been calculated in Idukki district is on the basis of direct, indirect and the total economic loss. The cost of losing household appliances, repairing cost of houses and other related properties are headed in direct cost. As in the case of indirect economic loss it includes, health cost, loss of income due to the employment loss were estimated. The major methods for the calculation of the economic loss are as follows.

2.1.2 Cost of Repairs

Under the model of ABM, estimation of the repairing cost is much important. The respondents should spend huge amount of expenses as a repair cost to the reconstruction, maintenance and others to the household and the appliances. The damage to the houses and the other appliances should varied with each other. The average cost of the repairing the houses and other appliances made by the respondents can be estimated through the following equation.

$$BB = \frac{\sum_{i=1}^{n} BBi}{n}$$

BB= Average repair cost
BBi= Repair cost made by the respondent (Rp)
n= Number of respondents (Households)
i= The i-the respondent (1,2,3……. n)

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2.1.3 Cost of Lost

The cost of loss can be calculated by the loss occurred to the houses and the other appliances. the cost borne by the loss can be calculated through dividing the total cost of loss by the number of respondents who ached damages or loss to the house and other properties. The following equation can be used for estimating the cost of loss due to the landslides.

$$\boldsymbol{BK = \frac{\sum_{i=1}^{n} BKi}{n}}$$

BK= Average cost of loss
BKi= Cost of loss due to the landslide
n= Number of respondents (Households)
i = Respondent i (1,2, 3…., n)

2.1.4 Revenue Loss

The respondents have lost their income for several days, or months or years due to the landslide in the study area. Majority of the working respondents are daily earners, so the landslide hinders them very badly and it restricted the people to earn their daily wage for several days, or month or years. This can be estimated with the help of following equation (Campina Illa Prihantini).

$$\boldsymbol{HP = \frac{\sum_{i=1}^{n} PRiXBli}{n}}$$

HP= Loss of income per respondent
PRi= Daily revenue lost on the i-th respondent
LB= not working in the household
n= Number of respondents
i= The i -th respondent (1,2,3…., n)

2.1.5 Health Cost

The health cost is an important cost to the respondents. It should be in the forms of injuries and other related diseases due to the disaster. The total health cost can be calculated by the summation of, transaction cost, treatment cost and other related cost, that is

HC= trtc+ trmc+ oc

HC= Health Cost.
trtc= Transaction Cost.
trmc= Treatment Cost.
oc= Other Cost.

3. ANALYSIS AND DISCUSSION

The landslide which has made huge damage in the forms of house damage, loss of land, property loss belonging to the households. The economic loss felt by the people is tangible loss. The tangible loss can be distinguished as two heads, one is direct loss and the another is indirect loss. Through this way it is possible to calculate total economic loss met by the whole respondents of the study villages in the district. The reconstruction cost, repairing cost, purchasing of new materials, loss of income due to man days loss, health costs are as the major considerable cost faced by the respondents pre and post disaster times.

Under the direct economic loss, the cost of repairs and the cost of loss were estimated. Under the repair cost, the respondents spent the money for the reconstruction and the repair for the household, kitchen appliances, vehicles, sanitation and other properties.

The repair cost of the respondents (BB) = $\frac{48371770}{312} = 155037.72$ ----------(1)

Another component is the cost of loss from the household damage, land loss, appliances cost, and the other cost of damages. The total household damage is estimated at rupees 26881000, and the land loss is rupees 117159006, the appliances and the other property loss is estimated at rupees 4055900. So, the, cost of loss (BK) can be calculated as

The cost of loss for the respondents (BK) = $\frac{148095906}{312} = 477666.36$ ---------- (2)

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The total average direct economic loss for the respondents = BB+BK ----------(3)

$$155037.72+477666.36= 632704.08$$

The total direct economic loss in the study area = $48471770+148095906= 196467676$ rupees— (4)

3.1 The Direct Economic Loss

Tdirect economic loss experienced by the damage of the household, loss of land, repair cost and the reconstruction cost for the damaged properties. In the study region the houses were damaged in the forms of fully damaged, partially damaged and the cracks on the walls and the foundations. There are 72 households were fully damaged, 58 households were partially damaged and 118 houses were got cracked and rest of the houses were lost land instead of household damage. The damage cost was varied according to the type of damage. The total cost of the household was estimated at 26881000 rupees. In the case of land loss rupees 117159006 was estimated. Other appliances lost made damages cost of rupees 4055900, it included the loss of furniture and other kitchen appliances. The repair cost included the main items like, cost on repair on roof, wall, amount spent on kitchen items, amount spent on furniture and amount spent on the reconstruction of sanitation facilities and the water facilities. The total cost on repair and other amenities were counted as 48371770 rupees. According to the ABM model, the total cost of loss met by the whole targeted respondents was estimated as the 474666.36 rupees. In the case of repair cost the rupees 15503772 was estimated based on the model. Finally, all these costs were added and the estimated total direct economic loss was 196467676 rupees and the average of this direct cost is 632704.08 rupees.

According to this study, the indirect cost includes the loss of income due to the loss of employment due to landslide and the health cost experienced by the respondents.
The loss of income due to the loss of employment is estimated on the basis of income loss, number of not working and the total number of respondents, the total per day income loss was 90362 and the total number of not working members are 631.

Income Loss (HP)= $\frac{90362*631}{312}$ =182751.32 ----------(5)

For the estimation of total health cost transaction cost, treatment cost and the other cost were taken out.

Total Health Cost (HC)= $8500+147750+9450 = 165700$ ---------- -----(6)

Total Indirect Cost= HP+HC ----------(7)

$$182751.32+165700= 348451.32$$

3.2 The Indirect Economic Loss

The indirect cost, otherwise the subsidiary cost, which are occurring not directly but as a subsidiary of the direct cost. The study mainly dealt with the factors such as loss of income due to the landslide and the cost of health met by the respondents. For that, the number of not working class have found out that was 631. The total loss of income experienced by the targeted group is rupees 182751.32. Almost all the respondents were lost their job during the time of flood. An average of 585.74 rupees per day they lost during the time of landslide disaster. In the case of health cost, it included transaction cost, treatment cost and other cost. totally 33 respondents were injured due to the disaster. According to the data, the estimated health cost were 165700 rupees. The average amount was 5021.21 for 33 respondents. All others are moved to safer place or government camps because of the early warning signs of the landslides. The total estimated indirect loss in the study area comprising the income loss and the health cost is 348451.32 rupees.

3.3. Total Economic Loss

The total economic losses experienced by the respondents are the structural losses of the houses such as roof, wall, loss of sanitation facilities, loss of water facilities and so on. The respondents were spent certain amount for the reconstruction and the repair of their property. The respondents were brought back their properties by spending a considerable amount. The total loss of income by loss of employment and the health cost were also affected and made more intensity to the total loss of the study villages. The total loss is estimated as rupees 196816127.32 and the average loss of 312 households are 630820.92. That should be include the total loss from tangible losses, both

the direct and the indirect loss met by the households in the three study villages of the Idukki district such as Kanjikkuzhi, Konnathady and Rajakkad.

Economic loss faced by the respondents in Idukki landslide villages

No	Major Economic Losses experienced by the respondents	Amount (INR)
1.	Structural Loss	48371770
2.	Household Damage	26881000
3.	Land loss	117159006
4.	Appliances Loss Damage	4055900
5.	Total Income loss	182751.32
6.	Health Cost	165700
	Total Loss in Idukki villages	196816127.32
	Number of Households	312
	Average Economic Loss met by the households	630820.92

Primary Data 2021

CONCLUSION

The study can be concluded that, the economic loss of the study villages is calculated on the basis of direct and indirect loss faced by the inhabitants in the landslide area. The total estimated value of economic loss met by the people is 196816127.32rupees. The average loss is 630820.92rupees. The major suggestions are to be raised through this study is effective government resettlement policies. The resettlement should be in the forms of new house in the non -landslide prone area, financial assistance and land assistance, self -employment programme for job losers, adoption of insurance scheme regarding the natural disasters and so on. The major threat for the effective resettlement is the population density and the lack of land for rehabilitation of the people. The climate change in Kerala has made more stress on the landslide and other geological events as well as the un predictable heavy rain made the activity speedier. The economic loss mainly bourn by the direct impact of the disaster, the indirect costs have many times not estimated and not given much importance. The total economic loss only be carried out through the estimation of both the direct and the indirect loss. The local authorities of the areas should make more concern on the impacts of the landslides and provide more importance to the people those who are living in the prone areas. Finally, it is very important to reduce the impact of landslide. The recommendations made by the relevant studies can only be done with the strong co -operation of the government authorities.

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