Developing Dynamic Web-GIS based Early Warning System for the Communities at Landslide Risks in Chittagong Metropolitan Area, Bangladesh

Social Survey Report

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ABSTRACT

Landslides are one of the most significant natural damaging disasters in hilly areas. Chittagong Metropolitan Area (CMA), the second largest city of Bangladesh, is vulnerable to landslide hazard with an increasing trend of frequency and damage. Devastating landslides have hit CMA repeatedly in recent years. In CMA area, landslide events occurred at a much higher rainfall amount compared to the monthly average. Moreover, rapid urbanization, increased population density, improper land-use, cutting of hills, indiscriminate deforestation and agricultural practices are aggravating the landslide vulnerability in CMA. Against this backdrop, it is essential to develop an early-warning system for the hilly communities in CMA incorporating local knowledge. In this connection, this survey report is prepared to know the study areas well.

This report shows the physical and socio-economic condition of the inhabitants of four study areas vulnerable to landslide namely Moti Jharna, Batali Hill, Golpahar and Goachibagan Medical Hill of CMA. At first, a total of 590 respondents were interviewed to study their socio-economic condition, physical aspects and landslide management. Then a community survey was conducted using Participatory Rural Appraisal (PRA) tools in the four communities. Lastly, eight experts in Chittagong Metropolitan Area (CMA) were interviewed to know their opinion about managing landslide disaster.

A stakeholder meeting was arranged with the help of Chittagong Development Authority (CDA) where the representatives of ICIMOD, the project team and the authority of CDA participated. Different suggestions and opinion on different issues were given through a lively discussion among the participants.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Landslides are one of the most significant natural damaging disasters in hilly environments. Every year landslide occurs in the port city of Chittagong in south-eastern part of Bangladesh. Heavy rainfall during monsoon season causes single and multiple landslides that destroy the houses as well as lives of slum dwellers around the hilly areas. Landslide causes damage to properties, death to people and collapse social life. One of the main purposes of this project is to analyze the social vulnerability of landslide in Chittagong Metropolitan Area.

Vulnerability defines which populations or areas are more likely than others to suffer negative consequences of climate-related phenomena. Vulnerability not only involves physical factors but also socioeconomic factors that affect community resilience (Juntunen, 2005). Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. Studies have shown that in disaster events the socially vulnerable are more likely to be adversely affected, i.e. they are less likely to recover and more likely to die. Effectively addressing social vulnerability decreases both human suffering and the economic loss related to providing social services and public assistance after a disaster. (Barry, Edward, Elaine, Janet and Brian, 2011).

A questionnaire survey was conducted in Moti Jharna, Batali Hill, Goachibagan Medical Hill and Golpahar to understand the social condition of the people residing in these areas. There was an attempt to reveal people's perception about landslide, what do they do during landslide and how they face landslide events. This report represents all these issues as well as address community's lacking to face a disaster like landslide. A great deal of work has been done to identify the community's urgent need to face such kind of disaster. Along with questionnaire survey, different PRA techniques have been applied to understand the social context of these communities.

Finally an attempt has been made to identify all those socially significant issues that make the communities vulnerable to landslide disaster.

1.2 OBJECTIVE OF THE STUDY

The user groups of the Web-GIS based early warning system will be the people living in landslide risks. Therefore it is important to understand human adaptation to landslide risks under the condition of rapid urbanization in a fast growing city like Chittagong Metropolitan Area (CMA). The needs and threats of vulnerable communities will be assessed through the field survey. This study focuses on attaining information on following issues.

(a) Duration of people's living in these areas.
(b) Reasons for not leaving these areas.
(c) Consequences of leaving these areas.
(d) Steps taken by the local people for staying in these areas for long time.
(e) Possible threats or risks of living here.
(f) Identifying ways of planning these areas incorporating sustainable development strategies.

Feedback from the local community will be taken to define problems, map vulnerability, determine priorities, suggest solutions, determine the intervention to meet their needs; and talk about future aspirations through active focus group discussion.

1.3 THEORETICAL FRAMEWORK

For better understanding of the issues some theories have been studied. Knowledge from such kind of study has strengthened the theoretical base of these projects. Theories related to this project are discussed below.

1.3.1 Vulnerability

Vulnerability in this context can be defined as the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard. The concept is relative and dynamic. Vulnerability is most often associated with poverty, but it can also arise when people are isolated, insecure and defenceless in the face of risk, shock or stress.

1.3.2 Social Vulnerability

Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. Studies have shown that in disaster events the socially vulnerable are more likely to be adversely affected, i.e. they are less likely to recover and more likely to die. Effectively addressing social vulnerability decreases both human suffering and the economic loss related to providing social services and public assistance after a disaster.

1.3.3 Factors influencing Social Vulnerability

There is a general consensus within the social science community about some of the major factors that influence social vulnerability. These include: lack of access to resources (including information, knowledge, and technology); limited access to political power and representation; social capital, including social networks and connections; beliefs and customs; building stock and age; frail and physically limited individuals; and type and density of infrastructure and lifelines (Cutter, 2001a; Tierney, Lindell, and Perry, 2001; Putnam, 2000; Blaikie et al., 1994). Disagreements arise in the selection of specific variables to represent these broader concepts. Those characteristics that influence social vulnerability most often found in the literature are listed in Table 1, along with the relevant research that identified them. Among the generally accepted are age, gender, race, and socioeconomic status. Other characteristics identify special needs popula- tions or those that lack the normal social safety nets necessary in disaster recovery, such as the physically or mentally challenged, non-English- speaking immigrants, the homeless, transients, and seasonal tourists. The quality of human settlements (housing type and construction, infrastructure, and lifelines) and the built environment are also important in understanding social vulnerability, especially as these characteristics influence potential Social Vulnerability to Environmental Hazards economic losses, injuries, and fatalities from natural hazards. Given their general acceptance in the literature, can we empirically define a robust set of variables that capture these characteristics, which then allows us to monitor changes in social vulnerability geographically and over time?

1.3.4 Participatory Vulnerability Analysis

Different methods of PRA techniques have been used for this study. Methods that have been used are studied for better understanding. Detailed descriptions of methods are given below.

1.3.4.1 Social and resource map

Social and resource mapping is a popular method in PRA technique. The social map focus here on the depiction of habitation patterns and nature of housing and social infrastructure like roads, drainage systems, schools, drinking water facilities, etc. Resource map focuses on habitation, community facilities, roads, opens spaces, water body etc. social and resource information can be collectively presented in one map called social and resource map (Kumar, 2002).

Advantages of Social and resource map:

- The social and resource map produces an overview of the locality.
- It provides a spatial structure for discussion. They help to ensure that the focus remains on the theme chosen and that all issues are covered systematically.
- Social and Resource mapping can be used as monitoring and evaluation tool. (Kumar, 2002).

Disadvantages of Social and resource map

Some facilitators have found social and resource mapping rather difficult to initiate. But once the process begins and people take control, it goes ahead on its own. Sometimes the non literate participants are hesitant to start the mapping. Lack of confidence, fear of ridicule by others and belief that maps can be made only by experts are some of the main reasons behind the hesitation (Kumar, 2002).

1.3.4.2 Transect walk

Transect is another PRA method used to explore the spatial dimensions of people's realities. It provides a cross sectional representation of the different parameters building height, building type, width of access road, roadside land use, land type (kumar,2002).

Advantages of Transect walk

- Transect walk provide a quick cross sectional overview of the different agro-ecological zones of the locality.
- They have both an outdoor component like walking along with local people, observing, asking questions and listening as well as an indoor component like the preparation of a diagram which enhances their utility.

- They provide an opportunity to cross check the information generated through social maps, resource maps and other PRA methods.
- The local people tend to express their views on different aspects more candidly, which does not happen usually in a community meeting or even in one to one interview.

Disadvantages of Transect walk

- While most of the practitioners find the transect walk easy to facilitate, the subsequent drawing of the transect by the local people is more demanding. The tendency to focus on the output can really influence the quality of transects (Kumar, 2002).

1.3.4.3 Timeline

Timeline is an important PRA method used to explore the temporal dimension from a historical perspective. Timeline captures the chronology of events as recalled by local people. It is drawn as a sequential aggregate of past events. It thus provides the historical landmarks of the community, individuals or institution (Kumar, 2002).

Advantages of Timeline

- Time line has been used frequently to initiate a dialogue. It helps to build a rapport with local people.
- It gives a clear message to the elderly people, who are generally left out in other kinds of PRA exercises in community, that their views will also be taken into consideration and given due importance.
- Timeline provides a good understanding of historical perspective, which can be used to explore present and future possibilities (Kumar, 2002).

Disadvantages of Timeline

- Most elderly people can recollect the major events and the chronology rather correctly.
- Elderly people may have problems with recalling the precise years of their occurrence. Some of the elderly people have problems of memory as well.
- The Local concept of time, a different calendar system, etc pose major problems to the facilitators in drawing parallels between the local system and facilitator's frames of time.

- The tendency to glorify the past is found to be strong among elderly people. They also digress from the topic and facilitators have to try hard to keep the discussion focused (Kumar, 2002).

1.3.4.4 Venn diagram

Venn diagram is one of the commonly used methods in PRA to study institutional relationships and is sometimes also referred to as institutional diagram. This method in PRA has been found useful to study and understand local people's perceptions about local institutions, individuals, programmes, etc. The method provides valuable insights into analyses of the power structure, the decision making process, etc (Kumar, 2002).

Venn diagram is useful for studying:

- Various institutions and individuals and their influence on the local people.
- Various groups and individuals in the locality and their influence.
- Type of interactions between institutions, individual and local people (Kumar,2002)

Representation of Venn diagram

Venn diagram is usually represented by using circles of different sizes and lines of different width with direction.

Significance of the Symbols:

Circle: The bigger the circle, higher is the influence of the institution or individual and vice versa.

Line: Interaction of institutions, individuals with the community is shown by line.

- Width of the line: Thicker the width of the line, Stronger is the interaction of the institutions, individuals with the community and vice versa.
- Direction of the line: It shows the types of interaction. The interaction can be one way or two ways.
    - One way interaction: The direction sign is given in one way
    - Two ways interaction: The direction sign is given in both ways

Advantages of Venn diagram

- Venn diagram is a simple but useful tool to study complex relationships between various institutions, groups, individuals, program etc.

- The use of local material, visuals Venn diagram symbols generates a lot of interest among the local people and participation is quite high.
- Illiterate persons are also be able to follow the proceedings and participate effectively.
- The instance of the use of Venn diagram is very diverse contexts is evidence that this method allows for improvisation and innovation (Kumar, 2002).

Disadvantages of Venn diagram

- Venn diagram becomes complex when the number of items increases
- Relatively inexperienced facilitators find it difficult to explain Venn diagram process to participants.
- Sometimes it can become sensitive. In the presence of the individuals or representatives of institutions that are being rated in the Venn diagram the participants may play safe. Hence the output in such cases may not reflect the realities (Kumar, 2002).

1.3.4.5: Vulnerability mapping

Vulnerability map

A vulnerability map gives the precise location of sites where people, the natural environment or property are at risk due to a potentially catastrophic event that could result in death, injury, pollution or other destruction. Such maps are made in conjunction with information about different types of risks. A vulnerability map can show the housing areas that are vulnerable to a chemical spill at a nearly factory. But it just as likely, could delineate the commercial, tourist, and residential zones that would be damaged in case of a 100-year flood or, more devastation, a tsunami (Edwards, Gustafsson, & Landenmark, 2007).

Process:

After gathering the participants the survey team introduced the topic to the participants. Then the purpose of the exercise was explained to them. A map was given to them in which the boundary of the area was drawn and asked them to identify the vulnerable areas in the map. Then study team asked them on the basis of what conditions they thought the area is vulnerable. The conditions were noted down by study team. After completing the discussion the team thanked the participants for their participation and giving time (Edwards, Gustafsson, & Landenmark, 2007).

Benefits of vulnerability mapping

- Vulnerability mapping can allow for improved communication about risks and what is threatened.
- It allows for better visual presentations and understanding of the risks and vulnerabilities so that decision -makers can see where resources are needed for protection of these areas.
- The vulnerability maps will allow them to decide on mitigating measures to prevent or reduce loss of life, injury and environmental consequences before a disaster occurs.
- A vulnerability map with property maps determines which properties and buildings are at risk.
- Vulnerability maps can be of use in all phases of disaster management: Prevention, mitigation, preparedness, operations, relief, recovery and lessons-learned.
- In the prevention stage planners can use vulnerability maps to avoid high risk zones when developing areas for housing, commercial or industrial use.
- Technical experts can be alerted about places where the infrastructure can be affected in case of a disaster.
- Fire departments can plan for rescues before a potentially dangerous event is at hand.
- During an exercise where a predetermined scenario takes place, the rescue crews may use the map to determine where to respond first to save human lives, the environment or property.
- The vulnerability map can also include evacuation routes to test their effectiveness for saving lives.
- The operations officer can be updated about the disaster situation and the need for and the location of sensitive areas.
- After the disaster the vulnerability map and a new map showing the extent of the damage, can assist in assessing how well the emergency was managed.
- The evaluators can see if an accurate assessment of vulnerable areas was made and if they were adequately protected. It will also be apparent how effective the mitigation measures were (Edwards, Gustafsson, & Landenmark, 2007).

1.3.4.6 Cause Effect Diagram

Cause effect diagram is a popular PRA method which falls under the larger family of flow and linkage diagram methods. It focuses on the casual factors of a phenomenon, activity or

problem and the effect thereof. The cause effect diagram represents visually the causes, effects and their inter-linkages, which help in arriving at an in-depth understanding of a particular topic, and provide scope for analysis and subsequent action by the local people.

Advantages of Cause Effect Diagram

The major advantages of cause effect diagram include:

- Visual depiction of causes and effects of a problem, situation, phenomenon, etc.
- Focus on causes rather than just on symptoms.
- Providing an opportunity to the local people to express the complex realities of the causes of their specific problems and the consequences thereof in a simple visual mode.
- Identification of linkages between various causes and effects
- Discussion of possible ways of solving the problem by focusing on the causes and identifying ways of approaching them

1.3.4.7 Pair wise ranking method

Pair wise ranking is a popular PRA method. It helps in arriving at people's priorities and preferences.

General process of pair wise ranking

In pair wise matrix method two items, attributes, factors, etc are compared at a time. This process of comparing two items at a time is carried on till each item has been compared with each other. The frequency of how many times each of the items have been preferred is ascertained. The frequency gives an idea of people's preference. The more the frequency of an item, the higher the preference of that item.

Advantages of pair wise ranking

- Simple method
- Very informative
- It is better than casual conversation or direct observation. In a very short time depth of decision making process can be explored.

- Simplicity is its biggest advantage. At a time the participants compare two items and based on their preference, they select one.Later they are encouraged to look into the reasons for their preference.
- Gives opportunity to participants to learn many new points that they were not consciously aware of.

Disadvantages of pair wise ranking

- Decision making and the selection of preferences are very complex process. Preferences are not guided by a simplistic set of criteria.
- Becomes messy and boring if number of items to be compared is many
- Some facilitators have found the pair wise ranking difficult to facilitate.

1.3.4.8 SWOT analysis

SWOT analysis (strengths, weaknesses, opportunities, and threats analysis) is a framework for identifying and analyzing the internal and external factors that can have an impact on the viability of a project, product, place or person.

As its name states, a SWOT analysis examines four elements namely Strengths, Weaknesses, Opportunities, and Threats (Benefits and Limitations of SWOT Analysis, n.d.):

- Strengths are internal attributes and resources that support a successful outcome.
- Weaknesses are also internal attributes resources that work against a successful outcome.
- Opportunities are external factors the project can capitalize on or use to its advantage.
- Finally threats are also external factors that could jeopardize the project.

SWOT analysis aims to identify the key internal and external factors seen as important to achieving an objective. SWOT analysis groups key pieces of information into two main categories:

1. Internal Factors – The strengths and weaknesses are internal factors to the organization or place
2. External Factors – The opportunities and threats presented by the environment are external factors to the organization or place

Advantages of SWOT Analysis

The main advantages of conducting a SWOT analysis is that it has little or no cost, anyone who understands the project can perform a SWOT analysis. SWOT analysis is useful when there is a little time to address a complex situation. Another advantage of a SWOT analysis is that it concentrates on the most important factors affecting the area or project (Benefits and Limitations of SWOT Analysis, n.d.).

SWOT analysis indicates the priority threats to be mitigated, weaknesses to be corrected, opportunities to be seized, and strengths to be reinforced.

SWOT Analysis helps in strategic planning in following manner

- It is a source of information for strategic planning.
- Builds organization's strengths
- Reverse its weaknesses.
- Maximize its response to opportunities.
- Overcome organization's threats.

Disadvantages of SWOT Analysis

For complex issues it is not suitable. SWOT analysis only covers issues that can definitely be considered a strength, weakness, opportunity or threat. Because of this, it's difficult to address uncertain or two-sided factors, such as factors that could either be strength or a weakness or both.

SWOT analysis has some limitations like the following:

- Doesn't priorities issues
- Doesn't provide solutions or offer alternative decisions
- Can generate confusion to choose the best one within many options

1.3.4.9 Mobility Mapping

Mobility map is a PRA method used to explore the movement pattern of an individual, a group or the community. The focus is on where people go and for what. Other aspects of movement, like the frequency of visits, distance, and the importance of the places visited, may also be studied and depicted. It reflects the people's perception of movement patterns and the reasons therefore.

Applications

Mobility map can be used for various purposes including:

- Understanding the mobility pattern of the local people- where they go and for what
- Increasing gender sensitivity and awareness by using them for highlighting the difference between the mobility pattern for men and women.
- Evaluation of the impact of certain interventions in terms of their effects on mobility patterns
- Planning for interventions and projects

Process

The suggested steps for mobility mapping are as follows:

- Select the person, group or community whose mobility pattern you are interested in understanding.
- Explain the purpose of the exercise and initiate a discussion on the places they visit. List down the places. As they close the list, ask them whether they would like to add some more or delete any of the places in the list.
- Ask them to write the name of the places on small pieces of paper in bold letters. Encourage them to depict the places using symbols or visuals, particularly if the participants are non literate.
- Draw a circle in the middle of a paper or ground, representing the village/ locality and ask them to locate the pieces of paper with the names of the places they visit around the circle in such a way that they are properly represented.
- Ask them to link the cards representing the places visited with the circle depecting their locality by lines. The thickness of the lines could represent a particular feature, such as the frequency of visit.
- Ask them to follow a similar process, for all other places that they visit, one by one.
- Encourage them to represent other aspects in the form of visuals, symbols or in writing. Ask them whether they would like to make any alterations once the diagram is ready.
- Request them to explain the map and their learning from it.
- Ask them to explain the diagram in detail.
- Listen carefully to their discussion and take necessary notes.
- Copy the diagram onto paper with all the details.

Advantages

Mobility map provides a good understanding of the mobility patterns of an individual, group or community. The participants find it enjoyable. A lot of discussion and analysis follows.

Limitations

Like most other methods, mobility map is also subject to certain limitations. If not well facilitated, it can become a facilitator driven exercise. Too much focus on the output means the loss of other valuable information.

On the whole, mobility mapping is a useful method to study the mobility pattern of individuals, groups, etc., and the way they perceive their movements.

1.3.4.10 Dream map

Dream map, though not yet very common in PRA, is used to depict the future in line with the aspirations of local people. What distinguishes a dream map from other types of map is that it is futuristic.

Application

Arriving at the dreams, aspirations, feelings of deprivation and the perspective of the local people about their own development.

- Understanding the risks, vulnerabilities, strengths, etc., of the local people.
- Arriving at the areas where people want change.
- Planning interventions to arrive at the dream state.
- Monitoring the progress made against the standards or goals set.

Process

The suggested steps for dream mapping include

- Explain the purpose of the exercise to the participants and ask them to draw a map depicting the present situation.
- Later ask them to discuss amongst themselves how they would like it to be, if they had a choice and then draw what they can call their dream map.
- Once the dream map is made, keep the two maps in front and initiate discussion among the participants. The main points of discussion can include:
    - Present situation- Problems and causes.

  - The aspired state and the ways of realizing it; the actors who could help or hinder its realization.
  - Factors affecting realization of their dream
  - Their own role in the realization of their dreams.
- Ask them to list indicators against which the realization of their dream can be monitored. Similarly, help them establish time intervals for monitoring the progress.
- Interview the dream map by asking clarifications and questions, which can help to sharpen your understanding.
- Note down the points of discussions. In the end copy the map on a paper with relevant details.
- Thank the participants for their active participation and time.

Advantages of dream map

It generates a lot of interest among the participants and the use of visuals and symbols makes it fun as well. The discussions that follow the dream map provide valuable insights into the present situation, the aspiration of the people, their problems and possible ways of improving the situation. It can be a good motivator for many, as they can easily visualize what they are aiming for and find ways of achieving their dreams.

Limitations of dream map

One of the major limitations of the method is that the participants tend to be unrealistic and start fantasizing while doing a dream map unless special efforts are made to keep them grounded in reality. Lack of commitment to follow up on the outcomes of the dream map further worsens the situation.

CHAPTER 2: METHODOLOGY

2.1 SELECTION OF THE SITE

In the previous phase of this project, 57 locations have found where landslide event occurred in previous years. Those locations were organized into ten clusters (Appendix-A, Table 1) based on the landslide hazard locations, tentative similarity of the surroundings and landslide mechanisms. At this stage, Moti Jharna and Batali Hill of cluster 1, Golpahar of cluster 5 and Goachibagan Medical Hill of cluster 9 have been selected for social vulnerability analysis. These sites have been selected based on the following criteria.

- Landslide occurrence: It has been observed from the experience of the landslide inventory phase that the maximum numbers of landslide events have occurred in the hills of cluster 1, 5 and 9.
- Settlement density: As people are the main element of social vulnerability analysis, it is desirable to conduct survey in those hills where a considerable number of people live. From the previous experience it has been observed that dense settlement pattern exists in the areas of cluster 1, 5 and 9. Population density is quite high in these areas comparing to the areas of other clusters.

2.2 DATA COLLECTION

For conducting this study both primary and secondary data have been collected. Primary data has been collected through household questionnaire survey and Participatory Rural Appraisal method. Secondary data have been collected from different organizations like Department of Environment, Chittagong Development Authority, Ward Commissioner office etc.

2.2.1 Household questionnaire survey

Household survey technique has been applied in this study. Household surveys are one of the most important sources of social and demographic statistics. Household surveys collect comprehensive and diverse socio-demographic data pertaining to conditions under which people live — their welfare, demographic characteristics and cultural factors which influence behavior, as well as social and economic change. So to understand the socio economic

conditions and influence of landslide events on the social life of people household questionnaire survey has been conducted.

2.2.1.1 Preparation of questionnaire

To conduct household survey a questionnaire has been prepared (Appendix-A). This questionnaire has been prepared in a few steps. At first, a sample questionnaire was prepared. Then a pilot survey in Moti Jharna area was conducted. The aim of this pilot survey was to examine the questionnaire to judge its suitability with the socio-economic condition of the area. Based on the result of pilot survey, the questionnaire has been modified.

2.2.1.2 Determination of sample size

Household questionnaire survey has been conducted in Moti Jharna, Batali Hill, Golpahar and Goachibagan Medical Hill area. Total 590 people from these areas have been surveyed in random selection process. The sample size has been determined based on the total population of these areas. Sample size for each area has varied from each other as population of each area differs from others. Among the four Moti Jharna and Goachibagan Medical Hill contain highest and lowest number of population respectively. So, the sample size is determined accordingly. Details of sample have been given in Table 2.1.

Table 2.1: Population and sample size of the study areas.

Source: Report of Urban Partnerships for Poverty Reduction (UPPR) Project, UNDP (2011) and Field Survey, September, 2014.

Name of the study area	Total Population	Sample size
Moti Jharna	52000	248
Batali Hill	13000	142
Golpahar	33000	114
Goachibagan Medical Hill	5000	86
	Total sample size	**590**

2.2.2 Participatory Rural Appraisal Technique (PRA):

Along with household questionnaire survey, Participatory Rural Appraisal (PRA) technique has been applied. The main focus of PRA technique is to involve communities and other

stakeholders in an in-depth examination of their vulnerability to landslide and at the same time empowers or motivates them to take appropriate actions.

Household questionnaire survey provides information from the point of view of a person and different PRA techniques represent the overall condition of the community. As this study is focused on analyzing social vulnerability of landside of these communities, different PRA techniques have been found suitable to bring various social issues which are essential for this analysis. Ten different PRA tools have been applied during this study.

Social and resource map

Social and resource mapping has been applied to identify socially important features and different natural and man-made resources of communities.

Process

Social and resource map is a map depicting the social realities of the study area. (Kumar, 2002).

Steps Followed for Social Mapping

- The facilitators at first contacted the volunteers of the study area. The volunteers contacted some people of the area and they all gathered in a community place (School, club etc.). The facilitators explained to the participants the purpose of the study and how the tool works.
- Then some members were asked to draw the boundary line of the particular area. A base map obtained from the google earth and some colour pencils were given to them to facilitate the drawing. The facilitators helped them to understand the map.
- The participants were asked to identify prominent features of that area, such as- institutions, buildings and places that offer social services like school, health services, water source, local shop etc. and locate them on the social map.
- Important roads, building type, landuse types were shown with separate symbols. Easy symbols were chosen for identifying various resources and to make it easier to draw.
- Important details were written in notebook by the facilitators during the mapping process.

Transect walk

This tool is used to have a physical view of the area. As study areas are located in hilly regions and settlement have developed through hill cutting, transect will give a clear idea of the existing condition of hills and settlement. This will help to visualize the landslide scenario of this area.

General process followed

Transect walk is a systematic walk with the local people of the community observing, asking, listening, looking, identifying different zones, seeking opportunities and areas for improvements.

Steps Followed for Transect Walk

- The facilitators at first contacted the volunteers of the study area. The volunteers contacted some people having some knowledge of the area and they all gathered in a local common place.
- The facilitators explained to the participants the purpose of the study and how the tool works.
- Then the team went to the location where maximum detail can be found. Then the facilitators and local people started walking along the selected transect path. At the time of walking, transect maps have been drawn simultaneously with the help of local people.
- The team stopped at certain locations for detailed discussions on the points emerging and noted down in detail.
- Later, a transect map was clearly drawn on a large sheet in respect of the gathered information.

Timeline

For Social Vulnerability Analysis, it is important to know the area properly. The first step to know a community is to know its history. Timeline tool is used to know the significant events that took place in these communities. It also covers events associated with landslide and other calamities in these communities.

General process followed

To prepare the timeline of the study area an appointment was made with some local people who have been living in this place for a long time. After the arrival on the spot on the scheduled day the purpose of the exercise was explained to them. They described different incidents according to the respective year. Collected information was noted down and finally the timeline was prepared.

Venn diagram

For this study, it is important to understand the relationship between community and different institutions. As this will provide information about the institutions or organizations it may help the people during a disaster. For this, Venn diagram tool has been applied.

General process followed

To prepare this Venn diagram following process has been followed:

- At first, a contact was made with the representative of focus group and a date, time and place were fixed.
- After reaching the place on the scheduled time the purpose of the exercise was explained to the participants.
- They were asked to list the various institutions, individuals etc.
- They were asked to write on the small cards and place the cards on descending order on the basis of the perceived importance.
- They were asked to assign paper circles of different sizes to the institutions or individuals in such way that the bigger the circle, higher is the influence of the institution or individual and vice versa.
- A circle was drawn to represent the community and participants were asked to place the cards in such a manner that shows the accessibility of the community to the institutions or individuals. The closer the institutions or individuals the higher the accessibility and vice versa.
- The output was copied into a sheet of paper. Then they were asked to draw lines between the institutions or individuals with the community. They were told to use width on the lines in such a way that the thicker the line, stronger is the interaction of the institutions, individuals with the community and vice versa. They were also asked to give direction on line to show the type of the interaction.

- At last, the participants were thanked for their co-operation.

Vulnerability map

Vulnerability map for each community has been produced to find out the areas vulnerable to landslide, water logging, drug hazards and other natural and social hazards.

Map preparation process

The study is focusing on landslide and other social hazard, thus the vulnerable locations of the study area in respect to these hazards were identified with the help of the local people. The map preparation process is discussed:

- The facilitators prepared a base map before going to study areas.
- Arriving at the study area first the facilitators contacted the local volunteers and previously selected participants for the exercise. The whole team then gathered at the common local place.
- The facilitators then explained to the focus group about the meaning of vulnerability and under which circumstances an area could be vulnerable to landslide and other social hazards. They also described the vulnerability mapping tool.
- On basis of this knowledge the participants discussed among themselves and the identified the locations they think are vulnerable on the base map according to severity. The roads were identified as well.

Pair wise ranking method

This method has been applied to find out different problems that people face in their communities.

General process followed

The steps that were followed are given below.

- At first, a contact was made with the representative of focus group and a date, time and place were fixed.
- After reaching the place on the scheduled time the purpose of the exercise was explained to the participants.
- Participants were asked to name the problems they face in their areas. Those names of the problems were noted down.

- A matrix was drawn on a paper as many rows and columns as the number of problems.
- Questions were asked to the participants for comparing the two items. The preferences were recorded in the matrix by putting the name or symbol.
- At the end, count of how many times each items was preferred was made. It was noted down against the item at the end of the row.

Cause Effect Diagram

Cause effect diagram for each community has been produced to find out the root causes of landslide and effects of landslide.

Process of Developing Cause Effect Diagram

The following steps are showing how cause effect diagram can be made:

- First of all the purpose of the exercise was explained to the participants.
- The participants were asked to discuss the causes of the landslide phenomenon. The causes were noted down. Sometimes probing had been done to guide the participants in right track. Then team members asked them to discuss possible causes and effects of the identified problems. Participants were asked to list the causes and effects of the problems/issues. Their findings had been noted in brief by the team members.
- Then the team members helped local participants to draw the diagram of causes and effects and asked the participants for any modification if needed.

SWOT analysis

SWOT analysis for each community has been done to find out community's strengths, weaknesses, opportunities and threats from the perspective of disaster management.

Process of collecting information regarding SWOT analysis

To identify the SWOT of the study areas following steps were followed:

- First of all, SWOT Analysis method and its purposes were introduced to the Focus Group Discussion (FGD) group.
- The FGD group then started to identify the weaknesses and strengths (internal factors) for their areas regarding landslide vulnerability. The study team helped them to generate comments and extract as much information as they can. The team members

wrote down the factors. In the same way opportunities and threats were also identified and noted down by the team members.

- When the list was prepared, it was organized so that the analysis can be helpful. Final list was read out aloud to the FGD participants so that any missing point could be identified.

Mobility mapping:

Mobility mapping tool has been applied to show the movement pattern of people or any group of these communities.

General process followed:

- The facilitators at first contacted the volunteers of the study area. The volunteers contacted some people of the area and they all gathered in the local school. The facilitators the explained to the participants the purpose of the study and how the tool works.
- Then some members were asked to draw the boundary line of the particular area. A base map and some color pencils were given to them to facilitate the drawing. The facilitators helped them to understand the map.
- The participants were asked to identify prominent features of that area, such as- institutions, buildings, and places that offer social services like school, health services, water source, local shop etc. and locate them on the map.
- People were told to represent other aspects in form of visuals, symbols or in writing. Aspects that were asked to be represented by the people were as follows.
    - Purpose of visiting the places
    - Mode of transport
    - Frequency of visit

The diagram was copied to another paper and participants were thanked by the facilitators.

Dream map

Finally, a dream map has been produced to depict the future in line with the aspirations of local people.

General process followed

- The facilitators prepared a base map before going to study areas.
- Arriving at the study area first the facilitators contacted the local volunteers and previously selected participants for the exercise. The whole team then gathered at a local place.
- The facilitators then explained to the focus group about the meaning of dream map.
- The participants were initially asked to draw a map representing present scenario. Later they were asked to draw their desired situation in future representing their aspirations and dream.
- Finally, these information are merged into one file.

2.3 DATA ANALYSIS

After completing survey activities, data collected from household questionnaire survey has been given entry in SPSS 16 software. After the completion of data entry data are analyzed based on different criteria. Different graphs, charts are produced to show the relationship between different variables which explain the social scenario of the communities.

2.4 EXPERT OPINION SURVEY

For better understanding of the social condition, crisis and landslide issue an expert opinion survey has been conducted. Under this survey, eight experts were surveyed. They are:

1. Muhammad Muhibbullah,
   Assistant Professor and Chairman, Dept of Geography & Environmental Studies, University of Chittagong.
2. Professor, Dr. Ali Ashraf,
   Consultant & Civil Engineer, Southern University, Chittagong.
3. Engineer Mohammad Harun,
   Former Chairman, IEB Chittagong center.
4. Md. Zafar Alam,
   Director, Department of Environment (DOE), Chittagong.
5. Architect Rezaul Karim,
   Chief City Planner, Chittagong City Corporation (CCC), Chittagong.

6. Md. Samiul Masud,
   Assistant Commissioner (Land), Sadar Circle, Chittagong.
7. M. A. Issa Anshary,
   Town Planner, Chittagong Development Authority (CDA), Chittagong.
8. Md. Abutalha Talukdar,
   Assistant Town Planner, Chittagong Development Authority (CDA), Chittagong.

2.5 STAKEHOLDER MEETING

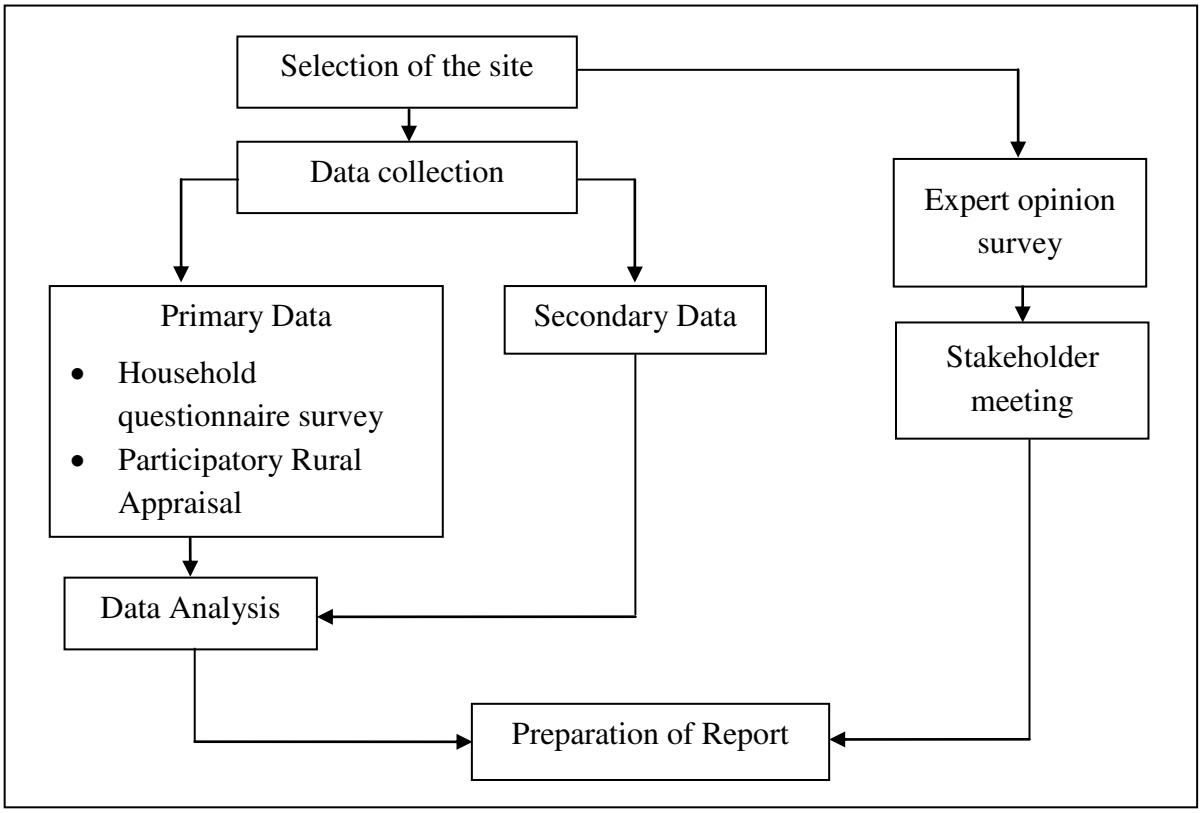
A Stakeholder meeting was arranged with the presence of the representatives from BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JIDPUS), Chittagong Development Authority (CDA) and International Centre for Integrated Mountain Development (ICIMOD). This meeting was organized jointly by BUET-JIDPUS and CDA. The main objective of this meeting was to inform CDA about this project. Representatives from BUET-JIDPUS and ICIMOD represented different aspects, benefits, problems and necessity of the projects to CDA. CDA representatives gave their valuable suggestions on different aspects of this project. They also informed some important local issues that must be considered in this project (Appendix-B).

2.6 PREPARATION OF THE REPORT:

Finally a report has been prepared describing study areas, data collection process, data analysis and results found from the analysis and other necessary information.

Figure 2.1: Methodology of the study

Source: Field Survey, September, 2014



CHAPTER 3:
STUDY AREA PROFILE (Community Perspective)

The four areas of Culster 1, Cluster 5 and Cluster 9 have been selected for this study. These areas are Moti Jharna and Batali Hill area of Cluster 1, Golpahar area of Cluster 5 and Goachibagan Medical Hill of Cluster 9. These areas are selected as landslide event is very frequent in these areas compared to other areas. Population density in these areas is quite high. This chapter will introduce the study area through its historic development. The physical and socio-economic information of the area would also be explored. Finally the locations of the study area which are vulnerable to natural and social hazard would be assessed.

3.1 PROFILE OF MOTI JHARNA AREA

Location: Moti Jharna area is located in Chittagong Metropolitan Area. Moti Jharna area is surrounded by Batali Hill, Tanker Pahar and A.K.K Hill area (Field survey).

3.1.1 Historic profile of Moti Jharna

For this study it is very important to know about the study area properly. Historic information of study areas is gathered. For this purpose timeline tool is used.

Major Findings from the Time line of Moti Jharna

After 1971 initial development took place in Moti Jharna. Establishment of non-built houses was dominant. Establishment of Yusuf School was a big event in this area. After the establishment of this school many commercial activities started to generate. Fire incident of 1985-1986 is very significant. After this incident people started to build semi-built and built houses instead of thatched houses. 2000-2005 is another significant period when many activities, especially development of utility facilities took place. After 2008, landslide events became frequent in this area. Some major landslide events occurred in this area.

Table 3.1: Time line of Moti Jharna area.

Source: Field Survey, September, 2014

Year	Incident	Remarks
After 1971	Commencement of settlement, Initiation of electricity facility	After the end of the liberation war of 1971, people from different region started to gather in this region.
1975	Establishment of Yusuf School	This was the first ever school in this area. At first the school building was constructed with tin. Later in 2004 this school building was rebuild with brick.
	Establishment of Moti Jharna Sahi Jame Mosque	This was the first mosque in this area
After 1975	Commercial activities started to increase	After the establishment of Yusuf school, many shops around the school started to develop.
1985-1986	Formation of Jalal sardar's committee	The main purpose of this committee was to solve different social issues as well as giving decision.
	Fire incident	Houses beside Hossain Saheb's house in Moti Jharna area were burnt in fire incident. 15 people died in this incident. Before this fire incident all houses were thatched house. After this incident semi built houses were made.
1988	Flood incident	This was the first flood incident in this area.
1989	Establishment of medical clinic	This was the first ever clinic in this area.
2000-2005	Commercial activities increased.	Different shops were settled in many places.
	Initiation of Utility facilities	Commencement of Water facility, Commencement of Electricity, Initiation of drainage system.
	Increase of hill cutting for the settlement of people	After 2000, population in this area increased. This resulted in indiscriminate hill cutting.
2008	Landslide event	Hills beside hossain saheb's colony collapsed. Two to three people died.
2010	Landslide event	Landslide occurred in Tanker Pahar area and it killed almost 20-25 people.
2013	Landslide event	Hills in Tanker Pahar area collapsed. There was some property damage due to this event.

3.1.2 Social characteristics of the study area

In this study, social and resource mapping was used to know about the social dimensions of the study area. Social and resource mapping is a very popular PRA tool to identify the nature of housing and social infrastructure in an area from the community peoples' perspective. Thus, to develop a broad understanding about the study area social mapping is the appropriate tool.

Major findings from social and resource map of Moti Jharna area

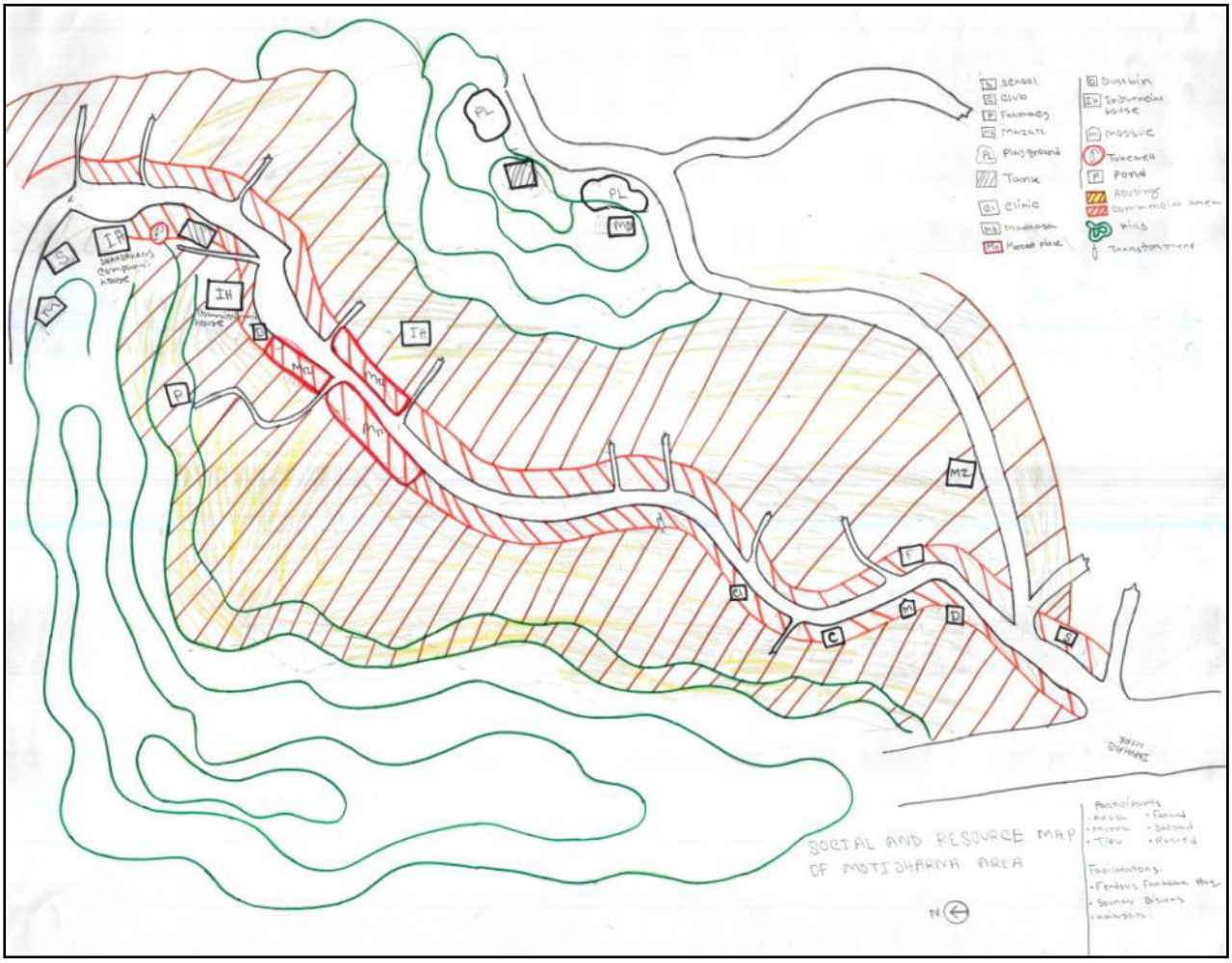
Social and resource map of Moti Jharna area represents the social institutions and resources of the area. First of all this map shows that there are hills in this area which can be considered as natural resource of this area. There is a pond located in Moti Jharna area and two playgrounds located in Tanker Pahar area. There is a water tank located in Tanker Pahar area. This water tank is used as the reservoir of water for the people of this whole area. One common tube well is identified which serves water facility to the people of this area. These are the resources of this area.

There are two schools, one mosque, one clinic, one pharmacy, one club, one madrasa located in this area. These social institutions are located along the side of Moti Jharna main road. Schools are used as landslide evacuation shelter during landslide hazard. There is a market place at the center of this area. There are two houses of influential people of this area identified. These people are known as 'Zamindar' (landlord) of this area.

Commercial shops are located along the side of the Moti Jharna main road. Behind these shops, residential development is seen.

Figure 3.1: Social and resource map of Moti Jharna area.

Source: Field Survey, September, 2014



3.1.3 Movement pattern of the people of Moti Jharna study area

Mobility map is a PRA tool that explores the movement pattern of people of a community. It shows where people go, for what purpose and how they go there. Mobility map for four study areas are prepared.

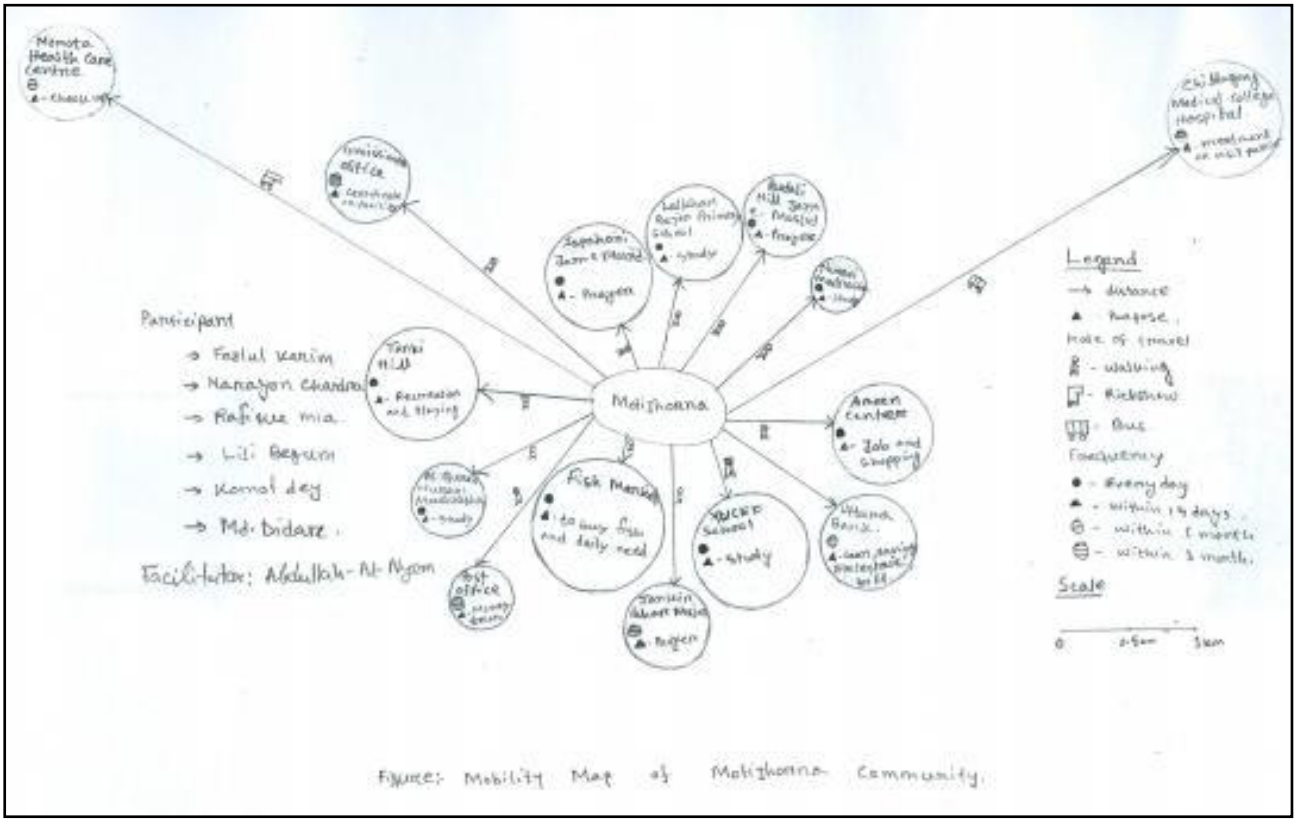
Findings from the mobility map:

Mobility map of Moti Jharna area shows that people usually travel to fourteen places for different purposes. These places are as follows:

Educational institute: Al-Quran Nurani Madrasa, UNICEF School, Nurani madrasa and lalkhan bazaar primary school are educational institutes of this area. People travel to these places daily for educational purposes.

Figure 3.2: Mobility map of Moti Jharna area.

Source: Field Survey, September, 2014



Religious institute: Tanker Pahar mazar, Batali Hill jame masjid, Ispahani jame masjid are the religious institutes of this area. People travel to these places on foot daily for prayer. In mosques (masjid) people travel daily and in shrine (mazar) people travel once a month.

Commercial places: Fish markets, Uttara bank, Amen center are the commercial institutes of this area. People travel to these places daily to run commercial activities.

Recreational places: Tanker Pahar is the nearest place of this community where people travel on foot for playing and recreation.

Health care facility: Momota health care center and Chittagong Medical College are the health care facilities around this area. People travel these places by transport once in a month.

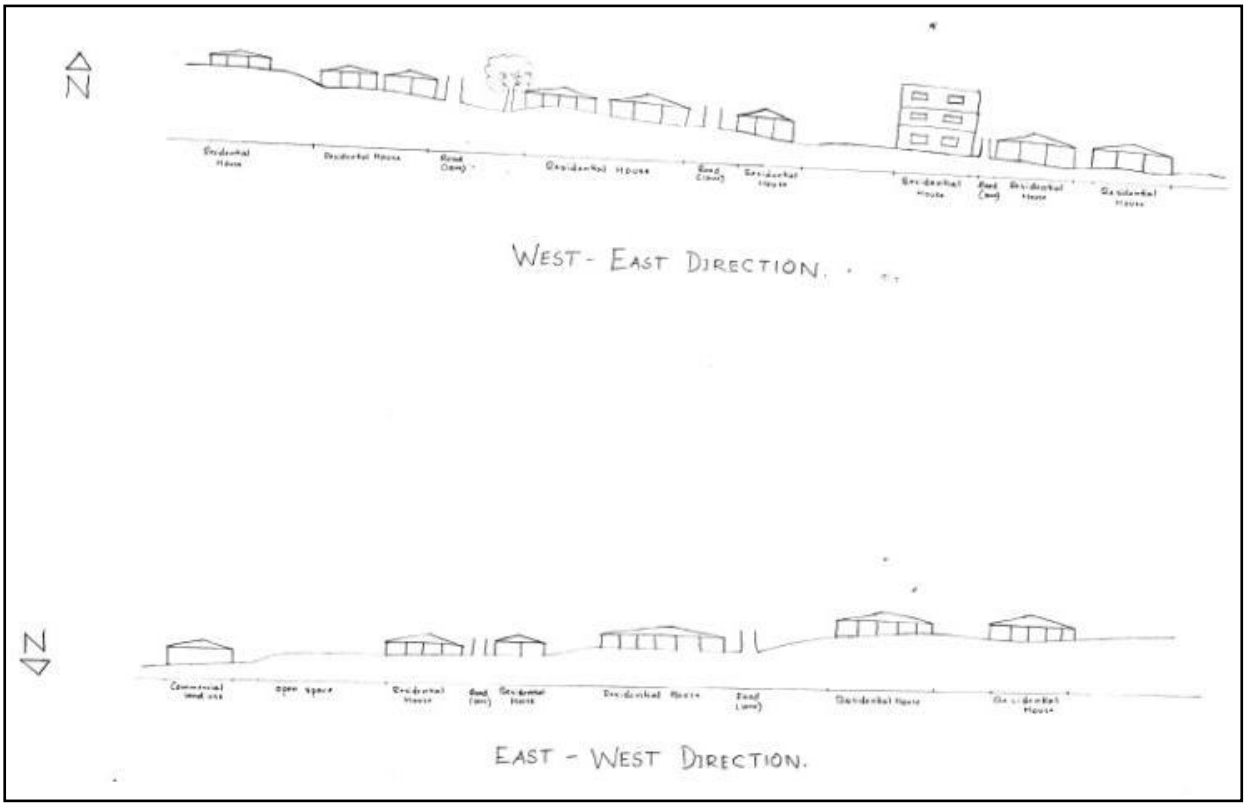
Others: Post office, commissioner's office are other places where people go once in three months on foot.

3.1.4 Physical characteristics of Moti Jharna area

Transect Walk is another PRA method used to explore the spatial dimensions of people's realities. A transect walk depicts a cross sectional view of different features of an area. Here it provides a comparative assessment of the parts of the area on different parameters including topography, land type, building type, building height, problems, opportunities and solutions. Transect walk is used for verification of issues raised during other PRA exercises particularly during social mapping, natural resource mapping etc. (Kumar, 2002)

Figure 3.3: Transect walk of Moti Jharna area.

Source: Field Survey, September, 2014



Major findings

In west-east direction most of the houses are made of tin and brick. Most of them are of one storey. One three story house is found along the side of the road. Roads are of three to five feet in width. Houses are constructed at the slope of the hills. All are residential houses. Similar characteristics can be seen in east-west direction. In east-west direction, density of houses is low.

3.1.5 Institutional context associated to landslide vulnerability in Moti Jharna

There are different institutions in Moti Jharna area. People depend on these institutions and these institutions help people. These institutions can be an organization, individual or a group etc. To study the relationship between the community and different institutions venn diagram tool is practiced. From this notion, a venn diagram of the study area has been prepared.

Venn diagram of Moti Jharna Area

There are fourteen institutes identified who give support to the people of Moti Jharna community.

Batali hill masjid: This mosque is located just outside of the community. People go to the mosque and get announcement of landslide through mike from the mosque. A two way strong interaction exists between the community and mosque.

Garage Ambagan: This is a garage of rickshaw and cars. Rickshaw pullers and drivers use this garage for work purpose. Influence of this institution is low. One way weak interaction exists between this garage and community.

Post office: There is a post office within 0.5 kilometre in this area. But people use this post office rarely. There exists a one way weak interaction between this institute and the community.

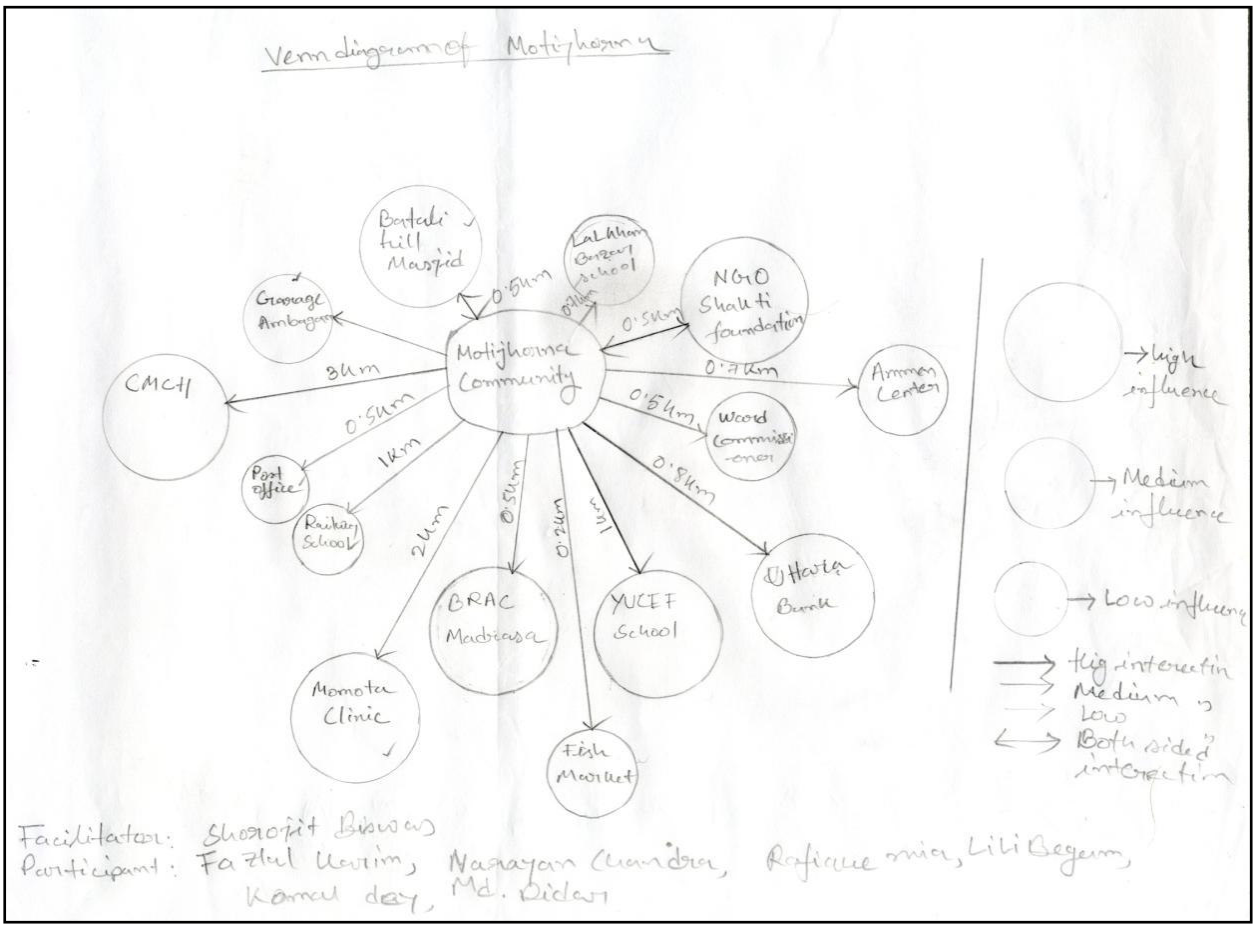
Railway school: This school is located within 1 kilometre of the community. This is a big school with medium influence on community. Interaction type is one way and strong.

Momota Clinic: It is located within 2 kilometres of the community. People go to this clinic for getting medical help. This clinic has big influence on the people of the community. Interaction type is one way and strong.

BRAC Madrasa: This is the only madrasa of this community located within 0.5 kilometre. People have great dependency on this institution for educational purpose. This madrasa has a great influence on people. Interaction type is one way and strong.

Figure 3.4: Venn diagram of Moti Jharna area.

Source: Field Survey, September, 2014



Fish Market: This fish market is located at the center of Moti Jharna community. Fish from other areas of Chittagong come to this place. People buy fish and other things. This fish market has medium influence on the community. Interaction type is strong and one way.

UNICEF School: This is a highly influential school of this area. It is located within one kilometre from the community. There exists a one way high interaction between this school and community.

Uttara bank: This bank is located within 0.8 kilometre. This bank has high influence on the people of the community. Interaction type is one way and strong.

Ward commissioner: People go to the commissioner's office but commissioner never visits. This institute has medium influence on the people of community.

Shakil foundation (NGO): This is an NGO which helps people through proving financial and health facilities. This is a highly influential institute located in this area. There exists a two way strong interaction between this institute and the community.

Lalkhan bazaar school: This school is located within 0.7 kilometre of this area. This school is used as evacuation center during the time of landslide hazard. This school has a good influence on the community. There exists a one way strong interaction between the school and the community.

3.1.6 Assessment of social and landslide vulnerability in the Moti Jharna study area

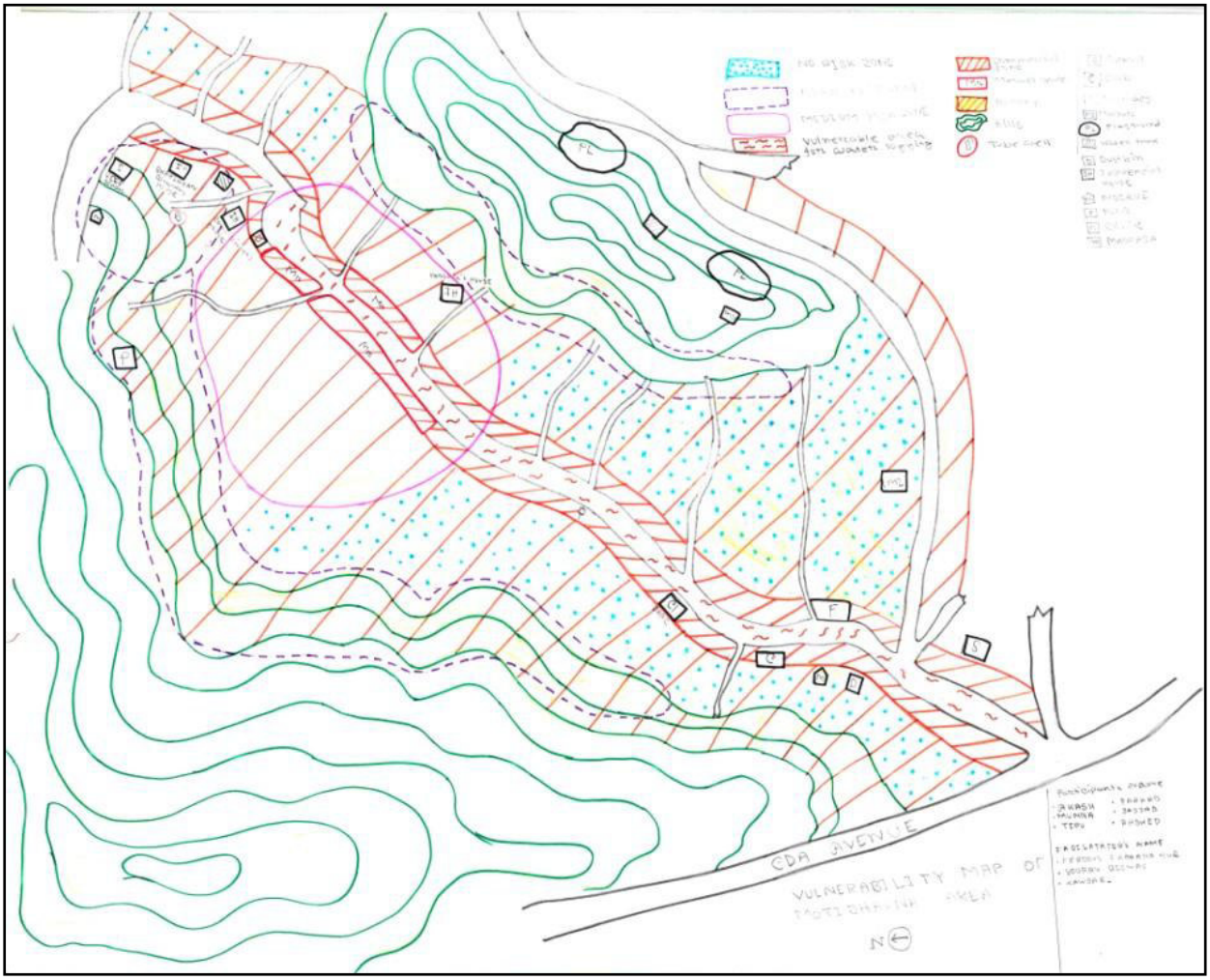
People of Moti Jharna area experienced landslide hazards in different periods. Many social problems also exist in these areas which make these areas vulnerable to different social hazards. It is necessary to identify the comparatively more and less vulnerable locations of the area so that the local people can take appropriate measures beforehand to mitigate the risks of landslide and other hazards. For this, a vulnerability map was prepared. This map is a tool for vulnerability assessment through a participatory approach. This map could also be a basis for preparedness and response plans for landslide and other hazards in the locality, to minimize loss of life and properties.

Major findings

Hills are located in north-western and eastern portion of Moti Jharna area. Settlements located at the down slope of the hills are indicated as high risk zone for landslide. Upper middle portion of the area is identified as medium risk and rest of the areas are considered as low risk zone for landslide. Water logging is a common phenomenon in this area. Moti Jharna main road is identified as vulnerable to water logging problem.

Figure 3.5: Vulnerability map of Moti Jharna area.

Source: Field Survey, September, 2014



3.1.7 Dream map of the Moti Jharna study area

People of the Moti Jharna area live with landslide and many other problems. Still they have some hopes and aspirations to improve their social and economic condition. Dream map of the study area was produced to get idea about the dreams and aspirations of people regarding their areas.

Findings from dream map of Moti Jharna area

People of Moti Jharna gave their suggestions on three aspects.

- **Tube well installation**: As there exists huge water crisis in Moti Jharna, people want proper water facility in this area. People dream about sufficient number of tube well in this area. In dream map, proposed tube wells are indicated by red circle.

- **Retention wall:** As landslide is a common phenomenon in this area, people suffer a lot because of landslide each year. People suggested a retention wall along the side of hills. In dream map retention wall is indicated by dark black line.
- **Relocation of houses**: At present, many households are located at the down slope of the hills. People living in these houses are most vulnerable to landslide hazard. So, the community people suggested the relocation of these people to other safe places. In dream map, houses to be relocated are indicated with black dots.

Figure 3.6: Dream map of Moti Jharna area.

Source: Field Survey, September, 2014

3.2 PROFILE OF BATALI HILL AREA

Location: Batali Hill area is located in Chittagong Metropolitan Area. Batali Hill area is surrounded by Moti Jharna, Tanker Pahar and A.K. Khan Hill area (Field survey).

3.2.1 Historic profile of the Batali Hill study area

For this study it is very important to know about the study area properly. Historic information of study areas is gathered. For this purpose time line tool is used.

Major Findings from the Time line of Batali Hill

Though settlement in this area took place in Pakistan period, after 1971 people from different regions started to come in this area. Establishment of thatched houses was dominant. Establishment of Yusuf School was a big event in this area. After the establishment of this school many commercial activities started to generate. Fire incident in 1985-1986 is very significant. After this incident people started to build semi-built and built houses instead of thatched houses. During 2000-2005 utility facilities were settled in this area, many NGO's, organizations and financial institutions were established. These institutions have contributed much to the social development in this area. Landslide incident of 2011 made a great impression on people. After this incident people actually came to know about the impacts of landslide.

3.2.2 Social characteristics of the Batali Hill study area

In this study social and resource mapping was used to know about the social dimensions of the study area. Social and resource mapping is a very popular PRA tool to identify the nature of housing and social infrastructure in an area, from the community peoples' perspective. Thus, to develop a broad understanding about the study area social mapping is the appropriate tool.

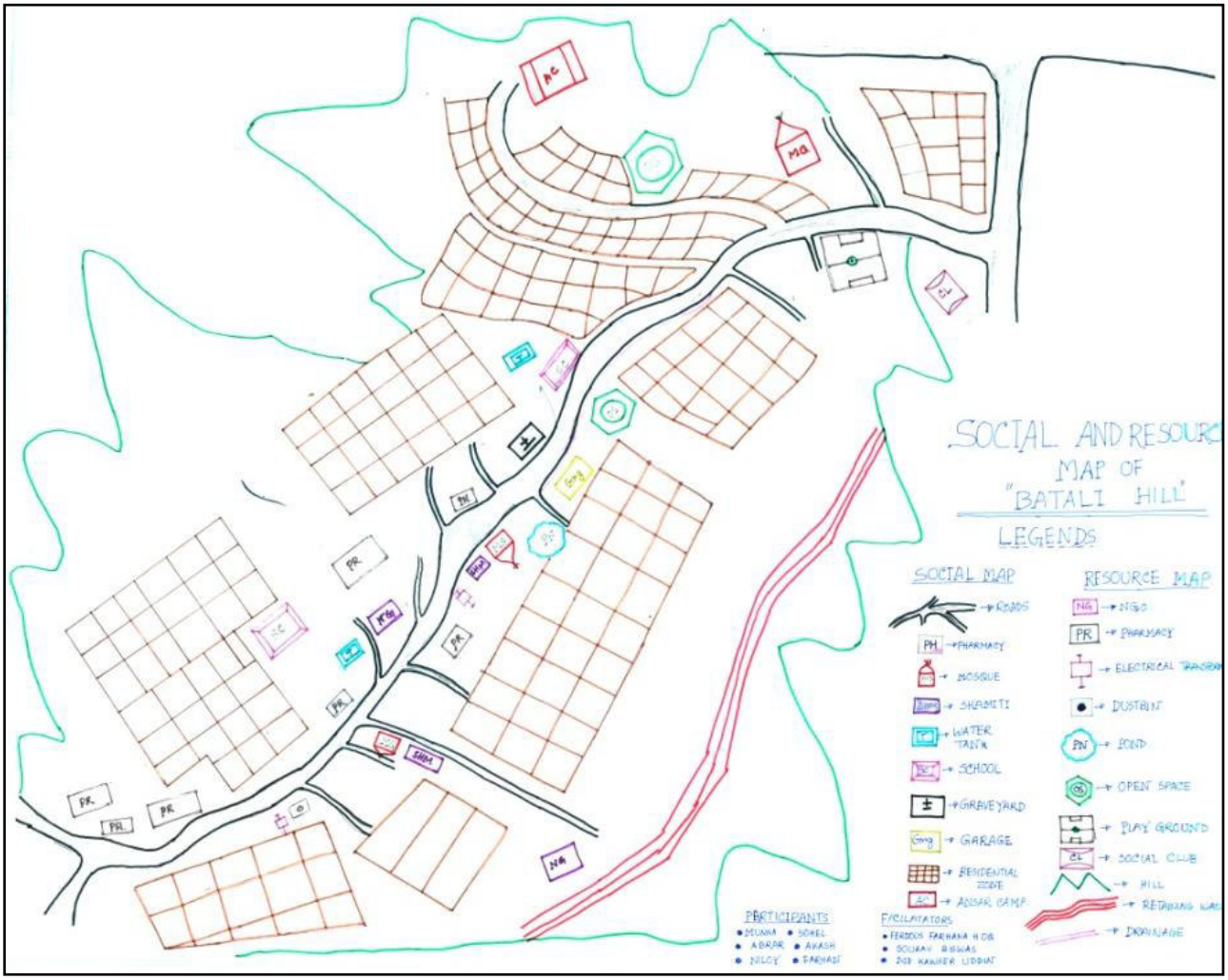
Table 3.2: Time line of Batali Hill area.

Source: Field Survey, September, 2014

Year	Incident	Remarks
Pakistan period (1947-1971)	Commencement of settlement	
After 1971	Settlement started to grow	After the end of the liberation war of 1971, people from different region started to gather in this region.
1975	Establishment of Yusuf School	This was the first ever school in this area. At first the school building was constructed with tin. Later in 2004 this school building was rebuild with brick.
After 1975	Commercial activities started to increase	After the establishment of Yusuf school, many shops around the school started to develop.
1985-1986	Fire incident	Houses beside Hossain Saheb's house in Moti Jharna area were burnt in fire incident. 15 people died in this incident. Before this fire incident all houses were thatched house. After this incident semi built houses were made.
1988	Flood incident	This was the first flood incident in this area.
1989	Establishment of medical clinic	This was the first ever clinic in this area
2000-2005	Commercial activities increased.	Different shops were settled in many places
	Initiation of Utility facilities	Commencement of Water facility Commencement of Electricity Initiation of drainage system
	Establishment of Madrasa	It was the first madrasa of this area.
	Establishment of Momota clinic	This clinic was settled in Lalkhan bazar
	Increase of hill cutting for the settlement of people	After 2000, population in this area increased. This resulted in indiscriminate hill cutting
	Different social organization, NGO and financial institution started to set up.	As population density started to increase, many organizations, NGO and financial institution started to set up.
2011	Landslide incident	A big landslide occurred in tiger pass near Batali Hill. Almost 15 people died in this incident.

Figure 3.7: Social and resource map of Batali Hill area.

Source: Field Survey, September, 2014



Major findings from social and resource map Batali Hill area.

In Batali Hill area, many social institutions and resources are identified. Batali hill area is surrounded by hills. Hill is the main natural resource of this area. There are two open spaces and a pond located at the center of the area. An Ansar camp and a playground are located at the northern side of the area. These are the resources of this area, as during a landslide people may use these resources. There is a retaining wall located at the eastern side of this area to protect people from landslide. There is a water tank located in this area to provide water to the people of this area. Among other resources electric transformers and dustbins are seen in this area.

There are many social institutions located in this area. There are one school, one mosque and eight pharmacies located in this area. There are some social organizations such as co

operative society, social club and NGO. A graveyard and a garage are located in this area. Commercial settlements are seen along the side of the Batali Hill road. Behind these commercial settlements, residential settlements are seen.

3.2.3 Movement pattern of the people of Batali Hill study area

Mobility map is a PRA tool that explores the movement pattern of people of a community. It shows where people go, for what purpose and how they go there. Mobility map Batali Hill is also prepared.

Findings from the mobility map

Mobility map of Batali Hill area shows that people usually travel to different places for different purposes. These places are as following:

Educational institute: BRAC School, UNICEF School and Railway high school are educational institutes of this area. People travel to these places daily for educational purposes.

Religious institute: Batali hill jame masjid is the religious institutes for Muslims of this area. People travel to this place on foot daily for prayer as well as for religious education.

Commercial places: Moti Jharna Fish market and Janata bank are the commercial institutes of this area. People travel to fish market daily to buy household things. People go to Janata bank once in a month for banking activities.

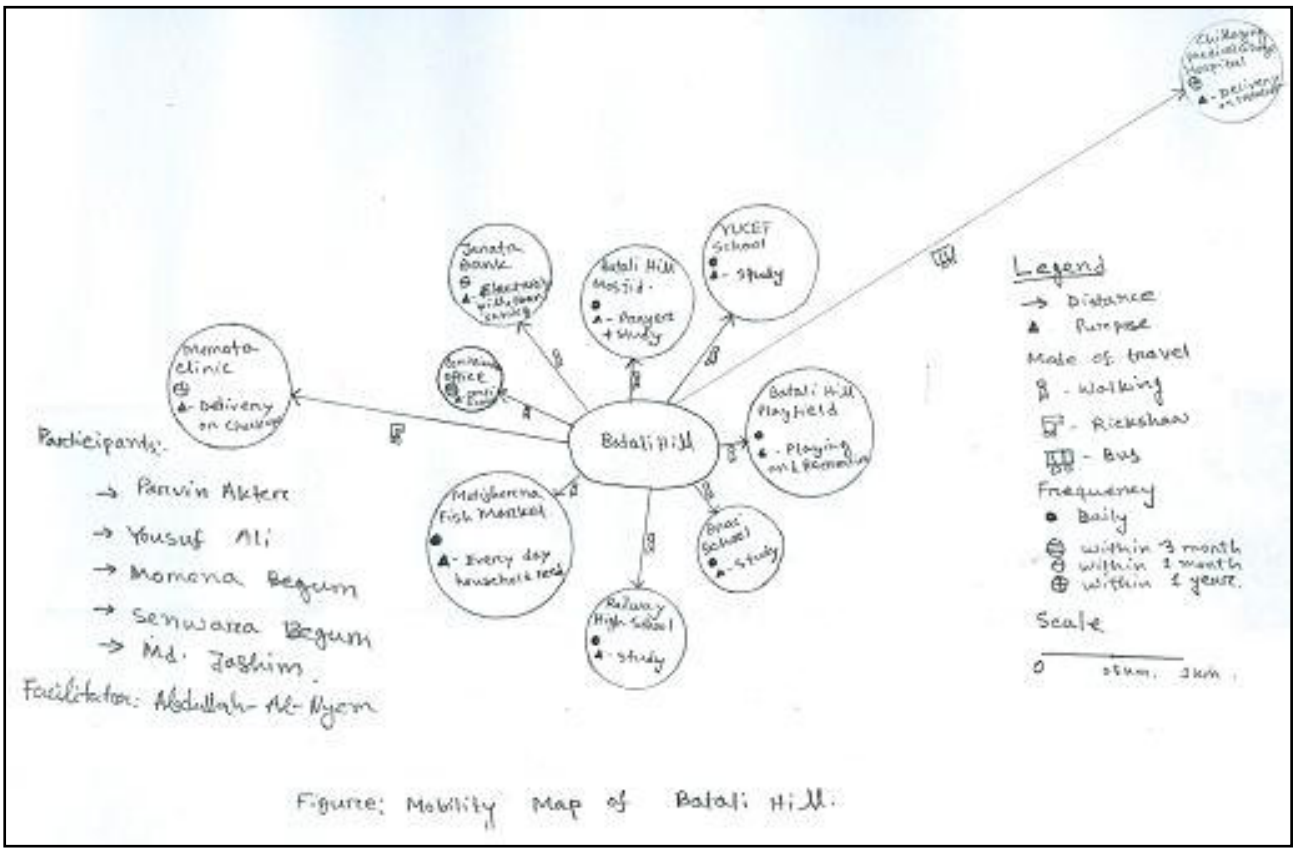
Recreational places: Batali Hill Playfield is the nearest place of this community where people travel on foot for playing and recreation.

Health care facility: Momota health care centers, Chittagong Medical College are the health care facilities of this area. People travel these places by transport once in a year.

Others: People go to the commissioner's office once in three months on foot for certificate or to discuss problems of the area.

Figure 3.8: Mobility map of Batali Hill area.

Source: Field Survey, September, 2014



3.1.4 Physical characteristics of Batali Hill study area

Transect Walk is another PRA method used to explore the spatial dimensions of people's realities. A transect walk depicts a cross sectional view of different features of an area. Here it provides a comparative assessment of the parts of the area on different parameters including topography, land type, building type, building height, problems, opportunities and solutions. Transect walk is used for verification of issues raised during other PRA exercises particularly during social mapping, natural resource mapping etc.(Kumar, 2002)

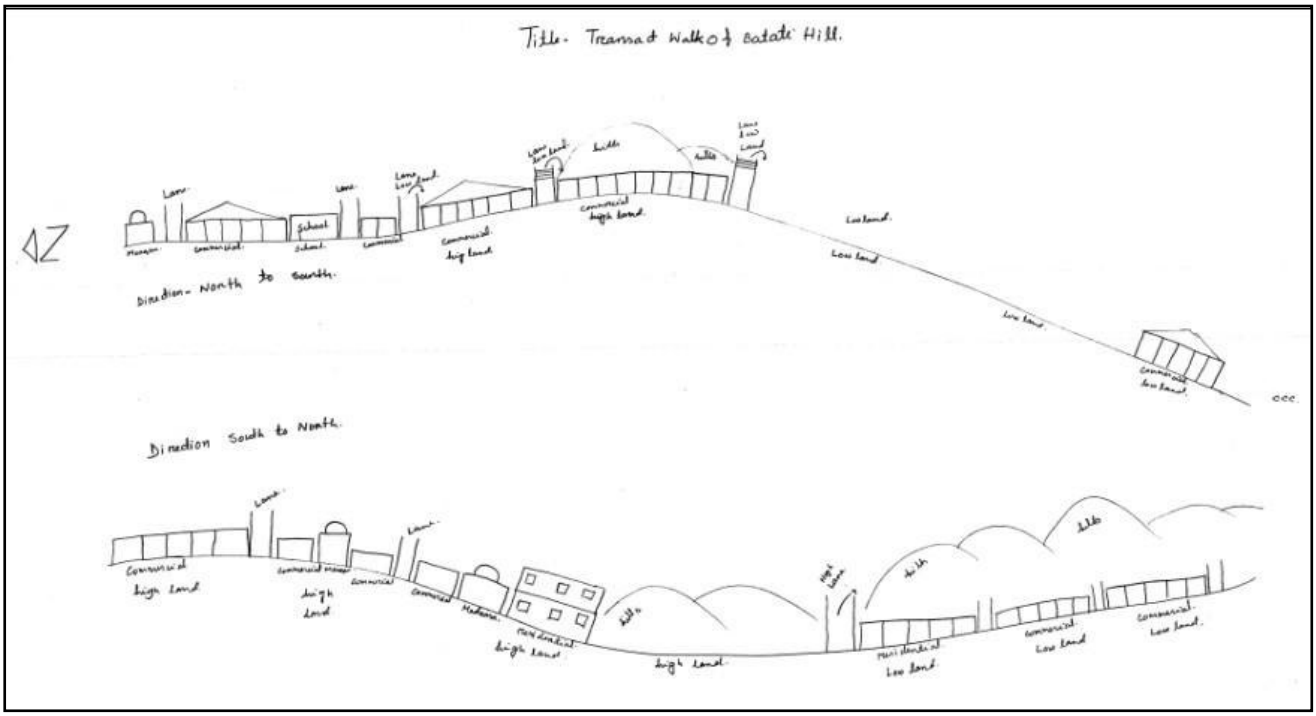
Major Findings

In north-south direction it is seen that settlements are located at the slope of the hills. Commercial settlements are seen along the transect. A school is found. Behind all commercial settlements residential houses of similar height are seen. Hills are located behind the commercial and residential settlements. Lanes of 5 feet to 8 feet width with stairs are seen along the side of the transect.

In south- north direction of another portion of area similar kind of commercial and residential settlements are observed. Settlements are located in maximum numbers in high land area. In the low land portion hills are prominent than other uses.

Figure 3.9: Transect walk of Batali Hill area.

Source: Field Survey, September, 2014



3.2.5 Institutional context associated to landslide vulnerability in Batali Hill area

There are different institutions in Batali Hill area. People depend on these institutions and these institutions help people. These institutions can be an organization, individual or a group etc. To study the relationship between the community and different institutions venn diagram tool is practiced. From this notion, a venn diagram of the study area has been prepared.

Venn diagram of Batali Hill Area

There are sixteen institutes identified who give support to the people of Batali Hill community.

Eye plaza: This is medical center for eye. This institution has low influence on the community with one way weak interaction.

Ispahani circle mosque: This mosque has good influence on the community. People get landslide warning from this mosque. There exists a strong two way interaction between the community and this institution.

Post office: There is a post office within 1 kilometre of this area. But people use this post office rarely. There exists a one way weak interaction between this institute and the community.

Momota clinic: It is located within 1.5 kilometres of the community. People go to this clinic for getting medical help. This clinic has big influence on the people of the community. Interaction type is one way and weak.

Batali hill masjid: This mosque is located just outside of the community. People go to the mosque and get announcement of landslide through mike from the mosque. One way weak interaction exists between the community and the mosque.

Tanker pahar majar: People go to this place for religious purpose. This institute has low influence with weak one way interaction.

Shakti foundation: This NGO helps people through proving financial and health facilities. This is a highly influential institute located in this area. There exists a one way medium interaction between this institute and the community

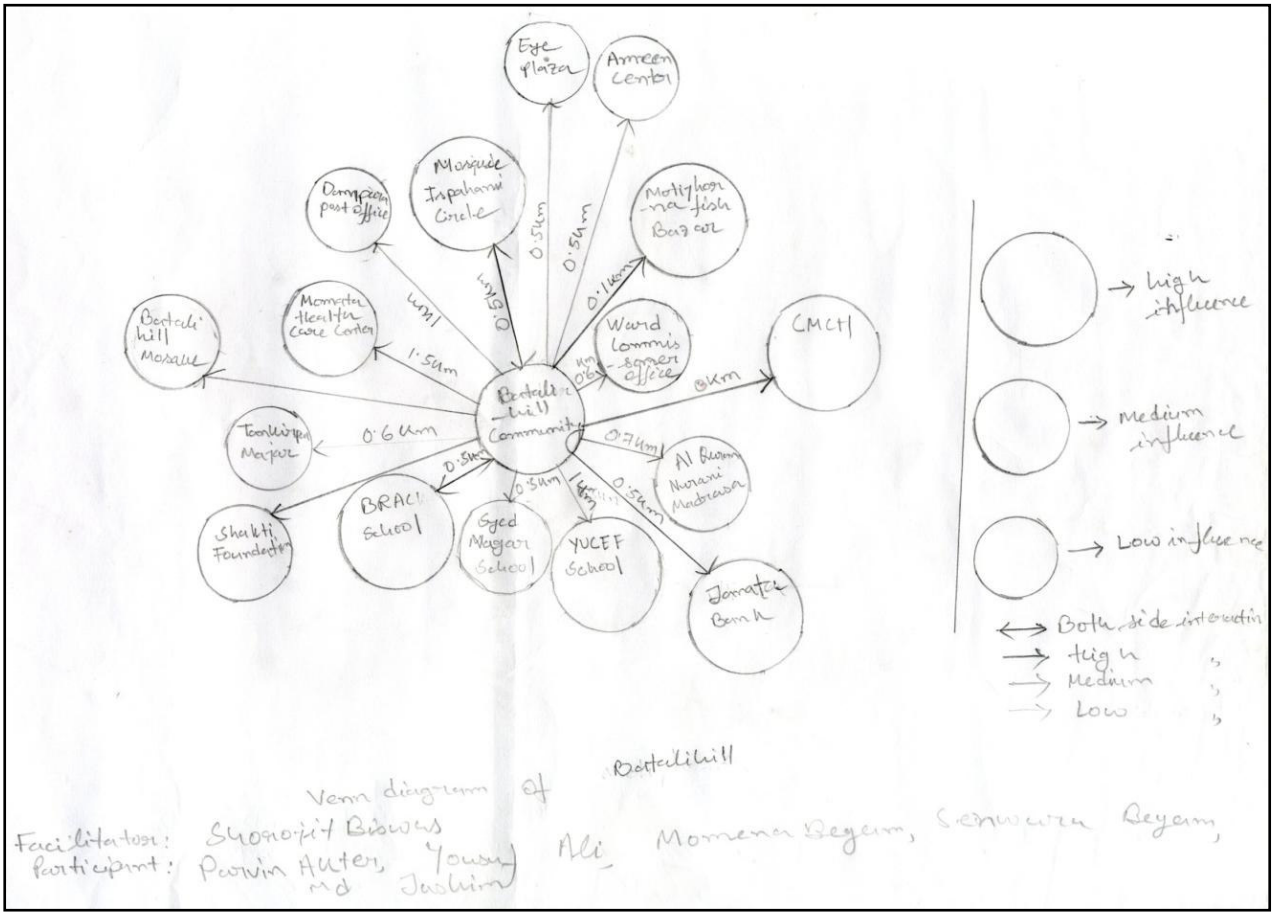
BRAC Madrasa: This madrasa is located within 0.5 kilometres of the community. People have great dependency on this institution for educational purpose. This madrasa has a great influence on people. Interaction type is both way and strong.

Syed Nagar School: This school also has good influence on the community. Interaction type is one way and weak.

UNICEF School: This is a highly influential school of this area. It is located within one kilometre from the community. There exists a one way high interaction between this school and community.

Figure 3.10: Venn diagram of Batali Hill area.

Source: Field Survey, September, 2014



Janata bank: This bank is located within 0.5 kilometre. This bank has high influence on the people of community. Interaction type is one way and strong.

Al-Quran nurani madrasa: This is the only madrasa of this community located within 0.5 kilometre. People have good dependency on this institution for educational purpose. This madrasa has a good influence on people. Interaction type is one way and strong.

Ward commissioner: People go to the commissioner's office but commissioner never visits. This institute has medium influence on the people of community.

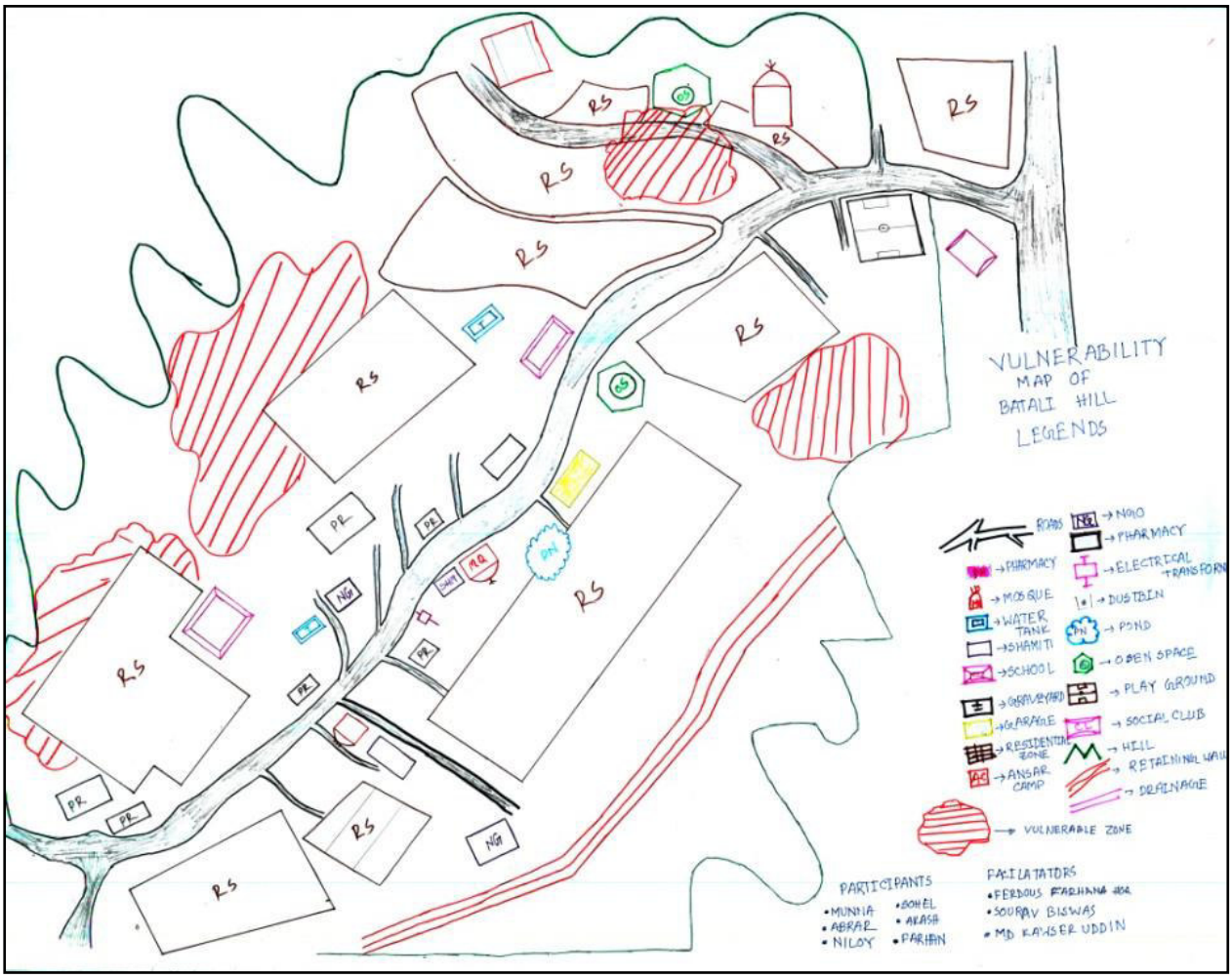
Moti Jharna fish market: This fish market is located at the center of Moti Jharna community. Fish from other areas of Chittagong come to this place. People buy fish and other things. This fish market has big influence on the community. Interaction type is strong and one way.

3.2.6 Assessment of social and landslide vulnerability in the Batali Hill area

People of the Batali Hill area experienced landslide hazards in different periods. Many social problems also exist in these areas which make these areas vulnerable to different social hazard. It is necessary to identify the comparatively more and less vulnerable locations of the area so that the local people can take appropriate measures beforehand to mitigate the risks of landslide and other hazards. For this, a vulnerability map was prepared. This map is a tool for vulnerability assessment through a participatory approach. This map can also be a basis for preparedness and response plans for landslide and other hazard in the locality to minimize the loss of life and properties.

Figure 3.11: Vulnerability map of Batali Hill area.

Source: Field Survey, September, 2014



Major findings

Hills are located in around everywhere of Batali Hill area. Settlements located at the down slope of the hills are indicated as high risk zone of landslide. A large number of settlements of western side, northern side and upper middle side of the area are identified as vulnerable to landslide.

3.1.7 Dream map of the Batali Hill study area

People of the Batali Hill area live with many problems and landslide. Still they have some hopes and aspirations to improve their social and economic condition. Dream map of these study areas were produced to get idea about the dreams and aspirations of people regarding their areas.

Findings from dream map of Batali Hill area

People of Batali Hill area gave their suggestions on following aspects.

- **Tube well and water tank installation**: As there is huge water crisis in Batali Hill area people want proper water facility in this area. People dream about sufficient number of tube well in this area. In dream map, proposed tube wells are indicated by black tube well sign. People also suggested for the establishment of a water tank on the middle of western side of the area.
- **Retention wall:** As landslide is a common phenomenon in this area, people suffer from landslide each year. There exists retention wall in eastern side, but no wall in western side. So, people suggested a retention wall along the hill at western side.
- **Open space and playfield**: At present, two open spaces exist in this area. People suggested four more open spaces in this area. At the middle of the area and eastern side of the area, people suggested a playfield.
- **Garage**: People suggested a garage for rickshaw and other type of vehicle along the side of the main road. This garage is indicated with green coloured square in map.

Figure 3.12: Dream map of Batali Hill area.

Source: Field Survey, September, 2014

3.3 PROFILE OF GOLPAHAR AREA

3.3.1 Historic profile of the Golpahar area

For this study it is very important to know about the study area properly. Historic information of study areas is gathered. For this purpose timeline tool is used.

Information about the Golpahar area was gathered from the local person who is living in this area for long time. Collected information was noted down and finally the timeline was prepared.

Table 3.3: Timeline of Golpahar.

Source: Field Survey, September, 2014

Year	Event	Remarks
1975 - 1976	Establishment of the colony	Landless people came here for making permanent residence.
1980	Rapid expansion of the colony	Rapid expansion was done by land grabber.
1980	Commercial activity started	
1984	Establishment of the Mosque	
1988	Fire Hazard occurred, 70% houses of the colony destroyed	
1988	First NGO, Prosika established their local office in the colony	
1992	7 people died, 3 cattle died due to landslide	
1997	Golpahar Social development committee established	
1998	Electrification of the area	
1999	Major road was constructed	
2006	Chader Alo, a non-govt. social service organization established	
2006	Start UPPR project started	
2007	Established 1st primary school by BRAC	
2009	First building was constructed by Eintu Mia	
2011	UNDP office established	
2014 (February)	1st murder took place in the area	

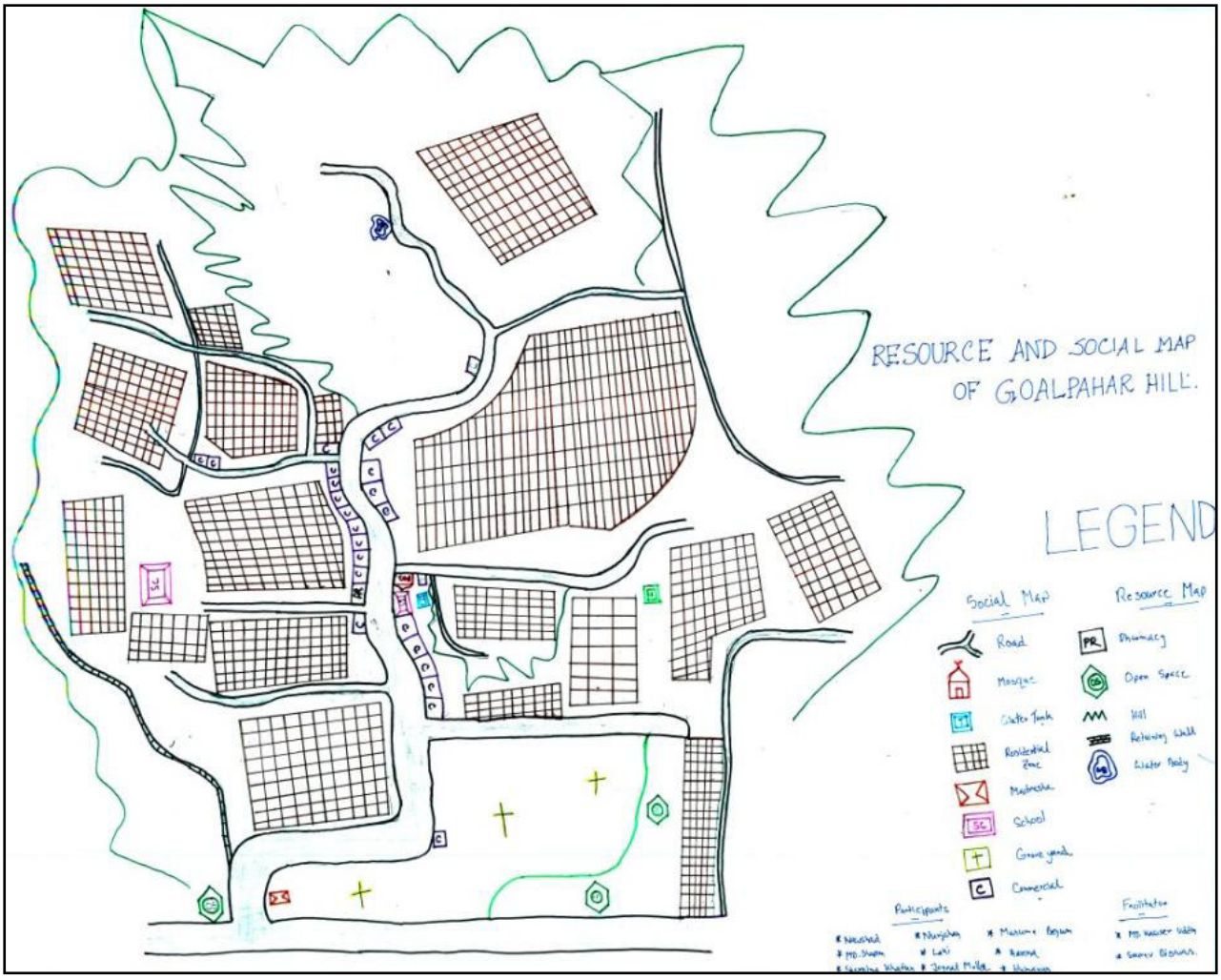
Findings: After the establishment of the settlement in 1970s, the colony rapidly expanded during 80s. In this period, commercial activities increased a lot. A significant fire hazard also took place in this period. By this time many NGOs and other organizations were established in this area which contributed to raise awareness among people on different health issues. Landslide event was first experienced by people of this area in 90s. In 90s utility facilities and roads in this area were improved. After 2000 schools, different NGO's offices started to be established in this area.

3.3.2 Social characteristics of the Golpahar study area

In this study social and resource mapping was used to know about the social dimensions of the study area. Social and resource mapping is a very popular PRA tool to identify the nature of housing and social infrastructure in an area, from the community people's perspective. Thus, to develop a broad understanding about the study area social mapping is the appropriate tool.

Figure 3.13: Social and resource map of Golpahar area.

Source: Field Survey, September, 2014



Major findings from social and resource map of Golpahar area

There are many social institutions and resources located in this area. This area is surrounded by hills. These hills are the main resources of this area. Apart from hills, there are open spaces and water body located in this area. These resources can be helpful during any type of

disaster. There is a retaining wall along the side of the hill to protect the area from landslide hazard.

There are some social institutions located in this area. There are two schools, one mosque, one madrasa located in this area. One pharmacy is located along the side of main road. There is a water tank located at the side of the main road to provide water to the people of this area. A big graveyard is located at one portion of the area. A few commercial shops are seen along the side of the main road. There are residential settlements located around every portion of this area.

3.3.3 Movement pattern of the people of Golpahar study area

Mobility map is a PRA tool that explores the movement pattern of the people of a community. It shows where people go, for what purpose and how they go there. Mobility map for Golpahar is prepared. A process for preparing mobility map is followed. The general process is discussed below.

Findings from the mobility map of Golpahar area

Mobility map of Golpahar area shows that people usually travel to different places for different purposes. These places are as following:

Educational institute: UNDP School, Ispahani Mirza Ahmed School and Feroz Shah School are educational institutes of this area. People travel to these places daily for educational purposes. Pahartali UNICEF School is another school. People go to this school by rickshaw.

Religious institute: Golpahar Baitul Mamur Jame Masjid is the religious institutes of this area. People travel to this place on foot daily for prayer as well as for education.

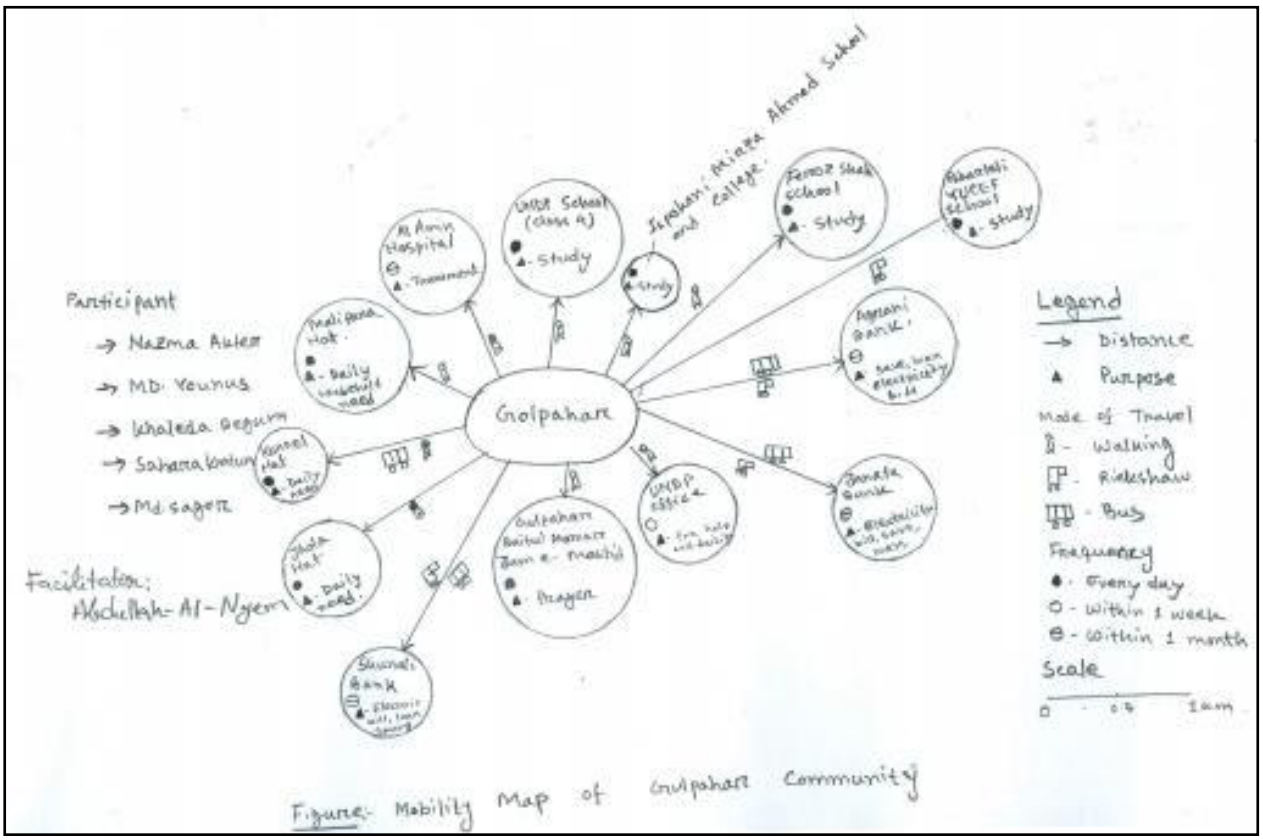
Commercial places: Mali para haat, Kornel haat and Jhola haat, Sonali Bank, Janata Bank and Agrani Bank are the commercial institutes of this area. People travel to malipara and jhola haat daily on foot to buy daily necessities. Sometimes, people use bus to reach Kornel haat daily to buy household goods. People go to banks of this area by rickshaw once in a month for banking activities.

Health care facility: Al-Amin Hospital is the only health care facilities of this area. People travel these places on foot once in a year.

Others: People go to the UNDP office of this area once a week on foot for help.

Figure 3.14: Mobility map of Golpahar area.

Source: Field Survey, September, 2014



3.3.4 Physical characteristics of Golpahar study area

Transect Walk is another PRA method used to explore the spatial dimensions of people's realities. A transect walk depicts a cross sectional view of different features of an area. Here it provides a comparative assessment of the parts of the area on different parameters including topography, land type, building type, building height, problems, opportunities and solutions. Transect walk is used for verification of issues raised during other PRA exercises particularly during social mapping, natural resource mapping etc.(Kumar, 2002)

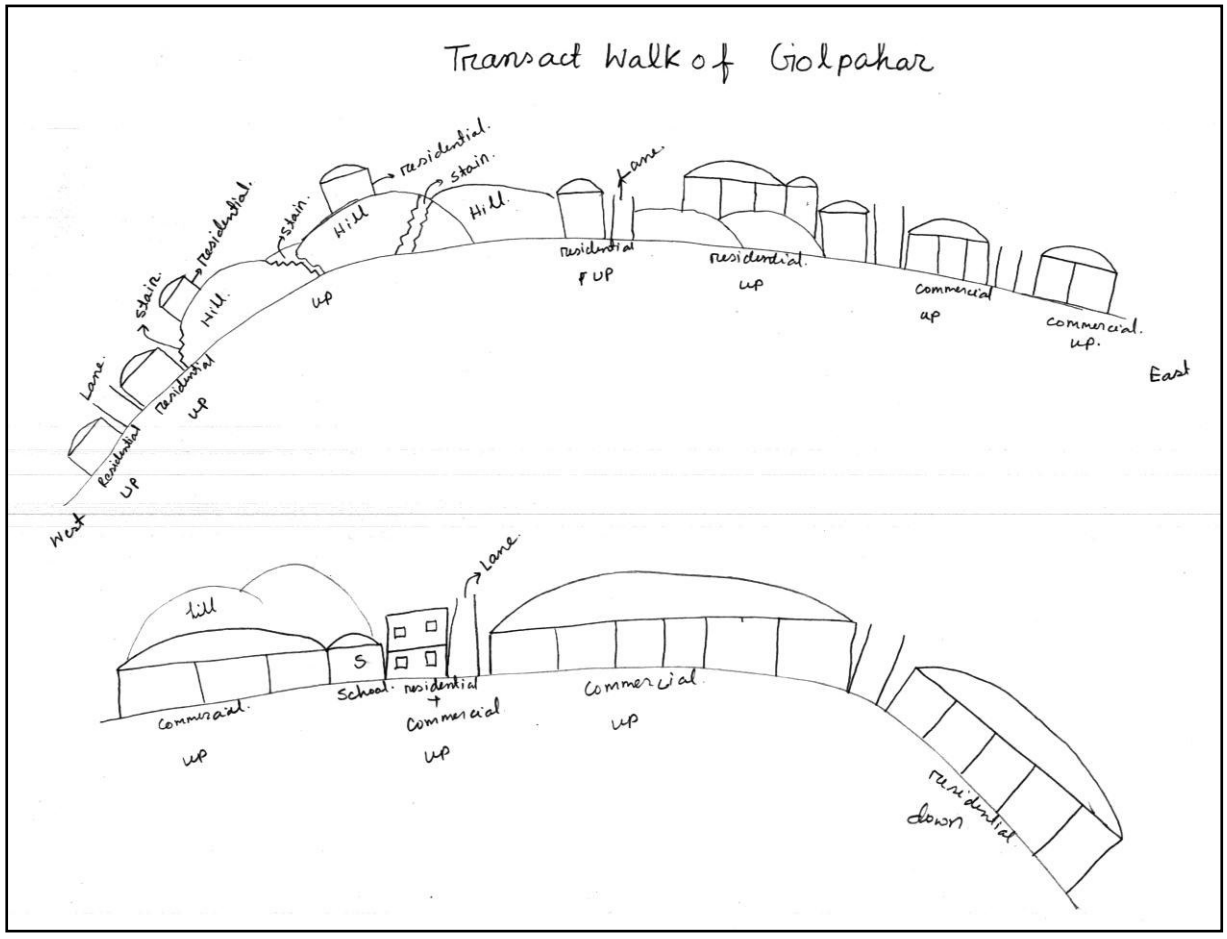
Major findings

In west-east direction houses are located on the slope of the hills. Many houses are located on the top of the hills. Stairs (by cutting hills) are used for movement of people. Along with residential settlements, commercial structures are seen.

In North-south direction, Commercial settlements are dominant. Structures are settled along the slope of the hills. Two storey residential houses are also found.

Figure 3.15: Transect walk of Golpahar area.

Source: Field Survey, September, 2014



3.3.5 Institutional context associated to landslide vulnerability in Golpahar study area

There are different institutions in Golpahar area. People depend on these institutions as these institutions help people. These institutions can be an organization, individual or a group etc. To study the relationship between the community and different institutions venn diagram tool is practiced. From this notion a venn diagram of the Golpahar has been prepared.

Venn diagram of Golpahar Area

UNDP School: This institution has a great influence on the people. This school is established by UNDP. Sometimes different health campaign is organized by UNDP in this school. These health campaigns are supported by Al-Amin Hospital. There exists a one way strong interaction between UNDP School and Al-Amin Hospital. A two way strong interaction between this community and the school also exists.

Malia para haat, Karnel haat and Jola haat: These institutions are used as commercial place. Interaction of community with these institutions is one way and weak.

Janata Bank: This bank is located within 1.5 kilometres. This bank has medium influence on the people of community. Interaction type is one way and strong. People get financial help from this institute.

Gol Pahar Buital Mamur Jame Masjid: This mosque is located at 0.2 kilometre distance from the community. People go to the mosque and get announcement of landslide through mike from the mosque. A two way strong interaction exists between the community and the mosque.

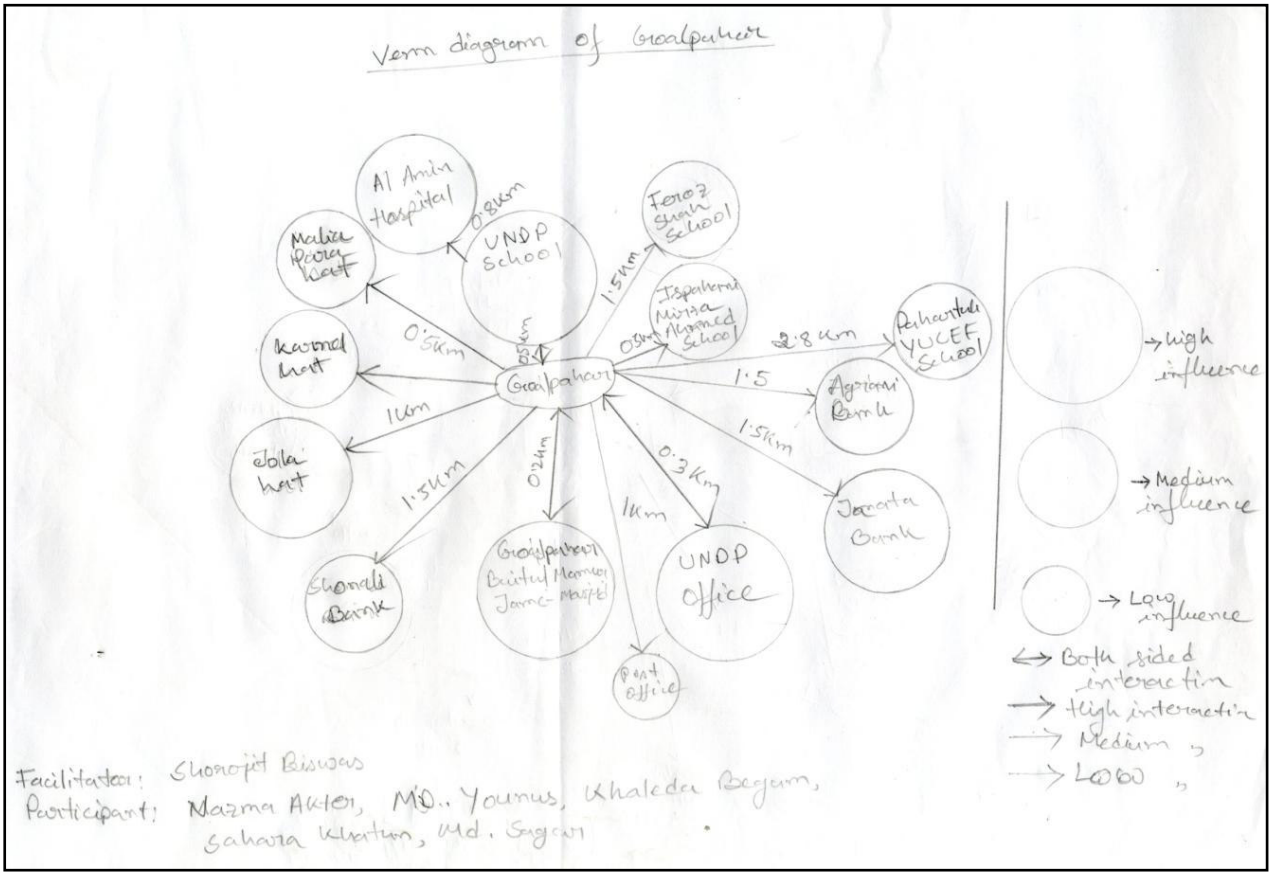
Post office: There is a post office within 1 kilometre in this area. But people use this post office rarely. There exist a one way weak interaction between this institute and the community.

UNDP Office: UNDP office is located in Golpahar area. People go to this area for different purposes. Their representatives visit this area and make people aware of hazard and diseases. Influence of this area is high. Interaction between this institute and the community is two way and strong.

Janata bank and Agrani bank: These banks are located within 1.5 kilometres of the area. Janata bank has higher influence to the community people than Agrani bank. Interaction type is one way and strong. People get financial help from these institutes.

Figure 3.16: Venn diagram of Golpahar area.

Source: Field Survey, September, 2014



UNICEF School, Ispahani Mirza School and Feroz Shah School: These schools have high influence on the community. These schools are located 0.5-1.5 kilometres range in the community. There exists a one way high interaction between this school and the community.

3.2.6 Assessment of social and landslide vulnerability in the Golpahar study area

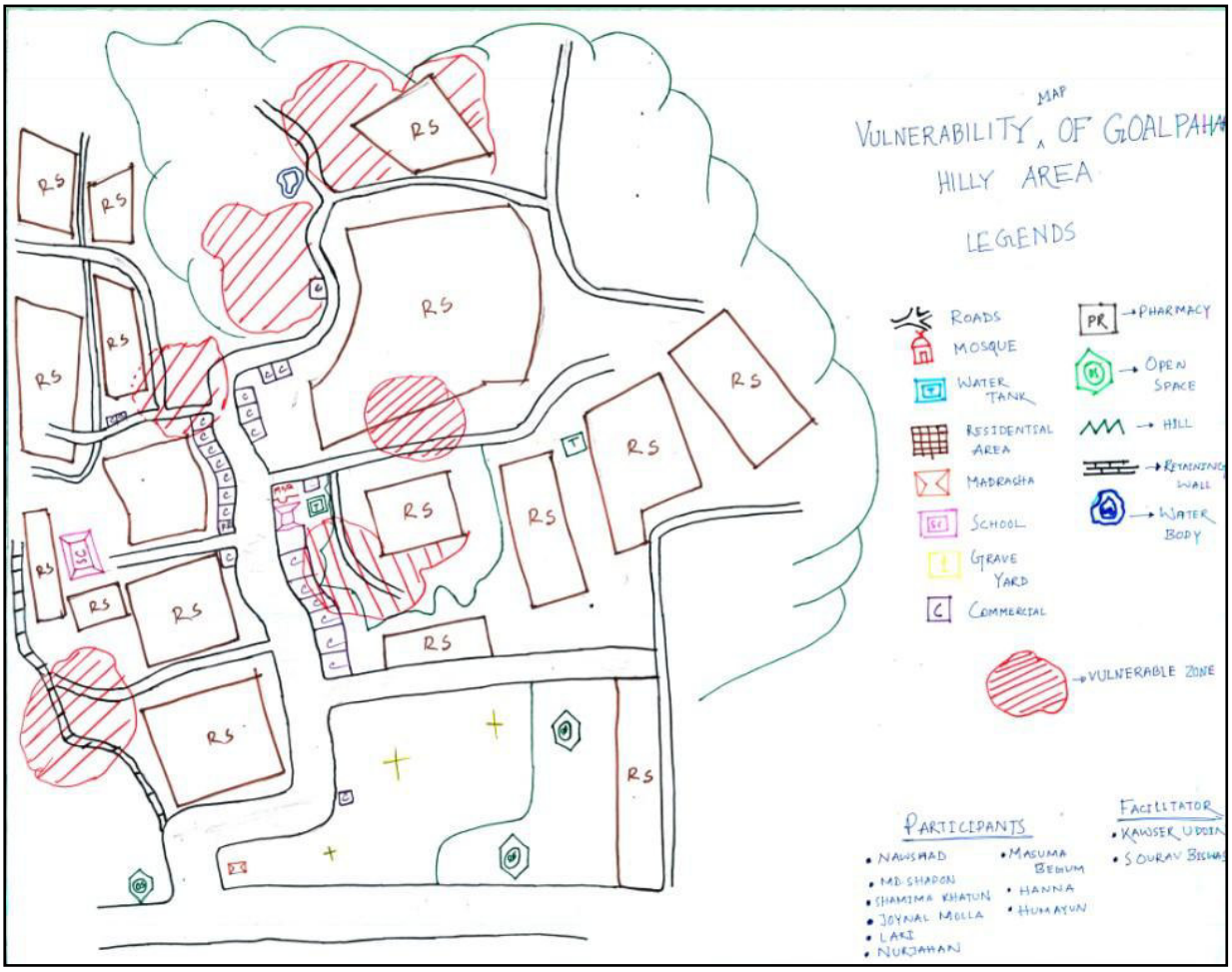
People of Golpahar area experienced landslide hazards in different periods. Many social problems also exist in this area which makes this area vulnerable to different social hazards. It is necessary to identify the comparatively more and less vulnerable locations of the area so that the local people can take appropriate measures beforehand to mitigate the risks of landslide and other hazards. For this, a vulnerability map was prepared. This map is a tool for vulnerability assessment through a participatory approach. This map could also be a basis for preparedness and response plans for landslide and other hazard in the locality, to minimize the loss of life and properties.

Major findings

Hills are located in northern and eastern portion of Golpahar area. Settlements located at the down slope of the hills are indicated as vulnerable to landslide. Some houses are located at different layers of hills. Those settlements are also indicated as vulnerable to landslide. Some commercial settlements at middle of the area are found vulnerable to landslide. Even the retaining wall is identified as vulnerable to land slide. Settlements along the side of the road on the north-western portion of the area are found as vulnerable to the landslide.

Figure 3.17: Vulnerability map of Golpahar area.

Source: Field Survey, September, 2014



3.1.7 Dream map of the Golpahar area

The people of Golpahar area live with many problems and landslide. Still they have some hopes and aspirations to improve their social and economic condition. Dream map of the study area was produced to get idea about the dreams and aspirations of people regarding their areas.

Figure 3.18: Dream map of Golpahar area.

Source: Field Survey, September, 2014

Findings from dream map of Golpahar area

People of Golpahar area gave their suggestions on six aspects.

In existing condition there are a few facilities located in this area. People gave their suggestions on different facilities.

- **Tube well and water tank installation**: As there exists huge water crisis in Golpahar, people want proper water facility in this area. People dream about sufficient number of tube well in this area. In dream map proposed tube wells are indicated by purple coloured tube well sign. People also suggested the establishment of a water tank on different portions of the area.
- **Educational institute**: People of Golpahar area proposed to establish schools and madrasa in this area.

- **Medical facilities**: As there is no medical facilities located in this area, people suggested a clinic to be established in this area.
- **Pond**: People of this area suggested four places which they want to be used as pond.
- **Market place**: People of this area want a market place which should be located at the center of the area.
- **Electric poles**: People of this area want some electric poles to be established in this area.

3.4 PROFILE OF GOACHIBAGAN MEDICAL HILL AREA

Location: Goachibagan is located in Chittagong Metropolitan Area. Goachibagan area is surrounded by Chittagong Medical College.

3.4.1 Historic profile of the Goachibagan study area

For this study, it is very important to know about the study area properly. Historic information of study areas is gathered. For this purpose timeline tool is used.

Timeline of Goachibagan

Information about Goachibagan area was gathered from the local persons named Shukhiya Begum, Rehana Parvin, Bahar Khanom who are living in this area for long time. An appointment was made with them. After the arrival on the spot on scheduled day the purpose of the exercise was explained to them. They described different incidents according to the respective year. Collected information was noted down and finally the timeline was prepared.

Findings from timeline:

A significant event of this area is the establishment of Chittagong Medical College. This persuaded the establishment of settlement in this area. Later drainage facility developed. Fire incident in 1996 is a significant event in this area. Due to lack of road facility fire service could not reach to the place. It resulted in a huge loss of property and life. After that, road facilities were improved. After 2000 commercial activities expanded in this area.

Table 3.4: Time line of Goachibagan area.

Source: Field Survey, September, 2014

Year	Event	Remarks
1957	Establishment of Chittagong Medical College Hospital (CMC).	
1964	Establishment of the settlement.	Electricity, water supply and Govt. primary school were from the very beginning.
1978	Establishment of Forkaniya Madrasa	
1989	Drains were made wider	
1996	A terrible fire incident occurred. It was induced from the Clay oven at 4 a.m. Almost 200 houses were destroyed, No one died	There were slopped roads made of stone. Fire service could not reach to the place in time.
1998	Roads were developed and the settlement expanded rapidly.	
2000	Roads and drains were built.	
2000	Supply of gas started.	
2002	Water supply by Govt. authority was stopped.	
2002-2004	4-5 shops were started in this locality. Gradually the number increased to 8-10.	There were Saloon, laundry, grocery shop and tea stall.
2008	Establishment of a deep tube well by Commissioner of ward no.16	Behind the building number 26.
2008	OSSEP started working in this locality	

3.4.2 Social characteristics of Goachibagan study area

In this study Social and resource mapping was used to know about the social dimensions of the study area. Social and resource mapping is a very popular PRA tool to identify the nature of housing and social infrastructure in an area, from the community peoples' perspective. Thus, to develop a broad understanding about the study area social mapping is the appropriate tool.

Major findings from social and resource map of Goachibagan area

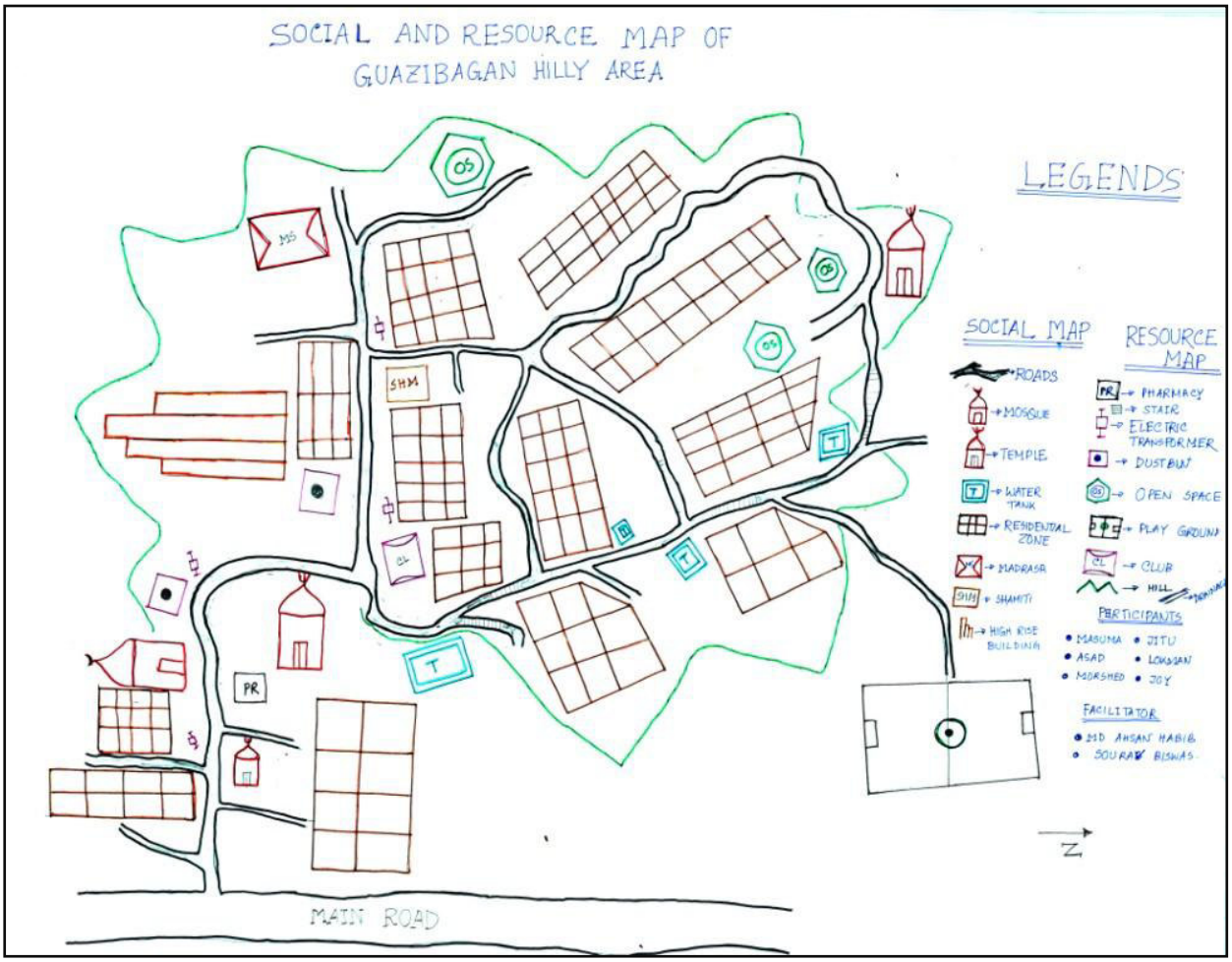
This is located on the hills of Chittagong Medical College. Houses are located at the slope of hills. Different social institutions and resources are also located at the slope of the hills. There are a playground and three open spaces located in this area. Four water tanks are located in

this area to provide water supply to the people of this area. Two locations of dustbins are identified.

Among different social institutions, three temples and one mosque are identified. This indicates to the presence of Hindu religious people in this area. Existence of different co operative institutions is found. There is a co-operative and a social club located in this area. One pharmacy is located at the side of the road of this area. People get medication facility from this pharmacy.

There is no school or madrasa identified in this school. These educational institutes are located to the neighboring communities. Most of the hill lands are used for residential purpose. There are high-rise buildings found at one side of the area.

Figure 3.19: Social and resource map of Goachibagan area.
Source: Field Survey, September, 2014

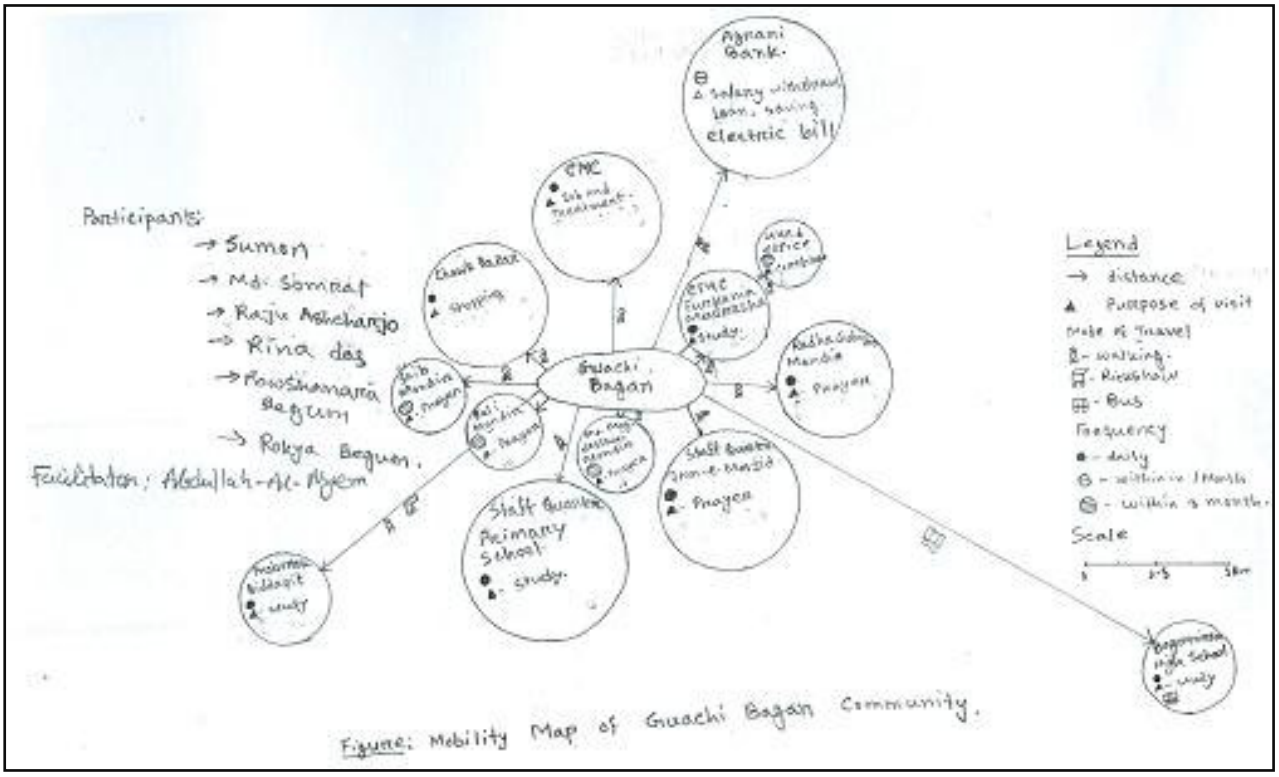


3.4.3 Movement pattern of the people of Goachibagan study area

Mobility map is a PRA tool that explores the movement pattern of people of a community. It shows where people go, for what purpose and how they go there. Mobility map for four study areas are prepared. A process for preparing mobility map is followed. The general process is discussed below.

Figure 3.20: Mobility map of Goachibagan area.

Source: Field Survey, September, 2014



Findings from the mobility map of Goachibagan area

Mobility map of Goachibagan area shows that people usually travel to different places for different purposes. These places are as following:

Educational institute: Staff quarter Primary school, CMC Fakrunnesa Madrasa and Probortok Biddapit are educational institutes of this area. People travel to these places daily for educational purposes. Sometimes people use rickshaw to reach Probortak biddapit.

Religious institute: Shib mondir, kali mondir, Radha Gobinda mondir and Maa mogedesshori mondir are temples where Hindu religious people go for prayer on foot once in

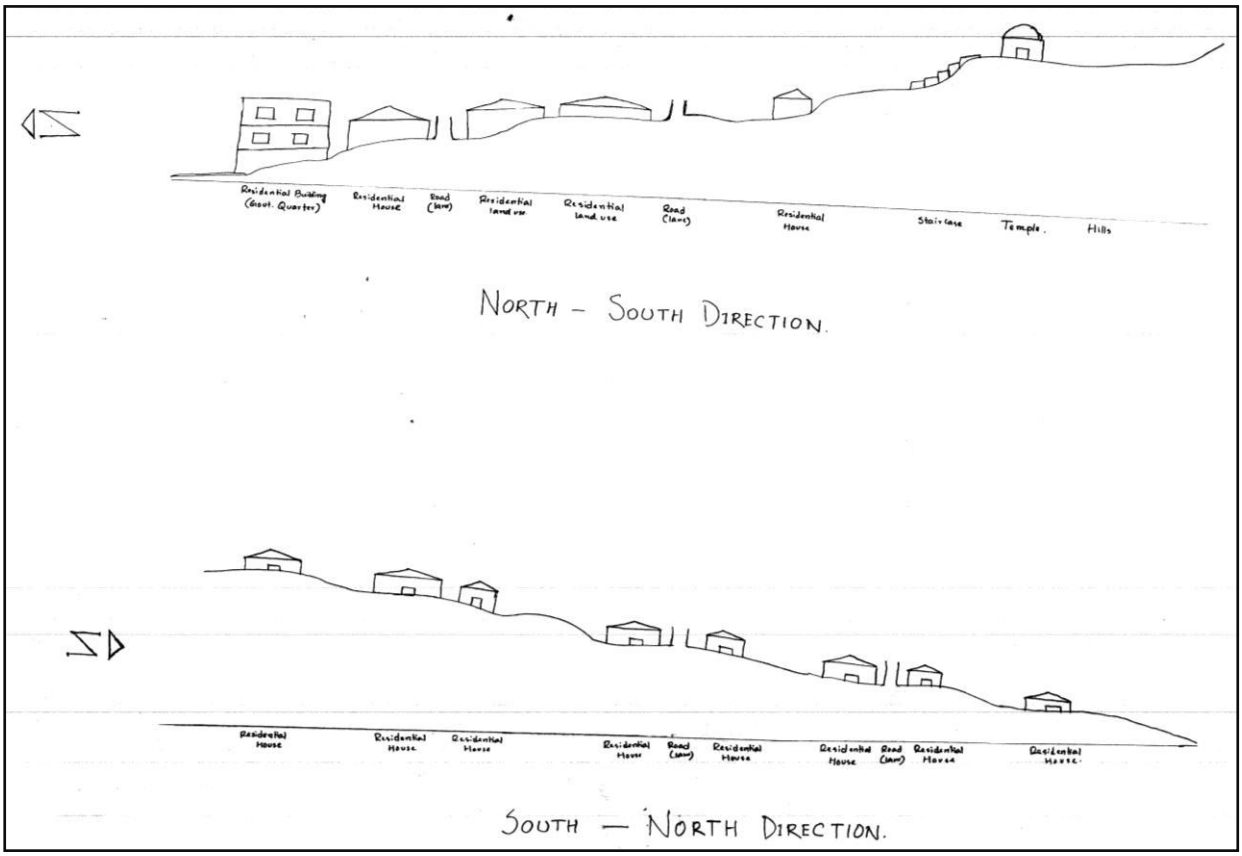
three months. Staff quarter jame masjid is the mosque where people go on foot daily for prayer as well as for religious education.

Commercial places: Chawkbazar, Chittagong Mediacal College (CMC), Agrani bank are the commercial institutes of this area. People travel to Chawkbazar and CMC daily on foot to buy daily necessities and job purposes. People go to bank once a month no foot.

3.4.4 Physical characteristics of Goachibagan study area

Transect Walk is another PRA method used to explore the spatial dimensions of people's realities. A transect walk depicts a cross sectional view of different features of an area. Here it provides a comparative assessment of the parts of the area on different parameters including topography, land type, building type, building height, problems, opportunities and solutions. Transect walk is used for verification of issues raised during other PRA exercises particularly during social mapping, natural resource mapping etc. (Kumar, 2002)

Figure 3.21: Transect walk of Goachibagan area.
Source: Field Survey, September, 2014



Major findings:

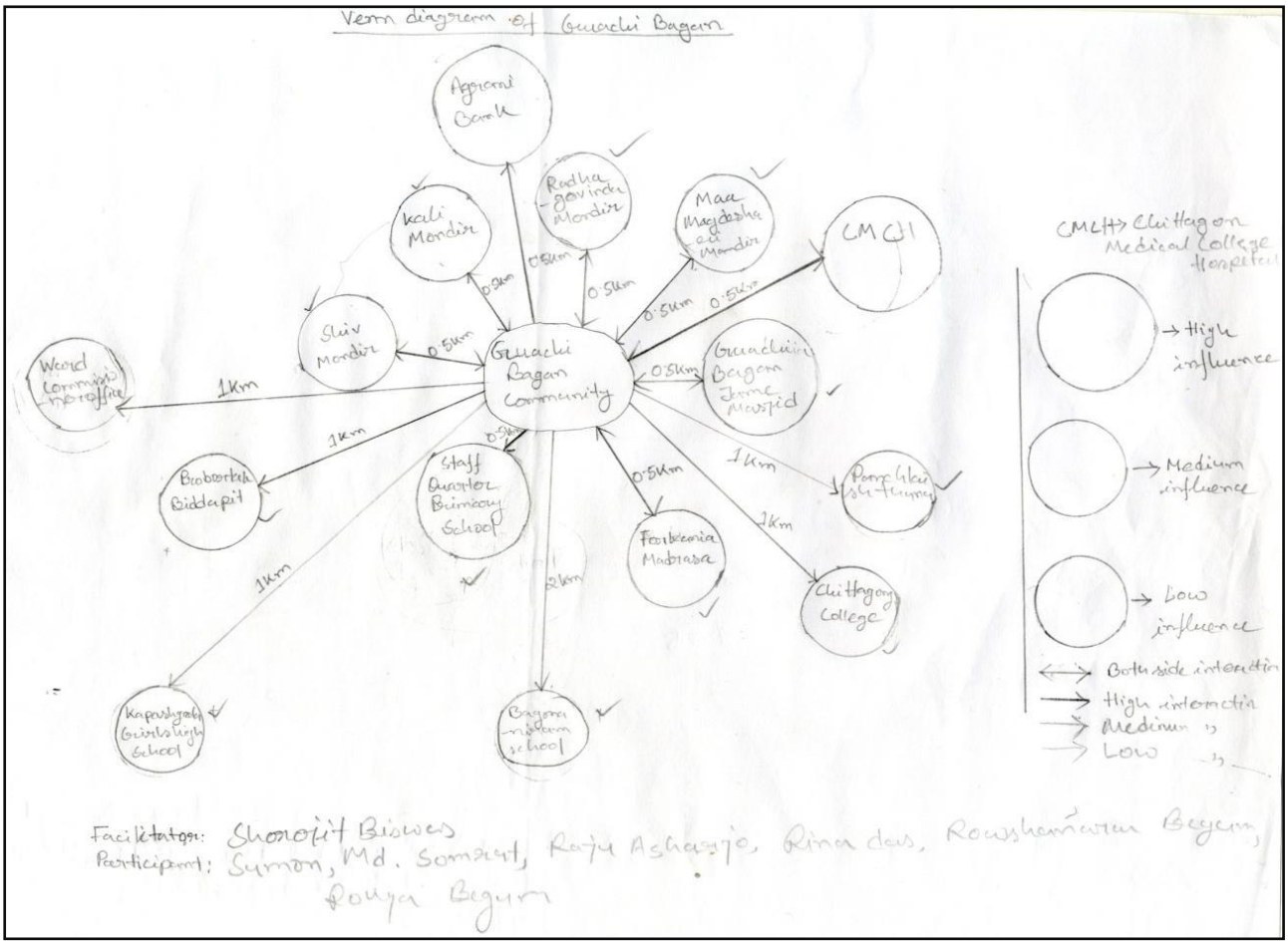
From the transect it is seen that the whole community is located on the slope of the hill. Small one storey houses are dominant. One temple is also seen. Residential settlement is found in this area. At the down of the slope of the hill a three storey house is located. Stair is used for movement in different levels.

3.4.5 Institutional context associated to landslide vulnerability in Goachibagan

There are different institutions in Goachibagan area. People depend on these institutions and these institutions help people. These institutions can be an organization, individual or a group etc. To study the relationship between the community and different institutions Venn diagram tool is practiced. From this notion a Venn diagram of the study areas have been prepared.

Figure 3.22: Venn diagram of Goachibagan area.

Source: Field Survey, September, 2014



Venn diagram of Goachibagan Area

Mondir: In Goachibagan area Kali mondir, Radha Govinda mondir, Maa Maydesha mondir and shib mondir are located. Existence of these institutions in this area indicates to the presence of Hindu people in this area. These institutions are located within 0.5 kilometre of the community. These institutions are used by local Hindu people for religious purpose. There exists low influence and two way medium interactions between these institutions and the community.

Schools: There are four schools located in this area. They are Staff quarter primary school, Kapashgola Girls' High School, Probortak Biddapit and Bagma Niram School. Among these Staff quarter primary school has the greatest influence on the people of the community. This school has the strongest one way interaction rather than other schools. Other schools have low influence, one way, medium interaction with the community.

Forkania Madrasa: This is the only madrasa of this community located within 0.5 kilometre. There is a two way strong interaction between this madrasa and the community.

Chittagong College: This College is located at a distance of 1 kilometre from the community. Interaction between the community and this institute is one way and medium.

Panchlaish Thana: Panchlaish thana is located at 1 kilometre distance from the community. It has small influence on the people of the community. One way weak interaction exists between the community and the institute.

Goachibagan Jame Masjid: This mosque is located at 0.5 kilometre distance from the community. This mosque has a great influence on the people of the community. People go to the mosque and get announcement of landslide through mike from the mosque. A two way strong interaction exists between the community and the mosque.

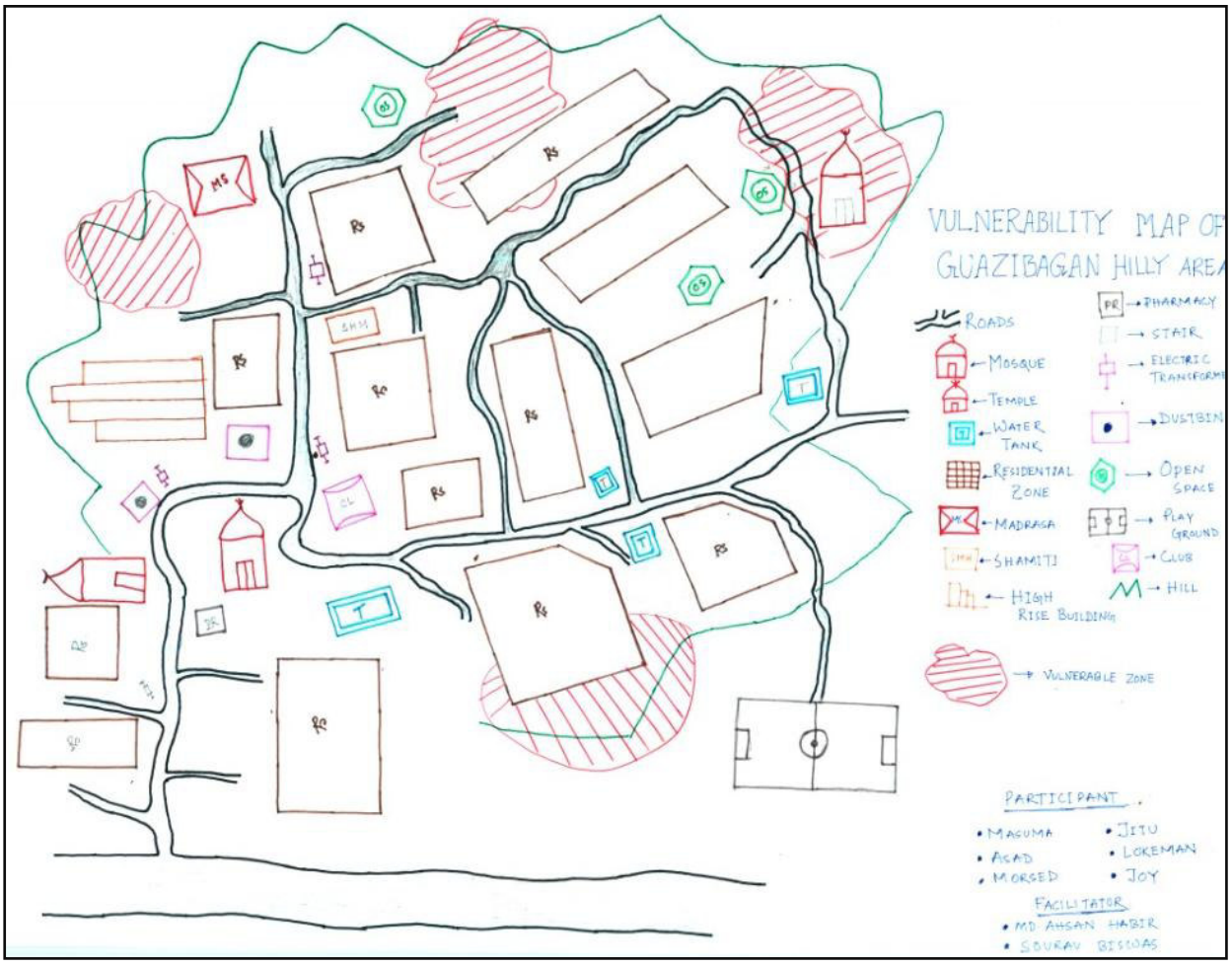
Ward commissioner: People go to the commissioner's office but commissioner never visits. This institute has medium influence on the people of community.

3.4.6 Assessment of social and landslide vulnerability in the Goachibagan study area

People of the Goachibagan area experienced landslide hazards in different periods. Many social problems also exist in this area which makes it vulnerable to different social hazards. It is necessary to identify the comparatively more and less vulnerable locations of the area so that the local people can take appropriate measures beforehand to mitigate the risks of landslide and other hazards. For this, a vulnerability map was prepared. This map is a tool for vulnerability assessment through a participatory approach. This map could also be a basis for preparedness and response plans for landslide and other hazard in the locality, to minimize the loss of life and properties.

Figure 3.23: Vulnerability map of Goachibagan area.

Source: Field Survey, September, 2014



Major findings

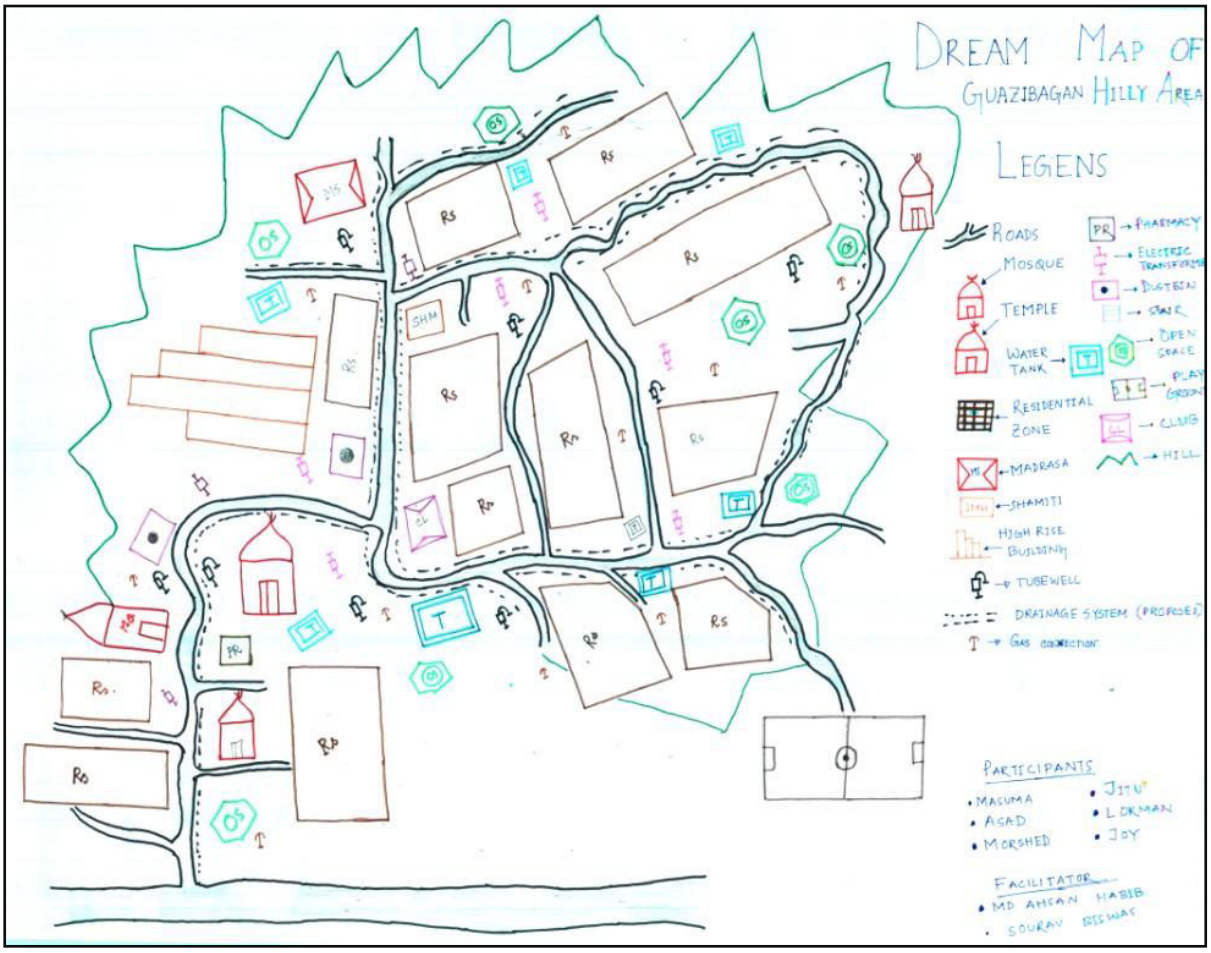
Goachibagan area is located at the different layers of the hill. Some specific portions of the area are identified as vulnerable to landslide. Residences located at East and west sides of the area are vulnerable to landslide. Temple located at the North-western side of the area is found to be vulnerable to landslide. Some houses at south are also identified as vulnerable to landslide. Hills are located in northern and eastern portions of Goachibagan area.

3.1.7 Dream map of the Goachibagan study areas

People of the Goachibagan area live with many problems and landslide. Still they have some hopes and aspirations to improve their social and economic condition. Dream map of these study areas were produced to get idea about the dreams and aspirations of people regarding their area.

Figure 3.24: Dream map of Goachibagan area.

Source: Field Survey, September, 2014



Findings from dream map of Goachibagan area

People of Goachibagan area gave their suggestion on three aspects.

In existing condition there are a few facilities located in this area. People gave their suggestion on different facilities.

- **Tube well and water tank installation:** As there exists a huge water crisis in Goachibagan people want proper water facility in this area. People dream about sufficient number of tube well in this area. In dream map proposed tube wells are indicated by black tube well sign. People also suggested the establishment of a water tank on different portions of the area.
- **Open space:** People suggested some open spaces on the southern side of the area.
- **Electric poles:** People of this area want some electric poles to be established in this area.
- **Installation of Gas conjunction point:** Gas facility is not available in this area. People want gas facility in this area.

CHAPTER 4:
PHYSICAL, SOCIO-ECONOMIC AND LANDSLIDE ASPECTS (Individual Respondents' Opinion)

Chittagong Metropolitan Area (CMA), the second largest city of Bangladesh, is vulnerable to landslide hazard. The main aim of this project is to develop an early warning system for the hilly areas of CMA incorporating local knowledge. Early warning is expected to contribute to life safety and damage reduction for landslide events. The user groups of the Web-GIS based early warning system will be the people living in landslide risks. Therefore, it is important to understand human adaptation to landslide risks under the condition of rapid urbanization in a fast growing city like CMA. It is also important to analyze how the local people react to the landslides and cope with the situation. This will help to enrich the landslide mitigation strategies for sustainable mountain development.

In this connection, a total of 590 respondents have been surveyed in four different areas named Moti Jharna, Batali Hill, Golpahar and Goachibagan Medical Hill. It is expected to have an idea about the physical aspects, socio-economic condition, experience related to landslide and its risk management of the people residing in the hilly areas in Chittagong Metropolitan Area (CMA).

4.1 STUDY AREA-1: MOTI JHARNA

A. Basic information and background of the respondents

Among the four study areas, Moti Jharna possesses the highest number of population. In Moti Jharna area, 248 respondents are surveyed. Male participants (58.47%) are dominating in number and most of the respondents are in age range 19-40 years, i.e, they are economically active people (Appendix-C, Figure 1 and Figure 2).

The respondents are mostly from Chittagong, Comilla and Noakhali districts of Bangladesh (Appendix-C, Table 2). The locations of their previous places are shown in Figure 4.1. The main cause to migrate in Moti Jharna area is for better employment opportunity. Besides,

27% respondents live here by born (Figure 4.2). Maximum number of respondents resides in this area for about 10 to 30 years whereas only 2% people reside here for more than 60 years (Appendix-C, Figure 3). There is contradiction among the respondents' opinion about the duration of settlement in this area. From the respondents, it is found that the settlement in Moti Jharna area was established before the liberation war of Bangladesh in 1971. But most of the people (32.66%) have reversed views and a significant number of people (37.5%) have no idea about it (Appendix-C, Figure 4).

Figure 4.1: Migration status of the inhabitants of Moti Jharna area.
Source: Field Survey, September, 2014

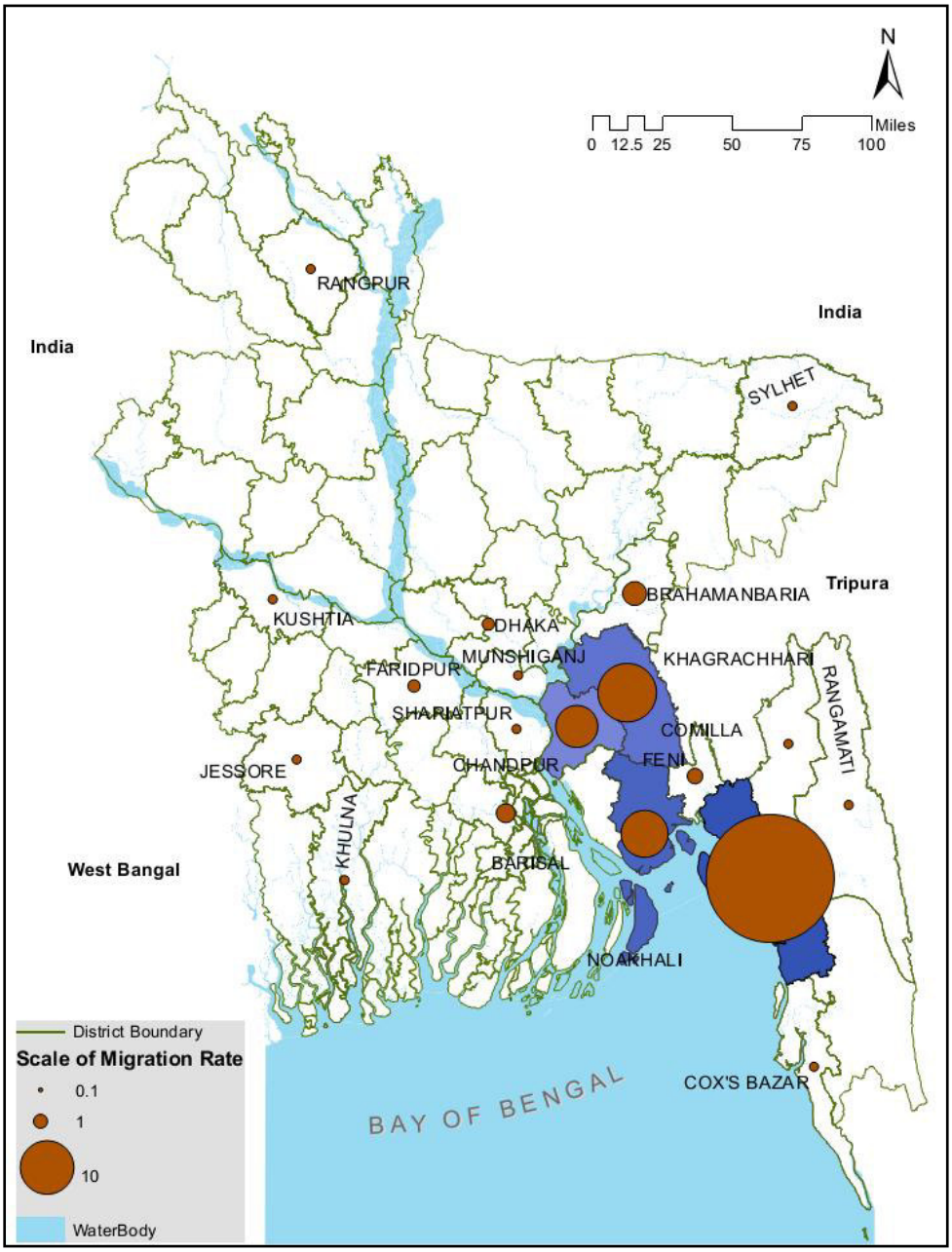
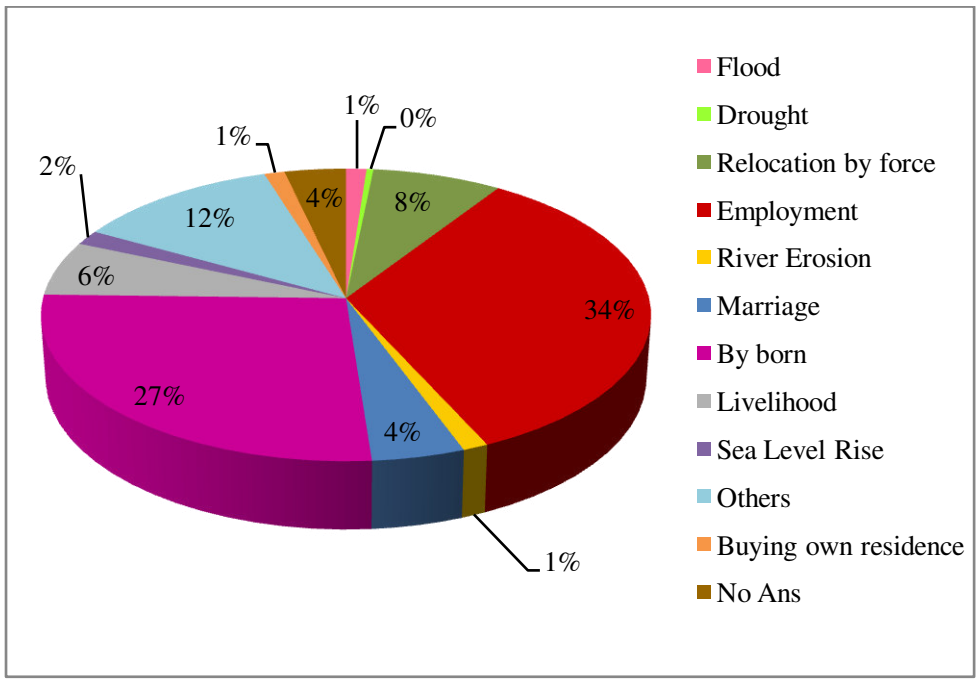


Figure 4.2: Respondents' Causes of migration to Moti Jharna.

Source: Field Survey, September, 2014



B. Demographic information/ Socio-economic aspects

The majority of the respondents in this locality are illiterate (37.9%), besides there are significant number of respondents having secondary and primary level of education respectively (Figure 4.3). Day labourer and shopkeeper are the main occupation of the surveyed households. Driver, garment worker, employee are also significant in this area (Figure 4.4). Most of the respondents have average monthly household income of Tk.5001-Tk.10000 and Tk.10001-Tk.15000 respectively (Figure 4.5). Besides, there is same scenario in case of average monthly household expenditure (Figure 4.6).

Figure 4.3: Education level of the respondents in Moti Jharna.

Source: Field Survey, September, 2014

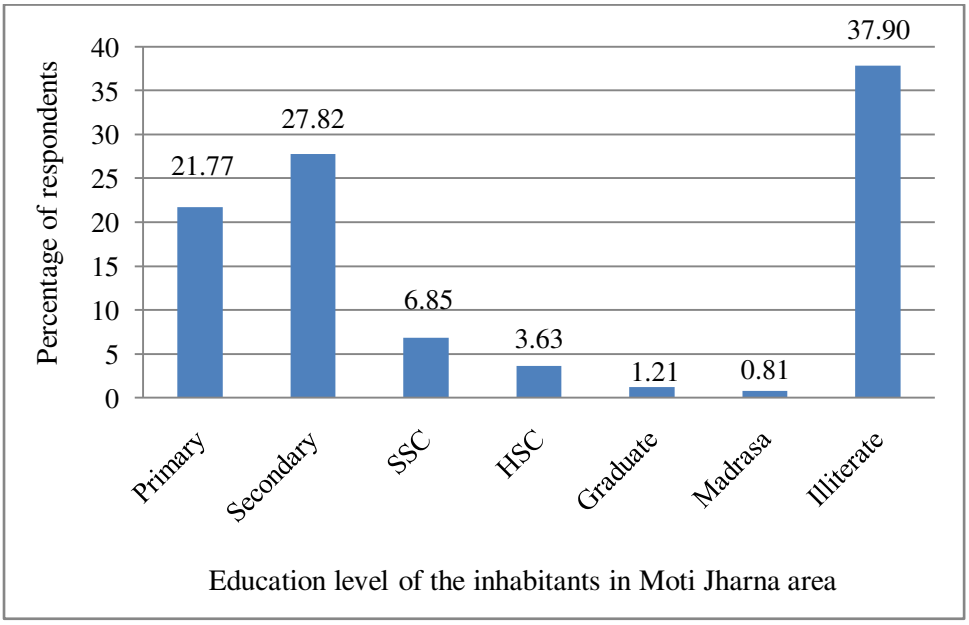


Figure 4.4: Main income sources (occupation) of the households.

Source: Field Survey, September, 2014

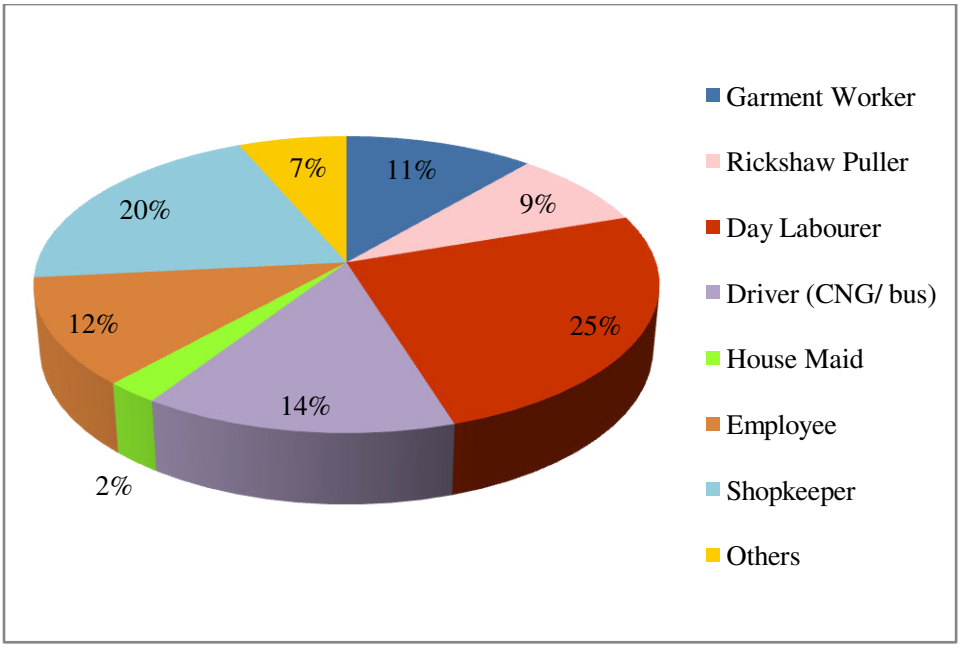


Figure 4.5: Average monthly income (in Taka) of the households.

Source: Field Survey, September, 2014

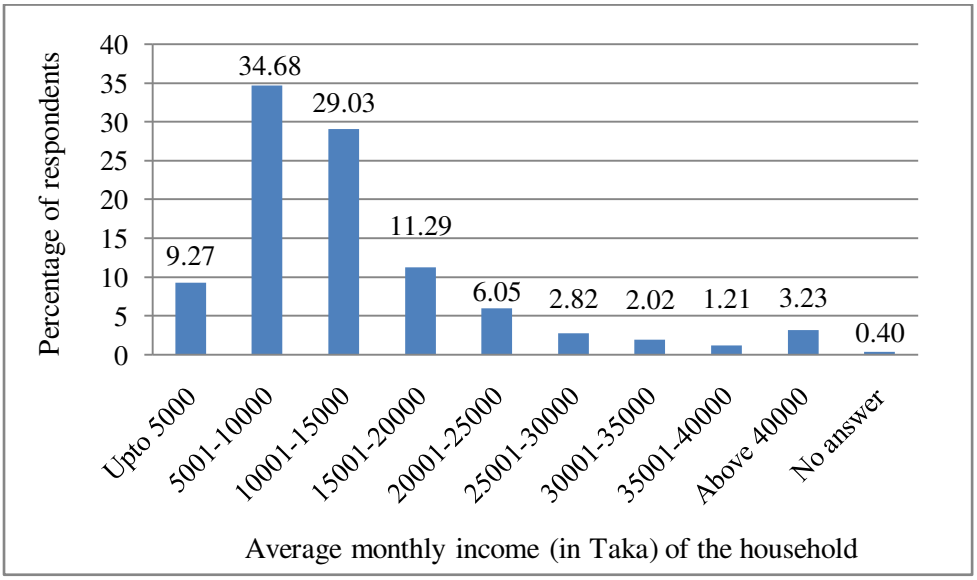
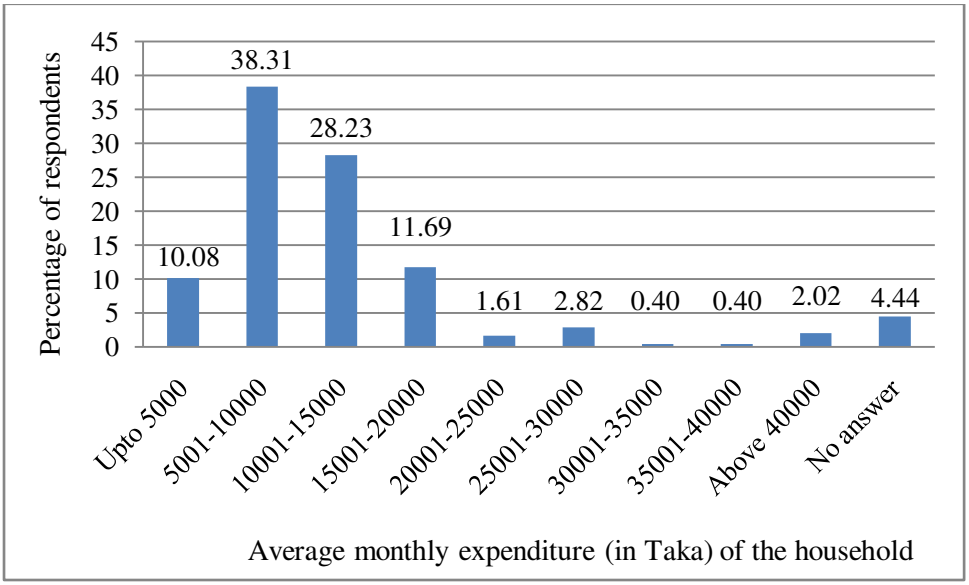


Figure 4.6: Average monthly expenditure (in Taka) of the households.

Source: Field Survey, September, 2014



From survey it is found that only six respondents get financial help from their family members living or working in Dhaka, Lakshmipur and Shariatpur region in Bangladesh (Table 4.1). Most of them get the money on monthly basis (Figure 4.7). Among the six respondents four said that each of them gets financial help of Tk. 100, Tk. 2,000; Tk. 3,000 and Tk. 20,000 respectively (Figure 4.8).

Table 4.1: Status of getting financial help from other regions of Bangladesh.

Source: Field Survey, September, 2014

	Districts in Bangladesh	Number of respondents	Percentage
Get financial help from other members within Bangladesh	Dhaka	2	33.33
	Lakshmipur	1	16.67
	Shariatpur	1	16.67
	No answer	2	33.33
	Total	6	100
Do not get any financial help		242	
Total		**248**	

Figure 4.7: Interval of getting financial help within Bangladesh.

Source: Field Survey, September, 2014

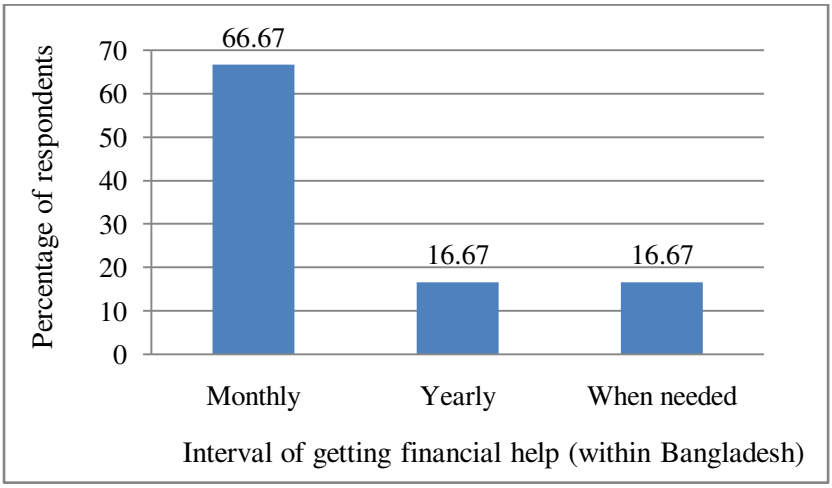


Figure 4.8: Amount (in Taka) of financial help respondents get from family members within Bangladesh.

Source: Field Survey, September, 2014

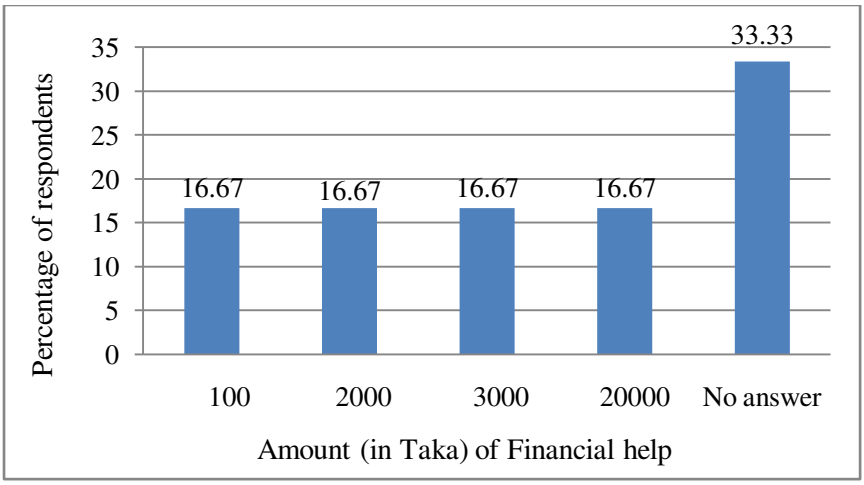


Table 4.2 shows the status of respondents' getting financial help from family members residing/ working abroad. 41.67% and 16.67% respondents get financial help from Oman and Saudi Arabia respectively. Among other countries people get help from their family members in Mauritius, South Africa and UAE. Most of them get financial support on monthly basis and 16.67% get when they need (Figure 4.9). Among the twelve respondents five said that each of them gets financial help of Tk. 12000, Tk. 15,000; Tk. 20,000; Tk. 30,000 and Tk. 50,000 respectively. 25% of twelve respondents get Tk.5000 whereas 33.33% were unwilling to say the amount they get (Figure 4.10). Moreover, 28.23% of the total respondents (Appendix-C, Table 4) borrow loan from different sources named BRAC, Shajeda Foundation, Proshika, Shakti Foundation and ASA (Table 4.3). They use the loan in different purposes. Most of the respondents use the borrowed money for the purpose of business and building/repairing houses (Figure 4.11).

Table 4.2: Status of getting financial help from abroad.

Source: Field Survey, September, 2014

	Country	Number of respondents	Percentage
Get financial help from other members residing/ working abroad	Mauritius	1	8.33
	Oman	5	41.67
	Saudi Arabia	2	16.67
	South Africa	1	8.33
	UAE	1	8.33
	No answer	2	16.67
	Total	**12**	**100**
Do not get any financial help		236	
Total		**248**	

Figure 4.9: Interval of getting financial help from abroad.

Source: Field Survey, September, 2014

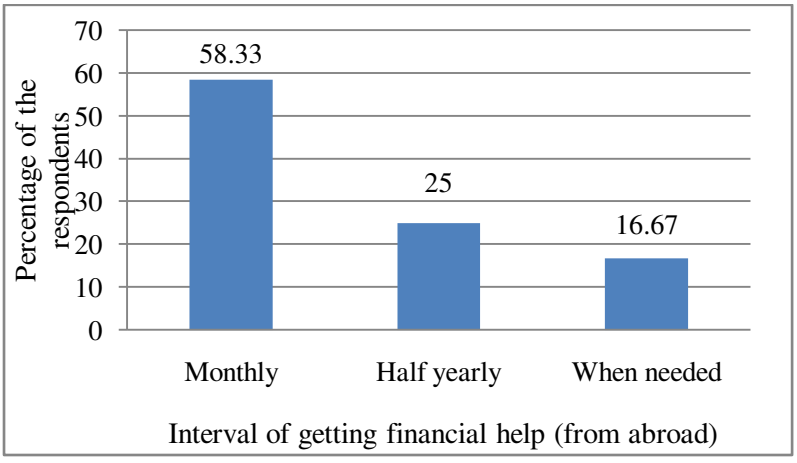


Figure 4.10: Amount (in Taka) of financial help respondents get from family members from abroad.

Source: Field Survey, September, 2014

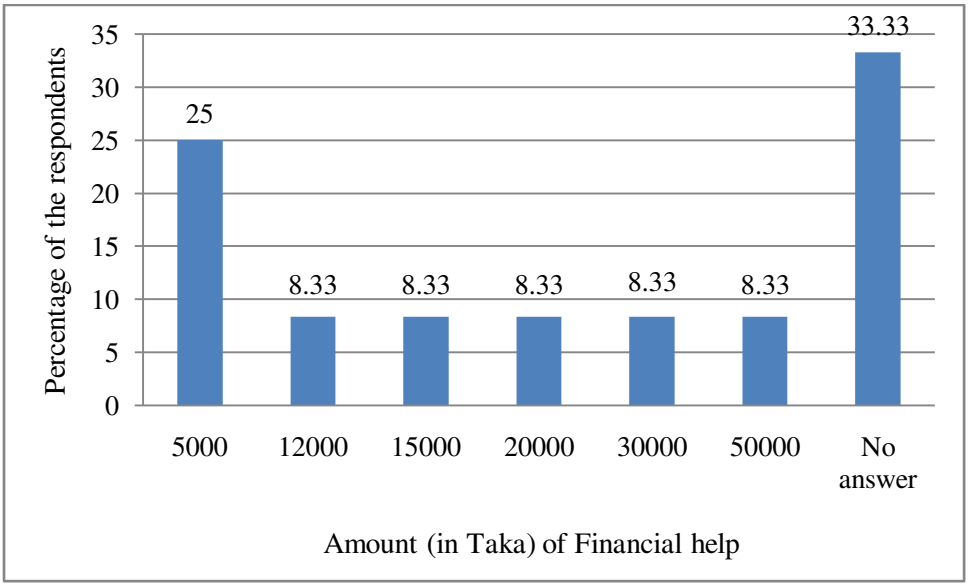


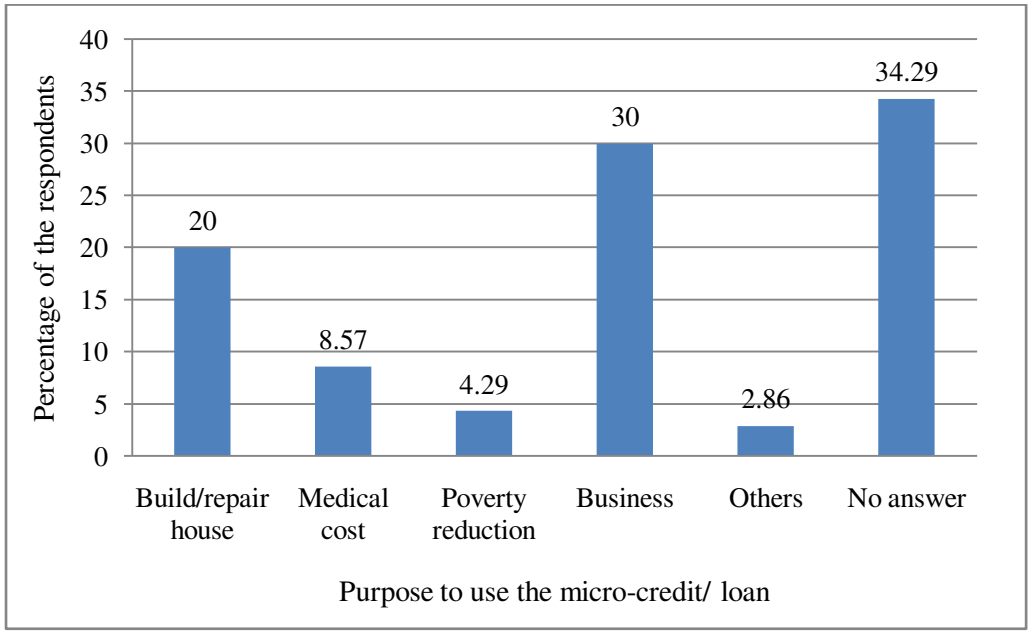
Table 4.3: Status of borrowing micro-credit/loan.

Source: Field Survey, September, 2014

	Institute	Number of respondents	Percentage
Get financial help by borrowing micro-credit/ loan	BRAC	22	31.43
	ASA	4	5.71
	Proshika	9	12.86
	Shajeda Foundation	22	31.43
	Shakti Foundation	5	7.14
	Others	8	11.43
	Total	**70**	**100**
Do not borrow micro-credit/ loan		178	
	Total	**248**	

Figure 4.11: Purpose to use the borrowed micro-credit/loan.

Source: Field Survey, September, 2014



Half of the respondents say that they do not face any type of threats to reside in this area. Some identified drug or illegal business, lack of utility facilities, political violence, social insecurity, theft and terrorism as problems of Moti Jharna area. A small number of people said that they face problem due to inadequate road/ drain, eviction for illegal business and water logging (Table 4.4). The main advantages for which people reside in this area are less living expenses and better job opportunity. Some say they reside here because the area is close to city center and nearer to community facilities (Table 4.5). 51% respondents say that they will be in a more problematic situation if they are relocated or evicted from here (Figure 4.12). Homelessness, increased house-rent in other places and identity crisis are main problems for them to face in this regard (Table 4.6).

Table 4.4: Threats faced by the respondents to reside in this area.

Source: Field Survey, September, 2014

Threats faced to reside in this area	Number of respondents	Percentage
Terrorism	9	3.63
Social Insecurity	10	4.03
Political violence	13	5.24
Theft	10	4.03
Water Logging	2	0.81
Lack of Utility facilities	15	6.05
Drugs or illegal business	18	7.26
Eviction for illegal business	4	1.61
Inadequate Road/Drain	6	2.42
Theft, Water logging, Drug or illegal business	8	3.23
Social insecurity, drags or illegal business, inadequate road and drain	10	4.03
No Problem	124	50.00
Others	19	7.66
Total	**248**	**100**

Table 4.5: Respondents' advantages of residing in this area.

Source: Field Survey, September, 2014

Advantages of residing in this area	Number of respondents	%
Better job	44	17.74
Less living expense	79	31.85
Close to city center	10	4.03
Nearer to community facilities	16	6.45
Higher living standards	1	0.40
Better job & less living expense	20	8.06
better job & close to city center	6	2.42
less living expense & close to city center	11	4.44
Others	52	20.97
Utility facility	3	1.21
Buying own residence	4	1.61
Living from childhood	1	0.40
Safety	1	0.40
Total	**248**	**100**

Figure 4.12: Respondents' opinion regarding in a problematic situation if evicted from here.

Source: Field Survey, September, 2014

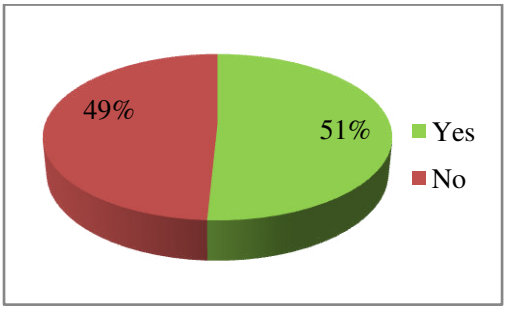


Table 4.6: Problems respondents will face if relocated or evicted from this area.

Source: Field Survey, September, 2014

Problem if relocated/ evicted	Number of respondents	Percentage
Increased house rent	45	35.71
Increased distance to workplace and school	3	2.38
Unemployment	9	7.14
Identity crisis	14	11.11
Homeless	48	38.10
Others	7	5.56
Total	**126**	**100**

The respondents were asked about their future plan to improve present living standard. But most of them (37.3%) have no plan yet. 25% people have a plan to increase income through getting better job/ business and almost 10% people's plan is to educate and establish their children. A small number of respondents are planning to buy land/ house in their hometown and return there (Table 1.8).

Table 4.7: Respondents' plan to improve present living standard.

Source: Field Survey, September, 2014

Respondents' plan to improve present living standard	Number of respondents	Percentage
Better job/ business	32	25.40
live in better place	9	7.14
Buy land/ house in hometown	5	3.97
Children's education and establishment	12	9.52
Others	21	16.67
No plan	47	37.30
Total	**126**	**100**

C. Physical aspects

Housing:

Maximum says that the land in Moti Jharna is owned by landlords (41.94%) and the respondents (29.84%). The other owners of the land are Government, Bangladesh Railway, WASA, PWD and others (Figure 4.13). Most of the residents (63.31%) live in rented houses (Appendix-C, Table 3). All of the houses are not built by the landowners. 37.9% of the respondents built their own houses and 48.79% houses were built by the landlords (Figure 4.14). Maximum respondents have to pay rent of Tk. 2001-3000 (Figure 4.15).

Figure 4.13: Ownership of the land

Source: Field Survey, September, 2014

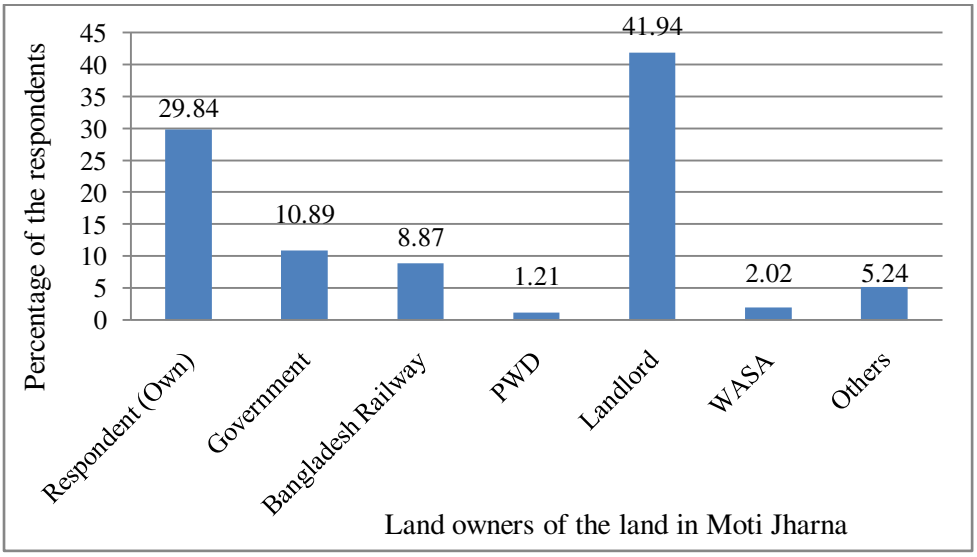


Figure 4.14: Builders of the houses

Source: Field Survey, September, 2014

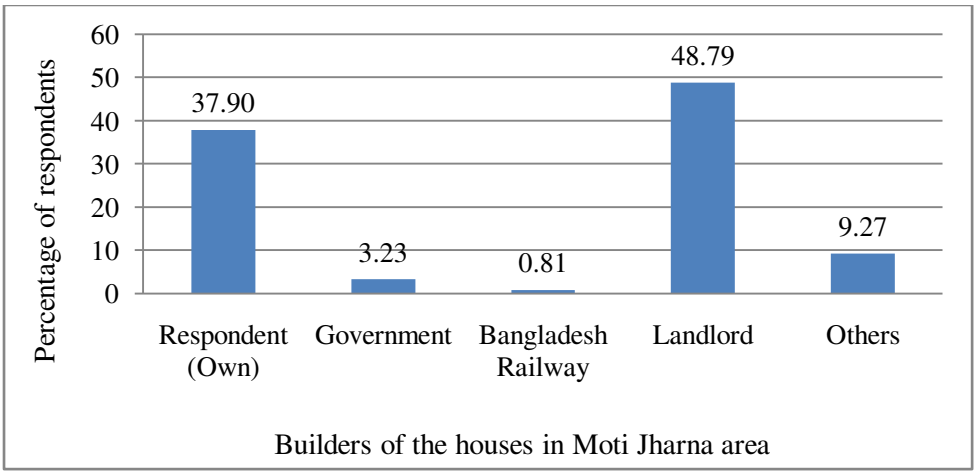
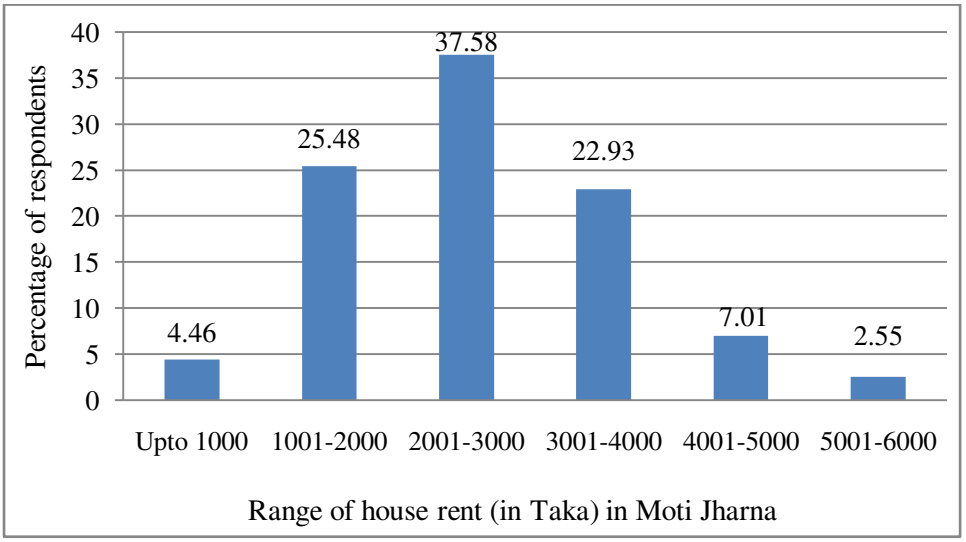


Figure 4.15: House rent per month (in Taka) in Moti Jharna.

Source: Field Survey, September, 2014



Most of the houses in Moti Jharna area are semi-built and non-built respectively (Figure 4.16). Only 18% houses are built. From field survey it is found that maximum respondents live in houses of one storey (Figure 4.17). Almost all the people in Moti Jharna use the surrounding hills for their housing and the rest use for recreation, commercial activity, agriculture and tree plantation (Figure 4.18). From Table 4.8 it is seen that the respondents who are housewife and unemployed need not to travel from their home. The shopkeepers reside nearer to their living place. Besides, the Day labourers and the drivers (CNG/ bus) have to travel to their working places >2 kilometres as their working places are the whole city (Table 1.9).

Figure 4.16: Building material of the houses

Source: Field Survey, September, 2014

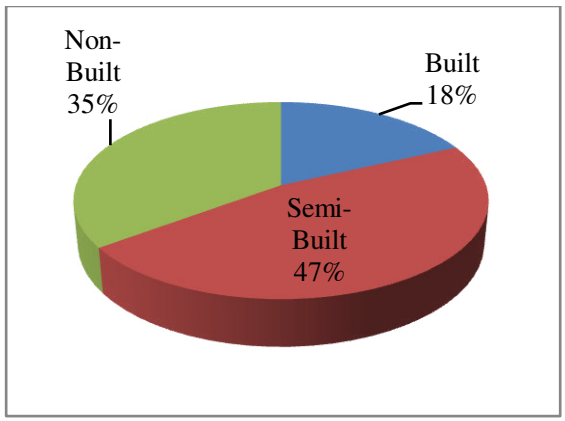


Figure 4.17: Number of storey of the houses

Source: Field Survey, September, 2014

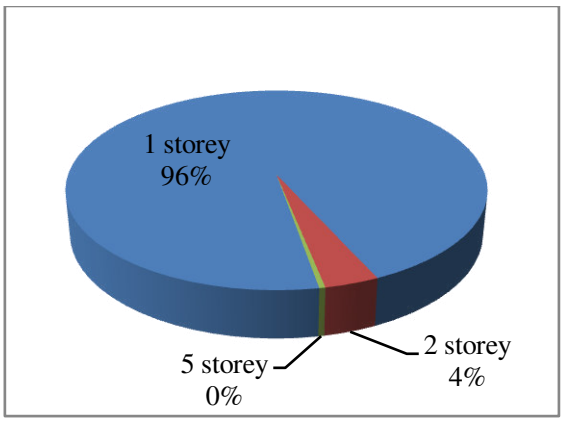


Figure 4.18: Purpose of hill use of the respondents in Moti Jharna.

Source: Field Survey, September, 2014

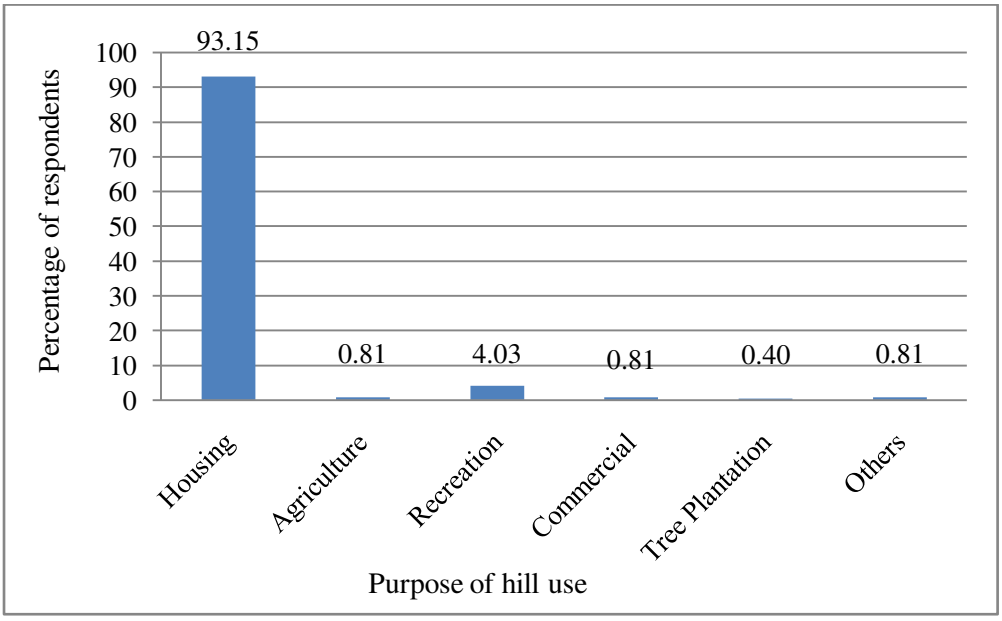


Table 4.8: Relation between occupation and distance from home to workplace of the respondents.

Source: Field Survey, September, 2014

Occupation	Distance between workplace and home (in km)																Total	
	0		0.25		0.5		1		1.25		1.5		2		>2			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Garment Worker	2	1.92	1	16.67	1	11.11	2	8.00	0	0.00	1	20.00	4	18.18	7	9.21	18	7.26
Unemployed	27	25.96	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	27	10.89
Others	2	1.92	1	16.67	0	0.00	2	8.00	0	0.00	0	16.67	0	0.00	5	6.58	10	4.03
Rickshaw Puller	0	0.00	0	0.00	0	0.00	1	4.00	0	0.00	0	0.00	0	0.00	8	10.53	9	3.63
Day Laborer	0	0.00	0	0.00	4	44.44	5	20.00	1	100.00	0	0.00	8	36.36	23	30.26	41	16.53
Driver (CNG/ bus)	0	0.00	0	0.00	0	0.00	5	20.00	0	0.00	1	20.00	1	4.55	16	21.05	23	9.27
House Maid	2	1.92	1	16.67	0	0.00	4	16.00	0	0.00	1	20.00	2	9.09	1	1.32	11	4.44
Employee	1	0.96	0	0.00	2	22.22	2	8.00	0	0.00	2	40.00	2	9.09	6	7.89	15	6.05
Shopkeeper	13	12.50	3	50.00	2	22.22	2	8.00	0	0.00	0	0.00	3	13.64	9	11.84	32	12.90
Student	2	1.92	0	0.00	0	0.00	2	8.00	0	0.00	0	0.00	2	9.09	1	1.32	7	2.82
Housewife	55	52.88	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	55	22.18
Total	**104**	**100**	**6**	**100**	**9**	**100**	**25**	**100**	**1**	**100**	**5**	**100**	**22**	**100**	**76**	**100**	**248**	**100**
%	**41.94**		**2.42**		**3.63**		**10.08**		**0.40**		**2.02**		**8.87**		**30.65**		**100**	

D. Community and utility facilities in Moti Jharna

According to the respondents in Moti Jharna the school, market, bank and playground are within 1 kilometre from their residence. Most of the people (33.87%) said that the health care facility is in distant place from their area (Table 4.9). Among the respondents 50.4% and 45.6% are satisfied with the existing roads and drainage facility respectively. Maximum number of the respondents says that water, electricity and sanitation are available in this area. There is gas supply in 51.2% respondents' houses (Figure 4.19).

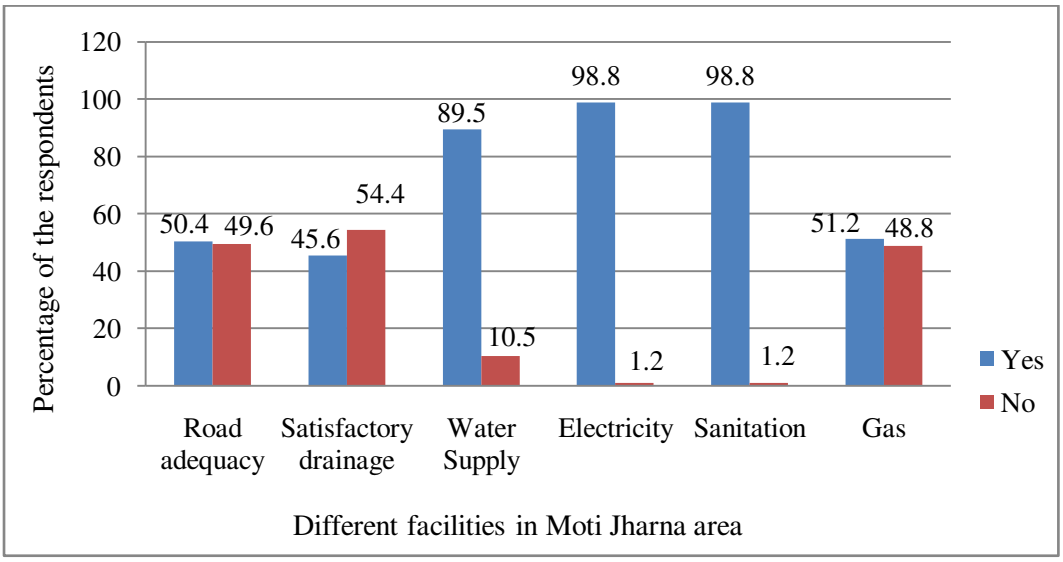
Table 4.9: Respondents' Opinion: Distance between community facilities and residence.

Source: Field Survey, September, 2014

Distance (kilometre)	Different community facilities in Moti Jharna area									
	School		Market		Bank		Playground		Health care centre	
	No	%	No	%	No	%	No	%	No	%
0 km	24	9.68	39	15.73	13	5.24	18	7.26	18	7.26
0.25 km	39	15.73	39	15.73	13	5.24	33	13.31	17	6.85
0.50 km	134	54.03	128	51.61	55	22.18	103	41.53	42	16.94
1 km	43	17.34	29	11.69	92	37.10	37	14.92	49	19.76
1.25 km	4	1.61	0	0.00	1	0.40	2	0.81	0	0.00
1.50 km	3	1.21	1	0.40	13	5.24	2	0.81	19	7.66
1.75 km	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2 km	0	0.00	4	1.61	16	6.45	10	4.03	19	7.66
> 2 km	1	0.40	8	3.23	45	18.15	43	17.34	84	33.87
Total	**248**	**100**	**248**	**100**	**248**	**100**	**248**	**100**	**248**	**100**

Figure 4.19: Existing condition of different facilities in Moti Jharna.

Source: Field Survey, September, 2014



E. Real life experience to landslide disaster

Almost half of the respondents think that landslide is not a problem for this area at all and only 14% marks it as a very serious problem (Figure 4.20). According to the respondents people residing beside the hill are most vulnerable and so the community people. 21.54% people are not concern about the vulnerability of the people (Table 4.10). More than half of the respondents (55.48%) say that landslide occurs once per year in this locality (Appendix-C, Table 5). High precipitation, hill cutting and both of them have been identified as the main triggering factors of landslide by the respondents (Table 4.11). There are negative impacts of landslides to the community people. According to respondents, due to the landslides in several years the houses were destroyed, property was damaged and people died (Table 4.12).

Figure 4.20: Intensity of landslide problem in Moti Jharna (Respondents' opinion).
Source: Field Survey, September, 2014

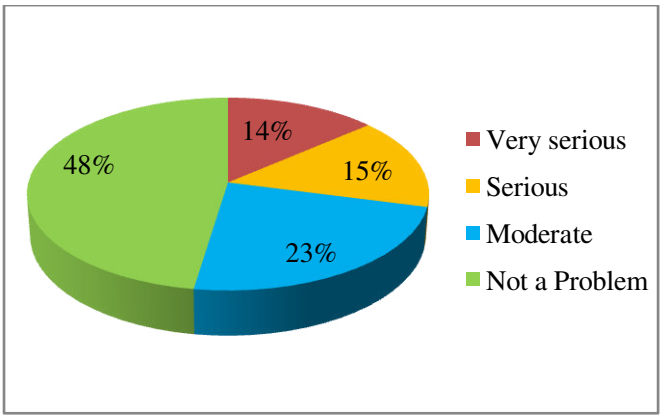


Table 4.10: Respondents' opinion: people vulnerable to landslide.
Source: Field Survey, September, 2014

Vulnerable people according to the respondents	Number of respondents	Percentage
Community people	32	24.62
No one	2	1.54
People residing near hill	56	43.08
People residing on hill top	7	5.38
Unknown	28	21.54
Women, poor and children	5	3.85
Total	**130**	**100**

Table 4.11: Causes of landslide in Moti Jharna (Respondents' opinion).

Source: Field Survey, September, 2014

Causes of landslide	Number of respondents	Percentage
Hill cutting	11	9.82
Deforestation	1	0.89
High precipitation	50	44.64
Construction of road/structure	2	1.79
Hill cutting & high precipitation	33	29.46
Hill cutting & residential use	2	1.79
High precipitation & residential use	2	1.79
Hill cutting, high precipitation & residential use	9	8.04
Others	2	1.79
Total	**112**	**100**

Table 4.12: Negative impact of landslide in Moti Jharna (Respondents' opinion).

Source: Field Survey, September, 2014

Negative impact of landslide	Number of respondents	Percentage
House destroyed	11	5.16
Property damaged	2	0.94
Road blocked	5	2.35
People died	33	15.49
People injured	3	1.41
Damage of utility facilities	1	0.47
House destroyed & property damaged	23	10.80
House destroyed, property damaged & people died	93	43.66
House destroyed, property damaged, people died & people injured	39	18.31
Others	3	1.41
Total	**213**	**100**

The respondents were asked about their last landslide observance. It is found that 43.55 % respondents never observed the landslide and the rest observed in different years of their lifetime. Most of the respondents (93.57%) observed last landslide between the years of 2005 to 2014 (Figure 4.21). During the landslide occurrence, three-fourth of the respondents was in this locality but they did not take any step to help the landslide victims. 23% of the residents participated in rescuing people (Figure 4.22 and Figure 4.23). During our survey we found 12 victims to landslide.

Figure 4.21: Respondents' last landslide observance (at 10 years interval) in last 30 years.

Source: Field Survey, September, 2014

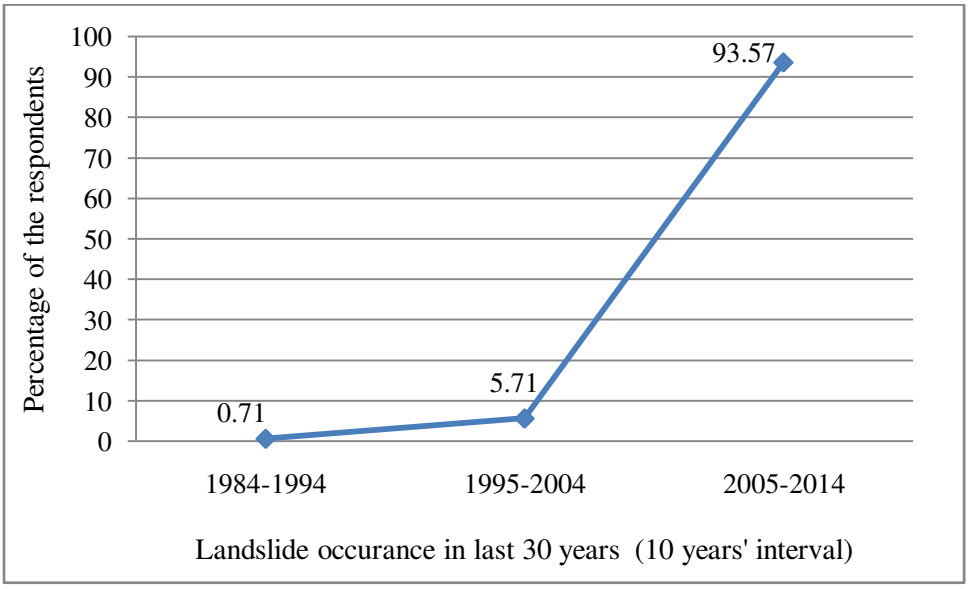


Figure 4.22: Respondents' location during the last landslide observed.

Source: Field Survey, September, 2014

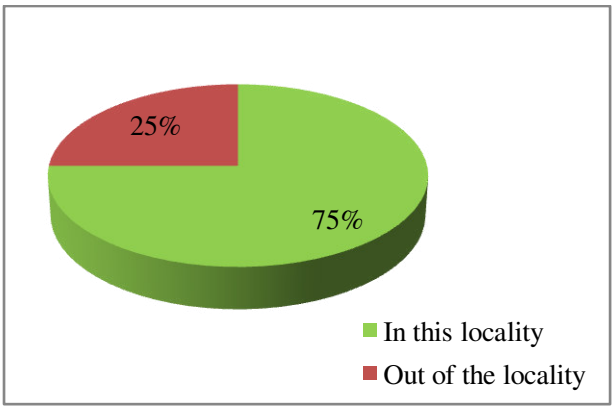


Figure 4.23: Respondents' response during last landslide observed.

Source: Field Survey, September, 2014

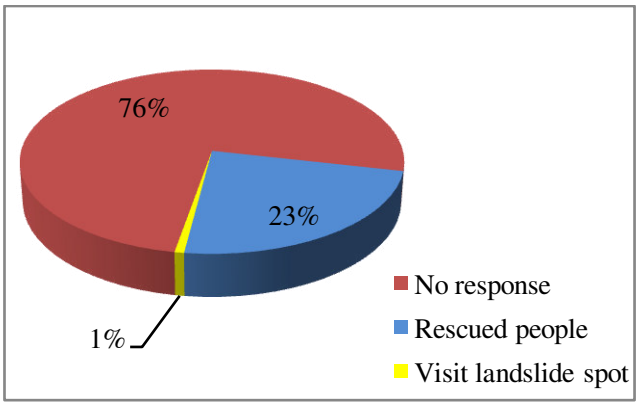


Table 4.13: Respondents' opinion regarding occurrence time of the last landslide observed.

Source: Field Survey, September, 2014

Time of landslide occurrence	Number of respondents	Percentage
Day	2	16.67
Night	7	58.33
No answer	3	25.00
Total	**12**	**100**

F. Landslide risk management

The respondents have their opinion about the positive and negative impacts of monsoon rain in their day to day life. In both cases most of the residents said that there is no impact of rainfall to their life. Rest of the respondents marked water collection, washing & bathing, cleaning of drain & road as the positive impacts; and damage of roads, water logging, landslide and surface runoff as the negative impacts due to rain (Table 4.14).

Table 4.14: Respondents' opinion regarding positive impacts of monsoon rain.
Source: Field Survey, September, 2014

Positive impact of monsoon rain	Number of respondents	Percentage	Negative impact of monsoon rain	Number of respondents	Percentage
Water collection	52	20.97	Damage of road	53	21.37
Washing & bathing	11	4.44	Water logging	58	23.39
Cleaning of drain & road	12	4.84	Landslide	26	10.48
Water collection, washing & bathing	6	2.42	Surface runoff	4	1.61
			Road damage & landslide	23	9.27
No impact	164	66.13	No impact	73	29.44
Others	3	1.21	Others	11	4.44
Total	**248**	**100**	**Total**	**248**	**100**

From the household survey it is found that only 16.13% of the respondents are relocated from their usual living places during the monsoon rain rainfall (Appendix-C, Figure 5). Among the relocated people maximum take shelter to the nearby school provided free of cost by the authority of Chittagong City Corporation (Figure 4.24 and Figure 4.25). The relocation places for most of the respondents are within 1 kilometre from their residing place (Table 4.15). Table 4.16 shows the benefit got and problems faced by the relocated respondents of Moti Jharna area during monsoon rain. 47.5% respondents said they get no benefit from the relocation place and 72.5% said nothing about the problems. Most of the respondents said that they can stay in the relocation place as long as they wish if there is heavy rainfall (Appendix-C, Table 7).

Figure 4.24: Respondents' relocation place during monsoon rain.

Source: Field Survey, September, 2014

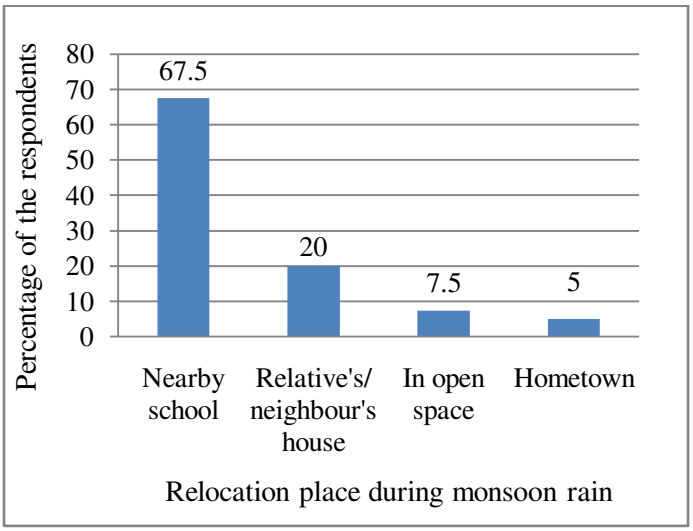


Figure 4.25: Providers of the relocation places to the respondents.

Source: Field Survey, September, 2014

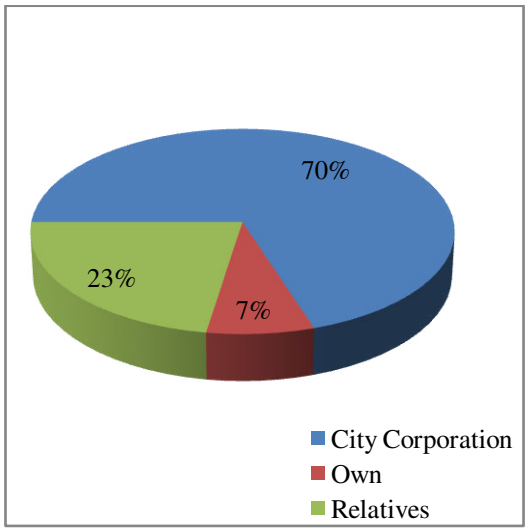


Table 4.15: Distance of relocation place from the respondents' house.

Source: Field Survey, September, 2014

Distance of relocated place	Number of respondents	Percentage
0.05 km	2	5.00
0.5 km	12	30.00
1 km	8	20.00
1.25 km	2	5.00
1.5 km	8	20.00
1 km	3	7.50
2 km	3	7.50
> 2 km	2	5.00
Total	**40**	**100**

Table 4.16: The benefit got and problems faced in relocation places by the respondents.

Source: Field Survey, September, 2014

Benefit got in relocation place	Number of respondents	Percentage	Problem faced in relocation place	Number of respondents	Percentage
Food help	5	12.50	Food	1	2.50
Save life	15	37.50	Lack of services	2	5.00
Safety	1	2.50	Low food supply and poor sanitation facility, fear of theft	8	20.00
No benefit	19	47.50	No answer	29	72.50
Total	**40**	**100**	**Total**	**40**	**100**

Only 10% people said that there is landslide voluntary committee in Moti Jharna area (Appendix-C, Table 8). They are Commissioner Group, City Corporation, PSTC and Lalkhan bazaar voluntary committee (Table 4.17). During landslide the emergency services are mainly provided by police, fire service, community groups, City Corporation officials, NGO and neighbours (Table 4.18). 57.66% are satisfied with the rescue effort (Appendix-C, Table 9). There are several causes behind dissatisfaction to the rescue effort also and late response is the major one identified by the respondents (Table 4.19). The relocated people get money, food, cloth and shelter as compensation from City Corporation, Government organization and ward commissioner (Table 4.20, Table 4.21; Appendix, Table 9).

Table 4.17: Existing landslide voluntary committee in Moti Jharna area.

Source: Field Survey, September, 2014

Landslide voluntary committee	Number of respondents	Percentage
City Corporation	7	28.00
Commissioner Group	8	32.00
Lalkhan bazar voluntary committee	1	4.00
PSTC	2	8.00
Unknown	7	28.00
Total	**25**	**100**

Table 4.18: Organization offering the emergency services in Moti Jharna.

Source: Field Survey, September, 2014

Emergency service offering organization	Number of respondents	Percentage
Neighbours	35	14.11
Community groups	9	3.63
Police	2	0.81
Fire service	25	10.08
City corporation councils	35	14.11
NGO	1	0.40
Police & fire service	22	8.87
Police, fire service, community groups & city corporation officials	74	29.84
Unknown	45	18.15
Total	**248**	**100**

Table 4.19: Causes of dissatisfaction to the rescue effort.

Source: Field Survey, September, 2014

Causes of respondents' dissatisfaction of the rescue effort	Number of respondents	Percentage
Lack of manpower	1	2.27
Lack of proper attention	7	15.91
Late response	22	50.00
Low efficiency	2	4.55
No answer	6	13.64
Shortage of equipment	6	13.64
Total	**44**	**100**

Table 4.20: Type of compensation to the victims.

Source: Field Survey, September, 2014

Victims' compensation type	Number of respondents	Percentage
Money	40	40.40
Food	13	13.13
Money, food & cloth	23	23.23
Unknown	19	19.19
Others	3	3.03
Shelter	1	1.01
Total	**99**	**100**

Table 4.21: Organizations helped/ compensated the victims.

Source: Field Survey, September, 2014

Organization helped/ compensated the victims	Number of respondents	Percentage
City Corporation	28	33.73
Government	28	33.73
Ward Commissioner	15	18.07
Unknown	12	14.46
Total	**83**	**100**

The respondents know about the landslide information mainly by announcement through mike (Table 4.22 and Appendix-C, Table 8). More than 80% respondents stay at their houses after getting warning. Most interesting thing is that 81.45% respondents do not have contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies for emergency purpose (Appendix-C, Table 8). Though living in this area for so many years the respondents gave some suggestion to reduce the risk of landslide of

Moti Jharna area. They mentioned permanent relocation, awareness building, stop hill cutting, engineering measurement through constructing retaining wall, tree plantation as the main thing to do in this regard. Some said a solution may be leveling the hills (Table 4.24). Among 248 respondents only 2 gave their suggestions. One wished to have job security for women and establish a school; and another said there should be planned administration to reduce the corruption and land encroachment.

Table 4.22: Early warning system during landslide.

Source: Field Survey, September, 2014

Organization providing early warning system for landslide	Number of respondents	Percentage
Announcement through Mike	174	72.50
Ward Commissioner	2	0.83
Local volunteers	2	0.83
Newspaper/ press	3	1.25
Electronic Media	2	0.83
Announcement through Mike and Electronic Media	57	23.75
Total	**240**	**100**

Table 4.23: Response of the respondents after getting early warning system.

Source: Field Survey, September, 2014

Respondents' response after getting early warning	Number of respondents	Percentage
Shift to other place	44	18.33
Stay in house	195	81.25
No answer	1	0.42
Total	**240**	**100**

Table 4.24: Respondents' suggestion towards landslide risk reduction process.

Source: Field Survey, September, 2014

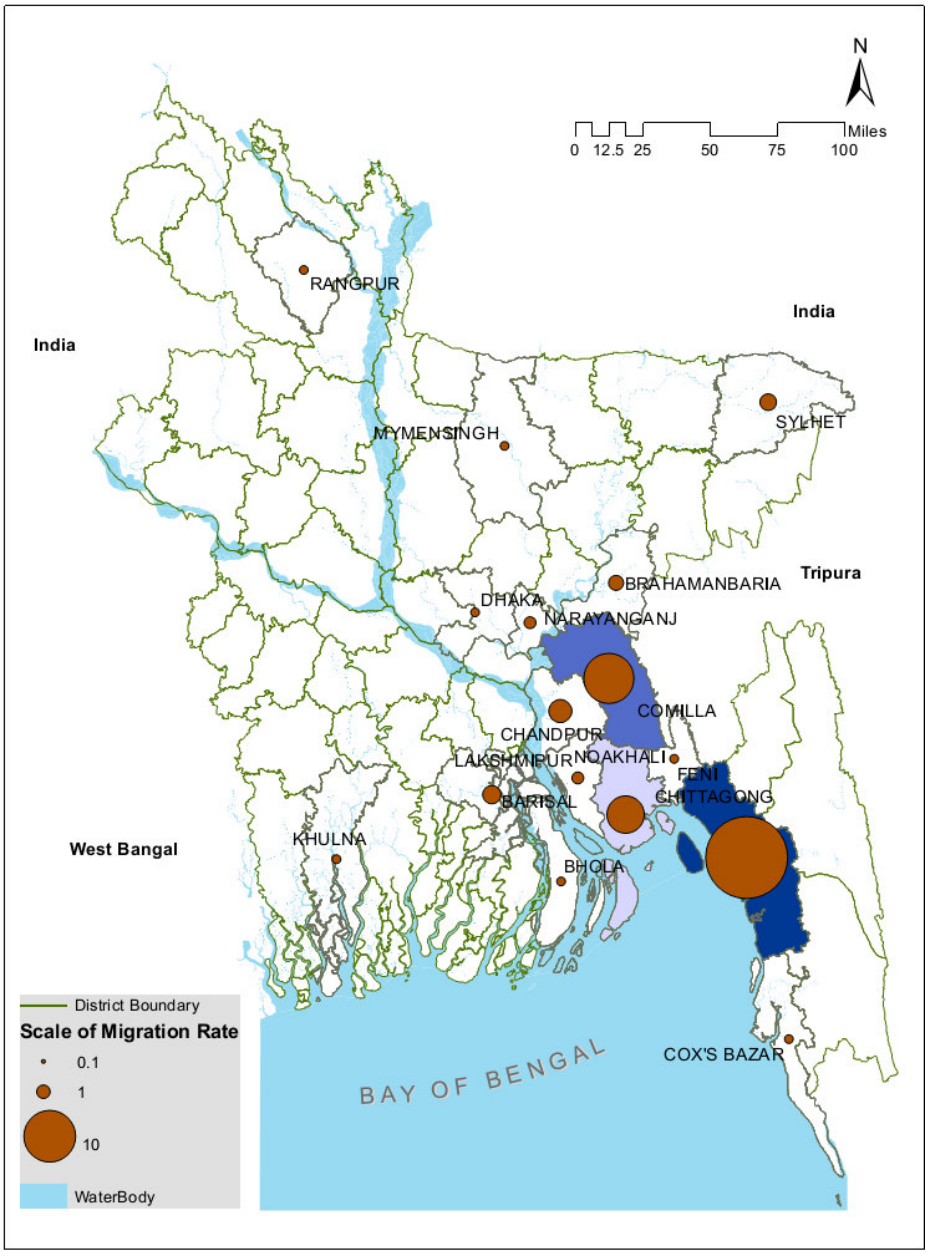
Landslide risk reduction process	Number of respondents	Percentage
Relocation	37	14.92
Tree plantation	6	2.42
Retaining wall	16	6.45
Engineering	12	4.84
Stop hill cutting	22	8.87
leveling the hill	28	11.29
Awareness building	31	12.50
Early warning	2	0.81
Stop precipitation	3	1.21
Stop deforestation	1	0.40
Proper planning	7	2.82
Government initiative	8	3.23
Others	3	1.21
No answer	50	20.16
Unknown	22	8.87
Total	**248**	**100**

4.2 STUDY AREA-2: BATALI HILL

A. Basic information and background of the respondents

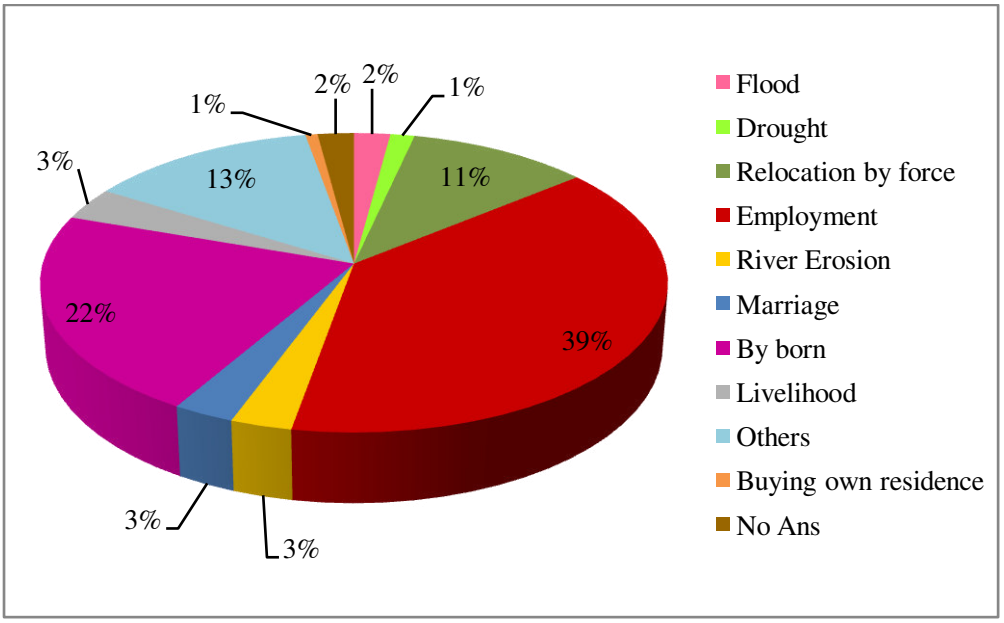
In Batali Hill area, 142 respondents are surveyed. Male participants (59%) are dominating in number and most of the respondents are in age range 19-40 years, i.e, they are economically active people (Appendix-C, Figure 6 and Figure 7).

Figure 4.26: Migration status of the inhabitants of Batali Hill area.
Source: Field Survey, September, 2014



The respondents are mostly from Chittagong, Comilla and Noakhali districts of Bangladesh (Appendix-C, Table-11). The locations of their previous places are shown in Figure 4.26. The main cause to migrate in Batali Hill area is for better employment opportunity. Besides, 22% respondents live here by born (Figure 4.27). Maximum number of respondents resides in this area for about 10 to 30 years whereas only 3.52% people reside here for more than 60 years (Appendix-C, Figure 8). There is contradiction among the respondents' opinion about the duration of settlement in this area. From the respondents, it is found that the settlement in Batali Hill area was established before the liberation war of Bangladesh in 1971. But most of the people (34.51%) have reversed views and a significant number of people (41.55%) have no idea about it (Appendix-C, Figure 9).

Figure 4.27: Respondents' Causes of migration to Batali Hill.
Source: Field Survey, September, 2014



B. Demographic information/ Socio-economic aspects

The majority of the respondents in this locality are illiterate (41.55%), besides there are significant number of respondents having secondary and primary level of education respectively (Figure 4.28). Employee, day labourer and rickshaw puller are the main occupation of the surveyed households. Shopkeeper, garment worker and driver are also significant in this area (Figure 4.29). Most of the respondents have average monthly household income of Tk.5001- Tk.10,000 (Figure 4.30). Besides, there is same scenario in case of average monthly household expenditure (Figure 4.31).

Figure 4.28: Education level of the respondents in Batali Hill.

Source: Field Survey, September, 2014

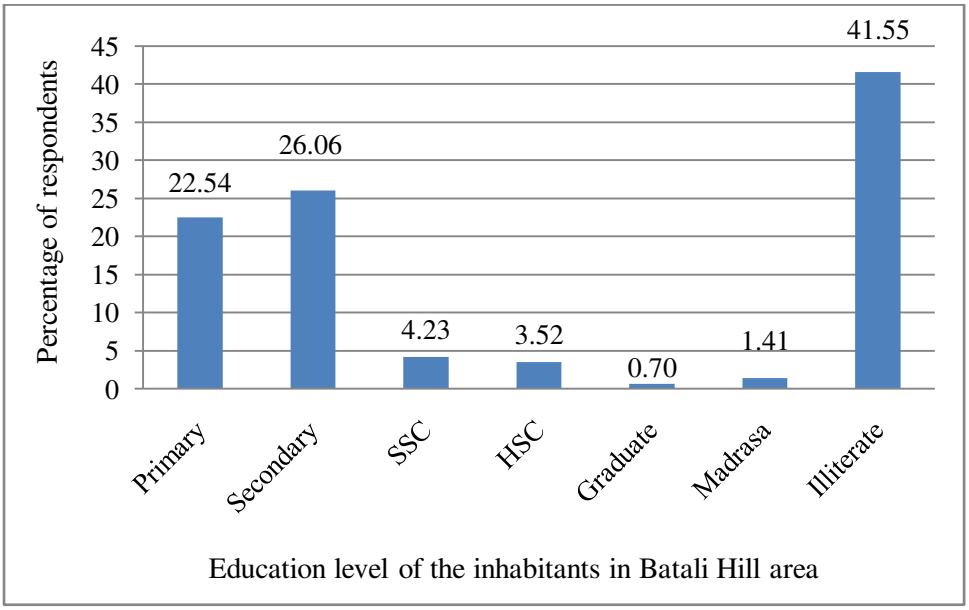


Figure 4.29: Main income sources (occupation) of the households.

Source: Field Survey, September, 2014

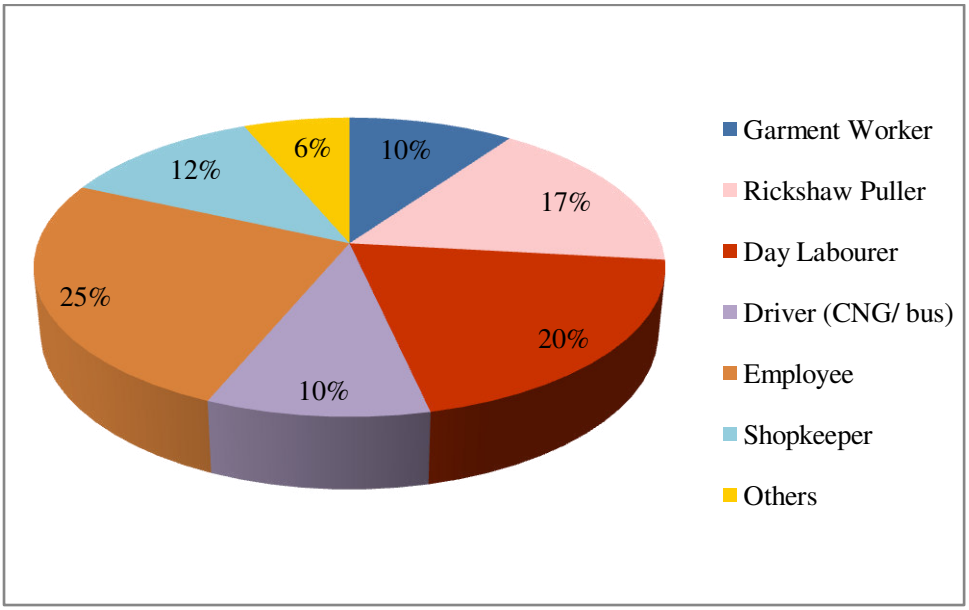


Figure 4.30: Average monthly income (in Taka) of the households.

Source: Field Survey, September, 2014

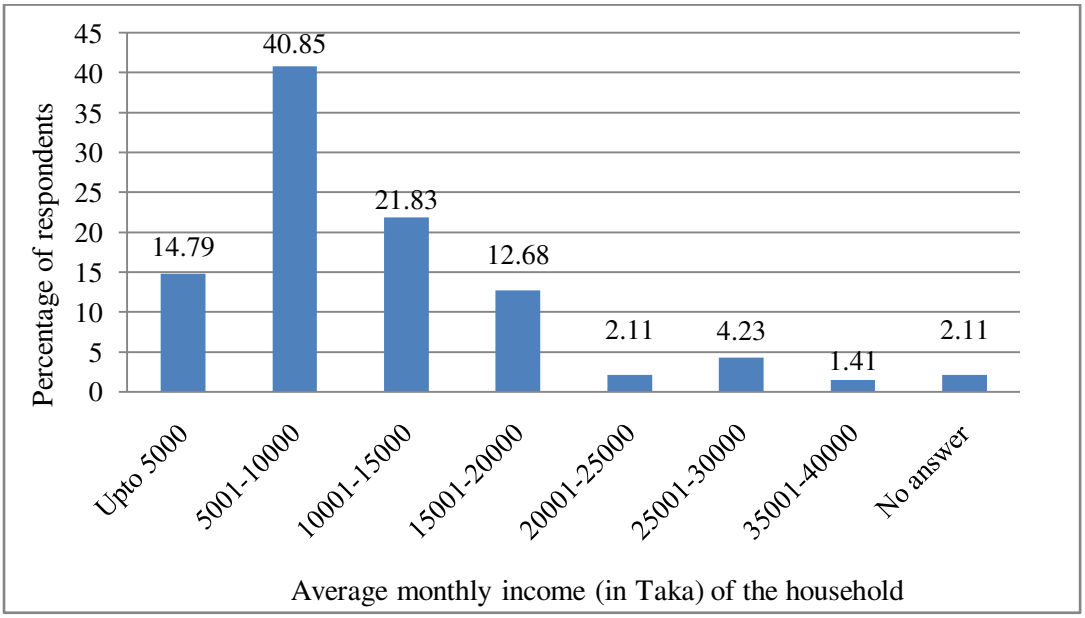
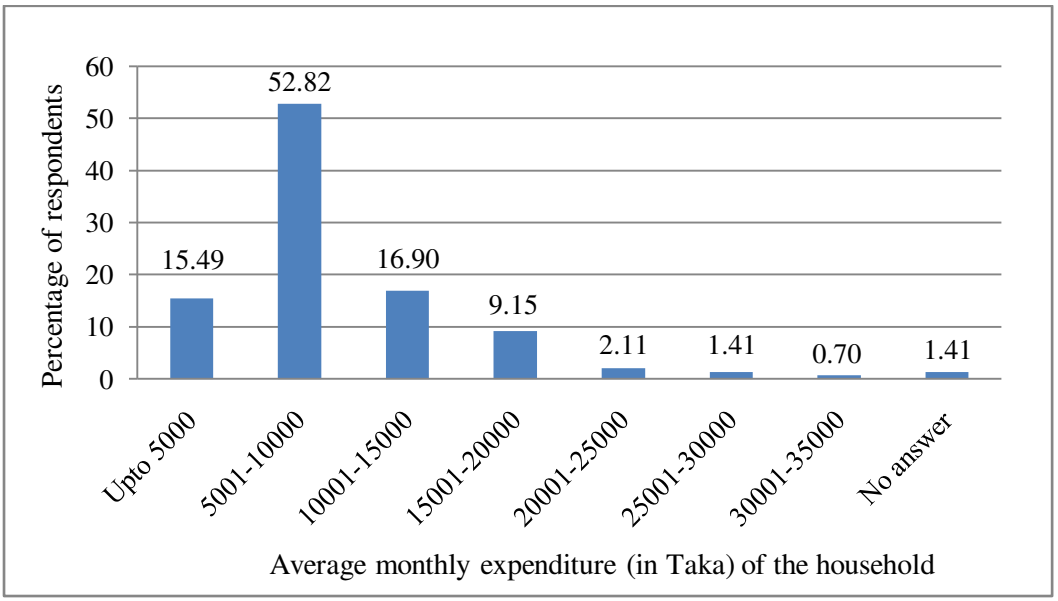


Figure 4.31: Average monthly expenditure (in Taka) of the households.

Source: Field Survey, September, 2014



From survey it is found that only eight respondents get financial help from their family members living or working in Chittagong, Brahmanbaria and Dinajpur regions in Bangladesh (Table 4.25). Most of them get the money on monthly basis (Figure 4.32). Among the eight respondents five mentioned the amount of money (Figure 4.33).

Table 4.25: Status of getting financial help from other regions of Bangladesh.

Source: Field Survey, September, 2014

	Districts in Bangladesh	Number of respondents	Percentage
Get financial help from other members within Bangladesh	Chittagong	2	25.00
	Brahmanbaria	1	12.50
	Dinajpur	1	12.50
	No answer	4	50.00
	Total	8	100
Do not get any financial help		134	
Total		**142**	

Figure 4.32: Interval of getting financial help within Bangladesh.

Source: Field Survey, September, 2014

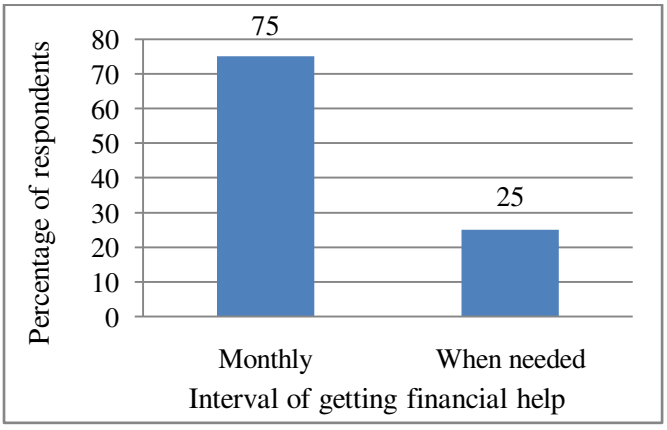


Figure 4.33: Amount (in Taka) of financial help respondents get from family members within Bangladesh.

Source: Field Survey, September, 2014

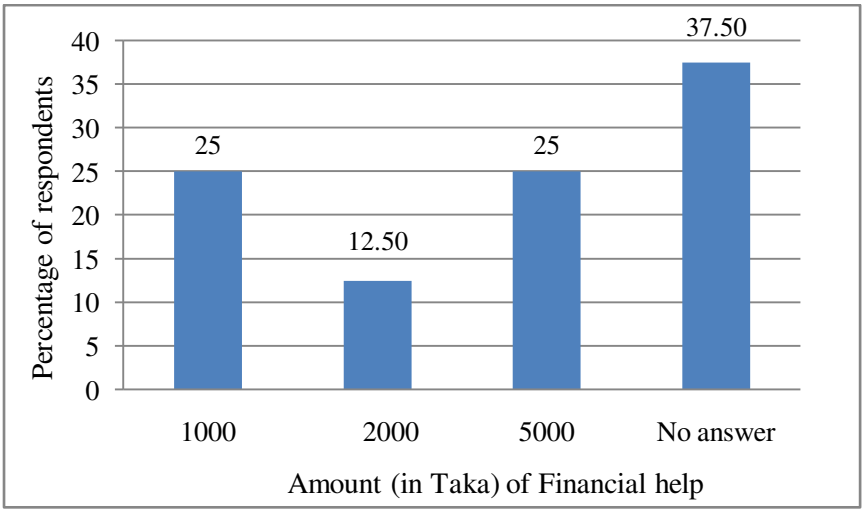


Table 4.26 shows the status of respondents' getting financial help from family members residing/ working abroad. 33.33% and 16.67% respondents get financial help from Saudi Arabia and UAE respectively. Most of them get financial support on monthly basis and 16.67% get when they need (Figure 4.34). Among the six respondents four said that each of them gets financial help of Tk. 1000; Tk. 3,000; Tk. 15,000 and Tk. 20,000 respectively whereas 33.33% were unwilling to say the amount they get (Figure 4.35). Moreover, 11.97% of the total respondents (Appendix-C, Table 13) borrow loan from different sources named Proshika, Shakti Foundation, Shajeda Foundation and BRAC (Table 4.27). Almost 60% did not answer about the use of the loans. Other people use the borrowed money for poverty reduction, medical cost, building/repairing houses and business (Figure 4.36).

Table 4.26: Status of getting financial help from abroad.

Source: Field Survey, September, 2014

	Country	Number of respondents	Percentage
Get financial help from other members residing/ working abroad	Saudi Arabia	2	33.33
	UAE	1	16.67
	No answer	3	50.00
	Total	**6**	**100**
Do not get any financial help		136	
	Total	**142**	

Figure 4.34: Interval of getting financial help from abroad.

Source: Field Survey, September, 2014

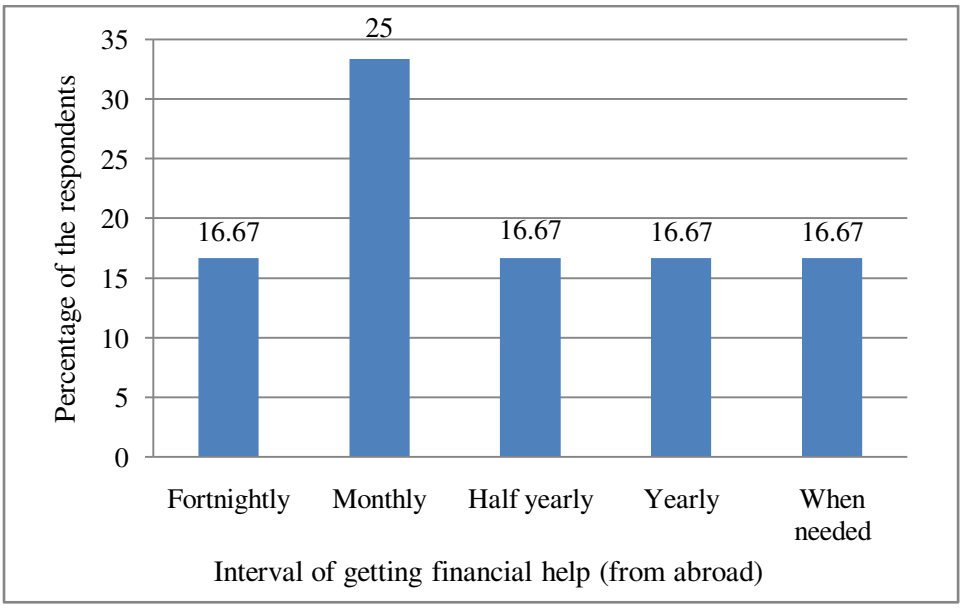


Figure 4.35: Amount (in Taka) of financial help respondents get from family members from abroad.

Source: Field Survey, September, 2014

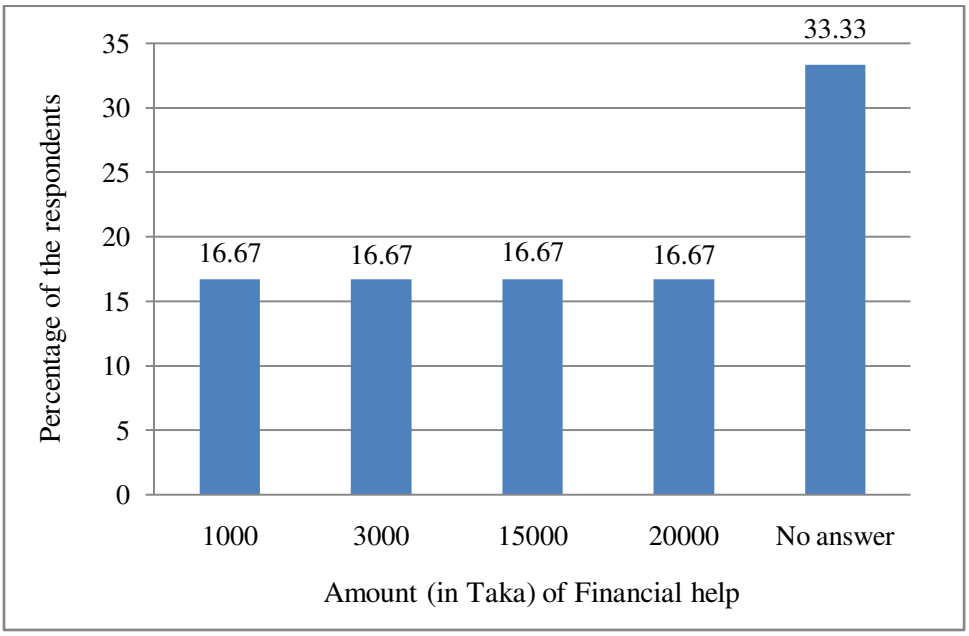


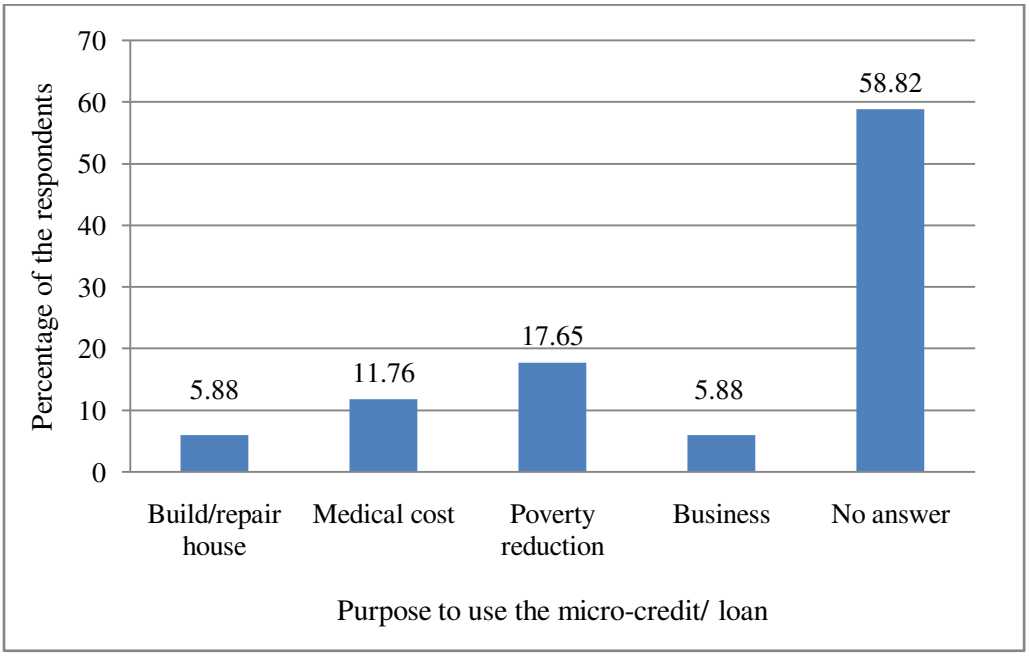
Table 4.27: Status of borrowing micro-credit/loan.

Source: Field Survey, September, 2014

	Institute	Number of respondents	Percentage
Get financial help by borrowing micro-credit/ loan	BRAC	1	5.88
	Proshika	7	41.18
	Shajeda Foundation	2	11.76
	Co-operatives	1	5.88
	Shakti Foundation	4	23.53
	Others	2	11.76
	Total	**17**	**100**
Do not borrow micro-credit/ loan		125	
	Total	**142**	

Figure 4.36: Purpose to use the borrowed micro-credit/loan.

Source: Field Survey, September, 2014



Almost 40% respondents say that they do not face any type of threats to reside in this area. Some identified drug or illegal business, social insecurity, theft, political violence, terrorism, lack of utility facilities, theft as problems of Batali Hill area. A small number of people said that they face problem due to inadequate road/ drain, eviction for illegal business and water logging (Table 4.28). The main advantages for which people reside in this area are less living expenses and better job opportunity. Some say they reside here because the area is close to city center and nearer to community facilities (Table 4.29). 55% respondents say that they will be in a more problematic situation if they are relocated or evicted from here (Figure 4.37). Homelessness, increased house-rent in other places and unemployment are main problems they face in this regard (Table 4.30).

Table 4.28: Threats faced by the respondents to reside in this area.

Source: Field Survey, September, 2014

Threats faced to reside in this area	Number of respondents	Percentage
Terrorism	6	4.23
Social Insecurity	12	8.45
Political violence	6	4.23
Theft	9	6.34
Water Logging	2	1.41
Lack of Utility facilities	5	3.52
Drugs or illegal business	11	7.75
Eviction for illegal business	4	2.82
Inadequate Road/Drain	5	3.52
Theft, Water logging, Drug or illegal business	4	2.82
Social insecurity, drags or illegal business, inadequate road and drain	7	4.93
No Problem	57	40.14
Others	14	9.86
Total	**142**	**100**

Table 4.29: Respondents' advantages of residing in this area.

Source: Field Survey, September, 2014

Advantages of residing in this area	Number of respondents	%
Better job	24	16.90
Less living expense	59	41.55
Close to city center	2	1.41
Nearer to community facilities	6	4.23
Higher living standards	2	1.41
Better job & less living expense	9	6.34
better job & close to city center	4	2.82
less living expense & close to city center	5	3.52
Others	24	16.90
Utility facility	1	0.70
Buying own residence	5	3.52
Living from childhood	1	0.70
Total	**142**	**100**

Figure 4.37: Respondents' opinion regarding in a problematic situation if evicted from here.

Source: Field Survey, September, 2014

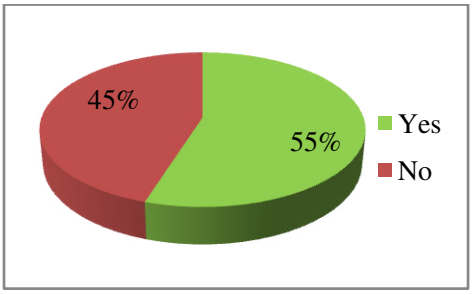


Table 4.30: Problems respondents will face if relocated or evicted from this area.

Source: Field Survey, September, 2014

Problem if relocated/ evicted	Number of respondents	Percentage
Increased house rent	24	30.77
Increased distance to workplace and school	7	8.97
Unemployment	8	10.26
Identity crisis	3	3.85
Homeless	31	39.74
Lack of safety	1	1.28
Others	4	5.13
Total	**78**	**100**

The respondents were asked about their future plan to improve present living standard. But most of them (32.43%) have no plan yet. Most of the respondents have a plan to increase income through getting better job/ business and almost 5% people's plan is to educate and establish their children. A small number of respondents are planning to buy land/ house in their hometown and return there (Table 4.31).

Table 4.31: Respondents' plan to improve present living standard.

Source: Field Survey, September, 2014

Respondents' plan to improve present living standard	Number of respondents	Percentage
Better job/ business	28	37.84
live in better place	3	4.05
Buy land/ house in hometown	4	5.41
Children's education and establishment	4	5.41
Others	11	14.86
No plan	24	32.43
Total	**74**	**100**

C. Physical aspects

Housing:

Maximum says that the land in Batali Hill is owned by landlords (41.55%). The other owners of the land are government, respondents, Bangladesh Railway, WASA, PWD and others (Figure 4.38). Most of the residents (63.31%) live in rented houses (Appendix-C, Table 12). All of the houses are not built by the landowners. 35.21% of the respondents built their own houses and 54.23% houses were built by the landlords (Figure 4.39). Maximum respondents have to pay rent of Tk. 1001-2000 (Figure 4.40).

Figure 4.38: Ownership of the land

Source: Field Survey, September, 2014

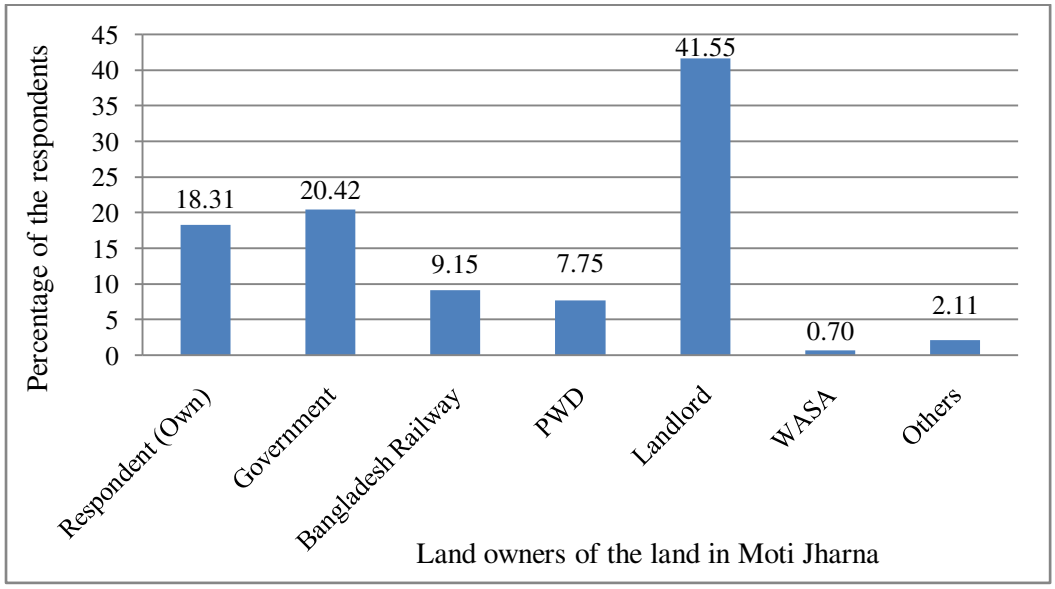


Figure 4.39: Builders of the houses

Source: Field Survey, September, 2014

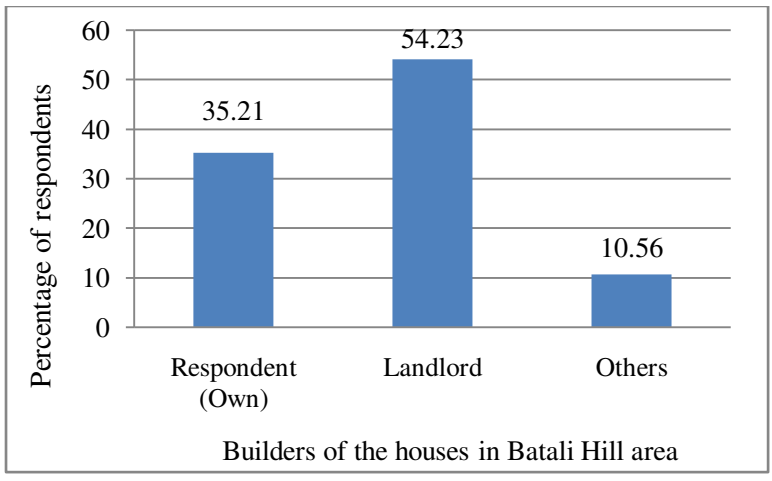
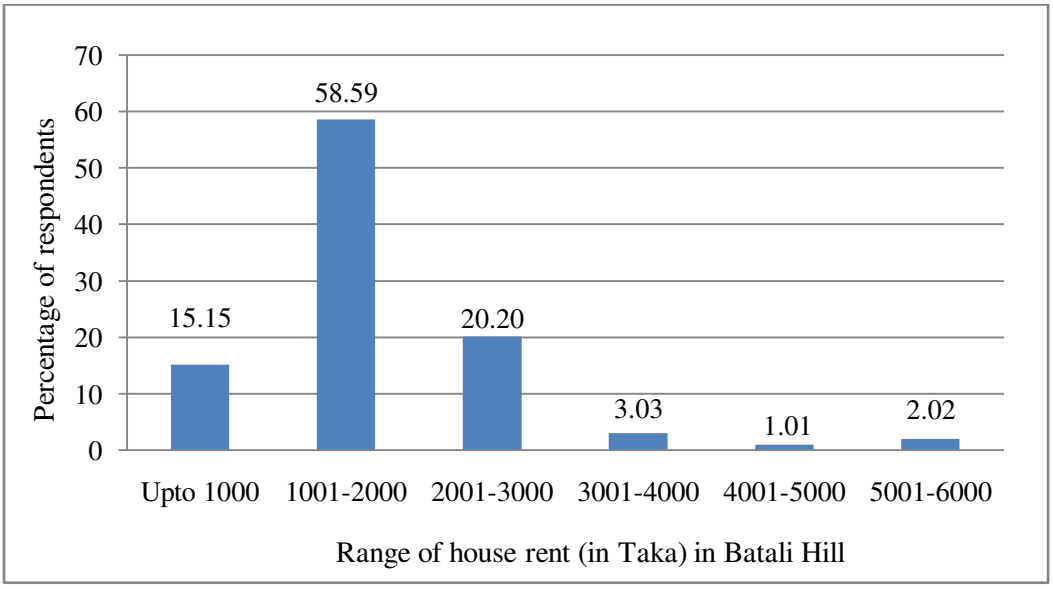


Figure 4.40: House rent per month (in Taka) in Batali Hill.

Source: Field Survey, September, 2014



Most of the houses in Batali Hill area are non-built and semi-built respectively. Only 8% houses are built (Figure 4.41). From field survey it is found that maximum respondents live in houses of one storey (Figure 4.42). Almost all the people in Batali Hill use the surrounding hills for their housing and the rest use for recreation, tree plantation, agriculture and commercial activity (Figure 4.43). From Table 4.32 it is seen that the respondents who are housewife and unemployed need not to travel from their home. The shopkeepers reside nearer to their living places. Besides, the employee, rickshaw puller, drivers (CNG/ bus) and day labourers have to travel >2 kilometres as their working places are the whole city (Table 4.32).

Figure 4.41: Building material of the houses

Source: Field Survey, September, 2014

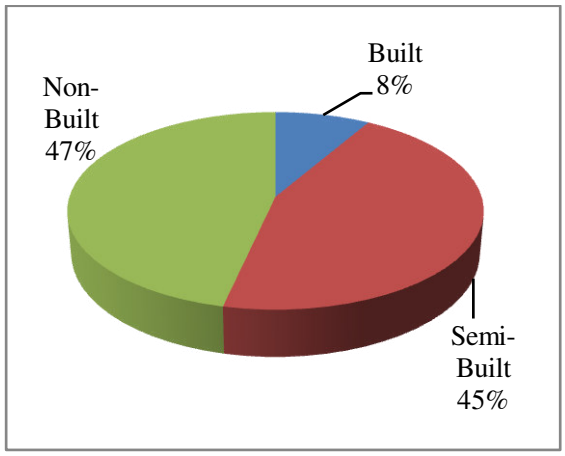


Figure 4.42: Number of storey of the houses

Source: Field Survey, September, 2014

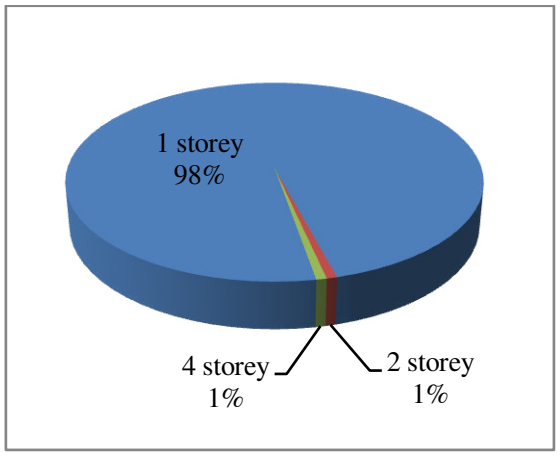


Figure 4.43: Purpose of hill use of the respondents in Batali Hill.

Source: Field Survey, September, 2014

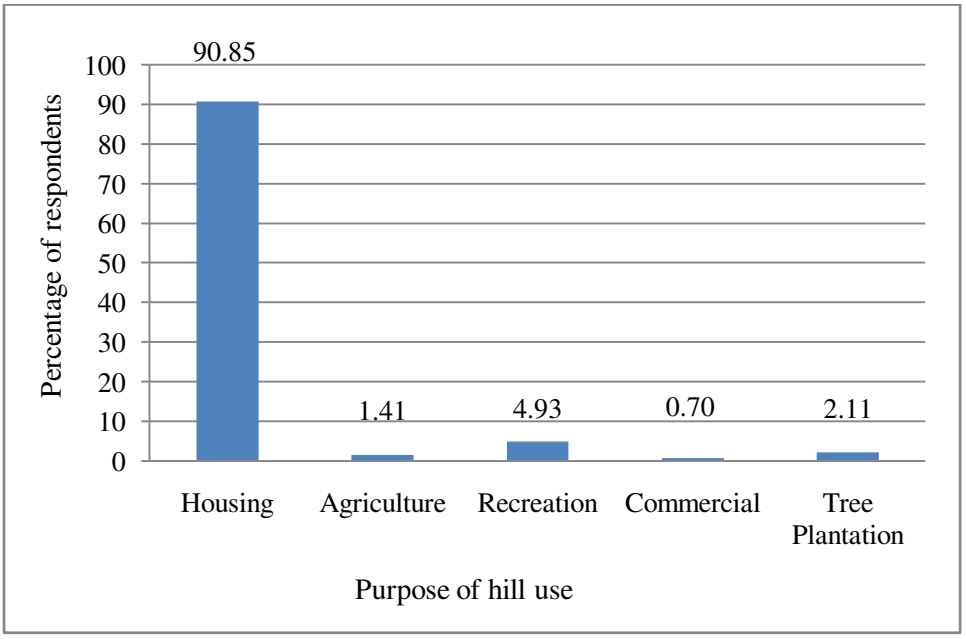


Table 4.32: Relation between occupation and distance from home to workplace of the respondents.

Source: Field Survey, September, 2014

Occupation	Distance between workplace and home (in km)																Total	
	0		0.25		0.5		1		1.25		1.5		2		>2			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Garment Worker	1	1.67	0	0.00	0	0.00	3	25.00	0	0.00	0	0.00	1	14.29	5	10.00	10	7.04
Unemployed	15	25.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	15	10.56
Others	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	20.00	0	0.00	1	2.00	2	1.41
Rickshaw Puller	0	0.00	0	0.00	1	20.00	1	8.33	0	0.00	0	0.00	0	0.00	13	26.00	15	10.56
Day Laborer	0	0.00	0	0.00	2	40.00	4	33.33	1	100.00	1	20.00	4	57.14	6	12.00	18	12.68
Driver (CNG/ bus)	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	20.00	0	0.00	7	14.00	9	6.34
Employee	2	3.33	1	50.00	2	40.00	2	16.67	0	0.00	2	40.00	1	14.29	13	26.00	23	16.20
Shopkeeper	2	3.33	1	50.00	0	0.00	1	8.33	0	0.00	0	0.00	0	0.00	3	6.00	7	4.93
Student	2	3.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	14.29	2	4.00	5	3.52
Housewife	38	63.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	38	26.76
Total	**60**	**100**	**2**	**100**	**5**	**100**	**12**	**100**	**1**	**100**	**5**	**100**	**7**	**100**	**50**	**100**	**142**	**100**
%	**42.25**		**1.41**		**3.52**		**8.45**		**0.70**		**3.52**		**4.93**		**35.21**		**100**	

D. Community and utility facilities in Batali Hill

According to the respondents in Batali Hill the school, market and playground are within 1 kilometre from their residence. Most of the people said that the bank and the health care facility are in distant places from their area (Table 4.33). Among the respondents 52.8% and 44.4% are satisfied with the existing roads and drainage facility respectively. Maximum number of the respondents says that water, electricity and sanitation are available in this area. There is gas supply in only 33.8% respondents' houses (Figure 4.44).

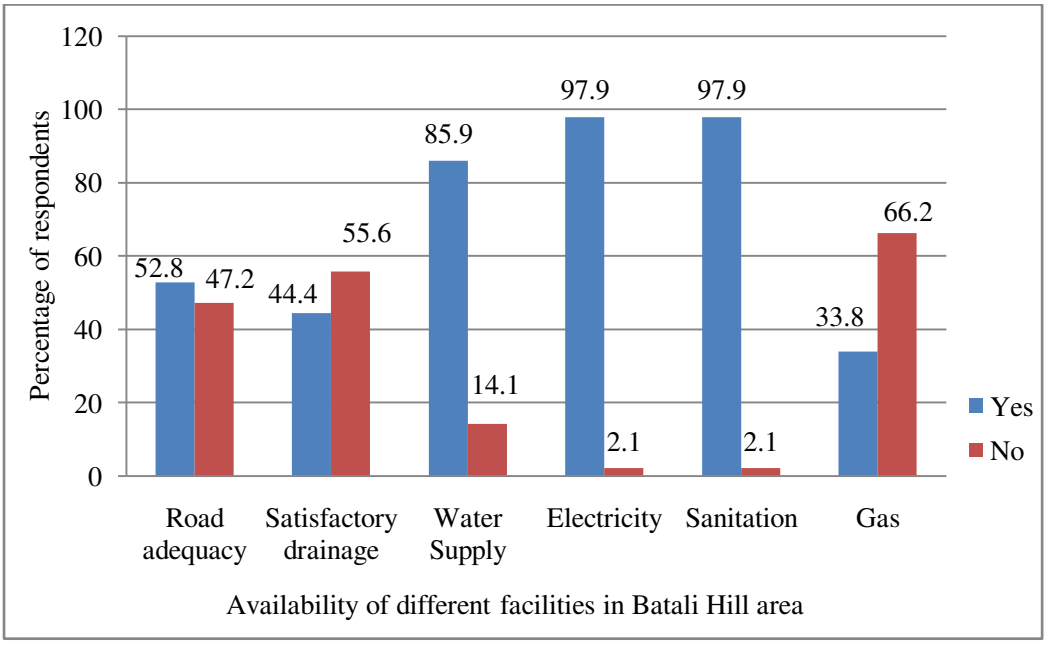
Table 4.33: Respondents' Opinion: Distance between community facilities and residence.

Source: Field Survey, September, 2014

Distance (kilometre)	Different community facilities in Batali Hill area									
	School		Market		Bank		Playground		Health care centre	
	No	%	No	%	No	%	No	%	No	%
0 km	5	3.52	3	2.11	0	0.00	19	13.38	1	0.70
0.25 km	30	21.13	17	11.97	3	2.11	23	16.20	6	4.23
0.50 km	68	47.89	87	61.27	34	23.94	53	37.32	16	11.27
1 km	35	24.65	17	11.97	30	21.13	23	16.20	34	23.94
1.25 km	1	0.70	1	0.70	1	0.70	0	0.00	0	0.00
1.50 km	1	0.70	2	1.41	12	8.45	3	2.11	6	4.23
1.75 km	1	0.70	1	0.70	1	0.70	1	0.70	0	0.00
2 km	1	0.70	2	1.41	12	8.45	3	2.11	27	19.01
> 2 km	0	0.00	12	8.45	49	34.51	17	11.97	52	36.62
Total	**142**	**100**	**142**	**100**	**142**	**100**	**142**	**100**	**142**	**100**

Figure 4.44: Existing condition of different facilities in Batali Hill.

Source: Field Survey, September, 2014



E. Real life experience to landslide disaster

39% of the respondents think that landslide is not a problem for this area at all and only 24% marks it as a very serious problem (Figure 4.45). According to the respondents people residing beside the hill are most vulnerable and so are the community people. 25.29% people are not concerned about the vulnerability of the people (Table 4.34). More than three-fourth of the respondents (77%) says that landslide occurs once per year in this locality (Appendix-C, Table 14). High precipitation, hill cutting and both of them have been identified as the main triggering factors of landslide by the respondents (Table 4.35). There are negative impacts of landslides to the community people. According to respondents, due to the landslides in several years the houses were destroyed, property was damaged and people died (Table 4.36).

Figure 4.45: Intensity of landslide problem in Batali Hill (Respondents' opinion).
Source: Field Survey, September, 2014

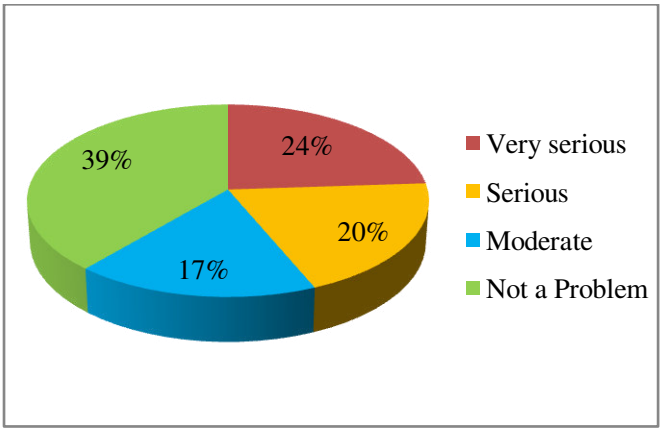


Table 4.34: Respondents' opinion: people vulnerable to landslide.
Source: Field Survey, September, 2014

Vulnerable people according to the respondents	Number of respondents	Percentage
Community people	29	33.33
No one	1	1.15
People residing near hill	31	35.63
People residing on hill top	4	4.60
Unknown	22	25.29
Total	**87**	**100**

Table 4.35: Causes of landslide in Batali Hill (Respondents' opinion).

Source: Field Survey, September, 2014

Causes of landslide	Number of respondents	Percentage
Hill cutting	13	9.56
Deforestation	2	1.47
High precipitation	70	51.47
Residential use	2	1.47
Construction of road/structure	4	2.94
Hill cutting & high precipitation	29	21.32
Hill cutting & residential use	6	4.41
Hill cutting, high precipitation & residential use	5	3.68
Others	5	3.68
Total	**136**	**100**

Table 4.36: Negative impact of landslide in Batali Hill (Respondents' opinion).

Source: Field Survey, September, 2014

Negative impact of landslide	Number of respondents	Percentage
House destroyed	1	0.77
Property damaged	2	1.54
Road blocked	1	0.77
People died	19	14.62
People injured	1	0.77
Damage of utility facilities	0	0.00
House destroyed & property damaged	11	8.46
House destroyed, property damaged & people died	66	50.77
House destroyed, property damaged, people died & people injured	26	20.00
Others	3	2.31
Total	**130**	**100**

The respondents were asked about their last landslide observance. It is found that 38.73% respondents never observed the landslide and the rest observed in different years of their lifetime. Most of the respondents (97.7%) observed last landslide in between last 10 years (Figure 4.46). During the landslide occurrence, three-fourth of the respondents was in this locality but they did not take any step to help the landslide victims. 15% of the residents participated in rescuing people (Figure 4.47 and Figure 4.48). During our survey we found 6 victims to landslide. Most of them said that the last landslide occurred at night (Table 4.37).

Figure 4.46: Respondents' last landslide observance (at 10 years interval) in last 30 years.

Source: Field Survey, September, 2014

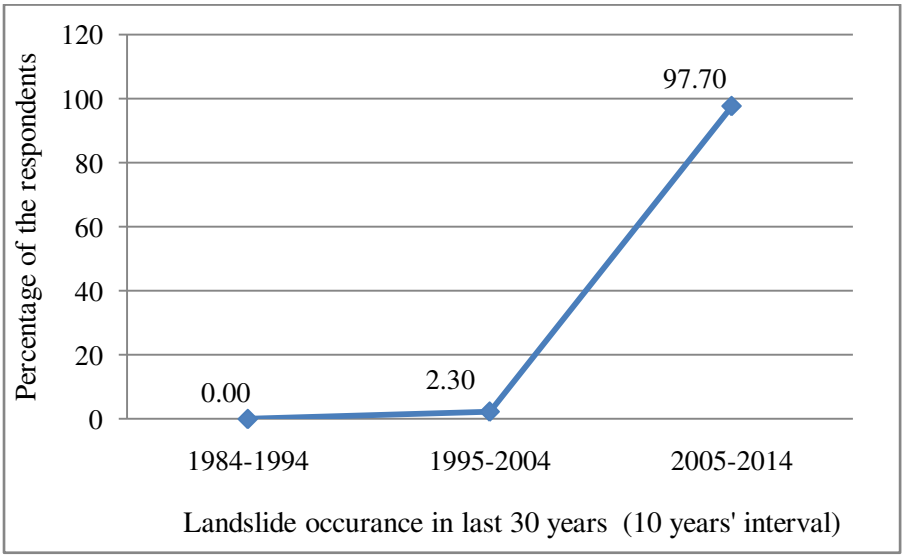


Figure 4.47: Respondents' location during the last landslide observed.

Source: Field Survey, September, 2014

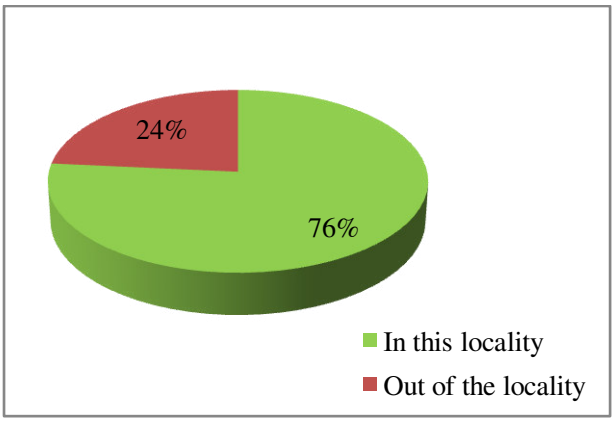


Figure 4.48: Respondents' response during last landslide observed.

Source: Field Survey, September, 2014

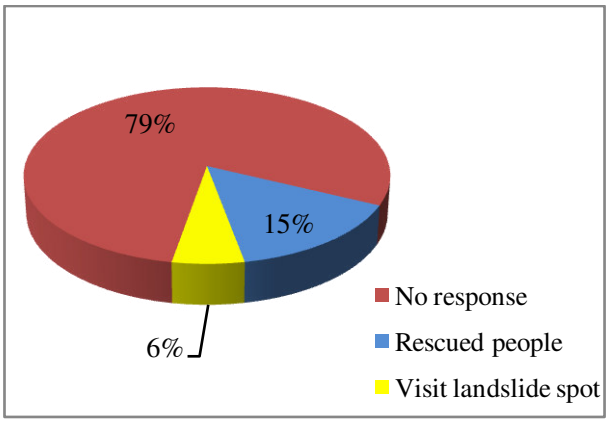


Table 4.37: Respondents' opinion regarding occurrence time of the last landslide observed.

Source: Field Survey, September, 2014

Time of landslide occurrence	Number of respondents	Percentage
Day	1	16.67
Night	2	33.33
No answer	3	50.00
Total	**6**	**100**

F. Landslide risk management

The respondents have their opinion about the positive and negative impacts of monsoon rain in their day to day life. In both cases most of the residents said that there is no impact of rainfall to their life. Rest of the respondents marked water collection, washing & bathing, water collection, washing & bathing as the positive impacts; and damage of roads, water logging, landslide and surface runoff as the negative impacts due to rain (Table 4.38).

Table 4.38: Respondents' opinion regarding positive impacts of monsoon rain.
Source: Field Survey, September, 2014

Positive impact of monsoon rain	Number of respondents	Percentage	Negative impact of monsoon rain	Number of respondents	Percentage
Water collection	33	23.24	Damage of road	31	21.83
Washing & bathing	11	7.75	Water logging	17	11.97
Water collection, washing & bathing	4	2.82	Landslide	12	8.45
			Surface runoff	2	1.41
			Road damage & landslide	21	14.79
No impact	92	64.79	No impact	45	31.69
Others	2	1.41	Others	14	9.86
Total	**142**	**100**	**Total**	**142**	**100**

From the household survey it is found that only 14.79% of the respondents are relocated from their usual living places during the monsoon rain rainfall (Appendix-C, Table 15). Among the relocated people maximum take shelter to the nearby school and City Corporation building provided free of cost by the authority of Chittagong City Corporation (Figure 4.49 and Figure 4.50). The relocation places for most of the respondents are within 1 kilometre from their residing place (Table 4.39). Table 4.40 shows the benefit got and problems faced by the relocated respondents of Batali Hill area during monsoon rain. 38.1% respondents said they get no benefit from the relocation place and 95.24% said nothing about the problems. Most of the respondents said that they can stay in the relocation place for 2-3 days if there is heavy rainfall (Appendix-C, Table 16).

Figure 4.49: Respondents' relocation place during monsoon rain.

Source: Field Survey, September, 2014

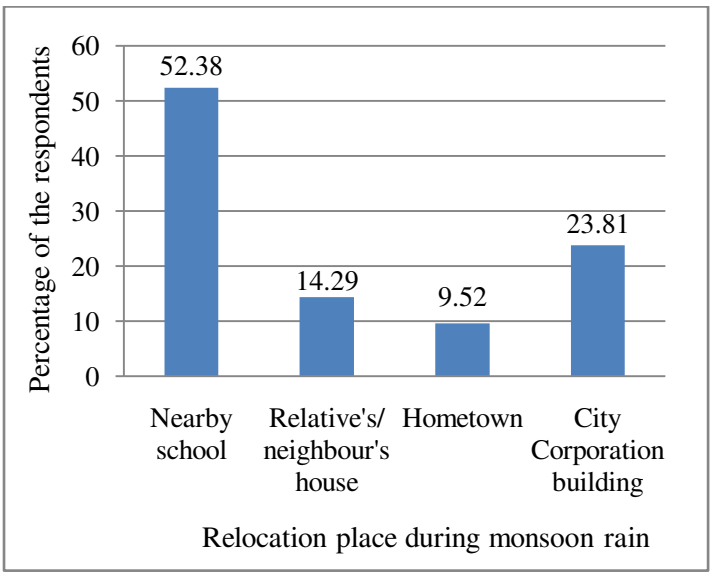


Figure 4.50: Providers of the relocation places to the respondents.

Source: Field Survey, September, 2014

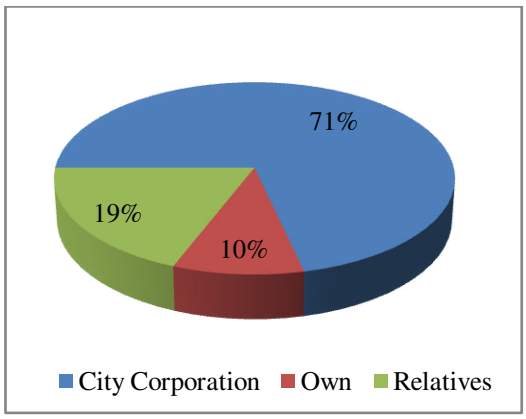


Table 4.39: Distance of relocation place from the respondents' house.

Source: Field Survey, September, 2014

Distance of relocated place	Number of respondents	Percentage
0 km	5	23.81
0.5 km	6	28.57
1 km	4	19.05
1.25 km	2	9.52
2 km	2	9.52
> 2 km	2	9.52
Total	**21**	**100.00**

Table 4.40: The benefit got and problems faced in relocation places by the respondents.

Source: Field Survey, September, 2014

Benefit got in relocation place	Number of respondents	Percentage	Problem faced in relocation place	Number of respondents	Percentage
Food help	5	23.81	Low food supply and poor sanitation facility, fear of theft	1	4.76
Save life	3	14.29			
Temporary shelter	5	23.81			
No benefit	8	38.10	No answer	20	95.24
Total	**21**	**100**	**Total**	**21**	**100**

Only 5.63% people said that there is landslide voluntary committee in Batali Hill area (Appendix-C, Table 17). There is Commissioner Group only to help during landslide (Table 4.41). During landslide the emergency services are mainly provided by police, fire service, community groups, City Corporation officials and neighbours (Table 4.42). 57.75% are satisfied with the rescue effort (Appendix-C, Table 18). There are several causes behind dissatisfaction to the rescue effort also and late response is the major one identified by the respondents (Table 4.43). The relocated people get money, food, cloth and shelter as compensation mainly from City Corporation, Government organization and ward commissioner (Table 4.44, Table 4.45 and Appendix-C, Table 18).

Table 4.41: Existing landslide voluntary committee in Batali Hill area.

Source: Field Survey, September, 2014

Landslide voluntary committee	Number of respondents	Percentage
Commissioner Group	5	62.50
Unknown	3	37.50
Total	**8**	**100**

Table 4.42: Organization offering the emergency services in Batali Hill.

Source: Field Survey, September, 2014

Emergency service offering organization	Number of respondents	Percentage
Neighbours	18	12.68
Community groups	3	2.11
Volunteers	1	0.70
Police	3	2.11
Fire service	14	9.86
City corporation councils	26	18.31
Police & fire service	6	4.23
Police, fire service, community groups & city corporation officials	49	34.51
Others	3	2.11
Unknown	19	13.38
Total	**142**	**100**

Table 4.43: Causes of dissatisfaction to the rescue effort.

Source: Field Survey, September, 2014

Causes of respondents' dissatisfaction of the rescue effort	Number of respondents	Percentage
Lack of proper attention	4	21.05
Late response	10	52.63
No answer	4	21.05
Shortage of equipment	1	5.26
Total	**19**	**100**

Table 4.44: Type of compensation to the victims.

Source: Field Survey, September, 2014

Victims' compensation type	Number of respondents	Percentage
Money	25	42.37
Food	6	10.17
Money, food & cloth	6	10.17
Unknown	17	28.81
Others	2	3.39
Shelter	3	5.08
Total	**59**	**100**

Table 4.45: Organizations helped/ compensated the victims.

Source: Field Survey, September, 2014

Organization helped/ compensated the victims	Number of respondents	Percentage
City Corporation	14	28.00
Community people	1	2.00
Government	16	32.00
Ward Commissioner	13	26.00
Unknown	6	12.00
Total	**50**	**100**

The respondents know about the landslide information mainly by announcement through mike and electronic media (Table 4.46 and Appendix-C, Table 17). More than 85% respondents stay at their houses after getting warning (Table 4.47). Most interesting thing is that 88.73% respondents do not have contact numbers of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies for emergency purpose (Appendix-C, Table 17). Though living in this area for so many years the respondents gave

some suggestion to reduce the risk of landslide of Batali Hill area. They mentioned permanent relocation, awareness building, stop hill cutting, engineering measurement through constructing retaining wall, tree plantation as the main things to do in this regard. Some (4.23%) said a solution may be leveling the hills (Table 4.48). Among 248 respondents only one added as suggestion to relocate the vulnerable people to other place gave suggestion (Appendix-C, Table 19).

Table 4.46: Early warning system during landslide.

Source: Field Survey, September, 2014

Organization providing early warning system for landslide	Number of respondents	Percentage
Announcement through Mike	87	64.44
Local volunteers	1	0.74
Newspaper/ press	3	2.22
Electronic Media	5	3.70
Announcement through Mike and Electronic Media	39	28.89
Total	**135**	**100**

Table 4.47: Response of the respondents after getting early warning system.

Source: Field Survey, September, 2014

Respondents' response after getting early warning	Number of respondents	Percentage
Shift to other place	16	11.85
Stay in house	118	87.41
No answer	1	0.74
Total	**135**	**100**

Table 4.48: Respondents' suggestion towards landslide risk reduction process.

Source: Field Survey, September, 2014

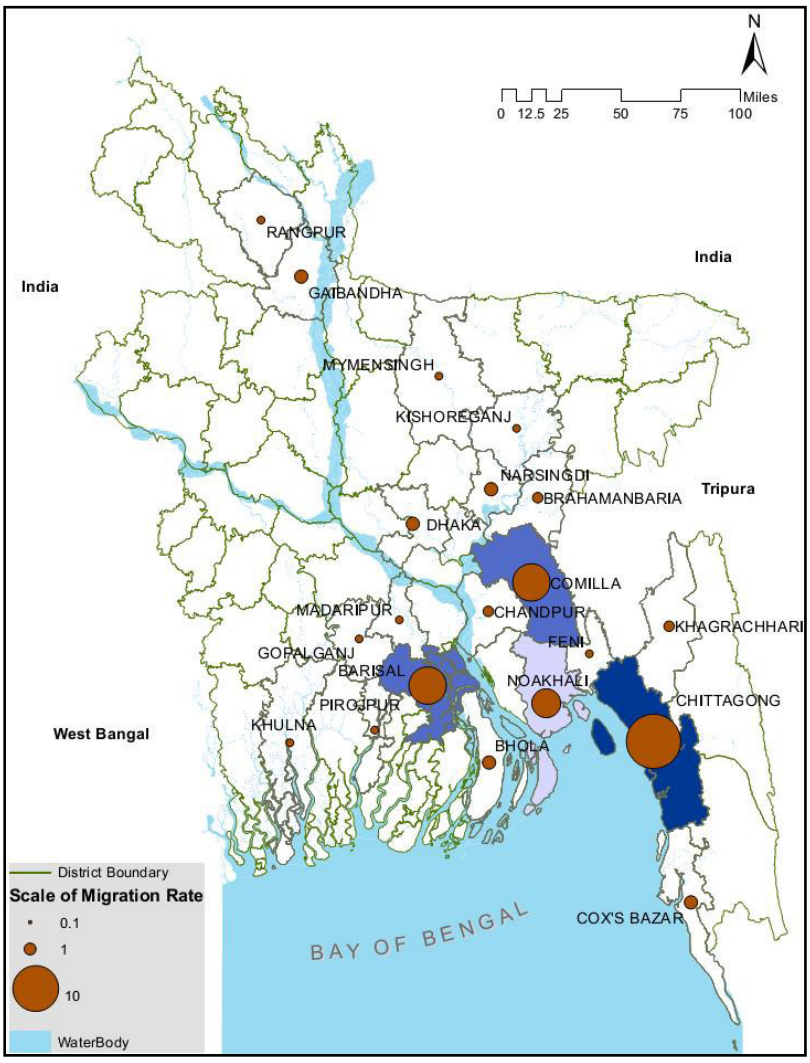
Landslide risk reduction process	Number of respondents	Percentage
Relocation	28	19.72
Tree plantation	3	2.11
Retaining wall	23	16.20
Engineering	8	5.63
Stop hill cutting	7	4.93
leveling the hill	6	4.23
Awareness building	16	11.27
Early warning	1	0.70
Stop precipitation	2	1.41
Stop deforestation	1	0.70
Proper planning	1	0.70
Government initiative	5	3.52
No answer	34	23.94
Unknown	7	4.93
Total	**142**	**100**

4.3 STUDY AREA-3: GOLPAHAR

A. Basic information and background of the respondents

A total of 114 households were surveyed. Male participants (59.657%) are dominating in number and most of the respondents are in age range 19-40 years. People of Golpahar were asked about their previous address and it was found that almost 29% people of them came from the other areas of Chittagong. Some people came from Comilla, Barisal and Noakhali (Figure 4.51 and Appendix-C, Table 20). From the study it is found that people came here for employment purpose. 45.61% responded agreed with this. 17.54% of the responded said that they live in this area by born (Appendix-C, Table 21). 41% of the people of Golpahar area said that this area settled after 1971 (Appendix-C, Table 22)

Figure 4.51: Migration status of the inhabitants of Golpahar area.
Source: Field Survey, September, 2014

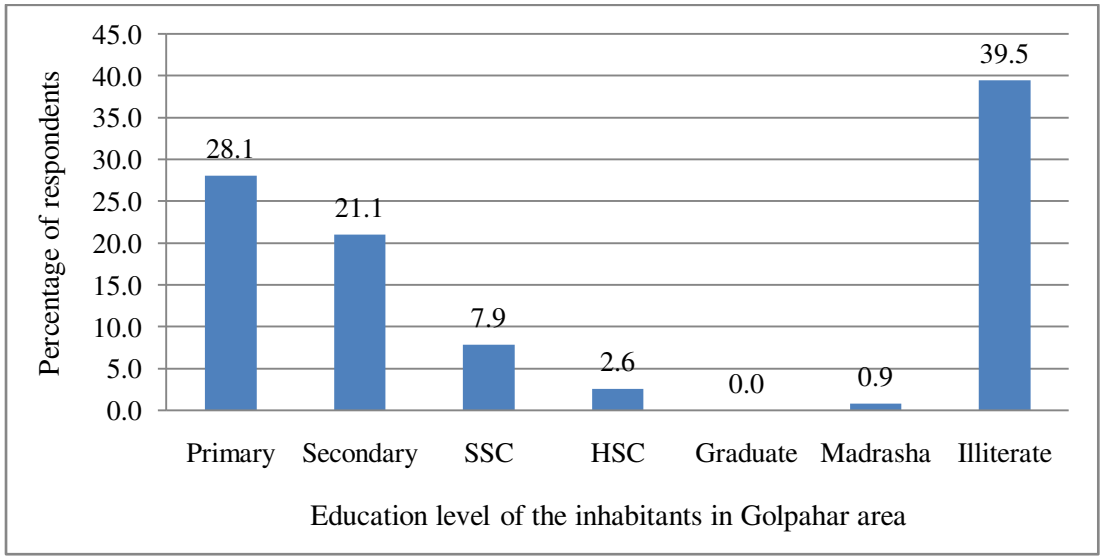


B. Demographic information/ Socio-economic aspects

The majority of the respondents in this locality are illiterate (39.5%). Besides, there is significant number of respondents having secondary and primary level of education respectively (Figure 4.52).

Figure 4.52: Education level of the respondents in Golpahar.

Source: Field Survey, September, 2014



Household income and expenditure:

People of Golpahar area are from different professions. Almost 30% people are involved with day labor profession. 13% of the responded found as employee and similar percentage of people found as shopkeepers. Apart from these professions many people of this area are rickshaw puller and garments worker (Figure 4.53). Mostly low income people live in Golpahar area. Almost 90% people of this area have income in between 5000 taka to 15000 taka. 50% people have income in between 5000-10000 taka (Figure 4.54).

Expenditure pattern of the people of Golpahar area is similar to the income pattern. Almost 90% expenditure lies in range between 5000 to 15000 taka. Highest 53.5% expenditure of people lies in 5000-10000 taka range. (Figure 4.55)

Figure 4.53: Main income sources (occupation) of the households.

Source: Field Survey, September, 2014

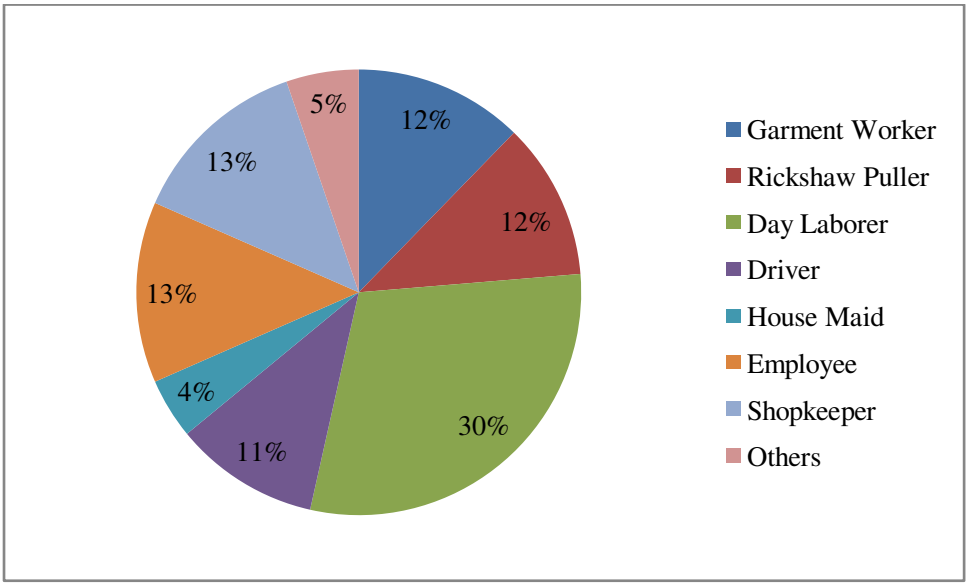


Figure 4.54: Average monthly income (in Taka) of the households.

Source: Field Survey, September, 2014

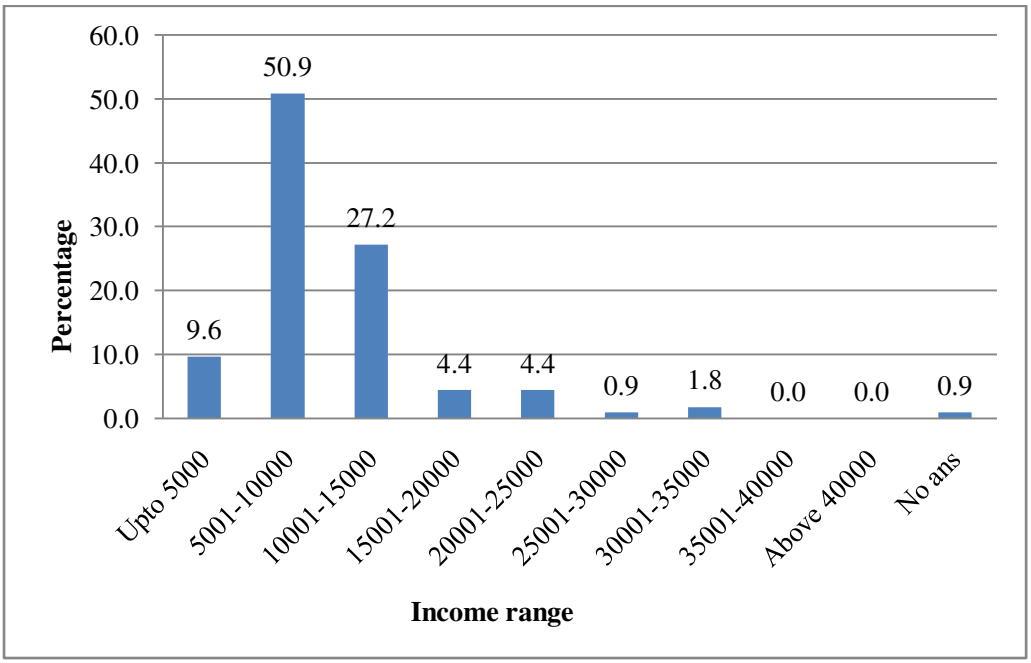
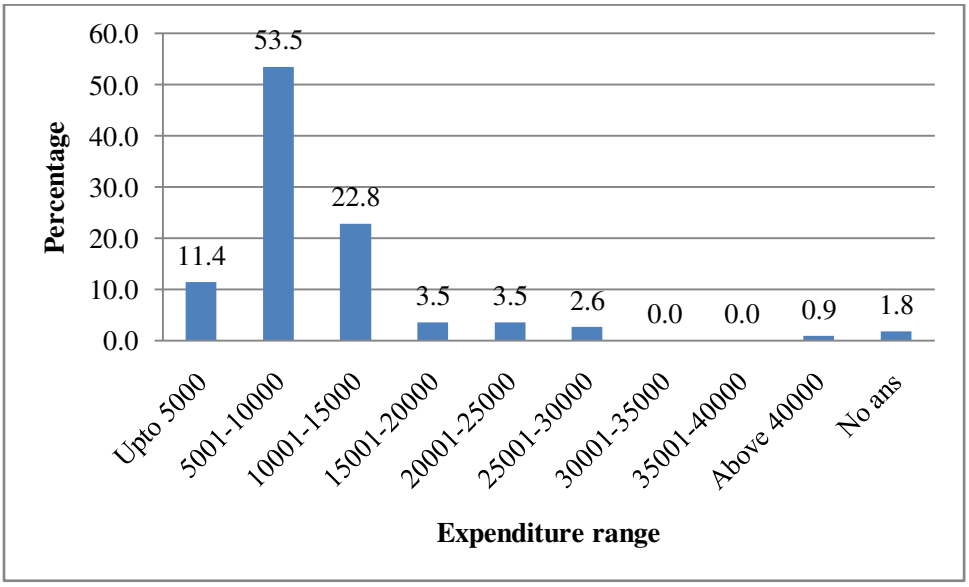


Figure 4.55: Average monthly expenditure (in Taka) of the households.

Source: Field Survey, September, 2014



From survey it is found that only four respondents get financial help from their family members living or working in Dhaka and Dinajpur region in Bangladesh (Table 4.49). They get money on monthly and when needed (Figure 4.56). Among the four respondents one said that he gets financial help of Tk. 500 (Figure 4.57).

Table 4.49: Status of getting financial help from other regions of Bangladesh.

Source: Field Survey, September, 2014

	Districts in Bangladesh	**Number of respondents**	**Percentage**
Get financial help from other members within Bangladesh	Barisal	1	25.00
	Dinajpur	1	25.00
	No answer	2	50.00
	Total	4	100
Do not get any financial help		110	
Total		**114**	

Figure 4.56: Interval of getting financial help within Bangladesh.

Source: Field Survey, September, 2014

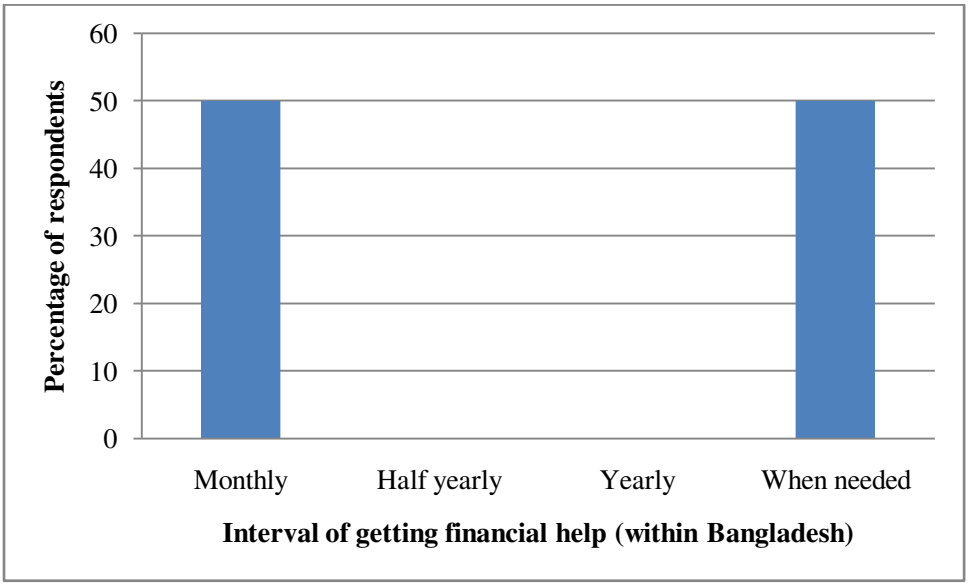


Figure 4.57: Amount (in Taka) of financial help respondents get from family members within Bangladesh.

Source: Field Survey, September, 2014

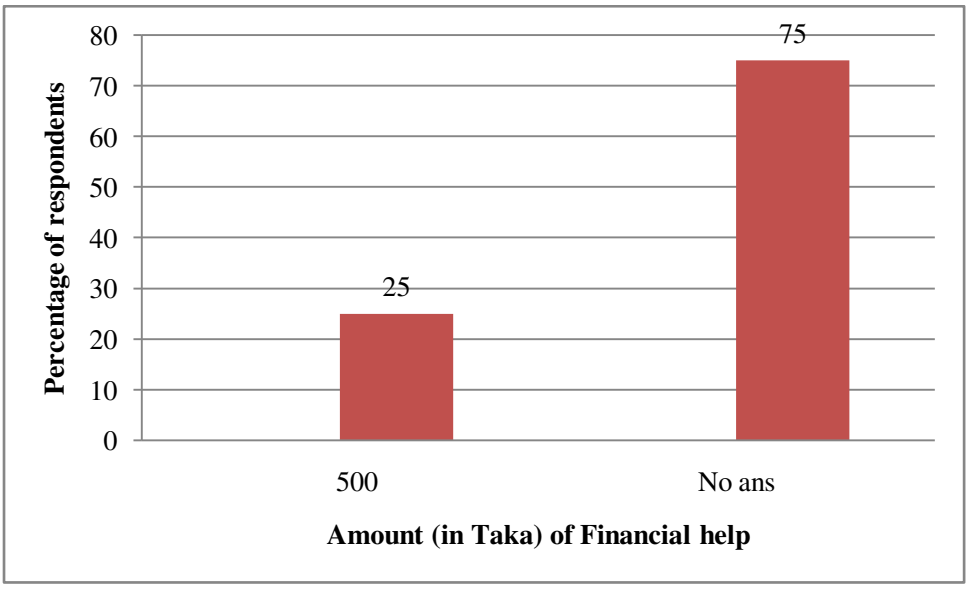


Table 4.50 shows the status of respondents' getting financial help from family members residing/ working abroad. 75% and 25% respondents get financial help from UAE and Saudi Arabia respectively. Among the four respondents one answered about the interval of getting financial help. He said that he gets money from abroad on half yearly basis (Figure 4.58). Among the four respondents one said that he gets financial help of Tk. 10000 (Figure 4.49). Moreover, 40.35% of the total respondents (Table 4.51) borrow loan from different sources named BRAC, Shajeda Foundation, Proshika, Shakti Foundation and ASA (Table 4.51). They use the loan in different purposes. Most of the respondents use the borrowed money for the purpose of business and building/repairing houses (Figure 4.60).

Table 4.50: Status of getting financial help from abroad.

Source: Field Survey, September, 2014

	Country	**Number of respondents**	**Percentage**
Get financial help from other members residing/ working abroad	Saudi Arabia	1	25.00
	UAE	3	75.00
	Total	**4**	**100**
Do not get any financial help		110	
Total		**114**	

Figure 4.58: Interval of getting financial help from abroad.

Source: Field Survey, September, 2014

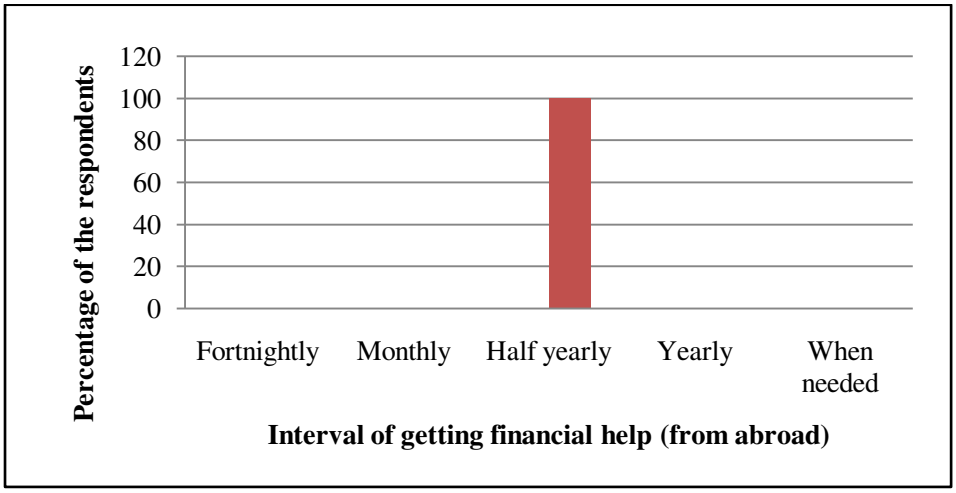


Figure 4.59: Amount (in Taka) of financial help respondents get from family members from abroad.

Source: Field Survey, September, 2014

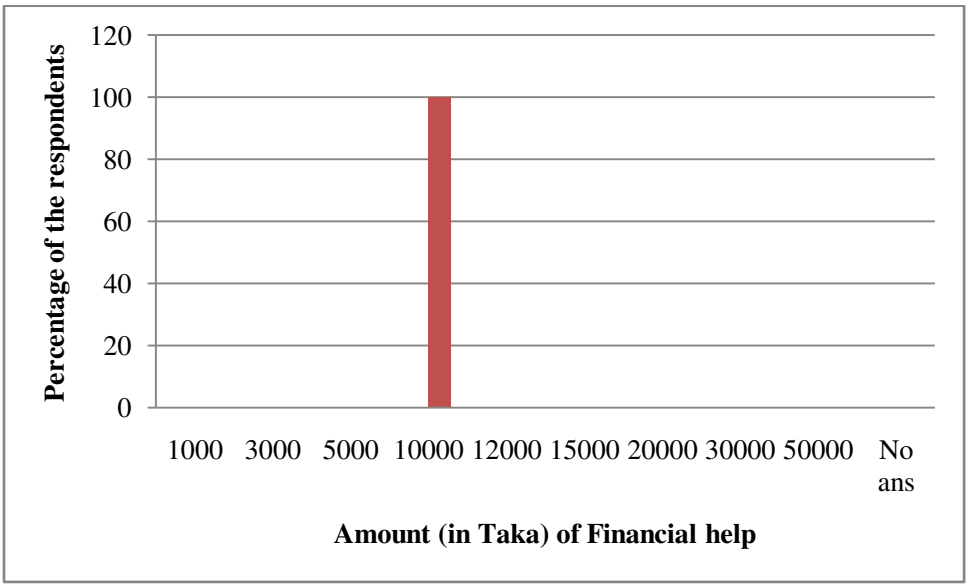


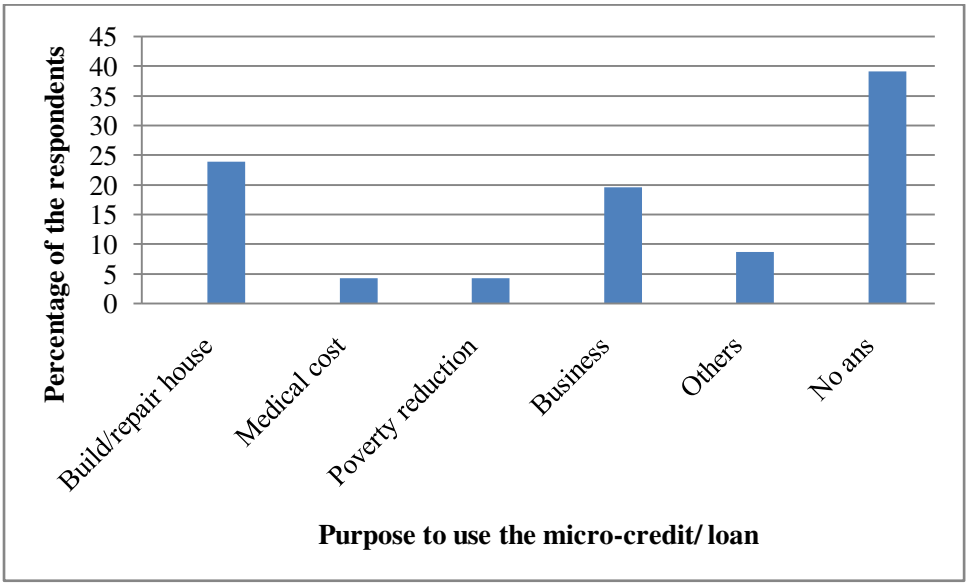
Table 4.51: Status of borrowing micro-credit/loan.

Source: Field Survey, September, 2014

	Institute	Number of respondents	Percentage
Get financial help by borrowing micro-credit/ loan	BRAC	4	8.70
	ASA	1	2.17
	Proshika	22	47.83
	DSK	10	21.74
	Bhasha	4	8.70
	Others	5	10.87
	Total	**46**	**100**
Do not borrow micro-credit/ loan		68	
Total		**114**	

Figure 4.60: Purpose to use the borrowed micro-credit/loan.

Source: Field Survey, September, 2014



30.70% of the respondents say that they do not face any type of threats to reside in this area. Some identified drug or illegal business, lack of utility facilities, political violence, social insecurity, theft and terrorism as problems of Golpahar area. A small number of people said that they face problem due to inadequate road/ drain, eviction for illegal business and water logging (Table 4.52). The main advantages for which people reside in this area are less living expenses and better job opportunity. Some say they reside here because the area is close to city center and nearer to community facilities (Table 4.53). 53.5% respondents say that they will be in a more problematic situation if they are relocated or evicted from here (Figure 4.61). Homelessness and increased house-rent in other places are main problems for them to face in this regard (Table 4.54).

Table 4.52: Threats faced by the respondents to reside in this area.

Source: Field Survey, September, 2014

Threats faced to reside in this area	Number of respondents	Percentage
Terrorism	3	2.63
Social Insecurity	12	10.53
Political violence	17	14.91
Theft	9	7.89
Water Logging	3	2.63
Lack of Utility facilities	6	5.26
Drugs or illegal business	5	4.39
Eviction for illegal business	1	0.88
Inadequate Road/Drain	7	6.14
Theft, Water logging, Drug or illegal business	3	2.63
Social insecurity, drags or illegal business, inadequate road and drain	5	4.39
No Problem	35	30.70
Others	8	7.02
Total	**114**	**100**

Table 4.53: Respondents' advantages of residing in this area.

Source: Field Survey, September, 2014

Advantages of residing in this area	Number of respondents	Percentage
Better job	10	8.77
Less living expense	58	50.88
Close to city center	7	6.14
Nearer to community facilities	3	2.63
Better job & less living expense	9	7.89
better job & close to city center	2	1.75
less living expense & close to city center	9	7.89
Others	14	12.28
Buying own residence	2	1.75
Total	**114**	**100**

Figure 4.61: Respondents' opinion regarding in a problematic situation if evicted from here.

Source: Field Survey, September, 2014

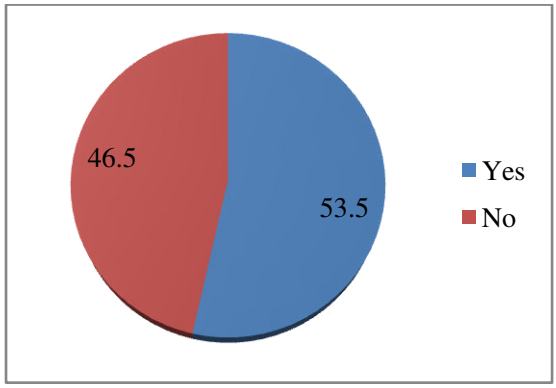


Table 4.54: Problems respondents will face if relocated or evicted from this area.

Source: Field Survey, September, 2014

Problem if evicted	**No of respondents**	**%**
Increased house rent	17	27.87
Increased distance to workplace and school	1	1.64
Unemplomент	8	13.11
Identity crisis	1	1.64
Homeless	26	42.62
Others	8	13.11
Total	**61**	**100**

The respondents were asked about their future plan to improve present living standard. But most of them (50%) have no plan yet. 34.62% people have a plan to increase income through getting better job/ business (Table 4.55).

Table 4.55: Respondents' plan to improve present living standard.

Source: Field Survey, September, 2014

Respondents' plan to improve present living standard	Number of respondents	Percentage
Better job/ business	18	34.62
live in better place	3	5.77
Buy land/ house in hometown	1	1.92
Children's education and establishment	1	1.92
Others	3	5.77
No plan	26	50.00
Total	**52**	**100**

C. Physical aspects

Most of the people of Golpahar area live in other's land.62.28% respondent said that they do not own land (Appendix-C, Table 23). 57.89% responded claimed that they build houses. Golpahar area is located in hilly region. People use hills for different purposes. But mostly hills are used for housing purposes. Analysis shows that 95% people use hills for housing purpose (Figure 1). People who do not own land or buildings pay rent. 57% of responded said that they do not pay rent. Rest of the people pay rent for living (Appendix-C Figure 10).

People of this area are involved with different types of jobs. Many of their workplaces are outside of this area.53% responded said that they travel daily for work purposes Appendix-C, Figure 11).

Figure 4.62: Percentage of use of hills for different purposes

Source: Field Survey, September, 2014

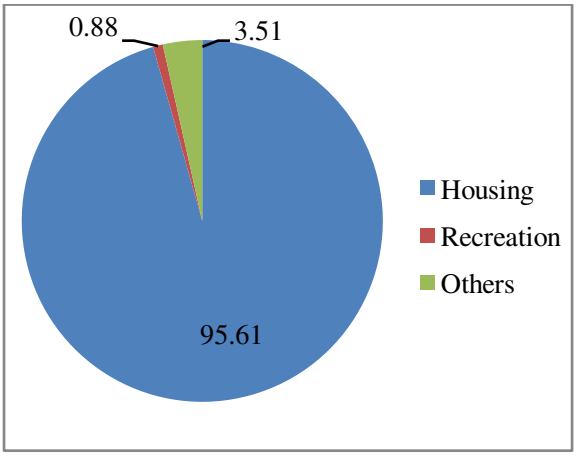
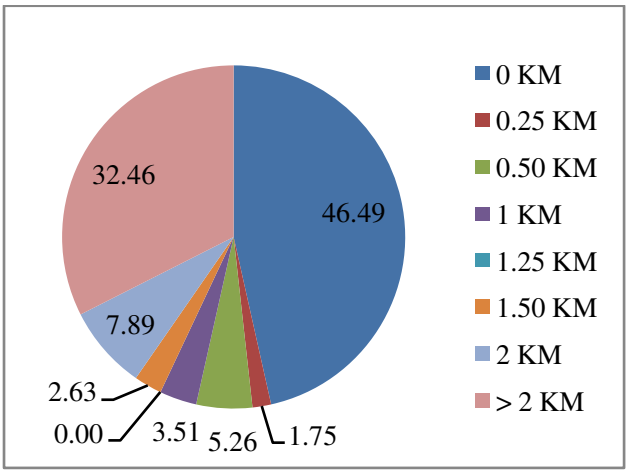


Figure 4.63: Percentage of people working in different distant workplaces.

Source: Field Survey, September, 2014



From the study it is found that 46.49% people do not travel for work. It means that they have job inside their area. 3.46% people travel more than two kilometer for job purposes. Other distances to workplace vary from 0.25 km to 2 km (Figure 4.63).

Community facilities:

According to the people of Golpahar area, School and Market places both are located within the Golpahar area.55% people said that schools and 30% people said market places are located within 0.5km. 43.86 % people responded said that banks are located within 1km of the area. People of the Golpahar area said that there is no playground or health care center in this area (Appendix-C, Table 25)

Road drainage and utility facilities:

People of Golpahar area are not satisfied with the condition of roads. 71% people said that the roads of this area are inadequate. People are also not satisfied with the drainage and gas facilities of this area.68% people said there is inadequate drainage facility in this area.97.4% people claimed that they do not have gas facility in their houses. People of Golpahar area have access to water supply.78.9% people said that they have access to water. 100% sanitation is achieved in Golpahar area. Almost 100% households of Golpahar area have electricity to their houses.

D. Real life experience to landslide disaster

Almost 19.3% of the respondents think that landslide is not a problem for this area at all and 24.6% marks it as a very serious problem (Figure 4.64). According to the respondents people residing beside the hill are most vulnerable and so the community people. 44% people think that the most vulnerable people to landslide are who live near hills (Table 4.56). More than half of the respondents (77.78%) say that landslide occurs once per year in this locality. High precipitation, hill cutting and both of them have been identified as the main triggering factors of landslide by the respondents (Table 4.57). There are negative impacts of landslides to the community people. According to respondents, due to the landslides in several years the houses were destroyed, property was damaged and people died (Table 4.58).

Figure 4.64: Intensity of landslide problem in Golpahar (Respondents' opinion).

Source: Field Survey, September, 2014

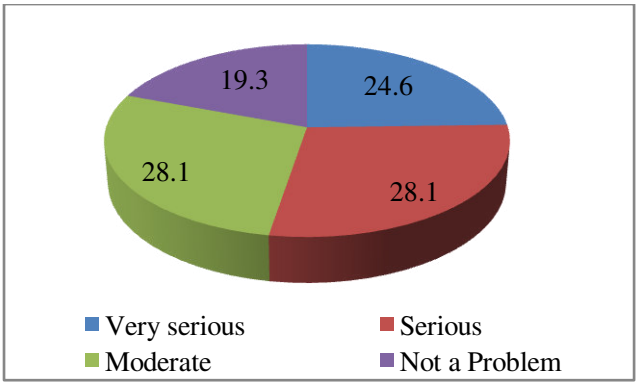


Table 4.56: Respondents' opinion: people vulnerable to landslide.

Source: Field Survey, September, 2014

Vulnerable people according to the respondents	**No of respondents**	**%**
Community people	23	25.00
No one	1	1.09
People residing near hill	41	44.57
People residing on hill top	4	4.35
Unknown	15	16.30
Women, poor and children	8	8.70
Total	**92**	**100**

Table 4.57: Causes of landslide in Golpahar (Respondents' opinion).

Source: Field Survey, September, 2014

Causes of landslide	**Number of respondents**	**Percentage**
Hill cutting	11	9.82
Deforestation	1	0.89
High precipitation	50	44.64
construction of road/structure	2	1.79
Hill cutting & high precipitation	33	29.46
Hill cutting & residential use	2	1.79
High precipitation & residential use	2	1.79
Hill cutting, high precipitation & residential use	9	8.04
Others	2	1.79
Total	**112**	**100**

Table 4.58: Negative impact of landslide in Golpahar (Respondents' opinion).

Source: Field Survey, September, 2014

Negative impact of landslide	**Number of respondents**	**Percentage**
House destroyed	7	6.42
property damaged	3	2.75
road blocked	6	5.50
people died	3	2.75
people injured	1	0.92
damage of utility facilities	0	0.00
house destroyed & property damaged	16	14.68
House destroyed, property damaged & people died	35	32.11
house destroyed, property damaged, people died & people injured	35	32.11
others	3	2.75
Total	**109**	**100**

The respondents were asked about their last landslide observance. Most of the respondents (59.52%) observed last landslide between the years of 2005 to 2014 (Figure 4.65). During the landslide occurrence, most of the respondents were out of the locality. 10.8% of the respondents were in this locality but they did not take any step to help the landslide victims. 25% of the residents participated in rescuing people (Figure 4.66 and Figure 4.67). During our survey we found 14 victims to landslide.

Figure 4.65: Respondents' last landslide observance (at 10 years interval) in last 30 years.

Source: Field Survey, September, 2014

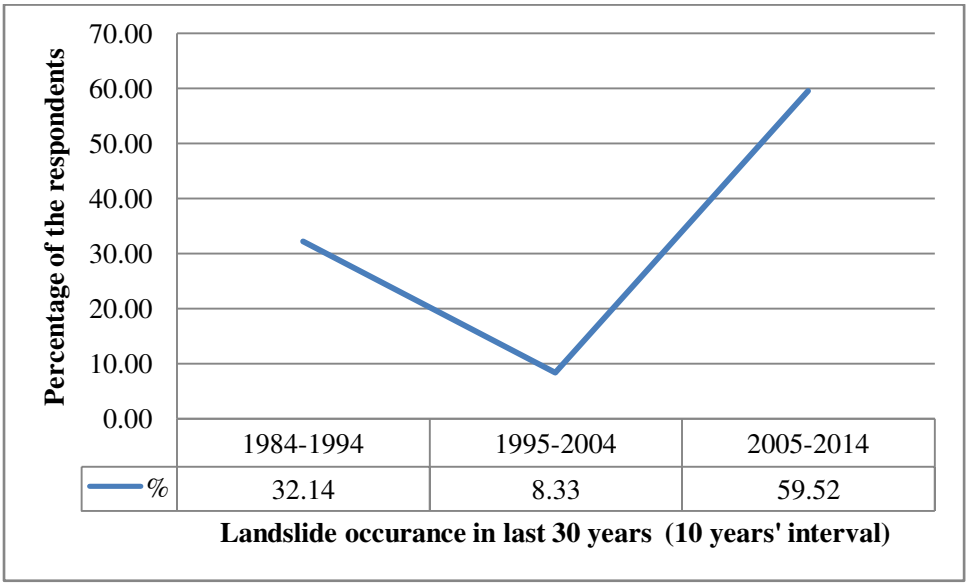


Figure 4.66: Respondents' location during the last landslide observed.

Source: Field Survey, September, 2014

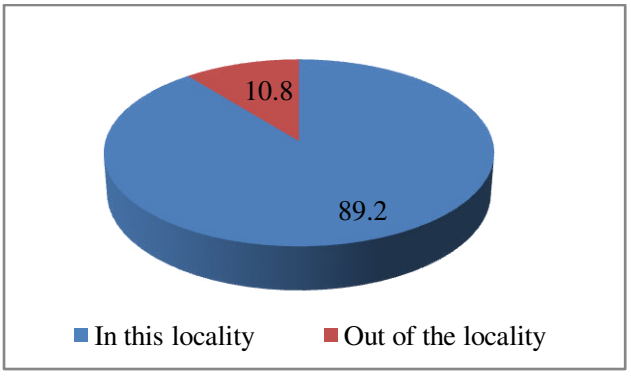


Figure 4.67: Respondents' response during last landslide observed.

Source: Field Survey, September, 2014

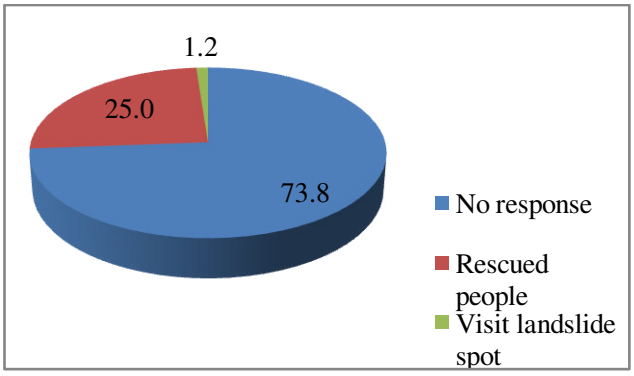


Table 4.59: Respondents' opinion regarding occurrence time of the last landslide observed.

Source: Field Survey, September, 2014

Time of landslide occurrence	Number of respondents	Percentage
Day	3	21.43
Early morning	2	14.29
Night	2	14.29
No answer	7	50.00

E. Landslide risk management

The respondents have their opinion about the positive and negative impacts of monsoon rain in their day to day life. In both cases most of the residents said that there is no impact of rainfall to their life. Rest of the respondents marked water collection, washing & bathing, cleaning of drain & road as the positive impacts; and damage of roads, water logging, landslide and surface runoff as the positive impacts due to rain (Table 4.60).

Table 4.60: Respondents' opinion regarding positive and negative impacts of monsoon rain. Source: Field Survey, September, 2014

Positive impact of monsoon rain	Number of respondents	Percentage	Negative impact of monsoon rain	Number of respondents	Percentage
Water Collection	26	22.81	Damage of road	48	42.11
Washing & Bathing	11	9.65	Water logging	10	8.77
Cleaning of Drain & Road	1	0.88	landslide	21	18.42
Water collection, washing & bathing	2	1.75	Surface runoff	1	0.88
			Road damage & landslide	13	11.40
No Impact	73	64.04	No impact	16	14.04
Others	1	0.88	Others	5	4.39
Total	**114**	**100**	**Total**	**114**	**100**

From the household survey it is found that only 16.13% of the respondents are relocated from their usual living places during the monsoon rain rainfall. Among the relocated people maximum take shelter to the relative's house or neighbor's house. Some relocate to nearby school provided free of cost by the authority of Chittagong City Corporation (Figure 4.68 and Figure 4.69). The relocation places for most of the respondents are within 0.5 kilometre from their residing place (Table 4.61). Table 4.61 shows the benefit got and problems faced by the relocated respondents of Golpahar area during monsoon rain. 100% respondents said they get no benefit from the relocation place and all of them said nothing about the problems. Most of

the respondents said that they can stay in the relocation place as long as they wish if there is heavy rainfall.

Figure 4.68: Respondents' relocation place during monsoon rain.

Source: Field Survey, September, 2014

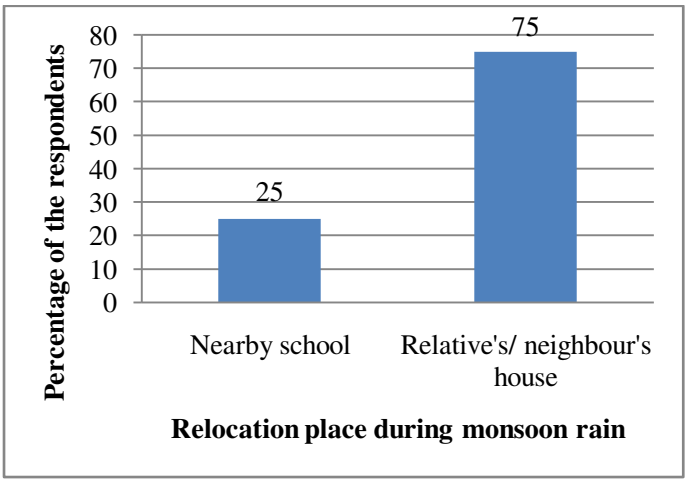


Figure 4.69: Providers of the relocation places to the respondents.

Source: Field Survey, September, 2014

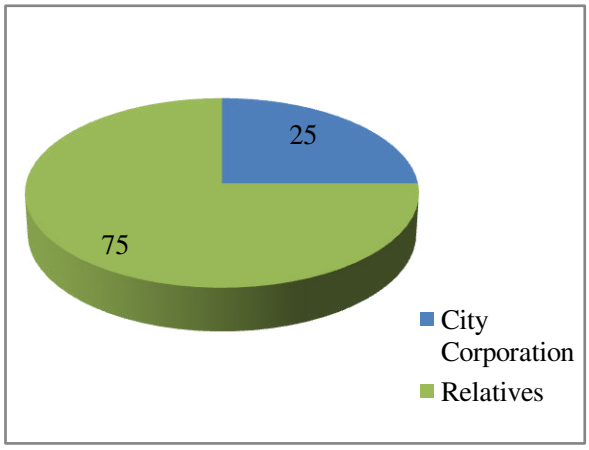


Table 4.61: Distance of relocation place from the respondents' house.

Source: Field Survey, September, 2014

Distance of relocated place	Number of respondents	Percentage
0.05 km	2	50.00
1 km	1	25.00
2 km	1	25.00
Total	**4**	**100.00**

Table 4.62: The benefit got and problems faced in relocation places by the respondents.

Source: Field Survey, September, 2014

Benefit got in relocation place	Number of respondents	Percentage	Problem faced in relocation place	Number of respondents	Percentage
No benefit	4	100.00	No answer	4	100.00
Total	**4**	**100**	**Total**	**4**	**100**

Table 4.63: Existing landslide voluntary committee in Golpahar area.

Source: Field Survey, September, 2014

Landslide voluntary committee	Number of respondents	Percentage
Commissioner Group	1	16.67
DSK	3	50.00
Unknown	2	33.33
Total	**6**	**100**

Table 4.64: Organization offering the emergency services in Golpahar area.

Source: Field Survey, September, 2014

Emergency service offering organization	Number of respondents	Percentage
Neighbours	31	27.19
Community groups	10	8.77
Volunteers	2	1.75
Police	0	0.00
Fire service	7	6.14
City corporation councils	20	17.54
NGO	10	8.77
Police & fire service	1	0.88
Police, fire service, community groups & city corporation oficals	29	25.44
Others	1	0.88
Unknown	3	2.63
Total	**114**	**100**

Only 5.26% people said that there is landslide voluntary committee in Golpahar area. They are Commissioner Group, DSK, and some unknown organization (Table 4.63). During landslide the emergency services are mainly provided by police, fire service, community groups, City Corporation officials, NGO and neighbors (Table 4.64). 57.66% are satisfied with the rescue effort. There are several causes behind dissatisfaction to the rescue effort also and late response is the major one identified by the respondents (Table 4.65). The relocated

people get money, food, cloth and shelter as compensation from City Corporation, Government organization and ward commissioner (Table 4.66, Table 4.67).

Table 4.65: Causes of dissatisfaction to the rescue effort.

Source: Field Survey, September, 2014

Causes of respondents' dissatisfaction of the rescue effort	**Number of respondents**	**Percentage**
Inefficient roadway	1	3.70
Lack of proper attention	2	7.41
Late response	11	40.74
Low efficiency	1	3.70
No answer	7	25.93
Shortage of equipment	5	18.52
Total	**27**	**100**

Table 4.66: Type of compensation to the victims.

Source: Field Survey, September, 2014

Victims' compensation type	**Number of respondents**	**Percentage**
Money	6	35.29
Food	4	23.53
Money, food & cloth	5	29.41
Unknown	2	11.76
Total	17	100

Table 4.67: Organizations helped/ compensated the victims.

Source: Field Survey, September, 2014

Organization helped/ compensated the victims	Number of respondents	Percentage
Chairman	1	9.09
Community people	1	9.09
Government	2	18.18
Unknown	2	18.18
Ward Commissioner	5	45.45
Total	**11**	**100**

The respondents know about the landslide information mainly by announcement through mike (Table 4.68). More than 94% respondents stay at their houses after getting warning (Table 4.69). Most interesting thing is that 83.33% respondents do not have contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies for emergency purpose. Though living in this area for so many years the respondents gave some suggestion to reduce the risk of landslide of Golpahar area. They mentioned permanent relocation, awareness building, stop hill cutting, engineering measurement through constructing retaining wall, tree plantation as the main thing to do in this regard. Some said a solution may be leveling the hills (Table 4.70). Among 114 respondents none gave their suggestions.

Table 4.68: Early warning system during landslide.

Source: Field Survey, September, 2014

Organization providing early warning system for landslide	Number of respondents	Percentage
Announcement through Mike	67	60.36
Ward Commissioner	4	3.60
Newspaper/ press	3	2.70
Electronic Media	6	5.41
Announcement through Mike and Electronic Media	31	27.93
Total	**111**	**100**

Table 4.69: Response of the respondents after getting early warning system.

Source: Field Survey, September, 2014

Respondents' response after getting early warning	Number of respondents	Percentage
Shift to other place	44	18.33
Stay in house	195	81.25
No answer	1	0.42
Total	**240**	**100**

Table 4.70: Respondents' suggestion towards landslide risk reduction process.

Source: Field Survey, September, 2014

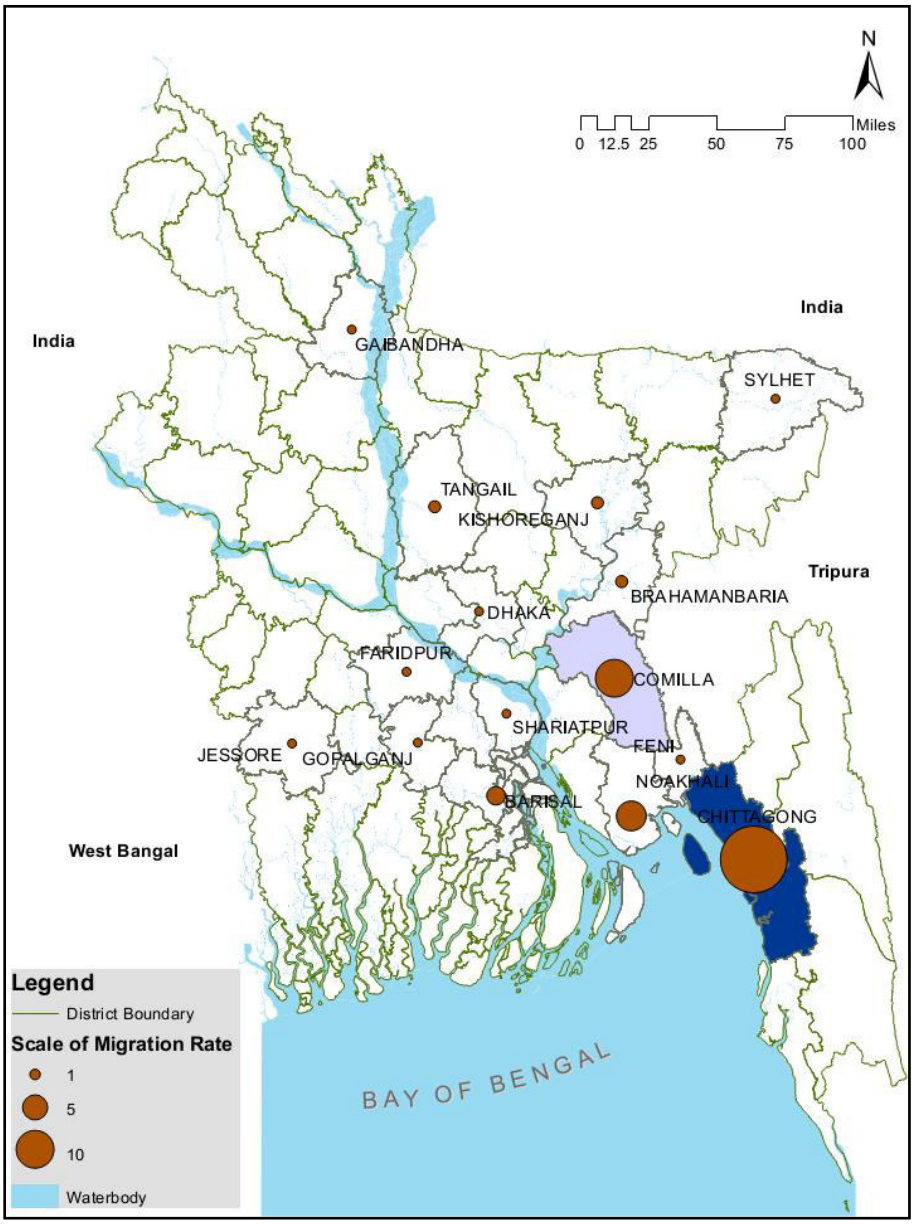
Landslide risk reduction process	Number of respondents	Percentage
Relocation	9	7.89
Tree plantation	3	2.63
Retaining wall	11	9.65
Engineering	1	0.88
Stop hill cutting	16	14.04
leveling the hill	24	21.05
Awareness building	14	12.28
No answer	18	15.79
Unknown	12	10.53
Early warning	2	1.75
Stop precipitation	0	0.00
Stop deforestation	0	0.00
Others	1	0.88
Proper planning	0	0.00
Govt. initiative	3	2.63
Total	**114**	**100**

4.4 STUDY AREA-4: GOACHIBAGAN MEDICAL HILL

A. Basic information and background of the respondents

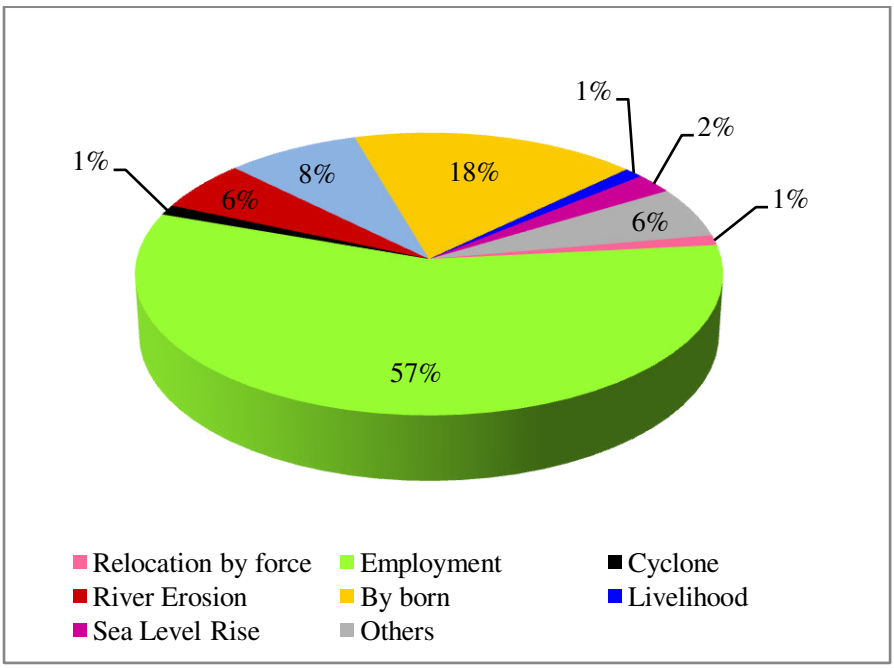
Among the four study areas, Goachibagan contains/ possesses the highest number of population/ household. In Goachibagan area, 86 respondents are surveyed. Male participants (58.47%) are dominating in number and most of the respondents are in age range 19-40 years, i.e, they are economically active people (Appendix-C, Figure 12 and Figure 13).

Figure 4.70: Migration status of the inhabitants of Goachibagan area.
Source: Field Survey, September, 2014



The respondents are mostly from Chittagong, Comilla and Noakhali districts of Bangladesh (Appendix-C, Table 26). The locations of their previous places are shown in Figure 4.70. The main cause to migrate in Goachibagan area is for better employment opportunity. Besides, 27% respondents live here by born (Figure 4.71). Maximum number of respondents resides in this area for about 10 to 30 years (Appendix-C, Figure 14). There is contradiction among the respondents' opinion about the duration of settlement in this area. From the respondents, it is found that the settlement in Goachibagan area was established before the liberation war of Bangladesh in 1971. But most of the people (32.66%) have reversed views and a significant number of people (37.5%) have no idea about it (Appendix-C, Figure 15).

Figure 4.71: Respondents' Causes of migration to Goachibagan.
Source: Field Survey, September, 2014



B. Demographic information/ Socio-economic aspects

The majority of the respondents in this locality are illiterate (37.9%), besides there are significant number of respondents having secondary and primary level of education respectively (Figure 4.72). Day labourer and shopkeeper are the main occupation of the surveyed households. Driver, garment worker, employee are also significant in this area (Figure 4.73). Most of the respondents have average monthly household income of Tk.5001-Tk.10000 and Tk.10001-Tk.15000 respectively (Figure 4.74). Besides, there is same scenario in case of average monthly household expenditure (Figure 4.75).

Figure 4.72: Education level of the respondents in Goachibagan.

Source: Field Survey, September, 2014

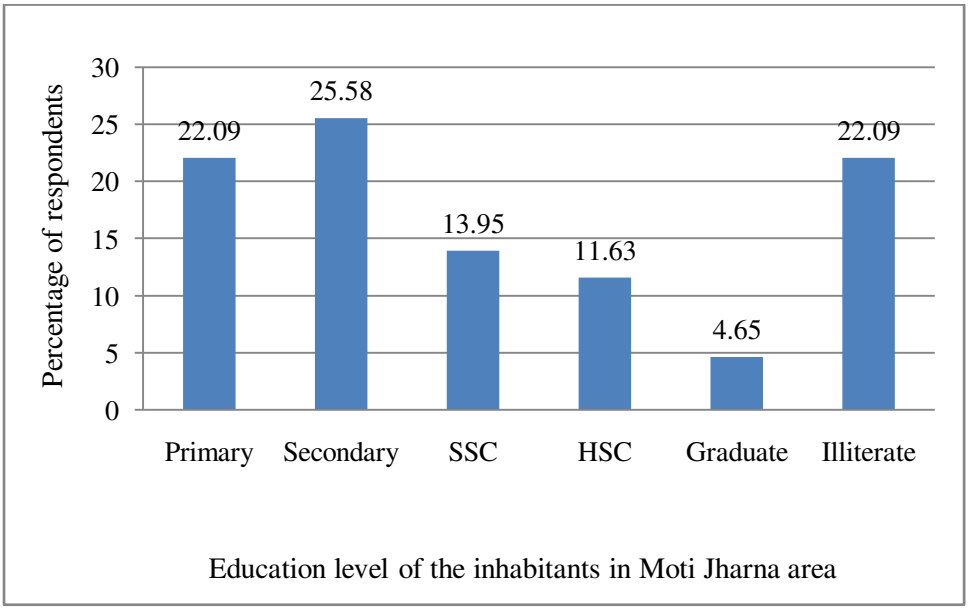


Figure 4.73: Main income sources (occupation) of the households.

Source: Field Survey, September, 2014

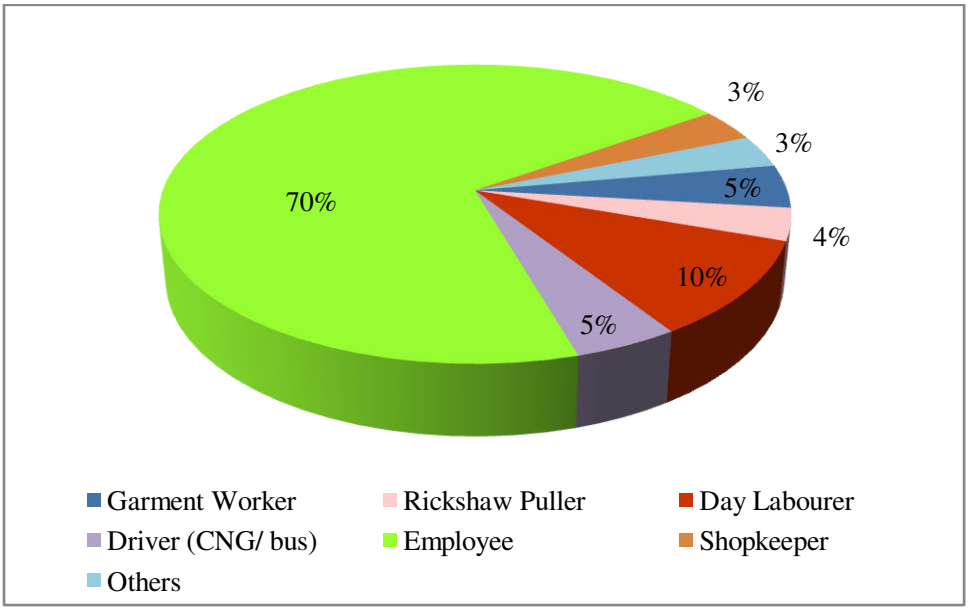


Figure 4.74: Average monthly income (in Taka) of the households.

Source: Field Survey, September, 2014

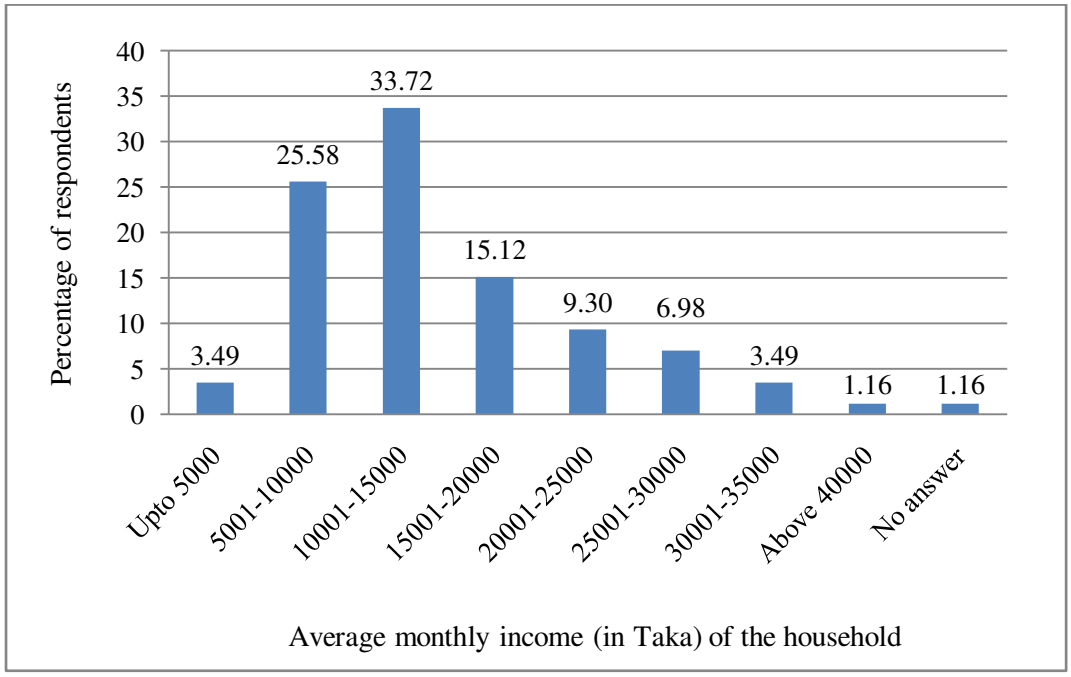
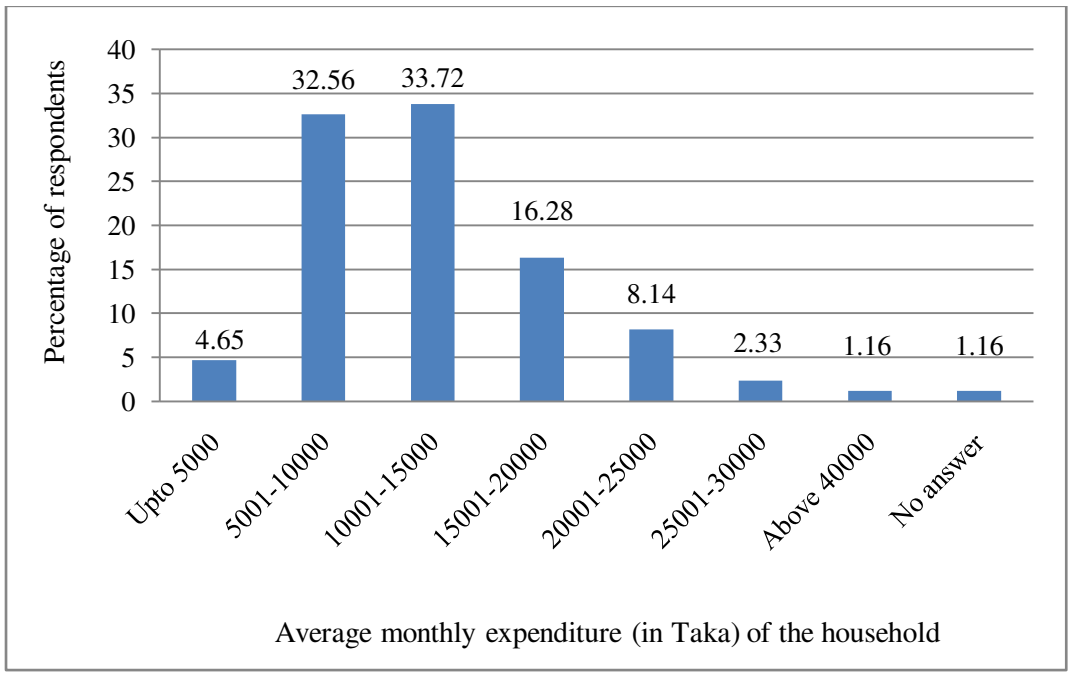


Figure 4.75: Average monthly expenditure (in Taka) of the households.

Source: Field Survey, September, 2014



From survey it is found that only two respondents get financial help from their family members living or working in Chittagong region in Bangladesh (Table 4.71). One of them gets the money monthly and another gets half yearly (Figure 4.76). Among the six

respondents four said that each of them gets financial help of Tk. 100, Tk. 2,000; Tk. 3,000 and Tk. 20,000 respectively (Figure 4.77).

Table 4.71: Status of getting financial help from other regions of Bangladesh.
Source: Field Survey, September, 2014

	Districts in Bangladesh	Number of respondents	Percentage
Get financial help from other members within Bangladesh	Chittagong	2	100
	Total	2	100
Do not get any financial help		84	
Total		**86**	

Figure 4.76: Interval of getting financial help within Bangladesh.
Source: Field Survey, September, 2014

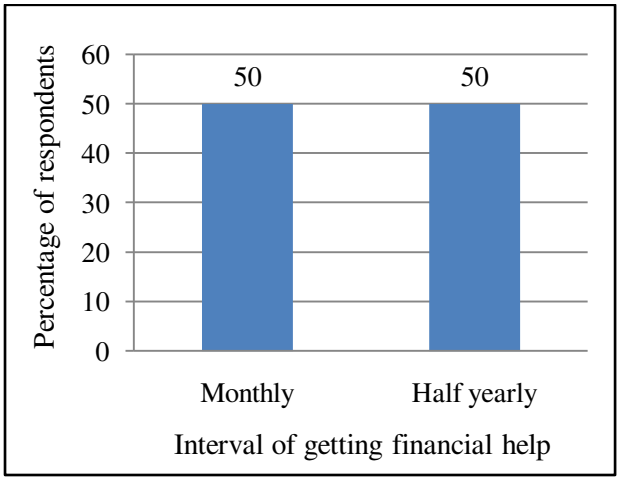


Figure 4.77: Amount (in Taka) of financial help respondents get from family members within Bangladesh.
Source: Field Survey, September, 2014

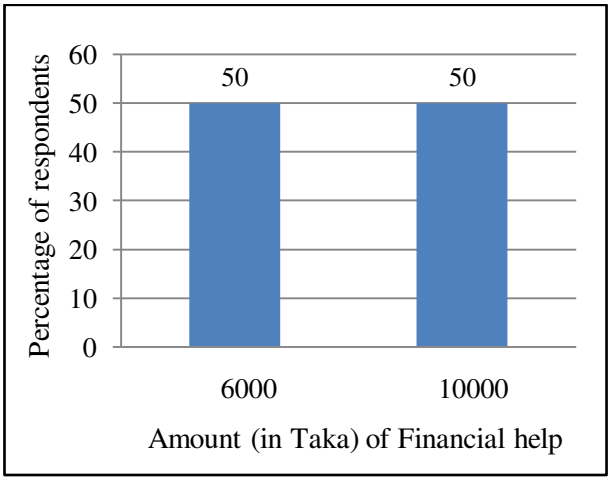


Table 4.72 shows the status of respondents' getting financial help from family members residing/ working abroad. Only four respondents get financial help from UAE and Saudi Arabia . Each of them gets Tk. 10000 monthly (Figure 4.78). Moreover, 28.23% of the total respondents (Appendix-C, Table 28) borrow loan from different sources named BRAC, Shajeda Foundation, Proshika, Shakti Foundation and ASA (Table 4.73). They use the loan in different purposes. Most of the respondents use the borrowed money for the purpose of business and building/repairing houses (Figure 4.79).

Table 4.72: Status of getting financial help from abroad.

Source: Field Survey, September, 2014

	Country	Number of respondents	Percentage
Get financial help from other members residing/ working abroad	Saudi Arabia	1	25.00
	UAE	3	75.00
	Total	**4**	**100**
Do not get any financial help		82	
	Total	**86**	

Figure 4.78: Amount (in Taka) of financial help respondents get from family members from abroad.

Source: Field Survey, September, 2014

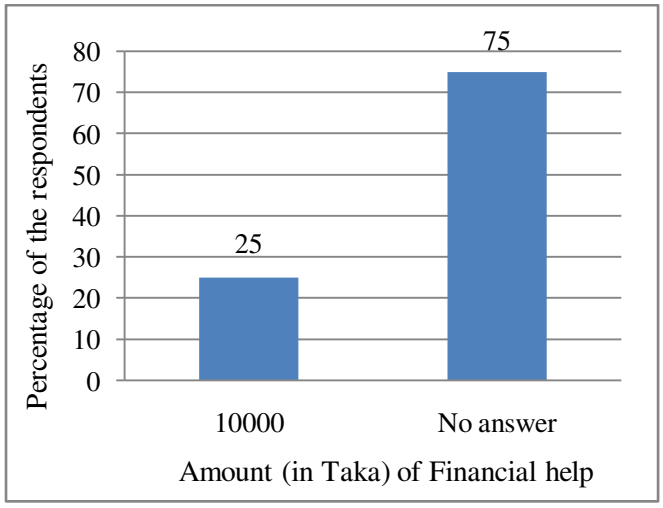


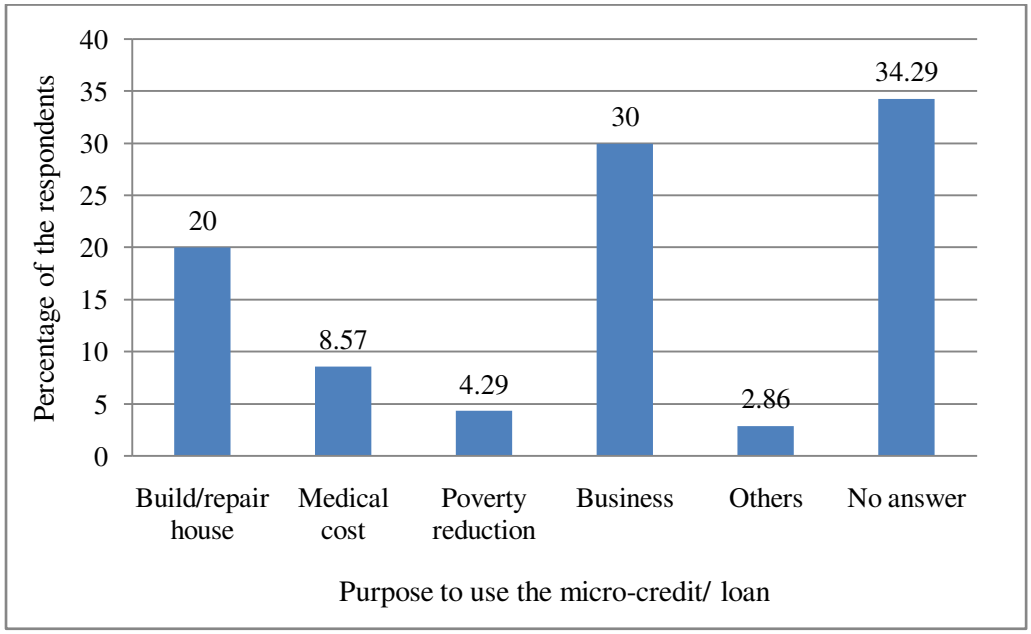
Table 4.73: Status of borrowing micro-credit/loan.

Source: Field Survey, September, 2014

	Institute	Number of respondents	Percentage
Get financial help by borrowing micro-credit/ loan	BRAC	22	31.43
	ASA	4	5.71
	Proshika	9	12.86
	Shajeda Foundation	22	31.43
	Shakti Foundation	5	7.14
	Others	8	11.43
	Total	**70**	**100**
Do not borrow micro-credit/ loan		178	
	Total	**248**	

Figure 4.79: Purpose to use the borrowed micro-credit/loan.

Source: Field Survey, September, 2014



Half of the respondents say that they do not face any type of threats to reside in this area. Some identified drug or illegal business, lack of utility facilities, political violence, social insecurity, theft and terrorism as problems of Goachibagan area. A small number of people said that they face problem due to inadequate road/ drain, eviction for illegal business and water logging (Table 4.74). The main advantages for which people reside in this area are less living expenses and better job opportunity. Some say they reside here because the area is close to city center and nearer to community facilities (Table 4.75). 51% respondents say that they will be in a more problematic situation if they are relocated or evicted from here (Figure 4.80). Homelessness, increased house-rent in other places and identity crisis are main problems for them to face in this regard (Table 4.76).

Table 4.74: Threats faced by the respondents to reside in this area.

Source: Field Survey, September, 2014

Threats faced to reside in this area	Number of respondents	Percentage
Terrorism	9	3.63
Social Insecurity	10	4.03
Political violence	13	5.24
Theft	10	4.03
Water Logging	2	0.81
Lack of Utility facilities	15	6.05
Drugs or illegal business	18	7.26
Eviction for illegal business	4	1.61
Inadequate Road/Drain	6	2.42
Theft, Water logging, Drug or illegal business	8	3.23
Social insecurity, drags or illegal business, inadequate road and drain	10	4.03
No Problem	124	50.00
Others	19	7.66
Total	**248**	**100**

Table 4.75: Respondents' advantages of residing in this area.

Source: Field Survey, September, 2014

Advantages of residing in this area	Number of respondents	%
Better job	44	17.74
Less living expense	79	31.85
Close to city center	10	4.03
Nearer to community facilities	16	6.45
Higher living standards	1	0.40
Better job & less living expense	20	8.06
better job & close to city center	6	2.42
less living expense & close to city center	11	4.44
Others	52	20.97
Utility facility	3	1.21
Buying own residence	4	1.61
Living from childhood	1	0.40
Safety	1	0.40
Total	**248**	**100**

Figure 4.80: Respondents' opinion regarding in a problematic situation if evicted from here.

Source: Field Survey, September, 2014

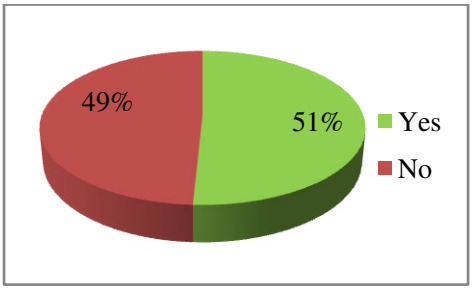


Table 4.76: Problems respondents will face if relocated or evicted from this area.

Source: Field Survey, September, 2014

Problem if relocated/ evicted	Number of respondents	Percentage
Increased house rent	45	35.71
Increased distance to workplace and school	3	2.38
Unemployment	9	7.14
Identity crisis	14	11.11
Homeless	48	38.10
Others	7	5.56
Total	**126**	**100**

The respondents were asked about their future plan to improve present living standard. But most of them (37.3%) have no plan yet. 25% people have a plan to increase income through getting better job/ business and almost 10% people's plan is to educate and establish their children. A small number of respondents are planning to buy land/ house in their hometown and return there (Table 4.77).

Table 4.77: Respondents' plan to improve present living standard.

Source: Field Survey, September, 2014

Respondents' plan to improve present living standard	Number of respondents	Percentage
Better job/ business	32	25.40
live in better place	9	7.14
Buy land/ house in hometown	5	3.97
Children's education and establishment	12	9.52
Others	21	16.67
No plan	47	37.30
Total	**126**	**100**

C. Physical aspects

Housing:

Maximum says that the land in Goachibagan is owned by CMC authority (44.19%) and the government (36.05%). The other owners of the land are respondents, Bangladesh Railway, and landlords (Figure 4.81). Most of the residents (86.05%) live in rented houses (Appendix-C, Table 27). All of the houses are not built by the landowners. 68.6% of the respondents built their own houses (Figure 4.82). Maximum respondents have to pay rent of Tk. 2001-3000 (Figure 4.83).

Figure 4.81: Ownership of the land

Source: Field Survey, September, 2014

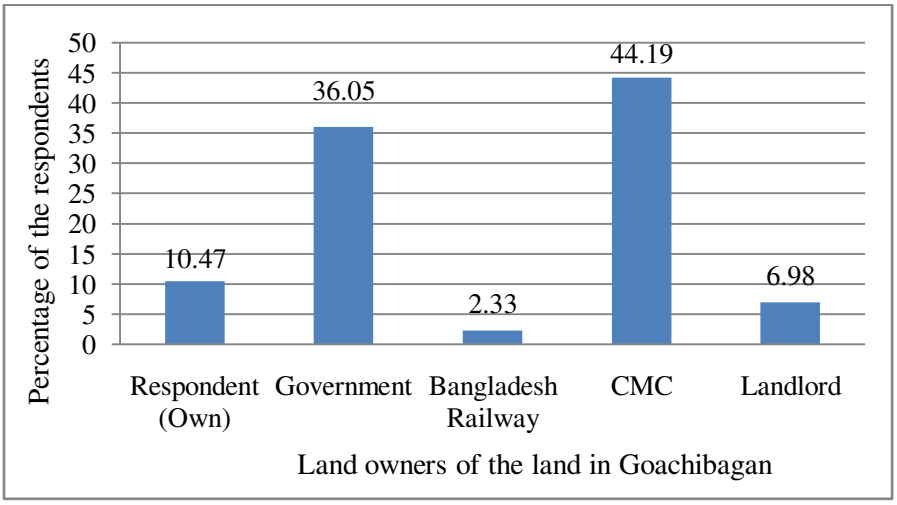


Figure 4.82: Builders of the houses

Source: Field Survey, September, 2014

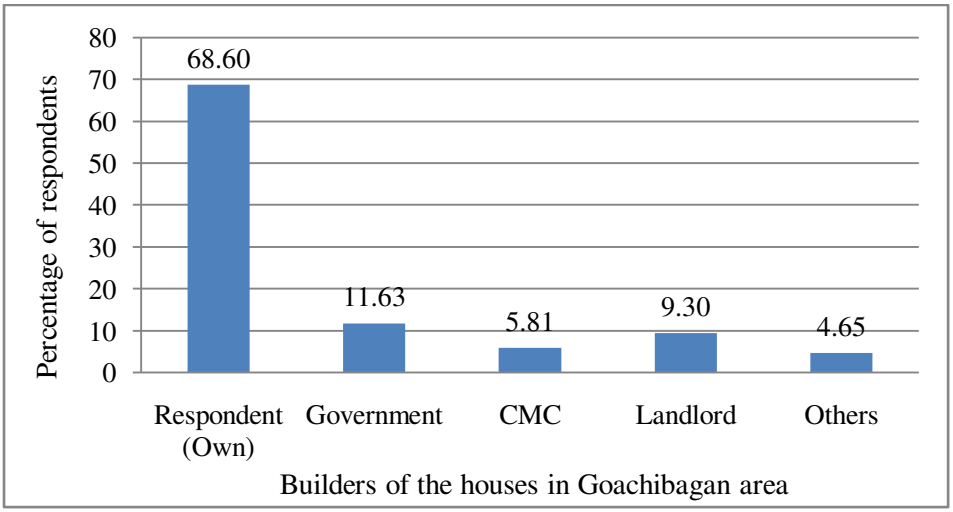
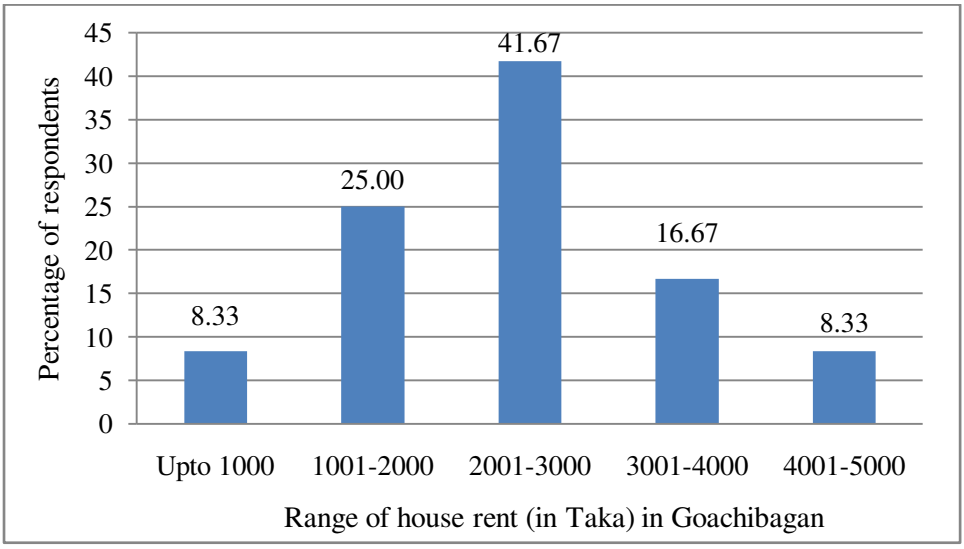


Figure 4.83: House rent per month (in Taka) in Goachibagan.

Source: Field Survey, September, 2014



Most of the houses in Goachibagan area are semi-built and non-built respectively (Figure 4.84). Only 18% houses are built. From field survey it is found that maximum respondents live in houses of one storey (Figure 4.85). Almost all the people in Goachibagan use the surrounding hills for their housing and the rest use for recreation, commercial activity, agriculture and tree plantation (Figure 4.86). From Table 4.77 it is seen that the respondents who are housewife and unemployed need not to travel from their home. The shopkeepers reside nearer to their living place. Besides, the Day labourers and the drivers (CNG/ bus) have to travel to their working places >2 kilometres as their working places are the whole city (Table 4.78).

Figure 4.84: Building material of the houses

Source: Field Survey, September, 2014

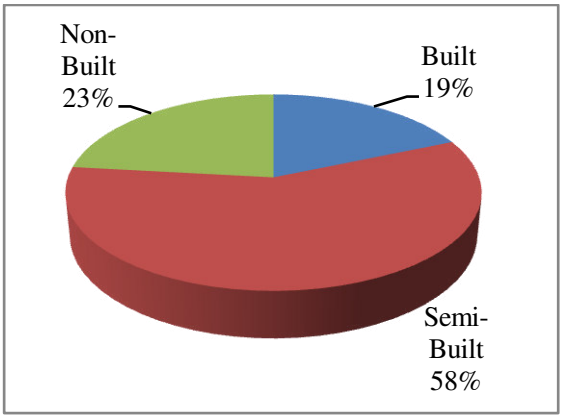


Figure 4.85: Number of storey of the houses

Source: Field Survey, September, 2014

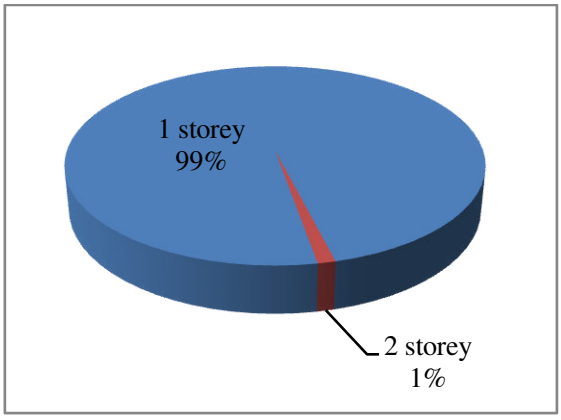


Figure 4.86: Purpose of hill use of the respondents in Goachibagan.

Source: Field Survey, September, 2014

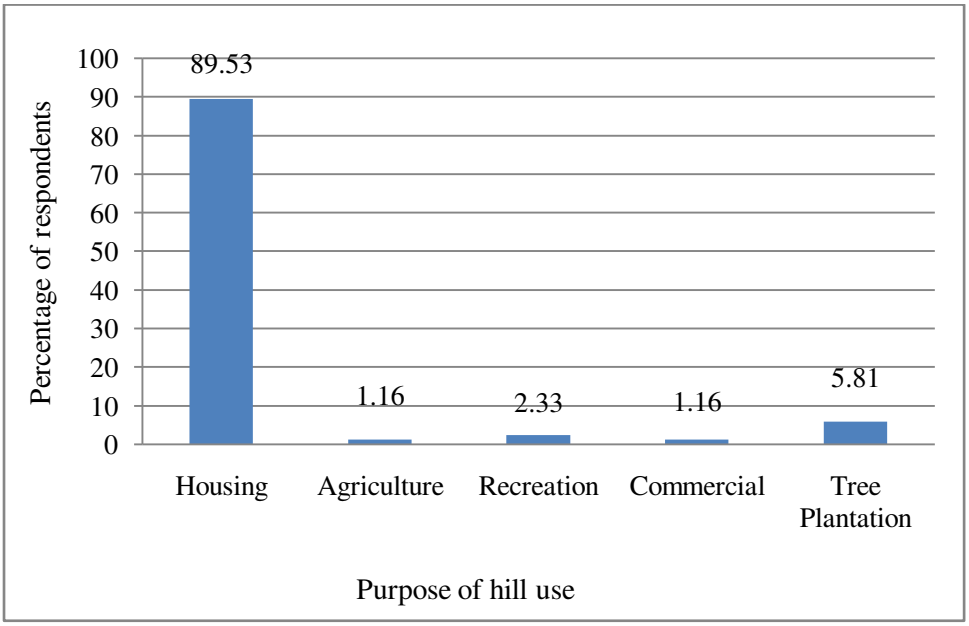


Table 4.78: Relation between occupation and distance from home to workplace of the respondents.

Source: Field Survey, September, 2014

Occupation	Distance between workplace and home (in km)													
	0		0.25		0.5		1		2		>2		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Garment Worker	0	0.00	0	0.00	1	6.25	0	0.00	0	0.00	2	16.67	3	3.49
Unemployed	6	15.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	6	6.98
Others	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Rickshaw Puller	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	16.67	2	2.33
Day Laborer	0	0.00	0	0.00	0	0.00	2	18.18	1	20.00	2	16.67	5	5.81
Driver	0	0.00	0	0.00	0	0.00	0	0.00	1	20.00	1	8.33	2	2.33
House Maid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Employee	4	10.00	1	50.00	13	81.25	9	81.82	3	60.00	2	16.67	32	37.21
Shopkeeper	2	5.00	0	0.00	0	0.00	0	0.00	0	0.00	1	8.33	3	3.49
Student	1	2.50	1	50.00	2	12.50	0	0.00	0	0.00	2	16.67	6	6.98
Housewife	27	67.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	27	31.40
Total	**40**	**100**	**2**	**100**	**16**	100.00	**11**	100.00	**5**	**100**	**12**	**100**	**86**	**100**
%	**46.51**		**2.33**		**18.60**		**12.79**		**5.81**		**13.95**		**100**	

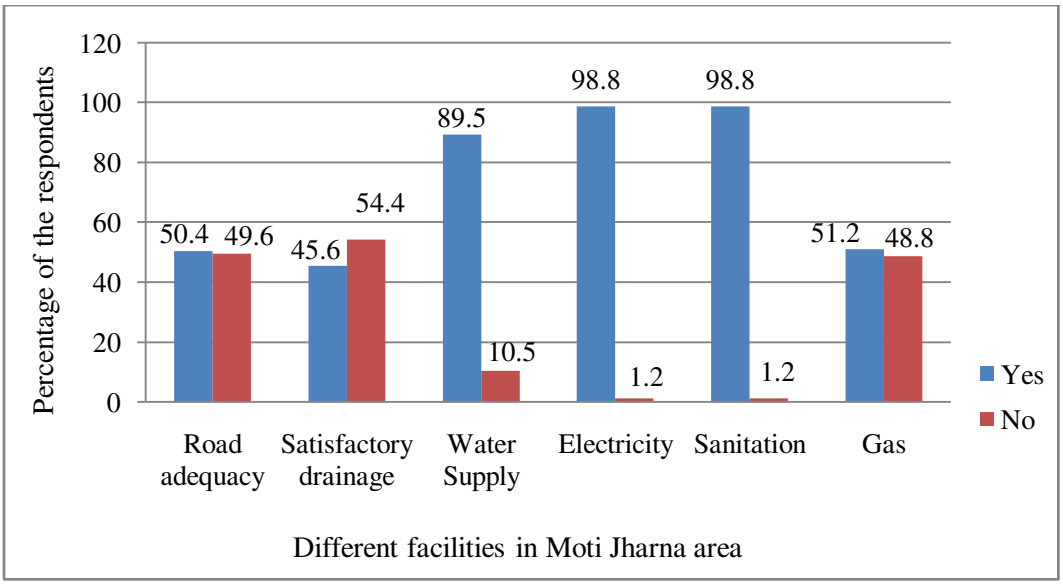
D. Community and utility facilities in Goachibagan

According to the respondents in Goachibagan the school, market, bank and playground are within 1 kilometre from their residence. Most of the people (33.87%) said that the health care facility is in distant place from their area (Table 4.79). Among the respondents 50.4% and 45.6% are satisfied with the existing roads and drainage facility respectively. Maximum number of the respondents says that water, electricity and sanitation are available in this area. There is gas supply in 51.2% respondents' houses (Figure 4.87).

Table 4.79: Respondents' Opinion: Distance between community facilities and residence.
Source: Field Survey, September, 2014

Distance (kilometre)	Different community facilities in Goachibagan area									
	School		Market		Bank		Playground		Health care centre	
	No	%	No	%	No	%	No	%	No	%
0 km	24	9.68	39	15.73	13	5.24	18	7.26	18	7.26
0.25 km	39	15.73	39	15.73	13	5.24	33	13.31	17	6.85
0.50 km	134	54.03	128	51.61	55	22.18	103	41.53	42	16.94
1 km	43	17.34	29	11.69	92	37.10	37	14.92	49	19.76
1.25 km	4	1.61	0	0.00	1	0.40	2	0.81	0	0.00
1.50 km	3	1.21	1	0.40	13	5.24	2	0.81	19	7.66
1.75 km	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2 km	0	0.00	4	1.61	16	6.45	10	4.03	19	7.66
> 2 km	1	0.40	8	3.23	45	18.15	43	17.34	84	33.87
Total	**248**	**100**	**248**	**100**	**248**	**100**	**248**	**100**	**248**	**100**

Figure 4.87: Existing condition of different facilities in Goachibagan.
Source: Field Survey, September, 2014



E. Real life experience to landslide disaster

Almost half of the respondents think that landslide is not a problem for this area at all and only 14% marks it as a very serious problem (Figure 4.88). According to the respondents people residing beside the hill are most vulnerable and so the community people. 21.54% people are not concern about the vulnerability of the people (Table 4.80). More than half of the respondents (55.48%) say that landslide occurs once per year in this locality (Appendix-C, Table 29). High precipitation, hill cutting and both of them have been identified as the main triggering factors of landslide by the respondents (Table 4.81). There are negative impacts of landslides to the community people. According to respondents, due to the landslides in several years the houses were destroyed, property was damaged and people died (Table 4.82).

Figure 4.88: Intensity of landslide problem in Goachibagan (Respondents' opinion).
Source: Field Survey, September, 2014

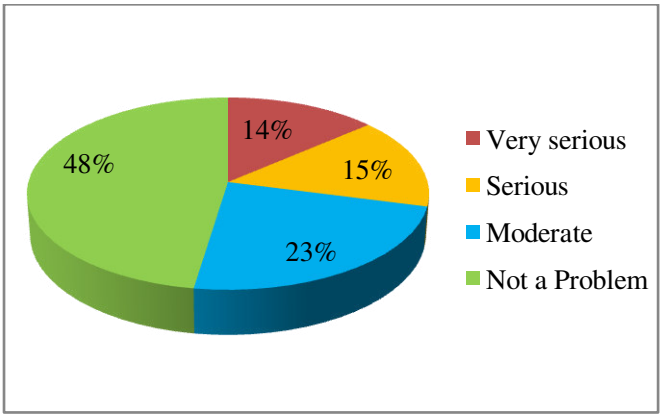


Table 4.80: Respondents' opinion: people vulnerable to landslide.
Source: Field Survey, September, 2014

Vulnerable people according to the respondents	Number of respondents	Percentage
Community people	32	24.62
No one	2	1.54
People residing near hill	56	43.08
People residing on hill top	7	5.38
Unknown	28	21.54
Women, poor and children	5	3.85
Total	**130**	**100**

Table 4.81: Causes of landslide in Goachibagan (Respondents' opinion).

Source: Field Survey, September, 2014

Causes of landslide	Number of respondents	Percentage
Hill cutting	11	9.82
Deforestation	1	0.89
High precipitation	50	44.64
Construction of road/structure	2	1.79
Hill cutting & high precipitation	33	29.46
Hill cutting & residential use	2	1.79
High precipitation & residential use	2	1.79
Hill cutting, high precipitation & residential use	9	8.04
Others	2	1.79
Total	**112**	**100**

Table 4.82: Negative impact of landslide in Goachibagan (Respondents' opinion).

Source: Field Survey, September, 2014

Negative impact of landslide	Number of respondents	Percentage
House destroyed	11	5.16
Property damaged	2	0.94
Road blocked	5	2.35
People died	33	15.49
People injured	3	1.41
Damage of utility facilities	1	0.47
House destroyed & property damaged	23	10.80
House destroyed, property damaged & people died	93	43.66
House destroyed, property damaged, people died & people injured	39	18.31
Others	3	1.41
Total	**213**	**100**

The respondents were asked about their last landslide observance. It is found that 43.55 % respondents never observed the landslide and the rest observed in different years of their lifetime. Most of the respondents (93.57%) observed last landslide between the years of 2005 to 2014 (Figure 4.89). During the landslide occurrence, three-fourth of the respondents was in this locality but they did not take any step to help the landslide victims. 23% of the residents participated in rescuing people (Figure 4.90 and Figure 4.91). During our survey we found 3 victims to landslide.

Figure 4.89: Respondents' last landslide observance (at 10 years interval) in last 30 years.

Source: Field Survey, September, 2014

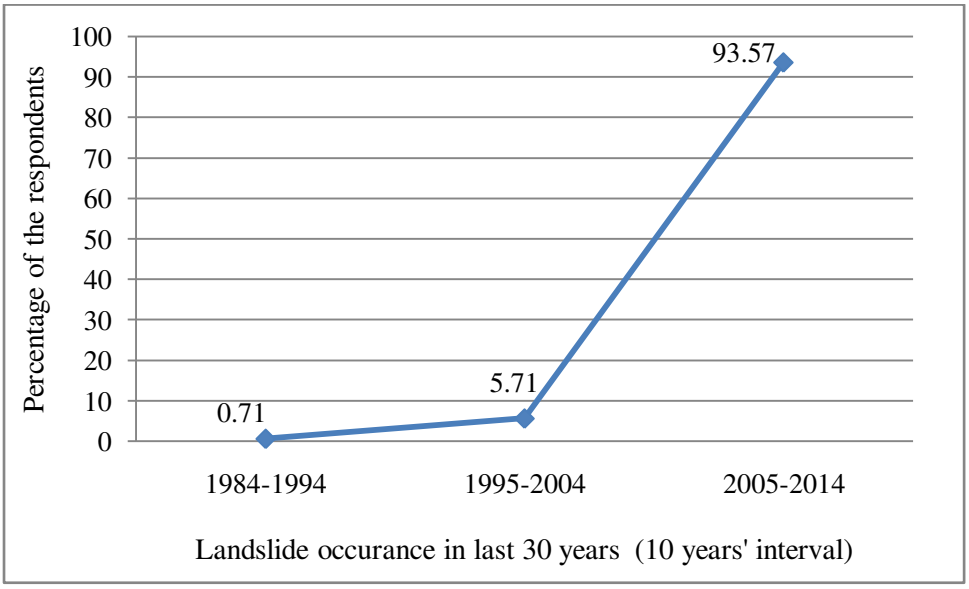


Figure 4.90: Respondents' location during the last landslide observed.

Source: Field Survey, September, 2014

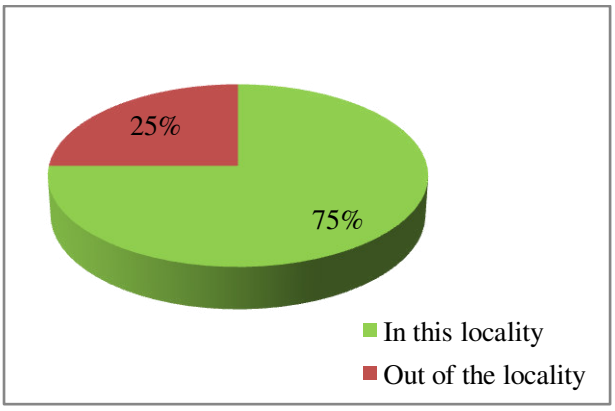


Figure 4.91: Respondents' response during last landslide observed.

Source: Field Survey, September, 2014

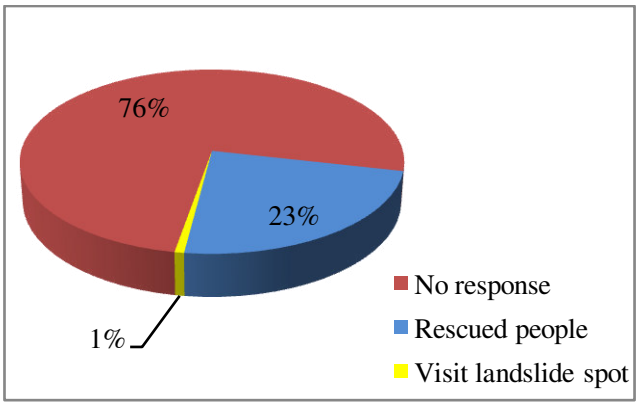


Table 4.83: Respondents' opinion regarding occurrence time of the last landslide observed.

Source: Field Survey, September, 2014

Time of landslide occurrence	Number of respondents	Percentage
Day	2	16.67
Night	7	58.33
No answer	3	25.00
Total	**12**	**100**

F. Landslide risk management

The respondents have their opinion about the positive and negative impacts of monsoon rain in their day to day life. In both cases most of the residents said that there is no impact of rainfall to their life. Rest of the respondents marked water collection, washing & bathing, cleaning of drain & road as the positive impacts; and damage of roads, water logging, landslide and surface runoff as the negative impacts due to rain (Table 4.84).

Table 4.84: Respondents' opinion regarding positive impacts of monsoon rain.
Source: Field Survey, September, 2014

Positive impact of monsoon rain	Number of respondents	Percentage	Negative impact of monsoon rain	Number of respondents	Percentage
Water collection	52	20.97	Damage of road	53	21.37
Washing & bathing	11	4.44	Water logging	58	23.39
Cleaning of drain & road	12	4.84	Landslide	26	10.48
Water collection, washing & bathing	6	2.42	Surface runoff	4	1.61
			Road damage & landslide	23	9.27
No impact	164	66.13	No impact	73	29.44
Others	3	1.21	Others	11	4.44
Total	**248**	**100**	**Total**	**248**	**100**

From the household survey it is found that only 16.13% of the respondents are relocated from their usual living places during the monsoon rain rainfall (Appendix-C, Figure 30). Among the relocated people maximum take shelter to the nearby school provided free of cost by the authority of Chittagong City Corporation (Figure 4.92 and Figure 4.93). The relocation places for most of the respondents are within 1 kilometre from their residing place (Table 4.85). Table 4.86 shows the benefit got and problems faced by the relocated respondents of Goachibagan area during monsoon rain. 47.5% respondents said they get no benefit from the relocation place and 72.5% said nothing about the problems. Most of the respondents said that they can stay in the relocation place as long as they wish if there is heavy rainfall (Appendix-C, Table 31).

Figure 4.92: Respondents' relocation place during monsoon rain.

Source: Field Survey, September, 2014

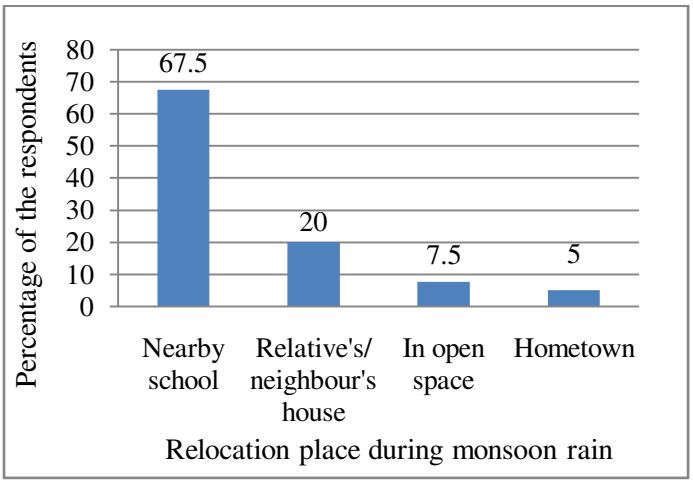


Figure 4.93: Providers of the relocation places to the respondents.

Source: Field Survey, September, 2014

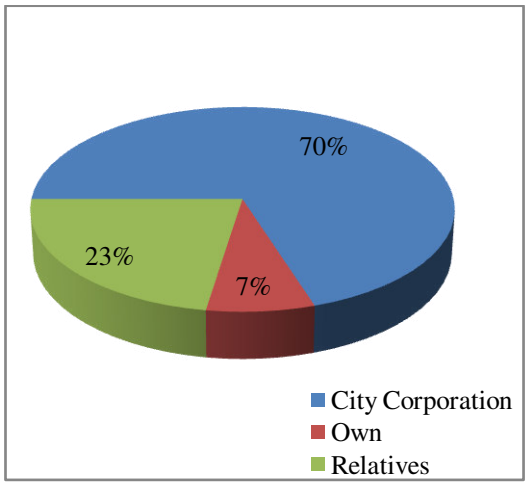


Table 4.85: Distance of relocation place from the respondents' house.

Source: Field Survey, September, 2014

Distance of relocated place	Number of respondents	Percentage
0.05 km	2	5.00
0.5 km	12	30.00
1 km	8	20.00
1.25 km	2	5.00
1.5 km	8	20.00
1 km	3	7.50
2 km	3	7.50
> 2 km	2	5.00
Total	**40**	**100**

Table 4.86: The benefit got and problems faced in relocation places by the respondents.

Source: Field Survey, September, 2014

Benefit got in relocation place	Number of respondents	Percentage	Problem faced in relocation place	Number of respondents	Percentage
Food help	5	12.50	Food	1	2.50
Save life	15	37.50	Lack of services	2	5.00
Safety	1	2.50	Low food supply and poor sanitation facility, fear of theft	8	20.00
No benefit	19	47.50	No answer	29	72.50
Total	**40**	**100**	**Total**	**40**	**100**

Only 10% people said that there is landslide voluntary committee in Goachibagan area (Appendix-C, Table 32). They are Commissioner Group, City Corporation, PSTC and Lalkhan bazaar voluntary committee (Table 4.87). During landslide the emergency services are mainly provided by police, fire service, community groups, City Corporation officials, NGO and neighbours (Table 4.88). 57.66% are satisfied with the rescue effort (Appendix-C, Table 33). There are several causes behind dissatisfaction to the rescue effort also and late response is the major one identified by the respondents (Table 4.89). The relocated people get money, food, cloth and shelter as compensation from City Corporation, Government organization and ward commissioner (Table 4.90, Table 4.91; Appendix, Table 33).

Table 4.87: Existing landslide voluntary committee in Goachibagan area.

Source: Field Survey, September, 2014

Landslide voluntary committee	Number of respondents	Percentage
City Corporation	7	28.00
Commissioner Group	8	32.00
Lalkhan bazar voluntary committee	1	4.00
PSTC	2	8.00
Unknown	7	28.00
Total	**25**	**100**

Table 4.88: Organization offering the emergency services in Goachibagan.

Source: Field Survey, September, 2014

Emergency service offering organization	Number of respondents	Percentage
Neighbours	35	14.11
Community groups	9	3.63
Police	2	0.81
Fire service	25	10.08
City corporation councils	35	14.11
NGO	1	0.40
Police & fire service	22	8.87
Police, fire service, community groups & city corporation officials	74	29.84
Unknown	45	18.15
Total	**248**	**100**

Table 4.89: Causes of dissatisfaction to the rescue effort.

Source: Field Survey, September, 2014

Causes of respondents' dissatisfaction of the rescue effort	Number of respondents	Percentage
Lack of manpower	1	2.27
Lack of proper attention	7	15.91
Late response	22	50.00
Low efficiency	2	4.55
No answer	6	13.64
Shortage of equipment	6	13.64
Total	**44**	**100**

Table 4.90: Type of compensation to the victims.

Source: Field Survey, September, 2014

Victims' compensation type	Number of respondents	Percentage
Money	40	40.40
Food	13	13.13
Money, food & cloth	23	23.23
Unknown	19	19.19
Others	3	3.03
Shelter	1	1.01
Total	**99**	**100**

Table 4.91: Organizations helped/ compensated the victims.

Source: Field Survey, September, 2014

Organization helped/ compensated the victims	Number of respondents	Percentage
City Corporation	28	33.73
Government	28	33.73
Ward Commissioner	15	18.07
Unknown	12	14.46
Total	**83**	**100**

The respondents know about the landslide information mainly by announcement through mike (Table 4.92 and Appendix-C, Table 33). More than 80% respondents stay at their houses after getting warning (Table 4.93). Most interesting thing is that 81.45% respondents do not have contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies for emergency purpose. Though living in this area for

so many years the respondents gave some suggestion to reduce the risk of landslide of Goachibagan area. They mentioned permanent relocation, awareness building, stop hill cutting, engineering measurement through constructing retaining wall, tree plantation as the main thing to do in this regard. Some said a solution may be leveling the hills (Table 4.94). Among 248 respondents only 2 gave their suggestions. One wished to have job security for women and establish a school; and another said there should be planned administration to reduce the corruption and land encroachment.

Table 4.92: Early warning system during landslide.

Source: Field Survey, September, 2014

Organization providing early warning system for landslide	Number of respondents	Percentage
Announcement through Mike	174	72.50
Ward Commissioner	2	0.83
Local volunteers	2	0.83
Newspaper/ press	3	1.25
Electronic Media	2	0.83
Announcement through Mike and Electronic Media	57	23.75
Total	**240**	**100**

Table 4.93: Response of the respondents after getting early warning system.

Source: Field Survey, September, 2014

Respondents' response after getting early warning	Number of respondents	Percentage
Shift to other place	44	18.33
Stay in house	195	81.25
No answer	1	0.42
Total	**240**	**100**

Table 4.94: Respondents' suggestion towards landslide risk reduction process.

Source: Field Survey, September, 2014

Landslide risk reduction process	Number of respondents	Percentage
Relocation	37	14.92
Tree plantation	6	2.42
Retaining wall	16	6.45
Engineering	12	4.84
Stop hill cutting	22	8.87
leveling the hill	28	11.29
Awareness building	31	12.50
Early warning	2	0.81
Stop precipitation	3	1.21
Stop deforestation	1	0.40
Proper planning	7	2.82
Government initiative	8	3.23
Others	3	1.21
No answer	50	20.16
Unknown	22	8.87
Total	**248**	**100**

CHAPTER 5:
Problems and Prospects (Community Opinion)

5.1 ISSUES ASSOCIATED WITH LANDSLIDE VULNERABILITY IN STUDY AREA

The vulnerability of the area is highly related with different causes that are responsible to increase the risk. Root causes of landslide vulnerability vary from area to area. The local problems of a particular area can best be described or identified by the people who live in that area. So, to identify the causes and effects of landslide vulnerability of Moti Jharna, Batali Hill, Golpahar and Goachibagan areas local people are incorporated using the PRA tool named 'Cause Effect Diagram'.

Cause and Effect Diagram is a tool that is useful for identifying and organizing the known or possible causes of specific problem. It graphically illustrates the relationship between a given outcome and all the factors that influence that outcome (Kumar S, 2002).

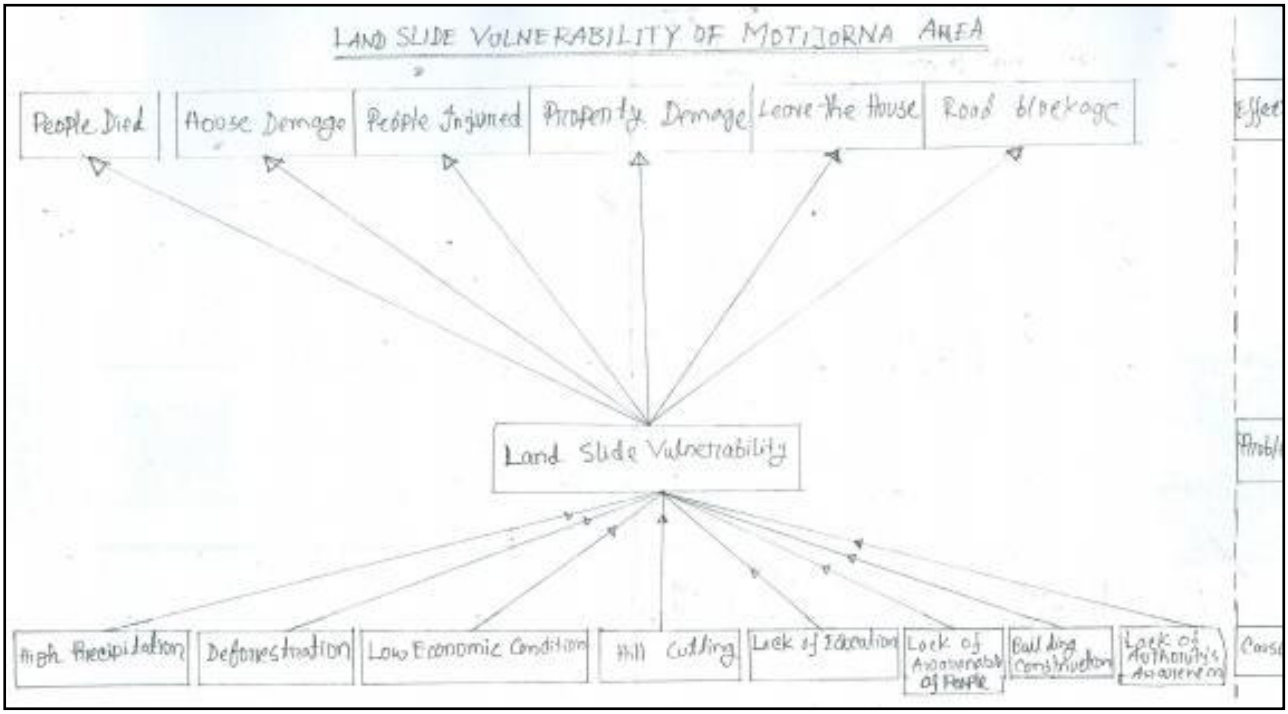
5.1.1 CAUSE EFFECT ANALYSIS FOR LANDSLIDE VULNERABILITY IN MOTI JHARNA AREA

Causes associated with landslide vulnerability problem in Moti Jharna area:
There are eight problems identified by the local participants which are thought to be responsible for landslide problem in Moti Jharna area.

High precipitation: High precipitation is thought to be one of the most important causes of landslide. In Moti Jharna area, landslide occurs in each year during monsoon.
Deforestation: People cut trees to clear hills for housing purpose. Trees are uprooted and so the soil gets loosen. This causes landslide.
Low economic condition: People with low economic conditions tend to live in low rent houses. Houses located just below the hills are rented low. So, people with low economic condition live there. This increases landslide vulnerability.

Figure 5.1: Cause effect diagram for landslide vulnerability in Moti Jharna area.

Source: Field survey, September, 2014



Hill cutting: Hills are cut for housing purposes. This destroys the natural slope characteristics of the hill. This is one of the main causes of landslide.

Lack of education: Education level of the people of Moti Jharna area is very low. They have a very low knowledge on the causes of landslide. Sometimes, their unconscious activities promote landslide.

Lack of awareness of people: People are not conscious about landslide events, its causes and effects. Their unconsciousness towards landslide event is one of the main reasons of vulnerability to landslide occurrence.

Building construction: People construct buildings on the slope of the hills. This causes landslide.

Lack of authority's awareness: Hill management of Moti Jharna area by the concerned authority is very poor. Lack of their awareness regarding hill management contributes the deteriorating conditions of hills.

Effects of landslide problem in Moti Jharna area:

There are six major effects identified by the people of Moti Jharna area.

Death of people: The most dominating effect of landslide is the death of people.

House damage: Many houses get destroyed due to landslide event.

People get injured: Many people get injured due to landslide events. Some people are injured so badly that they become paralyzed for the rest of their life.

Property damage: Many properties are damaged due to landslide event.

Leave the house: Many people leave area to save themselves from the attack of the landslide.

Road blockage: When a landslide occurs, roads get blocked by the huge mass fallen from the hills. This disturbs the daily movement of the people.

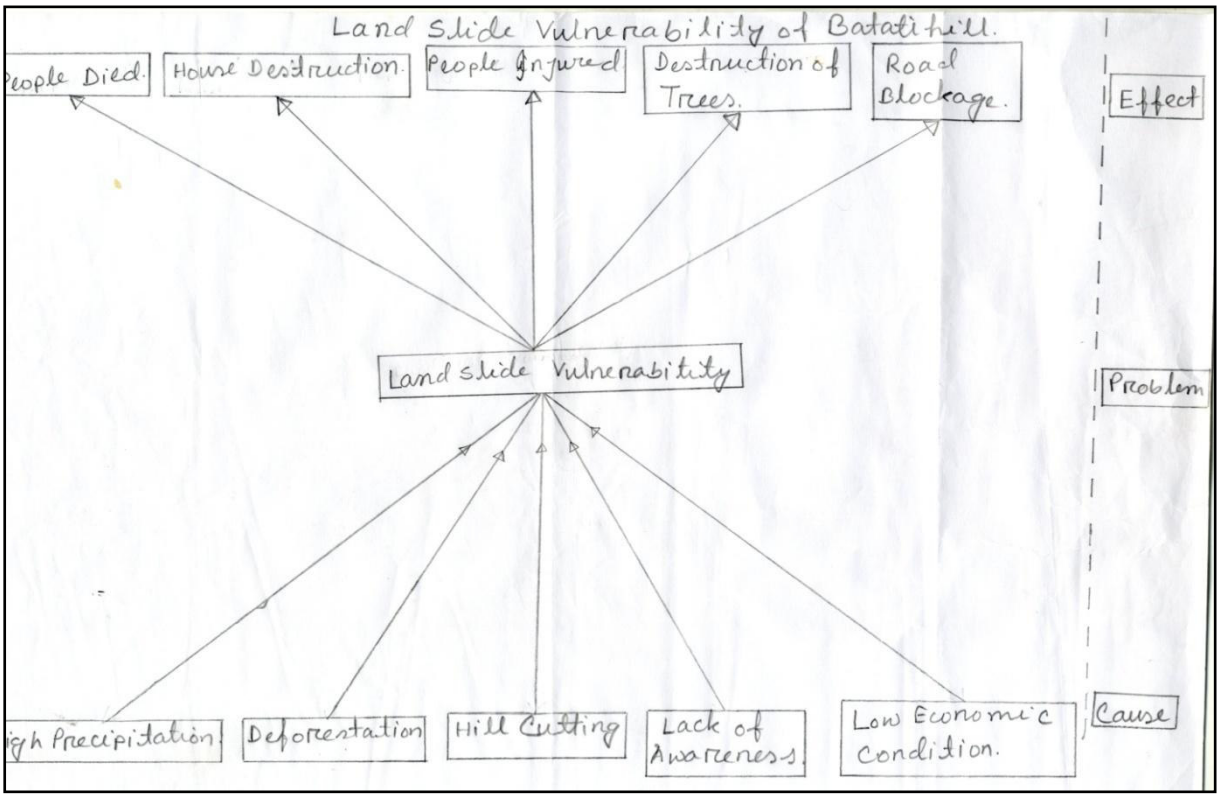
5.1.2 CAUSE EFFECT ANALYSIS FOR LANDSLIDE VULNERABILITY IN BATALI HILL AREA

Causes associated with landslide vulnerability problem in Batali Hill area

There are seven problems identified by the local participants which are thought to be responsible for landslide problem in Batali Hill area.

Figure 5.2: Cause effect diagram for landslide vulnerability in Batali Hill area.

Source: Field survey, September, 2014



High precipitation: High precipitation is thought to be one of the most important causes of landslide. In Batali Hill area, landslide occurs in every year during monsoon.

Deforestation: People cut trees to clear hills for housing purpose. Trees are uprooted and so the soil gets loosen. This causes landslide.

Low economic condition: People with low economic condition tend to live in low rent houses. Houses located just below the hills are rented low. So, people with low economic condition live there. This increases landslide vulnerability.

Hill cutting: Hills are cut for housing purposes. This destroys the natural slope characteristics of the hill. This is one of the main causes of landslide. Batali Hill area is completely located on the slope of hills.

Lack of awareness of people: People are not conscious about landslide events, its causes and effects. Their unconsciousness towards landslide event is one of the main reasons of vulnerability to landslide occurrence.

Effects of landslide problem in Batali Hill area

Following effects of landslide are identified by the people of Batali Hill area.

Death of people: The most dominating effect of landslide is the death of people.

Destruction or damage of houses: Many houses are destroyed due to landslide event.

People get injured: Many people get injured due to landslide events. Some people are injured so badly that they become paralyzed for the lifetime.

Destruction of trees: Many trees get destroyed due to landslide event.

Road blockage: When a landslide occurs, roads get blocked by the huge mass fallen from the hills. This disturbs the daily movement of the people.

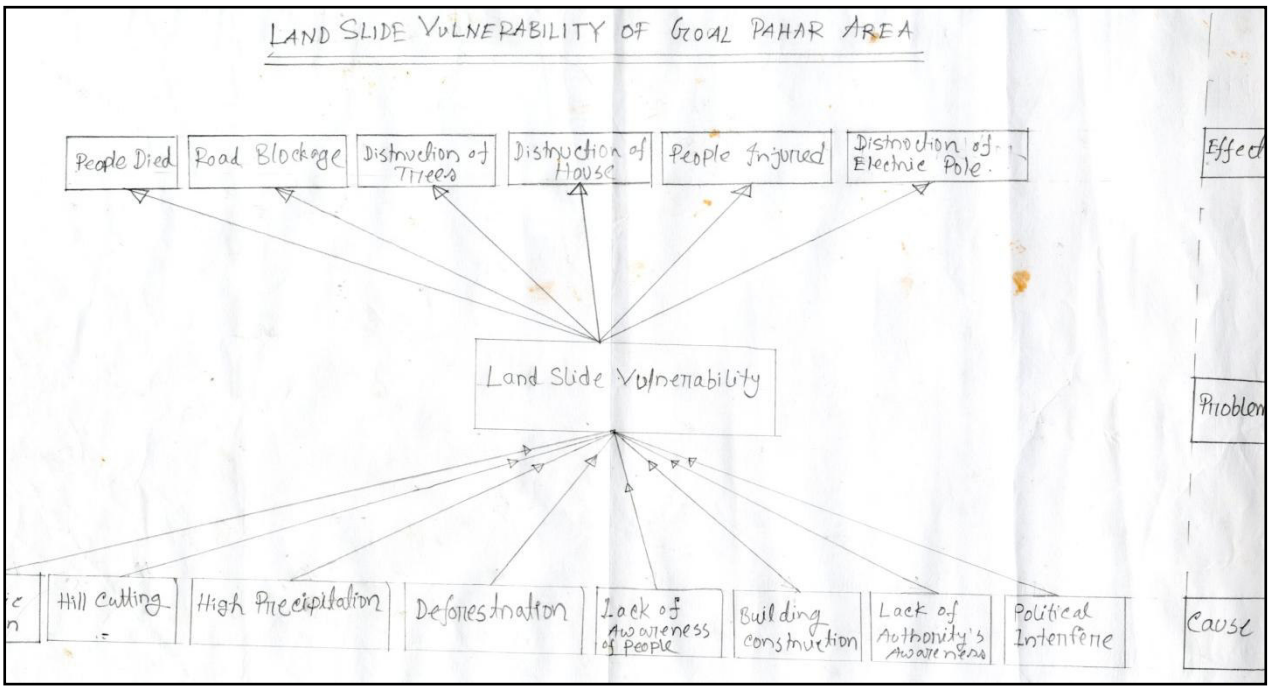
5.1.3 CAUSE EFFECT ANALYSIS FOR LANDSLIDE VULNERABILITY IN GOLPAHAR AREA

Causes associated with landslide vulnerability problem in Golpahar area

There are seven causes identified by the local participants which are thought to be responsible for landslide problem in Golpahar area (Figure 5.3).

Figure 5.3: Cause effect analysis for landslide vulnerability in Golpahar area.

Source: Field survey, September, 2014



High precipitation: High precipitation is thought to be one of the most important causes of landslide. In Golpahar area, landslide occurs in every year during monsoon.

Deforestation: People cut trees to clear hills for housing purpose. Trees are uprooted and so the soil gets loosen. This causes landslide.

Low economic condition: People with low economic condition tend to live in low rent houses. Houses located just below the hills are rented low. So, people with low economic condition live there. This increases landslide vulnerability.

Hill cutting: Hills are cut for housing purposes. This destroys the natural slope characteristics of the hill. This is one of the main causes of landslide. Golpahar area is completely located on the slope of hills.

Lack of awareness of people: People are not conscious about landslide events, its causes and effects. Their unconsciousness towards landslide event is one of the main reasons of vulnerability to landslide occurrence.

Building construction: For the construction purpose of houses many hills are cut down. Many houses of Golpahar area is constructed on the slope of hills. This is identified as one of the main reasons of landslide in this area.

Political interfere: Political interference is considered as one of the main reasons that promote landslide in this area. Political people construct houses through cutting hill illegally.

Lack of authority's awareness: The authority is not conscious enough to the vulnerability of landslide events. For this reason, the hills are becoming residence of lower income people day by day.

Effects of landslide vulnerability of Golpahar area:

Following effects of landslide are identified by the people of Golpahar area (Figure 5.3).

Death of people: The most dominating effect of landslide is the death of people.

Destruction or damage of houses: Many houses are destroyed due to landslide event.

People get injured: Many people get injured due to landslide events. Some people are injured so badly that they become paralyzed permanently.

Destruction of trees: Many trees get destroyed due to landslide event.

Property damage: Many properties get damage due landslide event.

Road blockage: when a landslide occurs, roads get blocked by the huge mass fallen from the hills. This disturbs the daily movement of the people.

Destruction of electric pole: Due to landslide events, electric poles of the area get damaged.

5.1.4 CAUSE EFFECT ANALYSIS FOR LANDSLIDE VULNERABILITY IN GOACHIBAGAN MEDICAL HILL AREA

Causes associated with landslide vulnerability problem in Goachibagan area

There are seven problems identified by the local participants which are thought to be responsible for landslide problem in Goachibagan area.

High precipitation: High precipitation is thought to be one of the most important causes of landslide. In Goachibagan, landslide occurs in every year during monsoon.

Deforestation: People cut trees to clear hills for housing purpose. Trees are uprooted so soil gets loosen. This causes landslide.

Low economic condition: People with low economic condition tend to live in low rent houses. Houses located just below the hills are rented low. So, people with low economic condition live there. This increases landslide vulnerability.

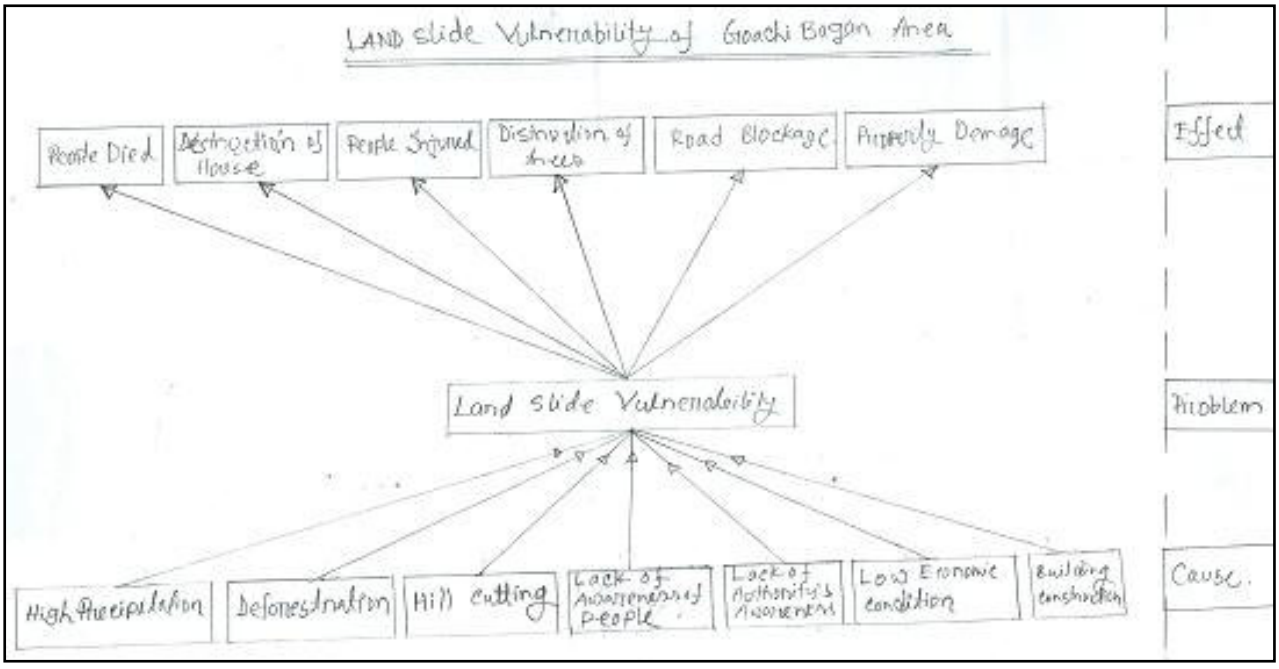
Hill cutting: Hills are cut for housing purposes. This destroys the natural slope characteristics of the hill. This is one of the main causes of landslide. Goachibagan area is completely located on the slope of hills.

Lack of awareness of people: People are not conscious about landslide events and its causes and events. Their unconsciousness towards landslide event is one of the main reasons of landslide occurrence.

Building construction: All the buildings of Goachibagan are constructed on the slopes of hills. People identified this as a major reason of landslide.

Lack of authority's awareness: Hill management of Goachibagan area by the concerned authority is very poor. Lack of their awareness regarding hill management contributes the deteriorating conditions of hills.

Figure 5.4: Cause effect analysis for landslide vulnerability in Goachibagan area.
Source: Field survey, September, 2014



Effects of landslide problem in Goachibagan area: Following effects are identified as the effects of landslide problem.

Death of people: The most dominating effect of landslide is the death of people.

Destruction of house/House damage: Many houses are destroyed due to landslide event.

People get injured: Many people get injured due to landslide events. Some people are injured so badly that they become paralyzed.

Destruction of trees: Many trees get destroyed due to landslide event.

Property damage: Many properties get damage due landslide event.

Road blockage: when a landslide occurs, roads get blocked by the huge mass fallen from the hills. This disturbs the daily movement of the people.

5.2 IDENTIFICATION OF LOCAL PROBLEMS RELATED TO SOCIAL ASPECTS

Social problems of the Moti Jharna, Batali Hill, Golpahar and Goachibagan are identified. Social problems are ranked according to the preference of the local people. Pair wise ranking method was applied for this purpose. Pair wise ranking method is a popular PRA method. It helps in arriving at people's priorities and preferences.

5.2.1 FINDINGS FROM THE PAIR WISE MATRIX OF MOTI JHARNA AREA

There are ten problems identified in Moti Jharna area (Appendix-C, Table 35). Among these ten identified problems, low working facility is identified as the ranked one problem. People find this is the most serious problem of Moti Jharna area. Most of the people of Moti Jharna area go to the neighboring areas or distant places for work. Human violence is considered as the second most serious problem of this area. People often quarrel and cause harm to each other. Low economic condition and illegal business both are considered as third problems of the area. Illegal drug dealings are a common scenario of Moti Jharna area. Lack of education, Lack of daily needs, Low health facility and no water supply are fourth preferred problems of the area. Drug business and no gas supply are considered as least significant problems by the local people.

5.2.2 FINDINGS FROM THE PAIR WISE MATRIX OF BATALI HILL AREA

There are nine problems identified in Batali Hill area (Appendix-C, Table 36). Among these nine identified problems; lack of education is identified as the ranked one problem. People find this is the most serious problem of Batali Hill area. Low working facility and Human

violence is considered as the second most serious problem of this area. People often quarrel and cause harm to each other. Most of the people of Batali Hill area go to the neighboring areas or distant places for work. Low economic condition Lack of daily needs and lack of gas supply are considered as third problems of the area. Illegal business and No water supply are fourth preferred problems of the area. Illegal drug dealings are a common scenario of Batali Hill area. Low health facility is considered as least significant problem of the area.

5.2.3 FINDINGS FROM THE PAIR WISE MATRIX OF GOLPAHAR AREA

There are ten problems identified in Golpahar area (Appendix-C, Table 37). Among these ten identified problems lack of health facility is identified as the ranked one problem. People find this is the most serious problem of Golpahar area. Most of the people of Golpahar area go to the neighboring areas or distant places for health service. Political violence and low working facility are considered as the second most serious problems of this area. There are some political groups in the area. They often create problems in the area regarding different issues. Limited water supply is considered as third problem of the area. People buy water and sometimes collect places from distant places. Load shedding, low capacity of drain and lack of daily needs are fourth preferred problems of the area. Drug business and no gas supply are considered as least significant problems by the local people. Bad condition of road and lack of gas supply are considered as least significant problems of the area.

5.2.4 FINDINGS FROM THE PAIR WISE MATRIX OF GOACHIBAGAN AREA

There are eight problems identified in Goachibagan area (Appendix-C, Table 38). Among these eight identified problems load shedding is identified as the ranked one problem. People find this is the most serious problem of Goachibagan area. Low economic condition is considered as the second most serious problems of this area. There are some political groups in the area. They often create problems in the area regarding different issues. Lack of daily needs, Low capacity of drain and inadequate road are considered as third problem of the area. Lack of education is fourth preferred problem of the area. Lack of gas supply and lack of water supply are considered as least significant problems by the local people.

5.3 IDENTIFICATION OF COMMUNITY'S POSITIVE AND NEGATIVE FACTORS REGARDING LANDSLIDE VULNERABILITY

Causes and their effects have been identified regarding landslide vulnerability and social perspective through cause effect diagrams and pair wise ranking method (Section 5.1 and section 5.2). Now it is necessary to know the factors that can increase or decrease the influences of these problems. Because to find the possible solutions for the identified problems it is necessary to identify the factors and attributes that can fuel up or lessen these problems. The factors can be identified through Strength, Weakness, Opportunity and Threat (SWOT) Analysis.

The SWOT Analysis of Study Area

SWOT analysis (strengths, weaknesses, opportunities, and threats analysis) is a framework for identifying and analyzing the internal and external factors that can have an impact on the viability of a project, product, place or person. SWOT analysis groups key pieces of information into two main categories:

1. Internal Factors: The strengths and weaknesses are internal factors to the organization or place
2. External Factors: The opportunities and threats presented by the environment are external factors to the organization or place

5.3.1 SWOT ANALYSIS OF MOTI JHARNA AREA

Internal Factors

Internal factors are the positive and negative factors or aspects inside the community regarding landslide vulnerability. These factors are known as Strengths (S) and Weaknesses (W) (Table 5.1).

Strengths: The community's strengths are its resources and other factors that can increase their capabilities to face landslide disaster and can lessen the possible risks. The strengths for study area are as following.

Table 5.1: SWOT analysis of Moti Jharna area.

Source: Field survey, September, 2014

Strength	Weakness	Opportunity	Threat
1. Voting opportunity 2. A helpful Lawyer in the Community 3. Link with some powerful and rich people 4. Hill that protect from Cyclone 5. High elevated land protecting from flood 6. Helpful ward commissioner	1. Illiterate people 2. Poverty 3. Lack of job opportunity investment in small business Temporary Job 4. Absent of responsive person during danger/disputes 5. Lack of unity among people 6. Lack of utilities/ facilities (Education, gas) 7. Poor medical facility/ Absent of qualified doctor in the community 8. Bad Social Environment Drug addiction Illegal business 9. Poor housing Weak building structure High density Houses on the top of the hill 10. Poor transport system (Specially during rainy season- wet road) 11. Hill cutting 12. Landslide	1. Hill can be used for recreation/tourism 2. Easy access to loan 3. Help of NGOs 4. Help of City Corporation 5. Help of Army, Police and Fire Service	1. Fear of Eviction 2. Land Speculator 3. Earthquake 4. Heavy Precipitation 5. Intension of hill cutting of the outsiders (Powerful businessmen)

Voting opportunity: People of Moti Jharna area think that their voting opportunity is a great strength. This opportunity allows them to give their decision on the selection of political leaders.

A helpful Lawyer in the Community: A helpful lawyer in Hossain saheb's colony is a great opportunity according to the people. Lawyer gives his valuable suggestion to the local people.

Link with some powerful and rich people: There exists good interactions between the local people with powerful and rich people of the community who help people.

Hills that protect from Cyclone: Cyclone is a common phenomenon in Chittagong district. Hills protect people of the Moti Jharna area from the attack of cyclone.

High elevated land protecting from flood: As Moti Jharna area is located on hilly region, high land characteristics protect area from flood.

Helpful ward commissioner: According to the people of Moti Jharna area, ward commissioner is helpful to them which is a strength of their community.

Weaknesses:

Weaknesses are those factors that generate or come within the community and have negative impacts on risk reduction program of earthquake vulnerability. The weaknesses for study area are shown in Table 5.1.

Illiterate people: According to the people of Moti Jharna area, illiteracy is the main weakness of this area.

Poverty: Most of the people of Moti Jharna area lead a very poor life. This is a weakness of this area.

Lack of job opportunity: Most of the jobs of this area are of temporary nature. People make their investment in small business.

Absence of responsive person during danger/disputes: There is no responsive person who can act with responsibility during a disaster. This makes the community weak.

Lack of unity among people: People of Moti Jharna area are not socially united. This is a weak point of community.

Lack of utilities/ facilities: There is lack of proper educational institutes and utility facilities in this area.

Poor medical facility/ absence of qualified doctor in the community: There is no qualified doctor and health facility in this area. For health facility people go to other areas like Lalkhan bazaar.

Bad Social Environment: Social condition is a big weakness of this community. People of different ages are addicted to drugs. Illegal business is a common scenario of Moti Jharna area.

Poor housing: Housing condition of Moti Jharna area is very poor. Buildings are made of tin, clay, bamboo etc. Houses are located on the slope of hills. Population density of this is very high.

Poor transport system: Transportation condition is very poor. Roads are poorly constructed and roads are very narrow.

Hill cutting: Hill cutting is major issue of this area. This makes area vulnerable to landslide.

External Factors

External factors are the positive and negative factors coming from outside the community. These external positive and negative factors or aspects can be classified as opportunities (O) and threats (T).

Opportunities

Opportunities are external chances to improve the situation of the study area regarding landslide risk reduction program as well as improving social condition. Opportunities for the study area are shown in Table 5.1.

Hill can be used for recreation/tourism: Moti Jharna ares is located on hilly site. Hills can be used for recreation and tourism purpose and from this many people can be employed.

Easy access to loan: There are many small banks which provide financial assistance to the local people.

Help of NGOs: There are many NGOs working in this area. They provide financial as well as social and health facilities.

Help of City Corporation: City Corporation helps people through providing facilities and help during landslide.

Help of Army, Police and Fire Service: During landslide disaster these institution take part actively in rescue and relief distribution.

Threats: Threats are external aspects that can affect the community negatively regarding landslide risk reduction program. Absence of certain opportunities can be viewed as threats. The probable threats for the study area discussed in Table 5.1.

Fear of Eviction: People of Moti Jharna area often face problems of threat of eviction
Land Speculator: There are many land speculators living outside of this area. This is a threat to the people of this area as land of this area is getting sold to the persons from other area.
Earthquake: Sometimes earthquake cause landslide to this area and this is a threat.
Heavy Precipitation: heavy precipitation causes landslide.
Intension of hill cutting of the outsiders: There are some powerful businessmen of other areas who cut hill of Moti Jharna for business purpose. This contributes to the landslide of this area.

5.3.2 SWOT ANALYSIS OF BATALI HILL AREA

Internal Factors

Strengths
Voting opportunity: People of Batali Hill area think that their voting opportunity is a great strength. This opportunity allows them to give their decision on the selection of political leaders.
Helpful ward commissioner: According to the people of Batali Hill area, ward commissioner is helpful to them which is a strength of their community.
Better Employment: People of Batali Hill area thinks that they have better job opportunity inside their community.
Protection from flood: As Batali hill area is located on hilly region; high land characteristics protect area from flood.
Tree creates cool environment: There are many trees surrounding the Batali Hill area. This keeps the area cool.
Social co-operation: there are many social Committee located this are who solve the social disputes of Batali Hill area.
Child's education/ good future: Children of Batali Hill area goes to school. This is a strengh of this area.

Strong family bond: People of Batali hill area think that there exists a strong family bonding in the families of this area. Family members help each other.

Enough security for female: people of Batali Hill area think that female of this area are secured in this area.

Table 5.2: SWOT analysis of Batali Hill area

Source: Field survey, September, 2014

Strength	Weakness	Opportunity	Threat
1. Voting opportunity 2. Helpful Ward commissioner 3. Better Employment 4. Protected from flood 5. Tree creates cool environment 6. Social co-operation Social Committee solve the social disputes 7. Child's education/ good future 8. Strong family bond 9. Enough security for female	1. Political clash 2. Hill cutting by local people to expand their house 3. Lack of utilities(Water and GAS) 4. Low income of people 5. Illiterate	1. Help of City Corporation 2. Help of NGO 3. Foreign Help	1. Political violence in the national level 2. Hill cutting by the outsiders (powerful people) 3. Encroachment of the developers

Weaknesses:

Political clash: there are many political parties in this area. Political Clash is a common incident in this area.

Hill cutting by local people to expand their house: Hill cutting is major issue of this area. This makes area vulnerable to landslide.

Lack of utilities (Water and GAS): There is lack of utility facilities in this area.

Low income of people: Most of the people of Batali Hill area lead a very poor life. Their income range is low. This is a weakness of this area.

Illiterate people: According to the people of Batali Hill area, illiteracy is the main weakness of this area.

External factors

Opportunities

Help of NGOs: There are many NGOs working in this area. They provide financial as well as social and health facilities.

Help of City Corporation: City Corporation helps people through providing facilities and help during landslide.

Foreign help: During a landslide event people of this area get relief and money from foreign countries.

Threat

Political violence in the national level: Political violence in national level retards the improvement of this area.

Hill cutting by the outsiders (powerful people): There are some powerful businessmen of other areas who cut hill of Batali Hill area for business purpose. This contributes to the landslide of this area.

Encroachment of the developers: many developers encroach hills for housing purposes.

5.3.3 SWOT ANALYSIS OF GOLPAHAR AREA

Internal factors

Voting opportunity: People of Golpahar area think that their voting opportunity is a great strength. This opportunity allows them to give their decision on the selection of political leaders.

Hill gives wood as fuel and protection from disaster: Hills provide wood as fuel and provide protection from many disasters like cyclone.

Elevated land As Golpahar area is located on hilly region; high land characteristics protect area from flood.

Social committee: there are many social Committee located this are who solve the social disputes of Golpahar area.

Child's education: Children of Golpahar area go to school. This is strength of this area.

Table 5.3 SWOT analysis of Golpahar area

Source: Field Survey, September, 2014

Strength	Weakness	Opportunity	Threat
1. Vote 2. Own Property 3. Local people 4. Child's education 5. More women are in job 6. Elevated land 7. Good transport system 8. Cohesion between the community people 9. Hill gives wood as fuel and protection from disaster 10. Social committee 11. Mosjid Committee	1.Narrow and elevated road (No access for fire service vehicles for narrow and elevated road. Ambulance face difficulty in reaching area) 2.Poor housing High density, Poor building structure 3.Lack of utilities(GAS and Water) 4.Poverty 5.Illiterate people 6.Poor drainage System 7.Lack of dustbin and lack of collection of wastes 8.Lack of facilities (Health, education) 9.Illegal business	1. NGO help 2. Help from local MP 3. City corporation 4. Help of JAKAT (EID)	1. Threat of eviction from Bangladesh Shipping Corporation 2. Dispute between the local people and powerful people of the surrounding area 3. Rapid in migration of disaster refugees resulting in the high density and lower occupancy rate of the houses

Own Property: Many local people of Golpahar area own land in this area. This land security makes them feel strong.

Local people: Most of the people of this are have been living in this area since a long period. This gives them a feeling of strong bonding to this area.

More women are in job: Many women of this area are employed to different kinds of jobs.

Good transport system: People of Golpahar area think that there is a good transportation system in this area.

Cohesion between the community people: there exists a good relation among the people of this community.

Mosjid Committee: There is a mosque committee which helps people in different purposes.

Weaknesses:

Weaknesses are those factors that generate or come within the community and have negative impacts on risk reduction program of earthquake vulnerability. The weaknesses for study area are shown in Table 5.3.

Illiterate people: According to the people of Golpahar area, illiteracy is the main weakness of this area.

Poverty: Most of the people of Golpahar area lead a very poor life. This is a weakness of this area.

Lack of utilities/ facilities: There is lack of proper utility facilities in this area.

Illegal business: Social condition is a big weakness of this community. People of different ages are addicted to drugs. Illegal business is a common scenario of Golpahar area.

Poor housing: Housing condition of Golpahar area is very poor. Buildings are made of tin, clay, bamboo etc. Houses are located on the slope of hills. Population density of this is very high.

Narrow and elevated road: due to narrow road of Golpahar area, it becomes difficult for the fire service and ambulance to reach to the spot during a crisis.

Poor drainage System: Drainage system of this area is very poor

Lack of dustbin and lack of collection of wastes: there is no waste management system in this area

Lack of facilities (Health, education): There are lack of health facilities as well as medical facilities.

External factors

Opportunities

Help from local MP: Different financial help is provided by the MP

Help of JAKAT : During Eid many rich people provide Jakat to the people of Golpahar area.

Help of NGOs: There are many NGOs working in this area. They provide financial as well as social and health facilities.

Help of City Corporation: City Corporation helps people through providing facilities and help during landslide.

Threat

Threat of eviction from Bangladesh Shipping Corporation: People of Golpahar area area often face problems of threat of eviction from Bangladesh Shipping Corporation

Dispute between the local people and powerful people of the surrounding area

Rapid in migration of disaster refugees resulting in the high density and lower occupancy rate of the houses

5.3.4 SWOT ANALYSIS OF GOACHIBAGAN AREA

Internal factors

Strength

Coordination & harmony between in community: People of Goachibagan area are very united. They help each others in different social and financial problems.

Weakness

Lack of education: According to the people of Goachibagan area lack of education is the main weakness of this area.

Drugs and illegal business: Social condition is a big weakness of this community. People of different ages are addicted to drugs. Illegal business is a common scenario of Goachibagan area.

Table 5.4 SWOT analysis of Goachibagan area

Source: Field Survey, September, 2014

Strength	Coordination & harmony between the community
Weakness	Lack of education, drugs and illegal doings
Opportunity	Communication facility, Community facilities
Threat	Land grabbers

External factors

Opportunity

Communication facility: Goachibagan area is well connected to the other areas of CMA.

Community facilities: There are hospital, college, schools and other facilities located on the adjacent areas.

Threat

Land grabbers: there are many businessmen on the other areas who are grabbing lands and hills of Goachibagan areas.

CHAPTER 6:
Expert Opinion to Mitigate Landslide Vulnerability

An expert opinion survey was conducted for the purpose of this study. Eight experts were surveyed. A questionnaire was prepared focusing on landslide hazards (Appendix-A). Experts gave their valuable opinion on those issues related to landslide hazard and vulnerability. A detailed overview of expert opinion survey is described in this chapter.

1. Expert Name: Muhammad Muhibbullah,
Assistant Professor and Chairman,
Dept of Geography & Environmental Studies, University of Chittagong, Bangladesh.

Different information related to different aspects of landslide was found from interviewing Muhammad Muhibbullah. According to him, hill cutting is the main cause of landslide. The reasons behind landslide are as follows:

- **Human induced hill cutting**: It makes the slope of the hill almost vertical.
- **Agricultural activities**: People initiate agriculture during rainy season and cut off all trees during summer. It destroys the plasticity of soil and makes soil loose.
- **Sandy character of the soil:** This is one of the important triggering factors of landslide.
- **Natural causes:** High precipitation.
- **Government policy**

According to Professor Muhammad Muhibullah, vulnerable people can be classified under two categories.

- **Directly vulnerable people:** Poor people living at hill bottom area.
- **Indirectly vulnerable people:** Urban citizen.

To reduce vulnerability of people the following steps can be following.

- **Stop settlement in hill:** Development of human settlement at hills must be stopped. Existing people living at hills must be rehabilitated.

- **Individual precautions:** Houses located at the bottom of hills are the main victim of landslide. These houses must be improved. Retaining wall has to be constructed around the houses.
- **Common Precautions:** Raising awareness among people can be a major preparedness measure against landslide. People must be socially motivated that they should not stay at hills.
- **Government measures:** Hill protection policy must be followed strictly.Different organizations must be welcomed to work on landslide issues.

2. Expert name: Engineer Ali Ashraf
Professor, Department of Civil Engineering,
Southern University, Chittagong, Bangladesh.

Engineer Ali Ashraf said, hills of Motijhorna and Tankir pahar area have been cut. Slums have developed through cutting hills. Khulshi residential area has been built by cutting trees. A big retaining wall has been constructed to protect the wall from landslide.According to him urbanized hilly areas are highly vulnerable to landslide. Mainly poor people living just at the bottom of the hills are vulnerable to landslide. High precipitation is the main cause of landslide. The other causes are hill cutting, deforestation and government policies. It has become very urgent to develop an early warning system for the people at risk. Soils of the hills of Chittagong are 95% sand and 5% clay. According to DOE thirty hills of Chittagong metropolitan area has been identified as landslide vulnerable hills. Other hill can become vulnerable in future.

3. Expert name: Engineer Mohammad Harun,
Former Chairman,
IEB Chittagong center, Chittagong, Bangladesh.

According to him urbanized hilly areas are highly vulnerable to landslide. People living around the hills are vulnerable to landslide. He said that Hill cutting is the main cause of landslide. Other causes are deforestation and government policies. Residential use of hills, earthquakes, illegal occupation of hills and unplanned structural development as other

reasons. He thinks an early warning system should be developed for landslide. Following steps are necessary to protect people from landslide.

Preparedness: Warning through miking or leaflet prevails in different areas. No other preparedness measures are available. Warning system should be established in a more organized way.

Response: Different organization should come forward. Different volunteers, rescue, operation team should be formed. At present activities at recovery stage are very insignificant. Government and other organizations, NGO have to come forward to contribute in recovery stage.

Mitigation: Mitigation measures should be taken at two steps. Two aspects must be handled. One is the natural loss due to landslide and other is the physical damage caused by landslide events.

He also added, to reduce landslide vulnerability, the natural condition of the hills cannot be disturbed. This should be done from the individual level. At community level, awareness program must be undertaken to create awareness among the mass people about landslide. Unauthorized occupancy of hills must be stopped from government level. At international level, different organization can take expert opinion regarding landslide.

He also said that it is very important to have a balance between the general people's opinion and policy makers decision is needed for better outcome. To stop land slide it is important to ensure the natural condition of hills. Nature should not be disturbed by human activities.

He also added, since 1962 hill cutting has been continuing. Many hills have been cut to develop Chittagong University. Since 1970 Landslide has been occurring in Chittagong University and many people have died in those events.

4. Expert Name: Md. Zafar Alam,
Director,
Department of Environment (DOE), Chittagong, Bangladesh.

Mohammad Jafar Alam said that all the urbanized hilly areas of Chittagong Metropolitan Area are vulnerable to landslides and urban citizens who are living just at the bottom of hills

are most vulnerable to landslide. According to him steep slope condition is the main cause of landslide. He said most of the hills of CMA have slope of almost 60 to 80 degrees. Rainfall acts as a triggering factor for landslide.

Landslide has become a regular phenomenon in CMA. He added ' If we look from the observation tower of Batali Hill we will see that there are many landslide spots in different areas" he also said trees of many hills are of bending position which represents that there is a slow movement occurring in hills.

It is very important for the population living in hilly areas to be very aware of this hazard. People living under the hills should be relocated.

5. Expert name: Architect Rezaul Karim
Chief City Planner,
Chittagong City Corporation (CCC), Chittagong, Bangladesh.

Architect Rezaul Karim addressed some causes of landslide and solutions of them.

Causes of landslide:

3 types: (a) Manmade (b) God fathers (c) Administration

- Hill cutting at 90^0 angles in Chittagong Metropolitan Area. It should be at less angular (60^0) to the base.
- If the hills are not grabbed illegally then landslide would not happen.
- Hills are of sandy soil instead of rock, so if the hills are cut then landslide will occur.

Solutions:

- Take Engineering measures.
- The tribes do not cut hill but make platform on the hills and then built house on it. This treatment can be followed in these hilly areas.
- Need planning in hills by corresponding authority (WASA, Railway, City Corporation).
- If branded facilities are introduced in areas with low mobility, then decentralization will happen automatically.
- Win-win solution: a high-rise housing project is ongoing by Chittagong City Corporation in Tiger pass to rehabilitate the slum people as well as protect the hills of that area. Total 161

families will be rehabilitated. 34 families left the place mutually. The Chittagong City Corporation Authority kept their national ID card and an amount of Tk. 10,000 as advance. When the building is completed, the recorded people will have the opportunity to live there and after paying rent for 15 years they will be the owner of those flats individually.

6. Expert name: Md. Samiul Masud
Assistant Commissioner (Land),
Chittagong Sadar Circle, Chittagong, Bangladesh.

People reside illegally in the hilly areas owned by Bangladesh Railway, Department of Public Works and Chittagong WASA. Local influential people having link with the powerful political bodies mainly accommodate the people in the slums of hilly areas. The vulnerable people were evicted from Tankir Pahar area on 25th June, 2014 to avoid the casualty due to landslide during rainy season. There is a possibility of landslide occurrence if there is 4.5cm rainfall in this area. They listed the name, address and some information through surveying 320 families in the sadar circle only.

There is no further scope of hill slide. Moti Jharna, Batali Hill, Tankir Pahar, A. K. Khan are most vulnerable area. If there is landslide thousands of people will die. The houses are rented illegally by some powerful bodies on government land. For illegal encroachment, the hills are cut at 90 degree angle which increases the vulnerability of people. Recently, in Tankir pahar, 50-60 families were evicted but it was very difficult for local people's aggressiveness. There is a possibility of landslide occurrence if there is 4.5cm rainfall in this area.

The slum dwellers are not willing to move from their houses. They have to reside in the city to survive as the work opportunities are mostly city centered. It is very difficult for the govt. rehabilitate this large number of people because if these people are rehabilitated to other places another group of people will migrate to these slum areas. If they are provided with facilities then more people will came to reside here. They can get water, electricity, gas facilities and housing at a cheaper rate (Tk. 1500 only) than that of the other places.

7. Expert name Plnr. M A Issa Anshary (mBIP)
Town Planner,
Chittagong Development Authority (CDA), Chittagong, Bangladesh.

According M A Issa Anshary not all the hills of Chittagong are vulnerable to landslide. Low income people and middle income people living in and around hills are most vulnerable. According to him hill cutting is the most significant causative factors of landslide. Other significant causative factors are high precipitation, poorly constructed houses, socio economic conditions, poorly constructed houses and illegal occupation of land respectively. At present only miking is done in different areas when it rains heavily to make people aware of landslide.

In case of reducing damage of landslide hazard following steps must be taken.
Preparedness: Land use control measure must be taken
Response: Different instrument must be implied to help people.
Recovery: Financial help must be provided.
Mitigation: To address the vulnerability of different areas, vulnerability programs must be undertaken.

At individual or household level following measures can be taken.
Individual/Household level: People living in landslide prone area must be shifted to safe places.
Community level: Awareness raising programs must be undertaken from community level.
Government level: People vulnerable to landslide must be relocated to safe place.
International level: Different donor agency must come forward. These donor agencies should provide fund to landslide projects and post landslide projects.

He also said that there should have balance between people's opinion and policy maker's decision to get a better outcome. At present landslide is not under control because of the political influence and reluctance of political leaders to implement plan.
In future, CDA has a plan to take projects on restricted development to protect hills. Finally he suggested to use hills properly such as creating recreation zone.

8. Expert name: MD. Abutalha Talukdar
Assistant town planner,
Chittagong Development Authority (CDA), Chittagong, Bangladesh.

According to Md. Tahla Talukdar, people who living around the hills are most vulnerable to landslide. Human activities are significantly contributing to environmental imbalance.
According to him, High Precipitation is the main causative factor of landslide. Other causative factors are illegal occupation of land, deforestation, hill cutting and no land use zoning. He also informed that there is no early warning system exists in digital format. When it rains cats and dogs, mike is used to alert people. Following steps are necessary to protect people from landslide.

Preparedness: Afforestation program can be undertaken as a preparedness measure. Zoning must be done to restrict hills from other uses.
Response: People victimized by landslide phenomena must be rescued. If there is no person living in the hill, no actions are needed.
Recovery: Resettlement program of people has to be ensured.
Mitigation: Awareness among the people is mandatory and has to be ensured as a mitigation measure. No settlement can be allowed in the down slope of the hills.

At individual or household level following measures can be taken.
Individual/Household level: People need to be aware of landslide hazard at this level.
Community level: Hill preservation practice must be initiated from the community level.
Government level: Rules prepared for hill management must be enforced properly.
International level: Financial support by different international organization, technical and economic support can be helpful.

Md. Abutalha Talukdal also added, it is not mandatory to maintain a balance between people's opinion and policy maker's decision for better outcome. Policy makers intend through land owners. Present landslide cannot be brought under control because of the political issues in khash land.

At present, CDA has no plan to reduce landslide. As this is a government organization, CDA depends on special assignment. He also suggested to expand city to the North which would help to save hills.

CHAPTER 7: CONCLUSION

In Chittagong Metropolitan Area (CMA), landslide is the most significant natural damaging disaster. Being a hilly region, it is highly vulnerable to landslide hazard with an increasing trend of frequency and damage. The frequency of landslide is increasing rapidly which causes devastating effects in CMA. It has become a crying need to develop an early warning system of landslide for the hilly areas of CMA. In this regard, it is very obvious to know the areas well. From this point of view this inventory report has been prepared.

In this phase, the survey report contains the individual respondents' socio-economic condition, physical aspects and coping mechanism to the landslide disaster. The respondents gave a good response during the interview. Moreover, the community people's opinion was collected through PRA tools to consider while developing an early warning system for the people of these areas. The community people identified the vulnerable locations of their locality and also told about their dreams, aspirations and future plans.

The experts' opinion regarding landslide disaster was collected. They gave their opinion in different aspects such as vulnerability of the people in the study areas, causes of landslides, early warning before landslide, ways to reduce the disaster of landslide.

APPENDIX-A

Questionnaire for Human Ecology to Landslide Risks Surveying - 2014

BASIC INFORMATION

Serial No:
Date:……, Time:
Interviewee Details:
Present Address (street level): ……
Previous Address (street level): ……

PHYSICAL ASPECTS

1. Have you come to live here because of
   - Flood
   - Drought/ Famine
   - Eviction/ Relocation by force
   - Employment/ Business
   - Cyclone
   - River erosion
   - Sea level rise
   - Others……
2. When and why have you settled in this area?
3. How old is this settlement (surrounding neighbourhood)? If possible please tell in brief the land-use change of this area?
4. Do you own this property? If not, who is the owner?
5. Did you build your own house (number of storeys)? If not, who built it?
6. What is your house made of?
   - Bamboo
   - Brick/ Concrete/ Cement
   - Wood
   - Clay/ Thatch
   - Tin
   - Others……
7. For what purpose do you use the hill or its surrounding area?
   - Housing
   - Agriculture
   - Recreation
   - Commercial activity
   - Tree plantation/ Forestry
   - Others……
8. Do you need to travel to your place of work? How far?

9. What is the distance to your nearest community facilities (e.g. School, Market, Bank, Playground; Health Care Centre etc.)?

10. Are the roads adequate in this area?

11. Is there necessary drainage facility in this area?

12. Do you have water, electricity; sanitation and gas facilities in this house? *(Please circle)*

SOCIO-ECONOMIC ASPECTS

13. What is the main source of your household income?
    - Garment worker
    - Rickshaw puller
    - Office work
    - Day labour
    - House maid
    - Others.....

14. Please give details of the household members: (Indicate the household head by a tick-mark and interviewee with a star-mark)

Relation	Sex	Age (Years)	Level of Education	Occupation	Avg. Monthly Income (Taka)	Avg. Monthly Expenditure (Taka)

15. Do you pay rent for this land/ house/ property? If yes, how much?

16. Do you get any sort of financial help from any of your family member(s) living or working in another place in Bangladesh? If yes, from where, how frequently and how much?

17. Do you get remittance from any of your family member(s) living or working in abroad? If yes, from which country, how frequently and how much?

18. Do you borrow micro-credit/ loan? If yes, from which micro-finance institution(s) (MFI)/ Bank? For what purpose you use it? Please give details.

Name of MFI/Bank	Target Group	Issuing of Membership	Admission Fees	Load Detail	Interest Rate	Payback Rules	Insurance/ Other Facilities

19. Do you face any other threats living in this area?

- Terrorism
- Social insecurity
- Political violence
- Theft/ Robbery
- Water Logging
- Lack of Utility Facilities
- Drugs or illegal business
- Eviction for illegal occupancy
- Inadequate Road/Drain
- Others……
  …

20. What are the advantages of living here?

- Better job/ business opportunity
- Less living expenses
- Close to city centre
- Nearer to community facilities
- Higher living standard
- Others……

21. Do you think that you will be in a more problematic situation if you are relocated or evicted from here? If yes, what problems you will face?

22. How can you improve your living standard if you stay here?

REAL LIFE EXPERIENCE

23. Are landslides a problem here?

- Very serious
- Serious
- Moderate
- No

24. If yes, who are vulnerable to landslide hazards? (Community/Gender/Age)

25. How frequently do landslides occur in this area?

26. What are the triggering factors of landslides?

- Hill cutting
- Deforestation
- High precipitation
- Agricultural activities
- Residential use
- Supernatural event
- God/ Religious belief
- Earthquakes/ Flash flood
- Construction of road/ structure
- Others……

27. What are the negative impacts of landslides?

- Houses destroyed
- Property damaged
- Road blocked
- People died
- People injured/stranded
- Loss of economy
- Loss of job
- Mental disorder
- Damage of utility facilities
- Relocation
- Low living standard
- Others.....

28. When was the last landslide you observed? Where you were then? What was your immediate response?

29. Are you a victim of landslide? If yes- when (date and time), where, how many of your family members/ others were injured or died; and how many houses were destroyed or damaged?

30. Do you think you remain vulnerable to landslide risks? Why or why not?

LANDSLIDE RISK MANAGEMENT

31. What are the positive impacts of monsoon rains in this area?

32. What are the negative impacts of monsoon rains in this area?

33. Do you relocate somewhere else in the time of monsoon rains? If yes please give details- [Where, how far, who provide the facility; do you need to pay any rent, what benefits you get or problems you face there, how long you can stay there etc.]

34. Is there any (landslide related) voluntary committee/ NGO located near to you?

35. Who offers the emergency services during landslides?

- Family members
- Friends
- Neighbours
- Community groups
- Volunteers/ rescue team
- Police/ army
- Fire service
- City corporation officials
- NGOs/ other agencies
- Others.....

36. Was the rescue effort good enough? If not, why?

37. Do the victims get any help or compensation? If yes; what and from whom? If not, why?

38. Have you ever participated in any disaster preparedness training/drill/workshop? If yes, explain.

39. Is there any early (landslide/flooding) warning system in this area?

40. How do you get the meteorological news/ warning/ information related to landslides?

- Radio
- Television
- Local agencies/ volunteers
- Newspaper/ press
- Announcement through Mike
- Others……

41. What do you do after getting an early warning?

42. Do you have the contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies? If not, why?

43. How the landslide risks can be reduced in this area?

44. Do you and your family, or does the local community, have any plans to reduce the risk of landslides in the future?

45. Is there anything you would like to add that might be of interest? (e.g. ethical, religious, myth or cultural issues; capacity building/ resilience, what Govt. can do for you; facing other disasters, how community can help providing safer housing, good governance etc.)?

Key Informant Survey Questionnaire- 2014

Serial No:

Designation: .....

1. Do you think the urbanized hilly areas are vulnerable to landslides?

2. If yes, who are vulnerable to landslides?

3. What are the causative factors of landslides (Please Rank)? Please explain.

- Hill cutting
- Deforestation
- High precipitation
- Govt. policies
- No landuse zoning
- Not implementing master plan
- Lack of good governance
- Lack of coordination
- Political unrest
- Corruption
- Agricultural activities
- Residential use
- Earthquakes
- Lack of manpower
- No early warning system
- No proper monitoring
- Illegal occupation of land
- Poorly constructed houses
- Construction of road/ structure
- Others.....

4. Is there any early warning system for the people at risk? If not, why?

5. What steps are taken/ can be taken in case of landslide hazards-

   Preparedness-

   Response-

   Recovery-

Mitigation-

6. Please explain, what measures can be taken to reduce landslide vulnerability at-
   Individual/ Household Level-

   Community Level-

   Government Level-

   International Level-

7. Do you think a balance between the general people's opinion and policy makers decision is needed for a better outcome? If yes, how it can be achieved? If no, why?

8. What are the main things that stop landslides from being brought under control?

9. What is the future plan of your organization/ yourself to reduce landslide risks?

10. Is there anything you would like to share that may be of interest?

APPENDIX B

FIELD PHOTOGRAPHS

Figure 1 : Interviewing the people

Figure 2: Interviewing the people in Batali Hill area

Figure 3 : Interviewing the people

Figure 4: Interviewing people in Golpahar area

Figure 5: Community survey in Golpahar area

Figure 6: Community survey in Moti Jharna

Figure 7: Interviewing people in Moti Jharna

Figure 8: Discussion on Project activities

Figure 9 and 10: Interviewing Key Informant

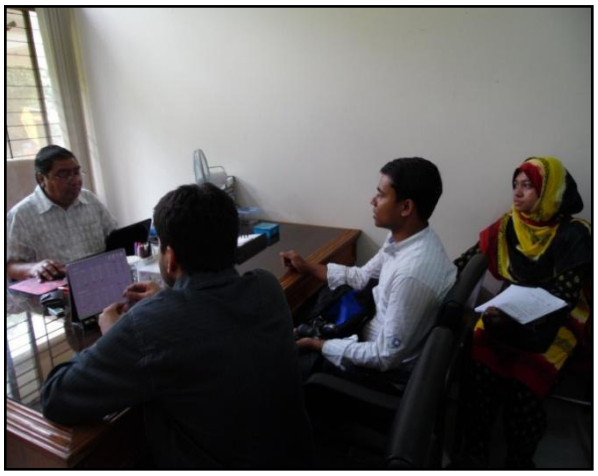


Figure 11 and 12: Meeting arranged by CDA

APPENDIX-C

Data from Social Survey

Table 1: Cluster of hills according to areas.
Source: Field Survey, August, 2014

Hill Name	Area	Cluster Name
Tankir Pahar 1	Moti Jharna	**Cluster 1**
Tankir Pahar 2		
Tankir Pahar 3		
Moti Jharna 1		
Moti Jharna 2		
Batali Hill 1		
Batali Hill 2		
Chanmari Bi Lane		
Tiger Pass Hill		
LebuBagan 1	Chittagong Cantonment	Cluster 2
LebuBagan 2		
LebuBagan 3		
Kaicchaghona 1		
Kaicchaghona 2		
Sekandar Para 1		
Sekandar Para 2		
Sekandar Para 3		
KushumbaghHousing	Kushumbagh	Cluster 3
GoribullahShah Mazar Hill		
Ispahani Hill		
GolachipaHill	University of Chittagong	Cluster 4
Hill beside ShahidMinar		
KharaPahar1		
KharaPahar2		
Akbar Shah MazarHill	Akbar Shah Mazar	**Cluster 5**
LalPahar		
Golpahar 1		
Golpahar 2		
Golpahar 3		
Observation Tower hill	Foy's Lake	Cluster 6

Foy's Lake Zoo Hill 1		
Foy's Lake Zoo Hill 2		
Foy's Lake Zoo Hill 3		
Foy's Lake Zoo Hill 4		
Holy Crescent 1	Khulshi	Cluster 7
Holy Crescent 2		
Krishnochura Housing 1		
Krishnochura Housing 2		
Nasirabad Housing 1		
Nasirabad Housing 2		
Nasirabad Housing 3		
Zakir Hossain Road, South Khulshi		
AKS brickfield	Chotesshori	Cluster 8
Finley Hill		
Finley Hill		
Dolphin Hill		
Medical Hill (Goachi Bagan) 1	Pachlish	**Cluster 9**
Medical Hill (Goachi Bagan) 2		
Medical Hill (Goachi Bagan) 3		
Medical Hill (Goachi Bagan) 4		
The King of Chittagong		
The King of Chittagong		
Amin Taxtile	Others	Cluster 10
Blossom Garden		
A.K. Khan's House		

Study Area-1: Moti Jharna

Figure 1: Gender of the respondents

Source: Field Survey, September, 2014

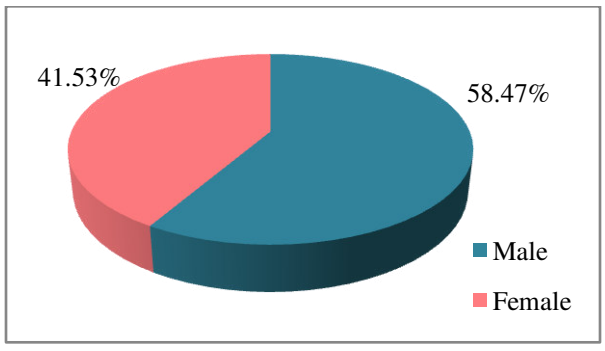


Figure 2: Age of the respondents

Source: Field Survey, September, 2014

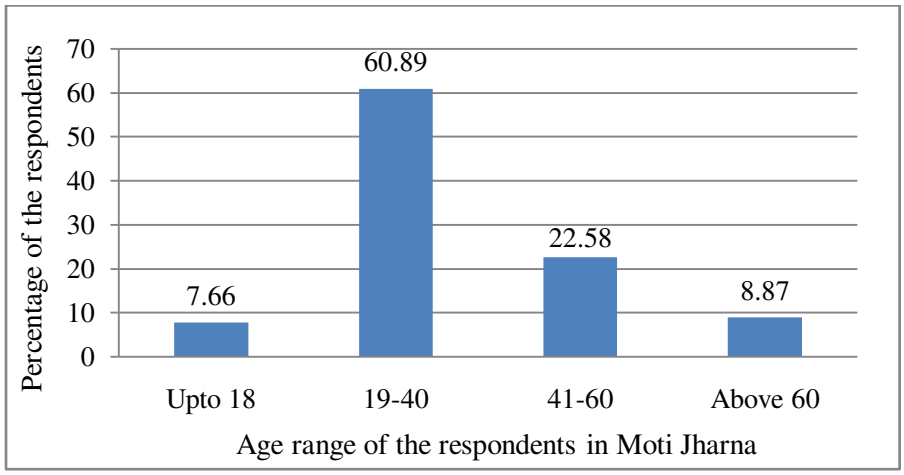


Table 2: Migration status of the inhabitants of Moti Jharna area.

Source: Field Survey, August, 2014

Previous address	Number of respondents	Percentage
Barisal	4	1.6
Brahmanbaria	6	2.4
Chandpur	16	6.5
Chittagong	110	44.4
Comilla	29	11.7
Cox's Bazar	1	0.4
Dhaka	2	0.8
Faridpur	2	0.8
Feni	3	1.2
Jessore	1	0.4
Khagrachari	1	0.4
Khulna	1	0.4
Kushtia	1	0.4
Munshiganj	1	0.4
Nepal	1	0.4
Noakhali	19	7.7
Other Area	46	18.5
Rangamati	1	0.4
Rangpur	1	0.4
Shariatpur	1	0.4
Sylhet	1	0.4
Total	**248**	**100**

Figure 3: Respondents' duration to reside in Moti Jharna area.

Source: Field Survey, September, 2014

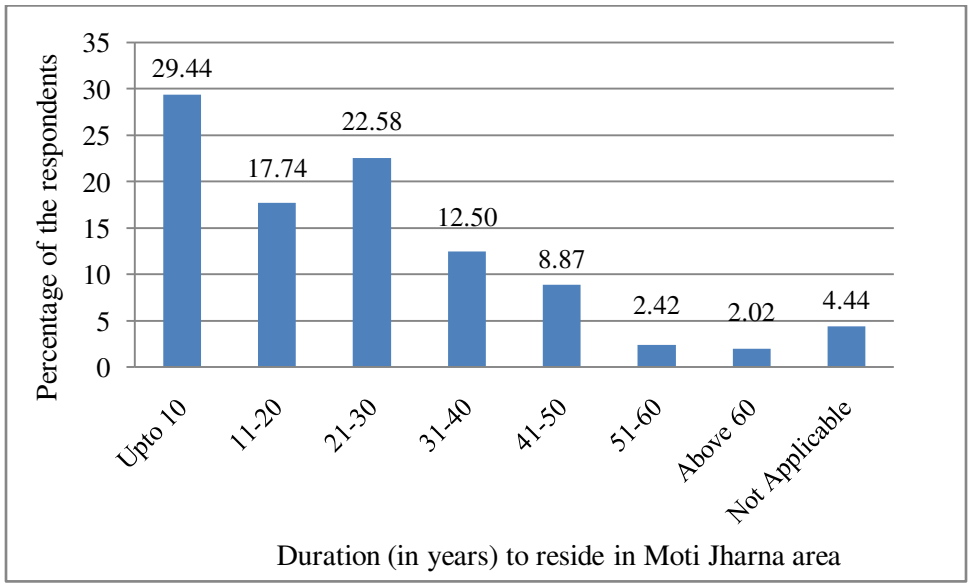


Figure 4: Respondents' opinion about the establishment of the settlement in Moti Jharna area.

Source: Field Survey, September, 2014

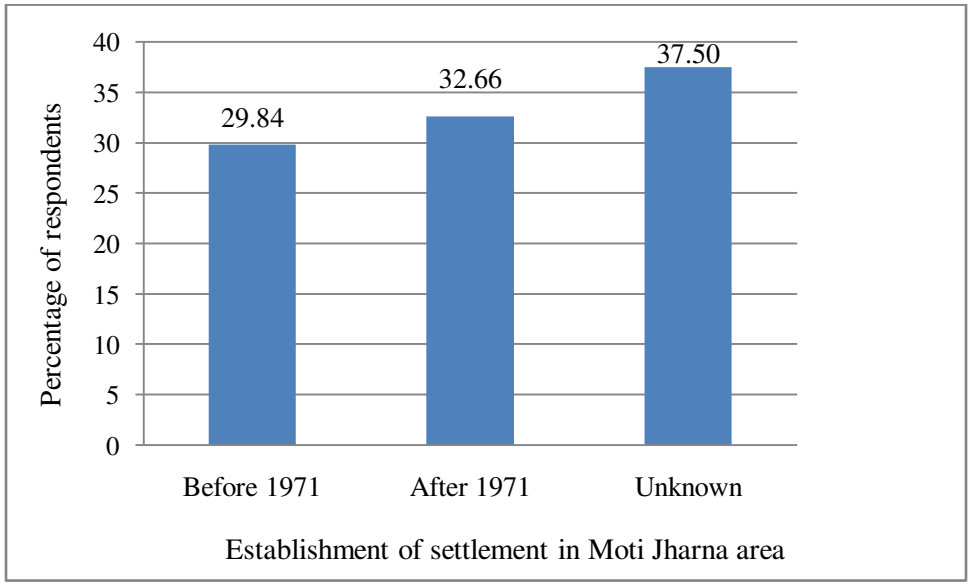


Table 3: Respondents' opinion about land ownership, house builders and rent payment.

Source: Field Survey, September, 2014

Respondents' opinion	Ownership of the land		Builders of the houses		Status of rent payment	
	Number	%	Number	%	Number	%
Yes	74	29.84	95	38.31	157	63.31
No	174	70.16	153	61.69	91	36.69
Total	248	100	248	100	248	100

Table 4: Respondents' opinion regarding financial help.

Source: Field Survey, September, 2014

Respondents' opinion	Financial help within Bangladesh		Financial help from Abroad		Help from micro-credit/ loan	
	Number	%	Number	%	Number	%
Yes	12	4.84	6	2.42	70	28.23
No	236	95.16	242	97.58	178	71.77
Total	248	100	248	100	248	100

Table 5: Interval of landslide occurrence in Moti Jharna.

Source: Field Survey, September, 2014

Interval of landslide occurrence	**Number of respondents**	**Percentage**
Once per year	86	55.48
Twice a year	2	1.29
2 years' interval	8	5.16
3 years' interval	9	5.81
4 years' interval	3	1.94
5 years' & above interval	6	3.87
Sometimes	20	12.90
No idea	21	13.55
Total	**155**	**100**

Table 6: Respondents' opinion regarding last landslide observance, remain vulnerable to landslide risk and relocation during monsoon rain.

Source: Field Survey, September, 2014

Respondents' opinion	Last landslide observed		Remain in vulnerable to landslide risk		Relocation during monsoon rain	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	140	56.45	57	22.98	40	16.13
No	108	43.55	191	77.02	208	58.33
Total	248	100	248	100	248	100

Figure 5: Relocation during monsoon rain

Source: Field Survey, September, 2014

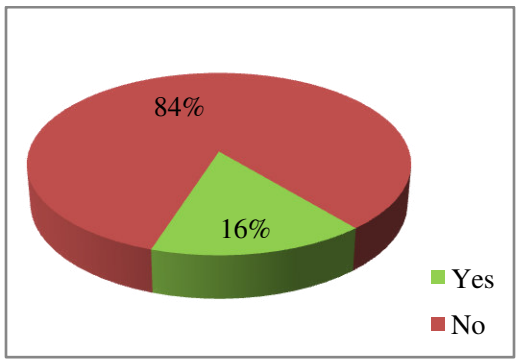


Table 7: Duration of stay in the relocation place

Source: Field Survey, September, 2014

Duration of stay in relocation place	**Number of respondents**	**Percentage**
2-3 days	3	7.50
3-4 days	2	5.00
7 days	3	7.50
10-15 days	2	5.00
2 months	1	2.50
3 months	2	5.00
4-5 months	2	5.00
As wish	4	10.00
Heavy rainfall time	8	20.00
No answer	13	32.50
Total	**40**	**100**

Table 8: Existence of landslide voluntary committee, early warning system for landslide, contact number of emergency services.

Source: Field Survey, September, 2014

Respondents' opinion	**Existence of landslide voluntary committee**		**Existence of early warning system for landslide**		**If have the contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies**	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	25	10.08	240	96.77	46	18.55
No	223	89.92	8	3.23	202	81.45
Total	**248**	**100**	**248**	**100**	**248**	**100**

Table 9: Satisfactory level of rescue effort and status of victims' getting compensation.

Source: Field Survey, September, 2014

Respondents' opinion	**Respondents' satisfactory level of the rescue effort**		**Victims' compensation getting status**	
	Number	Percentage	Number	Percentage
Yes	143	57.66	96	38.71
No	44	17.74	71	28.63
No answer/ Unknown	61	24.60	81	32.66
Total	**248**	**100**	**248**	**100**

Table 10: Respondents' suggestion.

Source: Field Survey, September, 2014

Suggestion	**Number of respondents**	**Percentage**
Job security for women and establish a school	1	0.40
No suggestion	246	99.19
Planned administration needed, commissioner is corrupted, encroach land	1	0.40
Total	**248**	**100**

Study Area-2: Batali Hill

Figure 6: Gender of the respondents

Source: Field Survey, September, 2014

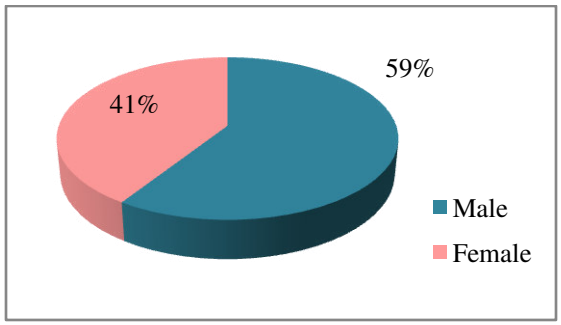


Figure 7: Age of the respondents

Source: Field Survey, September, 2014

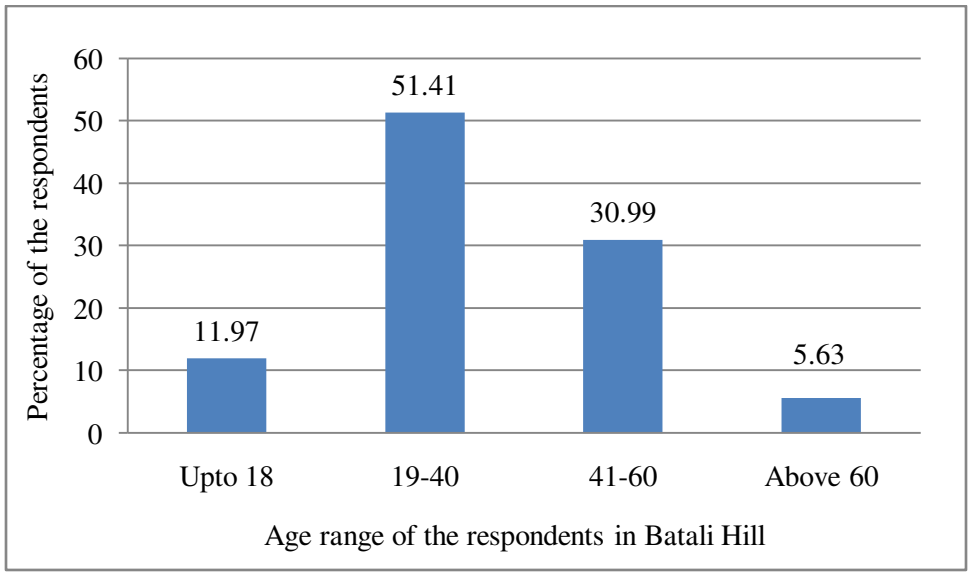


Table 11: Migration status of the inhabitants of Batali Hill area.

Source: Field Survey, September, 2014

Previous address	Number of respondents	Percentage
Barisal	4	2.82
Bhola	1	0.70
Brahmanbaria	3	2.11
Chandpur	6	4.23
Chittagong	55	38.73
Comilla	23	16.20
Cox's Bazar	1	0.70
Dhaka	1	0.70
Feni	1	0.70
Khulna	1	0.70
Lakshmipur	2	1.41
Mymensingh	1	0.70
Narayanganj	2	1.41
Noakhali	14	9.86
Other Area	22	15.49
Rangpur	1	0.70
Sylhet	4	2.82
Total	**142**	**100**

Figure 8: Respondents' duration to reside in Moti Jharna area.

Source: Field Survey, September, 2014

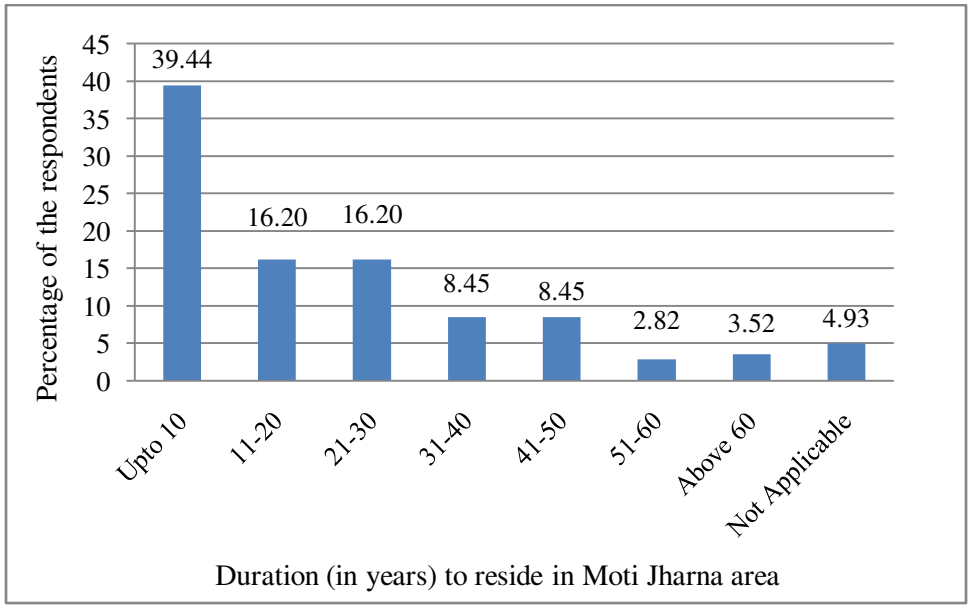


Figure 9: Respondents' opinion about the establishment of the settlement in Batali Hill area.

Source: Field Survey, September, 2014

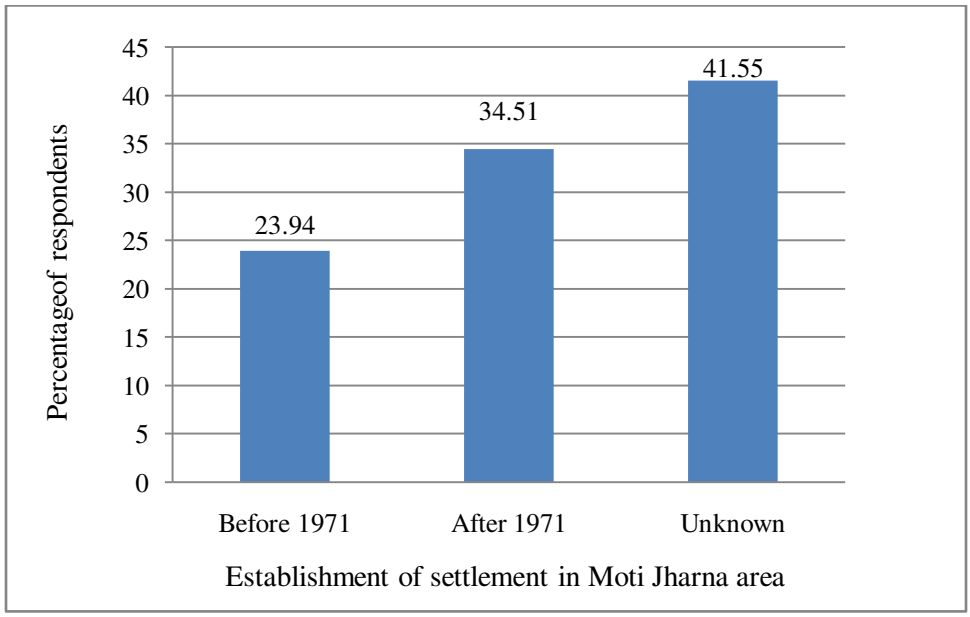


Table 12: Respondents' opinion about land ownership, house builders and rent payment.

Source: Field Survey, September, 2014

Respondents' opinion	Ownership of the land		Builders of the houses		Status of rent payment	
	Number	%	Number	%	Number	%
Yes	26	18.31	50	35.21	97	68.31
No	116	81.69	92	64.79	45	31.69
Total	142	100	142	100	142	100

Table 13: Respondents' opinion regarding financial help.

Source: Field Survey, September, 2014

Respondents' opinion	Financial help within Bangladesh		Financial help from Abroad		Help from micro-credit/ loan	
	Number	%	Number	%	Number	%
Yes	8	5.63	6	4.23	17	11.97
No	134	94.37	136	95.77	125	80.03
Total	142	100	142	100	142	100

Table 14: Interval of landslide occurrence in Moti Jharna.

Source: Field Survey, September, 2014

Interval of landslide occurrence	Number of respondents	Percentage
Once per year	77	77.00
Twice a year	1	1.00
Thrice a year	2	2.00
2 years' interval	5	5.00
3 years' interval	6	6.00
4 years' interval	1	1.00
5 years' & above interval	2	2.00
Sometimes	5	5.00
No idea	1	1.00
Total	**100**	**100**

Table 15: Respondents' opinion regarding last landslide observance, remain vulnerable to landslide risk and relocation during monsoon rain.

Source: Field Survey, September, 2014

Respondents' opinion	Last landslide observed		Remain in vulnerable to landslide risk		Relocation during monsoon rain	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	87	61.27	27	19.01	21	14.79
No	55	38.73	115	80.99	121	85.21
Total	142	100	142	100	142	100

Table 16: Duration of stay in the relocation place

Source: Field Survey, September, 2014

Duration of stay in relocation place	Number of respondents	Percentage
2-3 days	11	52.38
10-15 days	1	4.76
2 months	2	9.52
As wish	1	4.76
No answer	6	28.57
Total	**21**	**100**

Table 17: Existence of landslide voluntary committee, early warning system for landslide, contact number of emergency services.

Source: Field Survey, September, 2014

Respondents' opinion	**Existence of landslide voluntary committee**		**Existence of early warning system for landslide**		**If have the contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies**	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	8	5.63	135	95.07	16	11.27
No	134	94.37	7	4.93	126	88.73
Total	**142**	**100**	**142**	**100**	**142**	**100**

Table 18: Satisfactory level of rescue effort and status of victims' getting compensation.

Source: Field Survey, September, 2014

Respondents' opinion	**Respondents' satisfactory level of the rescue effort**		**Victims' compensation getting status**	
	Number	Percentage	Number	Percentage
Yes	82	57.75	57	40.14
No	19	13.38	49	34.51
No answer/ Unknown	41	28.87	36	25.35
Total	**142**	**100**	**142**	**100**

Table 19: Respondents' suggestion.

Source: Field Survey, September, 2014

Suggestion	**Number of respondents**	**Percentage**
No suggestion	141	99.30
Relocate the vulnerable people	1	0.70
Total	**142**	**100**

Study Area-3: Golpahar

Table 20: Migration status of the inhabitants of Batali Hill area.

Source: Field Survey, September, 2014

Previous address	Frequency	Percentage
Barisal	17	14.91
Bhola	3	2.63
Brahmanbaria	2	1.75
Chandpur	2	1.75
Chittagong	33	28.95
Comilla	17	14.91
Cox's Bazar	3	2.63
Dhaka	3	2.63
Feni	1	0.88
Gaibandha	3	2.63
Gopalganj	1	0.88
Khagrachari	2	1.75
Khulna	1	0.88
Kishoreganj	1	0.88
Madaripur	1	0.88
Mymensingh	1	0.88
Narsingdi	3	2.63
Noakhali	11	9.65
Other Area	7	6.14
Pirojpur	1	0.88
Rangpur	1	0.88
Total	**114**	**100**

Table 21: Cause to settle in Golpahar area of the inhabitants.

Source: Field Survey, September, 2014

Cause to settle in this area	**Number of the respondents**	**Percentage**
Flood	3	2.63
Drought	0	0.00
Relocation by force	6	5.26
Employment	52	45.61
Cyclone	0	0
River Erosion	6	5.26
Marriage	1	0.88
By born	20	17.54
Livelihood	6	5.26
Sea Level Rise	2	1.75
Others	13	11.40
Buying own residence	2	1.75
No answer	3	2.63
Total	**114**	**100**

Table 22: Duration of settlement in Golpahar area.

Source: Field Survey, September, 2014

Settlement Duration in this area	**Number of the respondents**	**Percentage**
Before 1971	35	30.70
After 1971	47	41.23
Unknown	32	28.07
Total	**114**	**100**

Table 23: Status of land ownership in Golpahar area.

Source: Field Survey, September, 2014

Ownership of the land	**Number of the respondents**	**Percentage**
Yes	43	37.72
No	71	62.28
Total	**114**	**100**

Table 24: Whether respondents build their house or not

Source: Field Survey, September, 2014

Builder house	**Number of the respondents**	**Percentage**
Yes	66	57.89
No	48	42.11
Total	**114**	**100**

Figure 10: Percentage of people paying rent.

Source: Field Survey, September, 2014

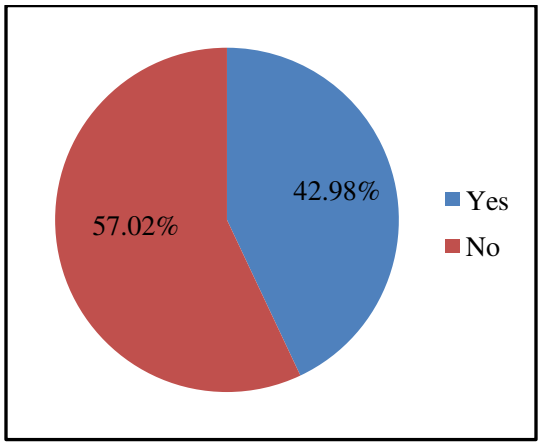


Figure 11: Percentage of people travel for work.

Source: Field Survey, September, 2014

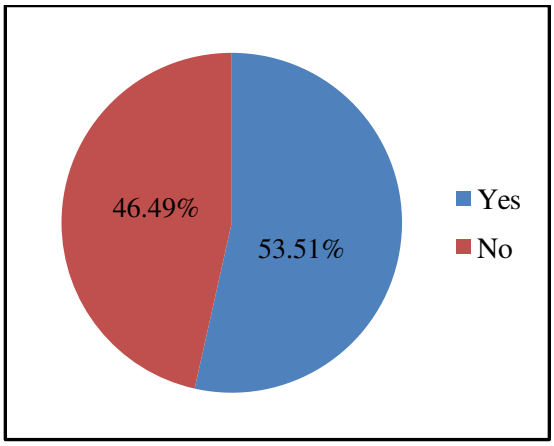


Table 25: Distance between community facilities and residence.

Source: Field Survey, September, 2014

Respondents' Opinion: distance between community facilities and residence										
Distance	School		Market		Bank		Playground		Health care centre	
	No	%	No	%	No	%	No	%	No	%
0 km	2	1.75	2	1.75	0	0.00	13	11.40	0	0.00
0.25 km	13	11.40	7	6.14	1	0.88	12	10.53	2	1.75
0.50 km	63	55.26	35	30.70	9	7.89	32	28.07	19	16.67
1 km	26	22.81	33	28.95	50	43.86	3	2.63	35	30.70
1.25 km	1	0.88	2	1.75	0	0.00	0	0.00	0	0.00
1.50 km	0	0.00	16	14.04	2	1.75	10	8.77	2	1.75
1.75 km	0	0.00	1	0.88	1	0.88	0	0.00	0	0.00
2 km	5	4.39	5	4.39	22	19.30	2	1.75	3	2.63
> 2 km	4	3.51	13	11.40	29	25.44	42	36.84	53	46.49
Total	**114**	**100**	**114**	**100**	**114**	**100**	**114**	**100**	**114**	**100**

Study Area-4: Goachibagan

Figure 12: Gender of the respondents

Source: Field Survey, September, 2014

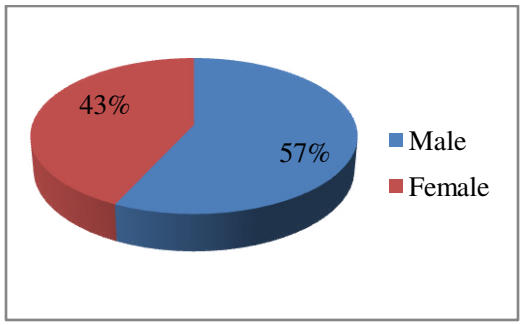


Figure 13: Age of the respondents

Source: Field Survey, September, 2014

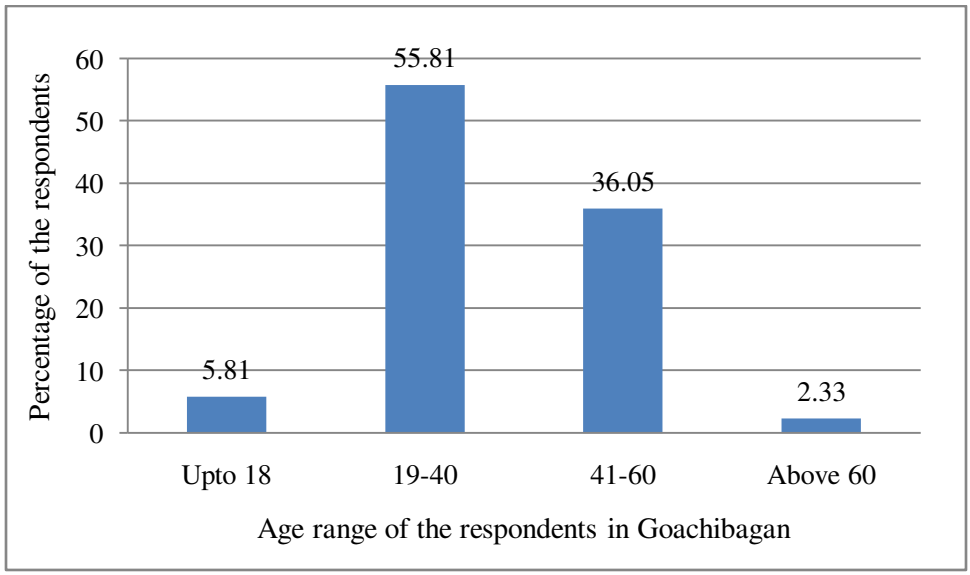


Table 26: Migration status of the inhabitants of Goachibagan area.

Source: Field Survey, September, 2014

Previous address	Number of respondents	Percentage
Barisal	4	4.65
Brahmanbaria	2	2.33
Chittagong	37	43.02
Comilla	14	16.28
Dhaka	1	1.16
Faridpur	1	1.16
Feni	1	1.16
Gaibandha	1	1.16
Gopalganj	1	1.16
Jessore	1	1.16
Kishoreganj	2	2.33
Noakhali	9	10.47
Other Area	8	9.30
Shariatpur	1	1.16
Sylhet	1	1.16
Tangail	2	2.33
Total	**86**	**100**

Figure 14: Respondents' duration to reside in Moti Jharna area.

Source: Field Survey, September, 2014

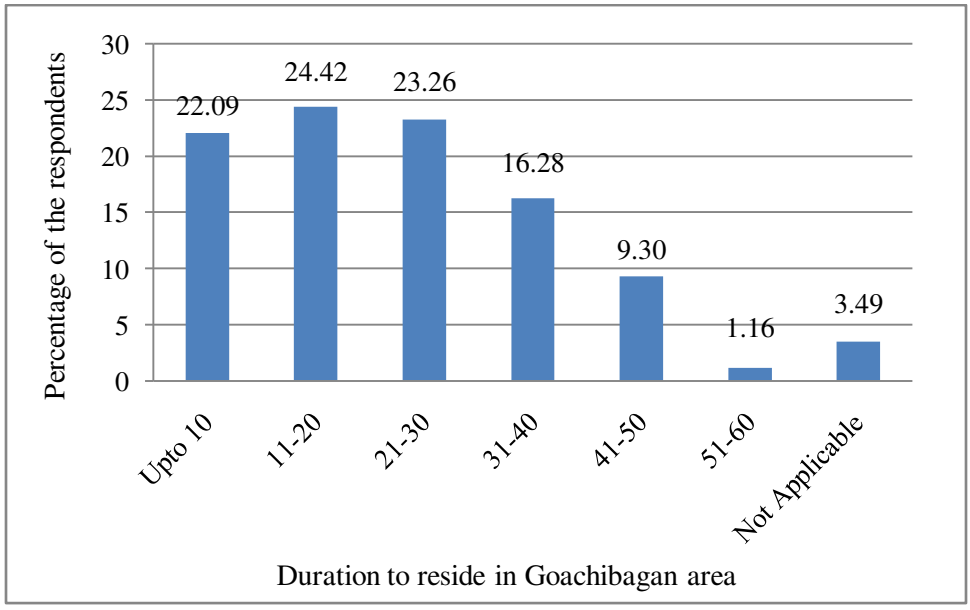


Figure 15: Respondents' opinion about the establishment of the settlement in Goachibagan area.

Source: Field Survey, September, 2014

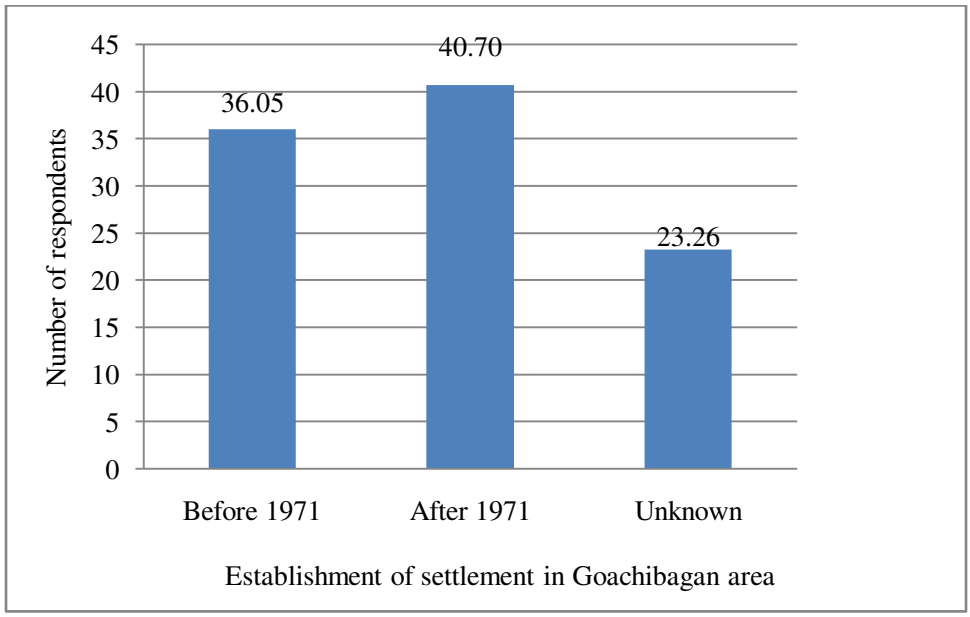


Table 27: Respondents' opinion about land ownership, house builders and rent payment.

Source: Field Survey, September, 2014

Respondents' opinion	Ownership of the land		Builders of the houses		Status of rent payment	
	Number	%	Number	%	Number	%
Yes	9	10.47	60	69.77	12	13.95
No	77	89.53	26	30.23	74	86.05
Total	**86**	**100**	**86**	**100**	**86**	**100**

Table 28: Respondents' opinion regarding financial help.

Source: Field Survey, September, 2014

Respondents' opinion	Financial help within Bangladesh		Financial help from Abroad		Help from micro-credit/ loan	
	Number	%	Number	%	Number	%
Yes	2	2.33	6	2.42	70	28.23
No	84	97.67	242	97.58	178	71.77
Total	**86**	**100**	248	100	248	100

Table 29: Interval of landslide occurrence in Goachobagan.

Source: Field Survey, September, 2014

Interval of landslide occurrence	Number of respondents	Percentage
Once per year	86	55.48
Twice a year	2	1.29
2 years' interval	8	5.16
3 years' interval	9	5.81
4 years' interval	3	1.94
5 years' & above interval	6	3.87
Sometimes	20	12.90
No idea	21	13.55
Total	**155**	**100**

Table 30: Respondents' opinion regarding last landslide observance, remain vulnerable to landslide risk and relocation during monsoon rain.

Source: Field Survey, September, 2014

Respondents' opinion	Last landslide observed		Remain in vulnerable to landslide risk		Relocation during monsoon rain	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	140	56.45	57	22.98	40	16.13
No	108	43.55	191	77.02	208	58.33
Total	248	100	248	100	248	100

Figure 16: Relocation during monsoon rain

Source: Field Survey, September, 2014

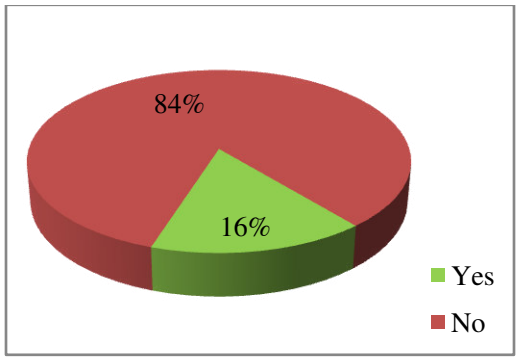


Table 31: Duration of stay in the relocation place

Source: Field Survey, September, 2014

Duration of stay in relocation place	Number of respondents	Percentage
2-3 days	3	7.50
3-4 days	2	5.00
7 days	3	7.50
10-15 days	2	5.00
2 months	1	2.50
3 months	2	5.00
4-5 months	2	5.00
As wish	4	10.00
Heavy rainfall time	8	20.00
No answer	13	32.50
Total	**40**	**100**

Table 32: Existence of landslide voluntary committee, early warning system for landslide, contact number of emergency services.

Source: Field Survey, September, 2014

Respondents' opinion	Existence of landslide voluntary committee		Existence of early warning system for landslide		If have the contact number of the nearest fire service/ police station/ volunteer groups/ emergency services/ relevant agencies	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	25	10.08	240	96.77	46	18.55
No	223	89.92	8	3.23	202	81.45
Total	**248**	**100**	**248**	**100**	**248**	**100**

Table 33: Satisfactory level of rescue effort and status of victims' getting compensation.

Source: Field Survey, September, 2014

Respondents' opinion	Respondents' satisfactory level of the rescue effort		Victims' compensation getting status	
	Number	Percentage	Number	Percentage
Yes	143	57.66	96	38.71
No	44	17.74	71	28.63
No answer/ Unknown	61	24.60	81	32.66
Total	**248**	**100**	**248**	**100**

Table 34: Respondents' suggestion.

Source: Field Survey, September, 2014

Suggestion	Number of respondents	Percentage
Job security for women and establish a school	1	0.40
No suggestion	246	99.19
Planned administration needed, commissioner is corrupted, encroach land	1	0.40
Total	**248**	**100**

Table 35: Pair wise ranking of the problems in Moti Jharna.

Source: Field Survey, September, 2014

	Sl. No.	1	2	3	4	5	6	7	8	9	10	Frequency	Rank
Sl. No.	Problems	Low economic condition	Lack of daily needs	Drug's business	No water supply	No gas supply	Human violence	Illegal business	Lack of education	Low health facility	Low working facility		
1	Low economic condition	×	1	1	1	1	6	7	8	9	1	5	3
2	Lack of daily needs	×	×	2	4	2	6	7	2	2	10	4	4
3	Drug's business	×	×	×	4	3	3	7	8	3	10	3	5
4	No water supply	×	×	×	×	5	6	4	8	4	10	4	4
5	No gas supply	×	×	×	×	×	5	5	8	9	10	3	5
6	Human violence	×	×	×	×	×	×	6	6	9	6	6	2
7	Illegal business	×	×	×	×	×	×	×	7	7	10	5	3
8	Lack of education	×	×	×	×	×	×	×	×	9	10	4	4
9	Low health facility	×	×	×	×	×	×	×	×	×	10	4	4
10	Low working facility	×	×	×	×	×	×	×	×	×	×	7	1

Table 36: Pair wise ranking of the problems in Batali Hill.

Source: Field Survey, September, 2014

	Sl. No.	1	2	3	4	5	6	7	8	9		
Sl. No.	Problems	Low economic condition	Lack of daily needs	No water supply	No gas supply	Human violence	Illegal business	Lack of education	Low health facility	Low working facility	Frequency	Rank
1	Low economic condition	×	1	1	4	1	6	7	8	1	5	3
2	Lack of daily needs	×	×	2	5	6	2	2	8	2	5	3
3	No water supply	×	×	×	4	5	6	4	8	4	3	4
4	No gas supply	×	×	×	×	5	5	8	9	10	5	3
5	Human violence	×	×	×	×	×	6	8	6	10	6	2
6	Illegal business	×	×	×	×	×	×	7	7	10	3	4
7	Lack of education	×	×	×	×	×	×	×	8	10	7	1
8	Low health facility	×	×	×	×	×	×	×	×	10	1	6
9	Low working facility	×	×	×	×	×	×	×	×	×	6	2

Table 37: Pair wise ranking of the problems in Goachibagan.

Source: Field Survey, September, 2014

	Sl. No.	1	2	3	4	5	6	7	8	Frequency	Rank
Sl. No.	Problems	Low economic condition	Lack of daily needs	Lack of water supply	No gas supply	Lack of education	Low capacity of drain	Inadequate road	Load shedding		
1	Low economic condition	×	1	1	1	5	1	1	8	5	2
2	Lack of daily needs	×	×	2	2	5	2	2	8	4	3
3	Lack of water supply	×	×	×	4	3	6	7	8	1	5
4	No gas supply	×	×	×	×	5	6	7	8	1	5
5	Lack of education	×	×	×	×	×	6	7	8	3	4
6	Low capacity of drain	×	×	×	×	×	×	6	8	4	3
7	Inadequate road	×	×	×	×	×	×	×	7	4	3
8	Load shedding	×	×	×	×	×	×	×	×	6	1

Table 38: Pair wise ranking of the problems in Golpahar.

Source: Field Survey, September, 2014

	Sl. No.	1	2	3	4	5	6	7	8	9	10		
Sl. No.	Problems	Low income	Lack of daily needs	Political violence	No gas supply	Limited water supply	Load shedding	Bad condition of road	Low capacity of drain	Low working facility	Health facility	Frequency	Rank
1	Low income	×	2	3	4	1	1	7	8	9	10	2	6
2	Lack of daily needs	×	×	3	4	2	6	2	2	9	10	4	4
3	Political violence	×	×	×	3	3	3	7	8	3	10	6	2
4	No gas supply	×	×	×	×	5	6	4	8	9	10	3	5
5	Limited water supply	×	×	×	×	×	5	5	5	5	10	5	3
6	Load shedding	×	×	×	×	×	×	6	6	9	10	4	4
7	Bad condition of road	×	×	×	×	×	×	×	8	9	10	2	6
8	Low capacity of drain	×	×	×	×	×	×	×	×	9	10	4	4
9	Low working facility	×	×	×	×	×	×	×	×	×	9	6	2
10	Health facility	×	×	×	×	×	×	×	×	×	×	8	1

APPENDIX D

Project Team

The project team comprises of **8** personnel. They are as follows:

- **Advisor and Geotechnical Specialist:** Professor Dr. Tahmeed M. Al-Hussaini, PhD
- **Foreign Advisor and Landslide Specialist:** Professor IkuoTowhata, PhD (Japan)
- **Foreign Advisor and Social Vulnerability Specialist**: Professor David E. Alexander, PhD (United Kingdom)
- **Disaster Management Specialist:** Md. Shahinoor Rahman
- **GIS Specialist and Web-GIS Programmer:** Bayes Ahmed
- **RS Specialist:** Sharmin Ara
- **Research Assistant:** Sonia Rahman
- **Research Assistant:** Ferdous Farhana Huq