

## Exploring Post Disaster Scenario in a community frequently affected by landslide using PRA Technique: A case study of Batali Hill community, Chattogram city

Irfat Kabir\*  
Sirazum Munira\*  
Joynta Das\*  
Md. Momin Ali\*  
Shaif Md. Mahfuz\*  
Debasish Roy Raja\*\*  
Tandra Das\*\*\*

### Abstract

The occurrences of the landslide at the Chattogram City Corporation Area is usual than other cities for excessive rainfall & hill cutting. The study aims to understand the post-disaster scenario due to landslide in Batali Hill community using PRA tools concerning community response of handling the difficulties. The study area Batali Hill has been chosen based on historical events & losses for being illiterate & poor respondents on that community; the Participatory Rural Appraisal techniques have been adopted to collect field data by emphasizing community capacities & effects of the landslide. To assess the situation of the community after the disaster the positive as well as the negative impacts are determined & also the extent of losses due to landslide has been determined. On the contrary, the external spatial opportunity to build strength against the disaster to influence the recovery level of the community can be determined. The losses of property, lives, injured, & other scarcities on the different seasons have been emphasized here with the role of government & non-government contribution. The broader issues in the context of all over the country have been discussed critically & the suggested strategies with impacts were based in local contexts to reduce the losses & increase community sustainability, which is not always suitable for a broader range.

**Keywords:** Hill-cutting, Landslide, Precipitation, Participatory Rural Appraisal, Vulnerable

### Introduction

As a developing country, Bangladesh is associated with several issues like overpopulation, poverty, low-level industrial base, resources, and, therefore, the lack of adequate institutional infrastructure and the absence of trained personnel (Barua et al., 2016:1895). The geographical and meteorological characteristics of this country are forced to face Geo additionally as hydro-meteorological hazards (M. H. Rahman & Rahman, 2017:139). From the last few decades, there are flood, cyclone & other several disasters occurred (Jakobsen et al., 2006), the landslide is one of them.

Proag (2014:369) states that the term 'Disaster' uses in contrasting manners, generally to insinuate any unexpected, abrupt or momentous misfortune, paying little regard to the

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\* Under graduate student, Department of Urban and Regional Planning, CUET

\*\* Assistant Professor, Department of Urban and Regional Planning, CUET

number of people, the size of the region, or country, or the entire world. Cartogram is the largest port & the second biggest city of Bangladesh with a contribution to the economic & trade sectors (M. S. Rahman et al., 2016:21). As for the special geographic condition & hilly terrain, a landslide occurs due to different events with enormous losses.

In this study, 'Landslide' refers to the mass movement of earth to downslope from the summit of the hill below the gravity effect. Though it happens naturally, the repeated environmental factors as excessive rainfall, earthquake, slope instability triggered that phenomenon happened frequently (Ahmed & Kelman, 2018:04). 18% of land in Bangladesh is hilly areas, primarily located in the Chattogram division faces the threat of frequent landslides, which makes the huge property & live loss (Ferdous et al., 2017:02). In the highly urbanized hilly area, this phenomenon occurs extremely for excessive heavy rainfall in a short period (Ahmed, 2015:1077).

In this article, human activity denotes the term 'Hill Cutting' which induces to increase the frequency of landslide. The unplanned hill cutting for housing & residential purposes induced the city to lost its hills with an imbalanced manner of the environment, which is now a significant threat of the environment (Chisty, 2014:02). Almost 36% of the landslides in urbanized hilly areas occurred directly or indirectly because of the performance of hill cutting (Mia et al., 2016:01). The Chattogram development Authorities marked 30 hilly areas as the risky high zone of the landslide (Ahmed, 2018:02).

Batali hill, owned by Bangladesh Railway, Public Works Department, and Chattogram Water Supply and Sewerage Authority, is one of the most vulnerable areas in Chattogram there with several landslide incidents occur among different phase of time. Almost 800 peoples live in the Batali hill area and are forced to evict the place during the monsoon to prevent losses like before (The Daily Star, 2013). Almost seventeen people died by collapsing the wall at Batali hill in the year of 2011 (Islam et al., 2014:918). In the hilly area, hill cutting is the major issue of landslide with the triggering factor of heavy precipitation records (Ahmed et al., 2015:39). The average hill slope is almost 69.2% (HOSSAIN, 2012:95).

Most of the inhabitation are poor (57%) & the major of them are day laborers as well as illiterate (49%) (Mia et al., 2016:1). For the scope of various facilities & locational advantage of accessibility, people gathered here in an unhygienic way.

The Participatory rural appraisal is one of the techniques which determines the opinions, facilities & words of stakeholders as well as useful for them whose are illiterate & disadvantaged group. For this study, this method is much more relevant to express suitable results (Cavestro, 2003:03). The key issue of this literature is to define the livelihood conditions of the community after the hazardous events & how they can recover their losses by adopting strategies. As of being a qualitative approach, there are some limitations to the collection & lacking quantitative data in a limited time.

### **Aim and Objectives**

The study aims to understand the post-disaster scenario due to landslide in the Batali Hill community using PRA tools. Two objectives are selected to fulfill the aim. The first objective of this study is to assess the effects of landslide in Batali Hill community. The second objective is to evaluate the institutional participation after landslide in Batali Hill.

### The Rationale for Selecting the Study Area

Batali Hill area is selected as the study area. The hill is located in Chattogram near the tiger pass cross and 1 km away from the city. It one of the highest hills in Chattogram and about 280 feet high. The total population of this area is around 13000 (Reduction & Kingdom, 2016:09). From August 2005 to July 2015, Batali Hill area was affected by a landslide several times. A road, named Ambagan road has crossed at the north-west side of the area. Tiger pass railway colony is also situated on that side. 14 number Lalkhan Bazar ward is situated in the south part of the selected area.

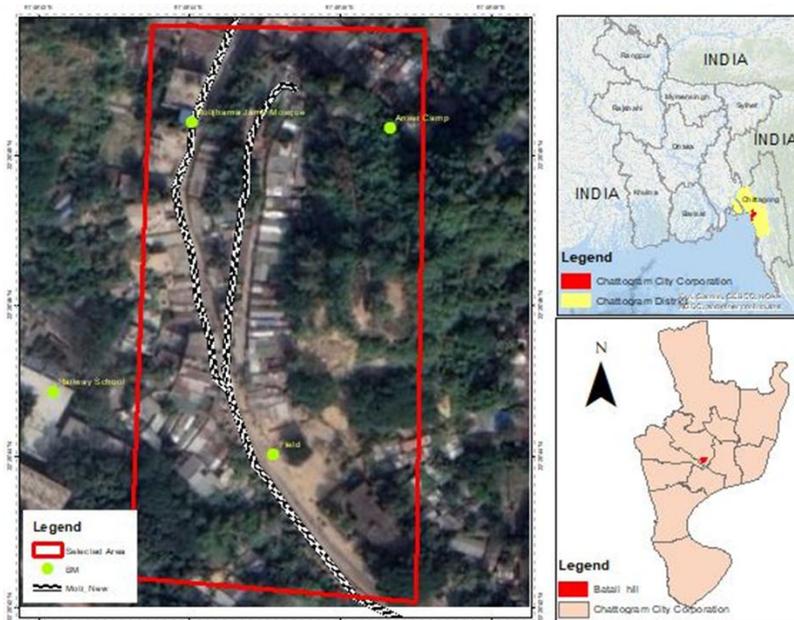


Figure 1: Location map Of the study area(Batali Hill); Source: Prepared by the Author

### Data & Methodology

This study considered the existing social, economic, institutional, and communal aspects of the landslide hazard zone Batali Hill area to understand the present condition and their response. To understand the study Participatory Rural Appraisal (PRA) is applied. Participatory Rural Appraisal (PRA) is a set of participatory and largely visual techniques for assessing group and community resources, identifying and prioritizing problems, and appraising strategies for solving them. It is a growing combination of approaches and methods that enable rural people to share, enhance, and analyses their knowledge of life and conditions, to plan and act to monitor and evaluate. To evaluate the cause and effect of the landslide, the cause-effect diagram and the impact diagram are also used. Livelihood analysis and the seasonal diagram is used to determine the economic condition of the area. The severity of losses is also calculated in this study. The procedure of all PRA field surveys have been done according to the (Panda, 2019:03)and the justification of each PRA tools using in this research are briefly explained in the following.

First, the participants were asked to draw social, resource & service-opportunity maps. Social map seeks to explore the spatial dimensions of people's realities and reflects their perception of the social dimension of their reality with a high degree of authenticity in

developing a broad understanding of the various factors of social and physical aspects. This method also collects demographic and other required data such as age, gender, family member, ethnicity, housing patterns, community facilities, important buildings, etc. Resource map helps to get information about local people's perception of resources (Cavestro, 2003:03). In this study, the resource map covers geology, territory, slope, soil quality, forest & vegetation. Service and opportunity map explores the real reflection factors of native individuals with specific reference to the native people's perceptions of the present services and opportunities(Cavestro, 2003:03).

In the next phase, those participants have marked their losses according to the timeline by covering impact diagram, livelihood analysis, seasonal diagram & trend analysis. Impact Diagram is used to evaluate both the positive and negative impact of an incident associated with the results of an incident as experienced directly and indirectly by the locality (Kariuki & Njuki, 2013:93). The livelihood pattern and its modification are often evaluated and delineate by livelihood analysis. It focuses on the financial gain, expenditure, food consumption, occupation, and employment connected issue stock, as well as focuses on the modification in keep pattern because of economic change as a result of a landslide. The seasonal diagram is one in every of the foremost vital analysis used for temporal analysis across annual cycles with months or seasons as a basic unit of study. This study uses a seasonal diagram to know the livelihood patterns, economic opportunities, and people's cope mechanisms during completely different seasons. Trend analysis captures changes and trends concerning certain variables over different spans of your time. Severity matrix may be a variety of trend analysis accustomed to outline the severity of n accident over an amount of your time in a specific locality. During this study, the severity matrix helps to determine the severe scenario and significant losses. After those two-phase, the institutional aspects & contributions are made by the Spider diagram & Venn diagram. The spider diagram is also called a cobweb diagram, a participation wheel, or an evaluation wheel. It is a highly visual method of realizing the relative importance of process on different aspects of an intervention (Singh et al., 2017:1931).To determine the performance of the individual/household and its range of dimensions, a spider diagram is used in this study.

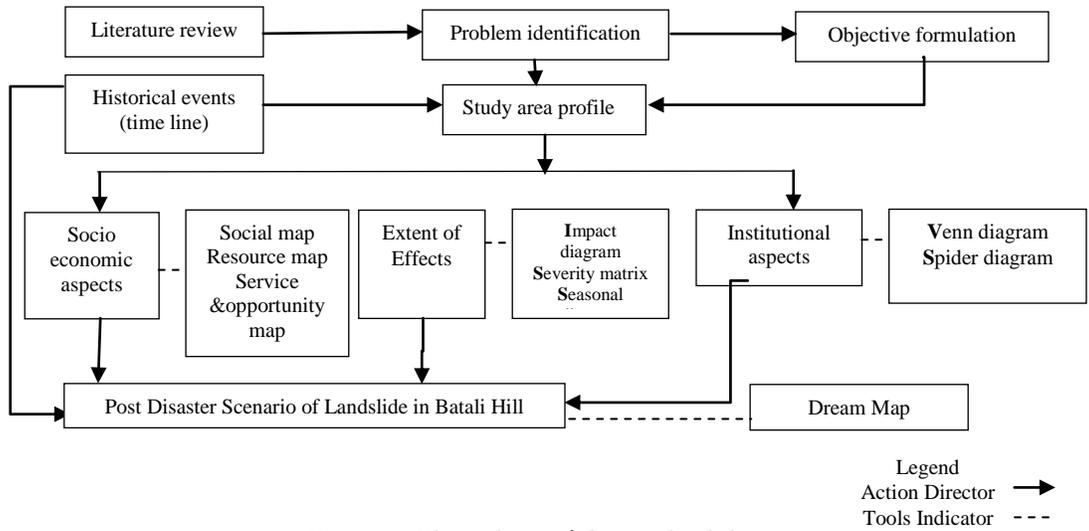


Figure 2: Flow chart of the methodology

The institutions, organizations, groups, and important individual organizations are figured out by the Venn diagram. It also indicates how close the contact and corporation between the individual and the group (Cavestro, 2003:03). At the final stage, with the help of the eldest & sensible group of the community, the dream map was made. Snake & Ladder Diagram (Dream map) can help to show the aspirations, dreams & feelings of deprivation as well as the perspectives of the local people about their developments. The snake & ladder exercise help to overcome the difficulties which derive the map more realistic than their dream concerning their securities, vulnerabilities, risks & opportunities.

## Results & Discussion

### Existing Scenario of Batali Hill

The landslide has occurred several times in Batali Hill area (Table no.1). After the occurrence of landslide in 2008, a retaining wall was built by Care Bangladesh (a leading NGO of Bangladesh) & Chattogram City Corporation with the financial assistance of USAID and govt. of Bangladesh. But in 2011 that wall was broken due to a severe landslide, and after this incident, ANSAR & Village defense party were deployed to ensure safety. After the landslide happened in 2013, people were said to move to a safer zone. Generally, people of Batali Hill area used to migrate to the Ambagan area during monsoon. Rehabilitation program for vulnerable people has taken in 2019 by the decision of the Divisional Commissioner after the landslide occurred in 2018 where 6 people were killed.

Table 1: Historical observation of Batali Hill Area (2007-2018)

Date	Major incidents	Remarks
10 September 2007	2 people died, 100 injured, around 30 households damaged	Bangladesh President with local administration got touched with ongoing development projects and govt approved 9 lakhs to assist the victim.
18 August 2008	11 people died, 25 injured, and around 20 households damaged	The building of retaining wall by Care Bangladesh and Chattogram City Corporation
01 July 2011	17 people died, 40 injured, around 20 households damaged	The retaining wall collapsed and the ANSAR & Village defense party were posted
26 June 2012	9 people died, 20 injured, and around 15 households damaged	An international conference was held for the enhancement of future disaster mitigation capacity
28 July 2013	2 people died, 10 injured, and around 5 households damaged	People living in vulnerable places were replaced in a safer zone
19 July 2015	6 people died, 20 injured, and around 50 households damaged	Initiatives are taken for replacing vulnerable people to a safer zone and started to build a retaining wall again.
July 2018	Around 50 households damaged	A rehabilitation program has taken by the decision of the Divisional Commissioner

Source: PRA Survey, 2020

To determine the spatial aspects of the selected area, 45 households are surveyed and their demographic information has been collected. Most of the houses are semi-pucca (roofs are made of tin).

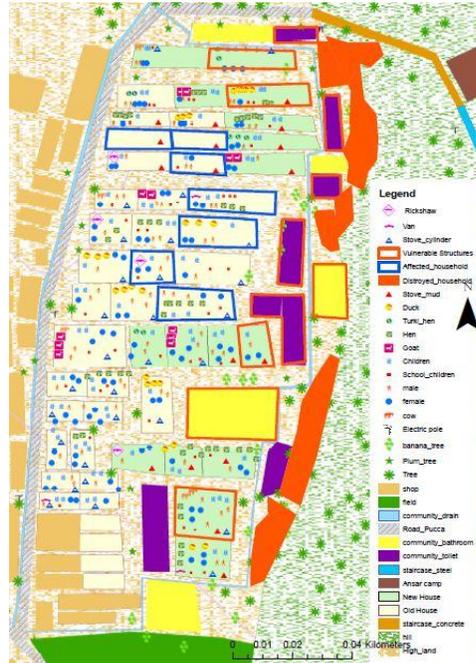


Figure 3: Social & Resource map Of the community ; Source: PRA Survey, 2020

About 55% of people have their livestock resources like a duck, turkey hen, cow, goat, etc. this livestock also plays a vital role in supporting their economy. In the selected boundary, there are 8 community toilets. Katcha, pucca and semi-pucca roads are seen in this area. Different types of shops are built in that area for community development. 5 community bathrooms are built to minimize the scarcity of bathrooms. Households use stoves, both made of cylinder and mud. About 65% of households use stoves made of mud. The hilly area is situated in the right portion of the selected community. There are concrete & Katcha road & ramp.

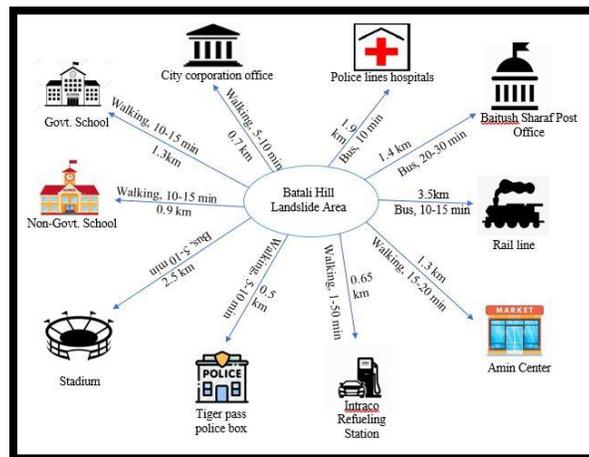
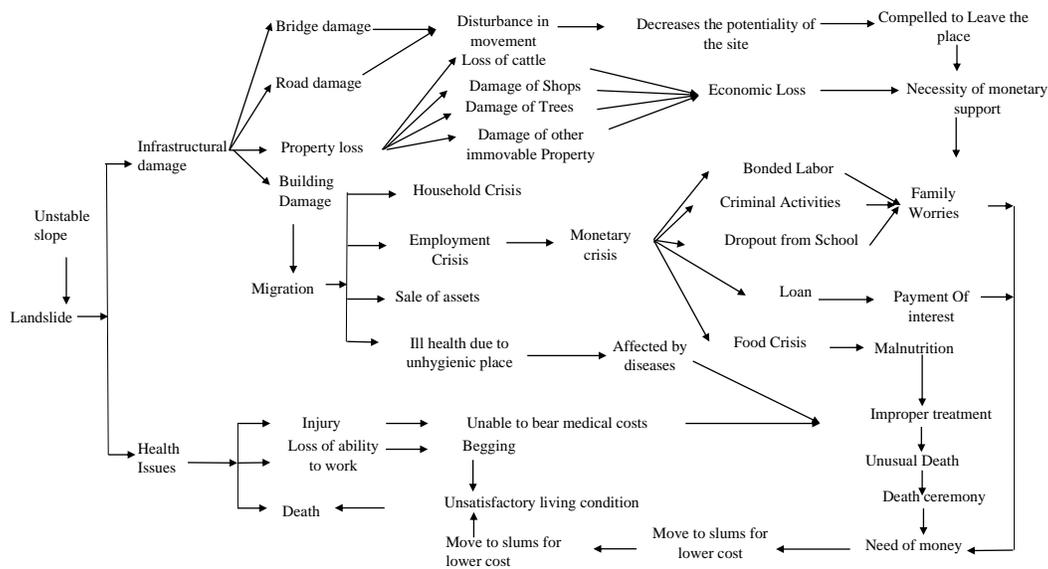


Figure 4: Service & opportunity map of the Batali Hill; Source: PRA Survey, 2020

Forgoing hospitals, rail lines, and stadium, buses are used as they have a longer distance from Batali Hill. Tiger pass Police Station is also near to the area (0.5km, required time 5-10 minutes). Residents of the Batali Hill area used to travel different nearby spots mostly by walking. From the Tiger pass Circle and Lalkhan Bazar Circle, public transport services are available. Governmental and non-governmental, both schools are situated within walking distance. The distance of schools is situated within the radius from 0.9 km to 1.3 km and residents go to the schools by waking. Chattogram City Corporation's office is situated at a distance of 0.7km and it requires around 5 to 10 minutes by walking. A market, named Ameen Center is located in the Lalkhan Bazar Circle; it is 1.3 km away from the selected area and takes 15-29 minutes by walking.



Source: PRA Survey, 2020

Figure 5: Impact Diagram Of Landslide

**The Extent of Landslide Effect**

To understand the present scenario of the affected community, this diagram shows the direct & indirect triggered factors & the interlinkages between those factors & the effects. The impact diagram discriminates the impacts of the landslide in the day to day life of the affected community. This diagram shows the major impacts, both intended & unintended, which induced to change the life pattern positively or negatively. The community of Batali hill people determines that the impacts severely occur on the economy & health, which causes the monetary losses, physical damages of infrastructure, death & loss of ability through the impact diagram. Those major effects induced to switch jobs, migrate in new places & involve in the criminal activities to earn their daily needs of livelihoods. The final destination of the diagram ensures the necessity of adequate money to maintain the demands, which further introduced other activities. At the end of the day, those impacts show the unstable and negative effects in their day to day life

The people of that area are forced to migrate before the peak period of landslide for safer grounds from the year 2013. Most of the peoples of that community are day laborers & garments workers so the affected community shifted temporarily to adjacent suitable low-income dwelling sites to reside. They move from the foot of the hill to Motijharna slum, Amabagan slum, Pora colony & other low-income housing areas near Batali Hill or Tiger pass for residence. The rest of the affected people sheltered in Sahidnagar City Corporation Primary School. Around 47% are moved to Ambagan for three to four months to escape from the government's force.

Table 2: The destination of temporary migration of people

Before migration	Place of Migration	Duration	Causes	Percentage
Batali Hill	Motijharna Slum (south)	May-August	Housing due to eviction for landslide	9%
Batali Hill	Ambagan slum	May-August	Housing due to eviction for landslide	47%
Batali Hill	Sahid Nagar City Corporation School	May-August	Shelter Center	27%
Batali Hill	Tankir pahar lane	May-August	Housing due to eviction for landslide	4%
Batali Hill	Pora colony	May-August	Housing due to eviction for landslide	2%
Batali Hill	Tiger pass low-income housing	May-August	Housing due to eviction for landslide	11%

Source: PRA Survey, 2020

Seasonal diagrams show the economic opportunities & the coping mechanism of the community in cases of different seasons. The resource map especially indicates the spatial information of the community; on the other hand, the seasonal diagram is responsible for describing the temporal dimension & information of the community based on seasons (Table 3). On the parts of food shortage, there is less of a shortage in the winter and summer season. Since at monsoon, those individuals need to move from to more secure grounds by the arrangement of government exercises. On that premise, individuals need to confront different troubles on food shortage, lack of business, financial misfortunes, and harms of homes. For the unsatisfactory, lower natural nature of homes to dwell spreads numerous sicknesses, which additionally increments on that stormy season. The alleviation items during that period aren't built the food request. Although the reliefs are provided from the government, the food shortage is additionally maintained within the next season as they're not enough for the community. Another impact of the landslide is the lack of employment. Throughout the season, the percent is higher due to landslides.

Table 3 Seasonal Diagram of the affected community

Aspects	Season	December-March (Winter)	March-May (Summer)	May-August (Rainy)	August-November (Autumn)
Food scarcity		0	0	4	3
Lack of employment		0	2	5	2
Diseases emerge		4	1	5	4
Loss of assets (trees, livestock resources, cattle or others monetary assets)		0	2	5	1
Sale of assets		0	0	5	2
Agricultural damage		2	2	4	0
Economic loss		2	2	4	3
Damaged houses		0	1	5	1

\*Note: Scale of 0-5, with 5 = highest impact, 0 = null (Participants : zobbar, Marium, Shefali)

Source: PRA Survey, 2020

As a result of the decline employed within the season and therefore, the amount of landslide, the financial gain level of individuals affected. The range of diseases will increase in winter precipitation and therefore the fall season thanks to lack of facilities. A landslide caused severe loss of qualities, and asset sales are higher within the season. Harm to agriculture is additionally seen within the season principally as a landslide happens particularly throughout the rainy season. Homes broken in rains in the main as a result of the landslide, the economic loss is larger at that point. In the rainy season, the large amount of expenditure occupied under the household shifting & moving to other places from their original places. The PRA based exercise trend analysis depicts the temporal dimensions that concentrate on changes with certain variables in numerous periods. From that analysis, the changes in variables with completely different aspects because of landslide are represented, which give an honest idea of the changes in their lives. The landslide severity matrix is that the table of the extent that depicts the dimension of the landslide in numerous years. This analysis shows the qualitative changes in the et of impacts during a quantitative way. The historical landslide severity matrix shows the results of landslide effects besides the difficulties & insufficiency of their day to day lifestyle during a quantitative view.

To identify an extent of the impact that historical landslide severity matrix depicts the difficulties & losses by scoring from zero and five, with five representing a high impact and zero representing no impact

Table 4: Historical landslide severity matrix

Aspects	Years	2018	2015	2013	2012	2011	2007
Migration		5	5	5	4	2	1
Lack of food		3	3	3	4	3	4
Damage households		3	3	3	5	4	3
Scarcity of water		4	4	3	4	3	2
Fatalities		0	3	1	4	3	3
Injury		1	3	2	4	4	3
Lack of employment		3	2	2	3	3	3
Economic loss		3	4	3	5	3	4
Loss of cattle		3	3	3	4	4	3
Loss of trees		3	2	2	4	2	2
Compelled sale of livestock		4	4	4	3	1	1

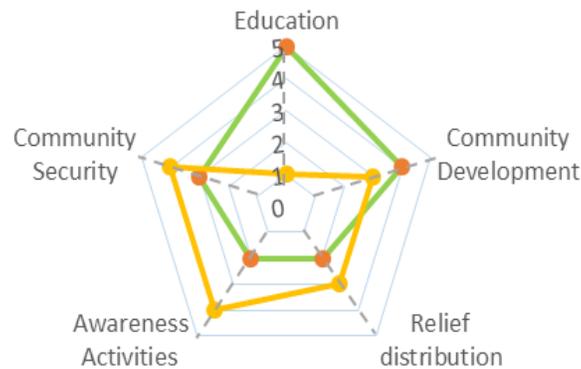
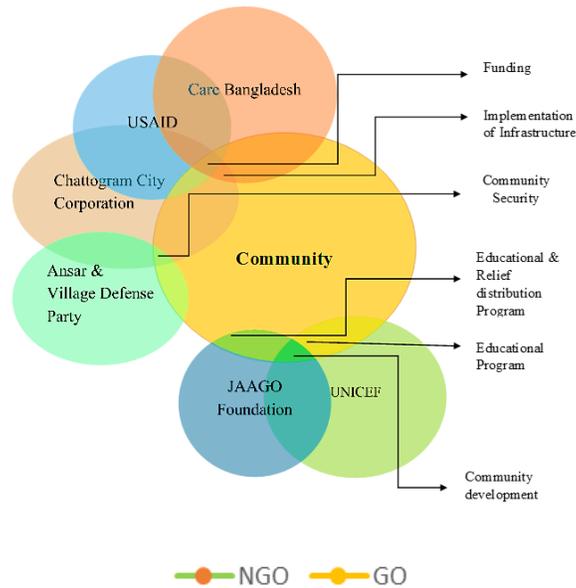
\*Note: Scale of 0-5, with 5 = highest impact, 0 = null (Participants : zobbar, Marium, Shefali),

Source: PRA Survey, 2020

Migration was highest in several years as numerous houses got broken because of a landslide in Batali hill space. Food inadequacy is often a typical issue throughout landslide in each year. Destruction dwellings were extreme in 2012 and still now affected family isn't able to reconstruct the homes. Throughout landslide and because of hilly space, the inadequacy of water remained in whenever. There was no death rate in 2018 attributable to increasing awareness among the community and shifted them to a safer place. As a result of the landslide, there was a loss of cattle and trees that results in an economic loss of the community each year. In some cases of loss of life, families had to migrate to another place because the main income person was a victim of the incident.

#### **Institutional Aspects**

The spider diagram is that the graph that portrays the network through a visual procedure of PRA primarily based exercises. This diagram shows the relative performance of the cluster or community & visualizes the performance of an acting cluster. During this diagram, there are 2 acting parties; they're non-government organizations & the opposite is government organizations. Those 2 acting groups have a contribution to 5 distinct areas they're an educational program, community security, awareness activities & relief distribution. The extent of performance is scoring from zero and 5, with 5 representing a high contribution and 0 representing no contribution



Source: PRA Survey, 2020

Figure 6: Influence of different NGO and GO institution presented in spider diagram ;

In Educational programs, there are mainly two non-government organizations are JAAGO Foundation School & UCEP School. Both two are taking part in a vital role within the program additionally as they supply the relief at the extreme period of the landslide. They additionally facilitate the community poor by providing monetary support from the school funds. On the opposite hand, there is a government primary school that doesn't play a vital role in financial compensation or support to the community that the explanation for those government faculty has lacked behind. This Shahid Nagar city Corporation school is acting as a shelter center. There are government subsidies provided at the community level. There are several precautionary activities adopted. The city corporation authority imposes power, promotes the announcement activities & compelled those people to leave that place at monsoon with partial

compensation. The Ansar activate their power to rescue them safely to the shelter center at extreme situations. In the monsoon, they also provided with some dry foods at the shelter center with medicines, oral saline & after landslide reliefs.

### **Community Development**

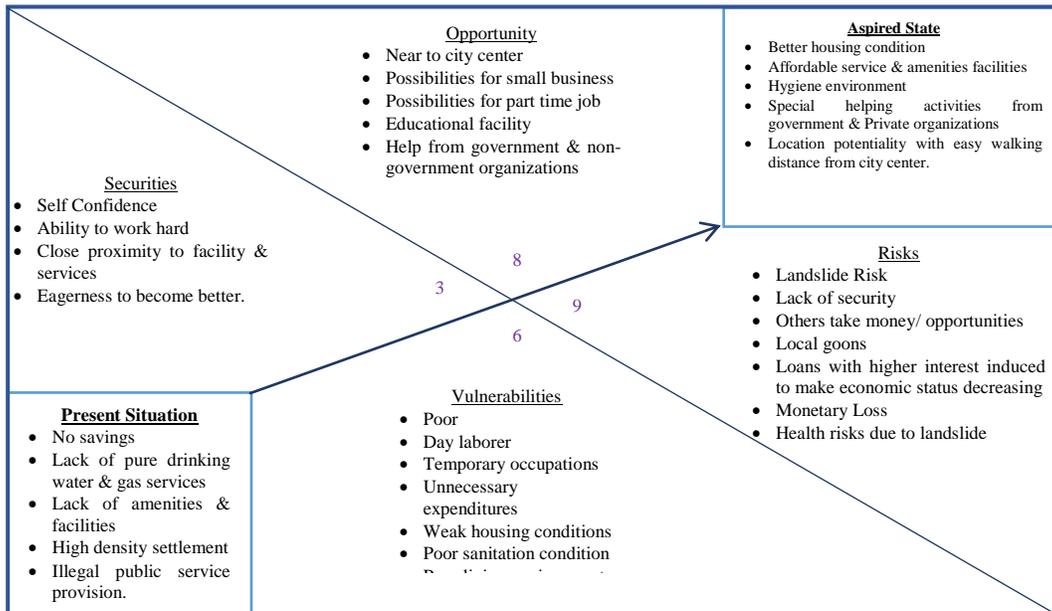
There is a development of road, retaining wall, drain & sanitary latrine additionally supplied with the

joint contribution of govt & non-government organizations. The waste disposal programs are additionally provided thereby the city corporation Authority. In the case of the institutional aspects, the many involvements of various institutions define the external adaptive capability & coping mechanism of the community. The Care Bangladesh, USAID & City Corporation authority jointly provided funding for infrastructural development. To ensure community security the Ansar & City corporation authority has implemented their eviction program. The JAAGO Foundation & UNICEF provided educational program as well as relief program to the community after the landslide

### **Recommendation**

shows the expectations, aspirations, feelings & desires of the affected community. The snake & ladder diagram is used to beat challenges and convey the needs into the real world. From figure 6, it's been denoted that the risks & vulnerability are higher than the security & opportunity of that community. So, the program is badly required for that community. There are several suggestions for that place anywhere the recovery program can happen foreseeable with potential requests of that community.

- Most of the peoples are low income therein community. This community is badly need of rehabilitation programs for better housing condition. These folks are affected by diseases due to unhealthy & congested living conditions. therefore a minimum of housing with an isolated room & toilet.
- The rehabilitation program won't be succeeded if the new area is not as much benefitted to service like before.
- In 2019 the divisional commissioner of Chattogram determined to relocate them however this announcement hasn't indicated its exercises. If the circumstance is will be regarding the matter of the lion's share's working separation then it'll be helpful.
- Most of the individuals of that community are pretty much poor so that they can't support their daily water, sanitation & infrastructural services with a higher value. This rehabilitation program can't work with higher service prices. the right service facilities in reasonable value of that community ought to be ensured.
- The action of government organizations should be strict to compelled them to leave the hillside & those land should be replanted with trees after launching a rehabilitation program. On the other hand, the non-government & other community development organizations have distributed many relief programs of that community during monsoon. The development programs for that community at a new location should be ensured & the access of different non-government organizations should be ensured for that community.
- The housing type should be relating to their income level & their preference.



Source: PRA Survey, 2020

Figure 7: Dream Map With Snake & Ladder Diagram

### Conclusion

Landslide is a very common hazard in Bangladesh, especially in Chattogram. Landslide vulnerability has become an important issue for people living in the hilly areas of Chattogram. Illegal hill cutting, deforestation, soil compaction, etc. are the main reasons for landslide in this area. The landslide has a long-term impact on the lifestyles of the people living in the area. This study identifies the effects on a landslide in the Batali hill area, and it also explores community response capacity after a disaster (Mia et al., 2016:03). Different governmental and non-governmental organizations are working to develop the community facilities of landslide affected areas. Minimization of hill cutting, afforestation, resettlement of affected people can be the possible recommendations to prevent landslide and to mitigate losses due to landslide

### References

- Ahmed, B. (2015). Landslide susceptibility mapping using multi-criteria evaluation techniques in Chittagong Metropolitan Area, Bangladesh. *Landslides*, Vol. 12(6), pp.1077–1095.
- Ahmed, B. (2018). Vulnerability and Resilience to Socio-Natural Hazards: Applying Community-based Participatory Techniques. *Building Resilient Communities: Land Use Change, Rural Development and Adaptation to Climate Consequences*, pp.1–35.
- Ahmed, B., & Kelman, I. (2018). Measuring Community Vulnerability to Environmental Hazards: A Method for Combining Quantitative and Qualitative Data. *Natural Hazards Review*, Vol. 19(3), pp. 1-28.
- Ahmed, B., Rahman, M. S., Rahman, S., Huq, F. F., & Ara, S. (2015). *Landslide Inventory Report of Chittagong Metropolitan Area, Bangladesh* (Issue August), pp. 39.

- Barua, U., Akhter, M. S., & Ansary, M. A. (2016). District-wise multi-hazard zoning of Bangladesh. *Natural Hazards*, Vol. 82(3), pp. 1895–1918.
- Cavestro, L. (2003). PRA-Participatory Rural Appraisal Concepts Methodologies and Techniques. *PRA-Participatory Rural Appraisal Concepts Methodologies and Techniques*, Vol.4(October), pp. 01–07.
- Chisty, K. U. (2014). Landslide in Chittagong City: A Perspective on Hill Cutting. *Journal of Bangladesh Institute of Planners*, Vol. 7(December), pp. 1–17.
- Ferdous, L., Kafy, A., Roy, S., & Chakma, R. (2017). An analysis of Causes , Impacts and Vulnerability Assessment for Landslides Risk in Rangamati District , Bangladesh. *Proceedings, International Conference on Disaster Risk Mitigation*, Vol. 23-24 September, pp. 2–6.
- HOSSAIN, M. I. (2012). HILL CUTTING AND ENVIRONMENTAL CONSEQUENCES IN CHITTAGONG CITY, BANGLADESH. *LAP LAMBERT Academic Publishing*, pp. 1–121.
- Islam, S., Hosain, M., Islam, M. S., Hoque, F., Ahmed, A. S. D., & Karim, S. U. (2014). Landslide problem in Lalkhan Bazar Area of the Chittagong city, Bangladesh. *International Journal of Scientific & Engineering Research*, December-2014, Vol. 5(12), pp. 918–927.
- Jakobsen, F., Azam, M. H., Ahmed, M. M. Z., & Mahboob-ul-Kabir, M. (2006). Cyclone storm surge levels along the Bangladeshi coastline in 1876 and 1960-2000. *Coastal Engineering Journal*, Vol. 48(3), pp. 295–307.
- Kariuki, J., & Njuki, J. (2013). Utilisation des diagrammes d'impact participatives pour évaluer un projet de développement communautaire au Kenya. *Development in Practice*, Vol. 23(1), pp. 90–106.
- Mia, M., Sultana, N., & Paul, A. (2016). Studies on the Causes, Impacts and Mitigation Strategies of Landslide in Chittagong city, Bangladesh. *Journal of Environmental Science and Natural Resources*, Vol. 8(2), pp. 1–5.
- Panda, C. K. (2019). *PRACTICING PARTICIPATORY RURAL APPRAISAL-An Comprehensive Approach for Learning from the People Introduction*. January, pp. 1–18.
- Proag, V. (2014). The Concept of Vulnerability and Resilience. *Procedia Economics and Finance*, Vol. 18(September), pp. 369–376.
- Rahman, M. H., & Rahman, M. M. (2017). *Disasters in Bangladesh : Mitigation and Management*. Vol. 4(1), pp. 139–163.
- Rahman, M. S., Ahmed, B., Huq, F. F., Rahman, S., & Al-Hussaini, T. M. (2016). Landslide Inventory in an Urban Setting in the Context of Chittagong Metropolitan Area, Bangladesh. *Proceedings of 3rd International Conference on Advances in Civil Engineering*, 21-23 December, 21–23.
- Reduction, D., & Kingdom, U. (2016). Developing Dynamic Web-GIS based the Risks in Chittagong Metropolitan Area , From Landslide Hazard Assessment to Early Warning System : A Case Study of Chittagong Metropolitan Area , Bangladesh. *2nd Annual Gobeshona Conference 2016*, pp. 1–33.
- Singh, G., Kumar, V., Sharma, K. R., Singh, A., Buttar, T. S., Gupta, R. K., Mir, G., & Kumar, A. (2017). Participatory Rural Appraisal (PRA) Approach for Watershed Management in India: A review. *International Journal of Current Microbiology and Applied Sciences*, Vol. 6(7), pp. 1924–1940.
- The Daily Star. (2013). *Ctg hill slope residents directed to move to safer grounds | The Daily Star*. <https://www.thedailystar.net/news/ctg-hill-slope-residents-directed-to-move-to-safer-grounds>