

Surviving Cyclones:

The Indigenous Wisdom



Surviving Cyclones: *The Indigenous Wisdom*

Author

Mohammad Tareq Hasan

Acknowledgement

The manuscript is an output of a research programme undertaken by the Unnayan Onneshan – The Innovators, a center for research and action of development, based in Dhaka, Bangladesh. The Report has immensely benefited from insights shared by Dr. Shahed Hassan, Professor, Department of Anthropology, University of Dhaka and *Rakhain* of *kuakta* during fieldwork.

(c) Copyright: Unnayan Onneshan – The Innovators

The content of this publication may be reproduced for non-commercial purposes with proper citation (please send output to the address mentioned below). Any other form of reproduction, storage in a retrieval system or transmission by any means for commercial purposes, requires permission from the Unnayan Onneshan – The Innovators.

Cover Concept and Design:

Printed by:

For orders and request please contact:

Unnayan Onneshan – The Innovators

House: 19A, Road: 16 (New), Dhanmondi, Dhaka-1209, Bangladesh.

Tel: +(880-2) 815 82 74, 911 06 36; Fax: + (880-2) 815 91 35

E-mail: info@unnayan.org; Web: www.unnayan.org

Table of Contents

	Page No.
Executive Summary	03
Section 01	04-05
1.1 Introduction	04
1.2 Objectives of the Study	05
Section 02	05-17
2.1 Indigenous Perception of Cyclone	05
2.2 Indigenous Predicting Indicators	06
2.3 Indigenous Survival Strategies at the Pace and Face of Cyclones	09
2.3.1 Pre-cyclone Adaptation	09
2.3.2 Coping With During Disaster Period	13
2.3.3 Coping with Post Disaster Period	13
2.4 Disaster Management Cycle	14
2.5 Rakhains' Knowledge about Cyclone and Transfer of Indigenous knowledge to the following generations	16
2.6 Generation Gap in Perceiving Cyclone and Traditional Knowledge of Survival Strategies	16
2.7 Rakhains' Belief in their Knowledge and Perception about Warning Signals	17
Chapter 03	17-24
3.1 Impacts of Cyclone "Sidr"	17
3.2 Impacts on livelihood strategies	19
3.3 Cultural Identity in Crisis	23
3.4 Rakhains' Struggle to Cope With the Vulnerabilities Created by the "Sidr"	23
Section 04	24-27
4.1 Recommendation	24
4.2 Concluding Remarks	27
Annex	28
References	30

Executive Summary

Cyclones are intense low-pressure systems that form over tropical oceans with sustained winds exceeding 63 km/hr surrounding the center. Bangladesh, due to its conical shape and location on the tip of the Bay of Bengal, is vulnerable to periodic natural disasters especially cyclones. Cyclone “Sidr” ravaged the coastal belt of Bangladesh on 15th November, 2007. The study was conducted at ‘*Kuakata*’, a coastal area of Southern Bangladesh in November 2008. The focus was to reveal the disaster management skills of the indigenous people who are living in this coastal area for centuries.

Indigenous communities living in the coastal areas for centuries with unique cultural identity have close contact with nature. It is assumed that they have developed an indigenous perception and prediction strategy for cyclones and, thereby possess effective survival strategies. They have inherited the time-tested experiences of generations internalized through a process of socialization. Originated within communities, based on local needs and specific to the local culture and context, this vast knowledge capital has helped in building the community resilience and enhancing their coping mechanisms to natural disasters (cyclones).

Based on three main predefined priorities: Indigenous ethnic communities, coastal region, and impact of the “Sidr”; the Rakhain (the only indigenous ethnic community with a considerable number who are living in the coastal belt for centuries having unique cultural identity) of the Patuakhali district was selected for intensive in-depth investigation. The study at large aimed at exploring the indigenous disaster management of the Rakhain’s at *before*, *during* and *post* cyclone periods, with special interest on the impact of the “Sidr” on the Rakhain. Using in-depth interviewing of key informants, group discussion with community members and associated case studies the study tried to identify: Indigenous perception of cyclones, predicting indicators used by the local people to determine the occurrences and intensity of cyclone, and their survival strategies prior institutional help arrives.

Disaster management involves preparing for disasters before it occurs, disaster response as well as supporting and rebuilding society. The Rakhain were found to have different adaptive strategies for *Pre*, *during*, and *Post* disaster periods of a cyclone. The people ignoring the formal preventive and survival strategies and rely upon cumulative experience of the earlier generations. The evidences of their community level preparedness include: the structural adjustment to reduce cyclone damage, specific forms of housing, prediction of cyclones using the state and level of the sea-water, wind direction, weather, behavior of some living organisms, etc. Their capacity to survive before any institutional help arrives after the cyclone hit demonstrate the effectiveness of their survival strategies. After the devastating cyclone “Sidr” Rakhain are facing problem regarding their livelihood strategies due to saline water intrusion. On the other hand due to unplanned rehabilitation process their unique cultural heritage is also under threat.

Since Bangladesh is a disaster prone country, the ecological knowledge of the Rakhain may have some applicability in other coastal areas vulnerable to periodic cyclones. Thus, there remains the necessity of further research in this subject of indigenous disaster management.

Section 01

1.1 Introduction

As the natural disasters make people vulnerable, every society perceives the natural disastrous events with its capacity to cope and peoples' interaction with their surroundings is important for their living in a particular area. Every social system responds in the crisis situation and that temporary adaptive process may transfer to the permanent pattern for that society if the occurrences take place again and again. Ethnic communities while living in the coastal areas for centuries with unique cultural identity having close contact with nature, it is assumed that they have developed an indigenous perception and prediction strategy for cyclones and, there by posses effective survival strategies (Hassan, 2000; Hossain, 2001).

Cyclone 'Sidr' devastated the coastal region of Bangladesh on 15th November 2007. The cyclone battered vast areas of Khulna, Barishal, and Chittagong divisions with a wind speed of almost 250 km per hour with giant waves up to 30ft high (MoFDM, 2008). Various reports of the local journalists and volunteers working in relief and rescue operations reported that seriously affected people were from all wakes of life.

Almost every year, small to medium range cyclones are formed in the Bay of Bengal, hit the landmass causing moderate damage. But periodically strong mightiest cyclones associated with high tidal surges engulf the entire coastline and even sometimes approach further north. Thus, not only property loss but also death toll goes beyond any imagination. Given the periodic catastrophes affecting the Bay of Bengal coast, there is a serious need for an effective disaster management plan to minimize the loss of lives and property. Unfortunately, the present cyclone warning signal is not only effective enough but sometimes also confusing (Hassan, 2000). We do not have any comprehensive disaster management strategy also. Some of the local NGOs in collaboration with government agencies; undertake certain activities but that too have been limited to mostly relief and rehabilitation activities. Cyclone preparedness plan is hardly found among these agencies. People, living in the coast, apply their own weather reading skill and thereby, take necessary precautions. In view of this the present study has two distinct purposes to serve:

1. Revealing the indigenous disaster strategy and coping mechanism.
2. The academics, particularly engaged in disaster anthropology, are likely to be benefited for practical reasons.

Therefore, the research is expected to provide planning and programming input and enhance human knowledge.

While it is not possible to prevent natural disasters, protective measures to reduce the vagaries of disasters can be evolved. For these reasons, this research aims to analyze the Rakhain's (the only ethnic minority community with a considerable number are living in the coastal belt for centuries with unique cultural identity) indigenous perception of cyclone and risk situation, predicting indicators of cyclone, coping mechanism and impact of the "Sidr" on the Rakhain. The Rakhain living in the coastal areas of Bangladesh since 1789 (Khan, A. M, 1999:50) thus, facing numerous cyclones; possess extended knowledge about cyclone prediction and survival strategies.

1.2 Objectives of the Study

Given the magnitude of the adverse impacts of tropical cyclones; community perception, prediction and survival strategies to combat cyclonic disaster is a matter of utmost importance, especially in the context of Indigenous communities who have been living in the extreme vulnerable zones for quite a long time and surviving mostly without outside help. The present research intends to compile environmental concerns and traditional environmental knowledge of an indigenous community, namely, the Rakhain; living in the coastal area for centuries. The specific objectives are:

- a) reveal the perception and prediction indicators used by the Rakhain during cyclones;
- b) examine their survival strategies at the face and pace of cyclones;
- c) assess the impact of the “Sidr” on the Rakhain;
- d) highlight important findings that can be used by the disaster management programmers/ planners of NGOs and GO line agencies.

Section 02

2.1 Indigenous Perception of Cyclone

The Rakhains use the word *Lemungrai* to denote any natural calamity. But they the terms *tulong*, *mundai*, *le mundai* are commonly used to describe cyclone, tidal surge, and cyclone without tidal surge respectively. Wind is described by the Rakhain term *li-thare*; wind blowing with a high intensity is denoted by *li-ben-thare*. And flood due to excessive rain is denoted by *mouri prera*.

According to the Rakhains cyclones of the late rainy season (*ni-radi*) and the early winter season (*mo-radi*) are most devastating because of higher intensity and bigger tidal surge but during dry season there are frequent cyclones of less intensity in terms of tidal surge. Rakhains explain this difference as because due to rain during rainy season rivers (*penle*) and sea (*mraima*) has more water than in dry season. However, prefixes are also used to classify the intensity of cyclone. For examples, cyclones with low intensity and high intensity are called *leingri* and *laeingshi* respectively. Similarly The People of Maheshkhali classify cyclones on the basis of intensity as “*choto Tufan*” (small cyclone) and “*boro tufan*” (big cyclone) (Hassan, 2000) this type of distinction between cyclones is common in cyclone prone areas of Japan too as *large*, *medium* and *small* cyclones (Hassan, 2000).

When Rakhains of the study area were asked if they know the causes of formation of cyclones they replied that as cyclone are created in the deep sea and they have not seen the creation of cyclone they don't know the actual cause. But they believe: *Its all because of will of the God*. Mostly all over Bangladesh cyclones/ natural disasters are also traditionally seen as Punishment from Allah (Howell, 2001 and 2003; Schmuck, 2000) or Doomsday or Curses of God (Hassan, 2000).

Rakhains do believe that cyclone is inevitable in this coastal region due to natural causes also. As they have seen water level of sea have risen about 3 ft. in last 30 years and sea is

coming nearer to human settlements due to land erosion. Few also look at pollution of sea as a cause of cyclone formation.

“The sea is coming nearer so where the waves of the sea will go, it will come and hit the shore in the form of cyclones”, male: 76

One more aspect of their belief about cyclone is that they believe that a mighty cyclone will hit the coast every five years. This belief came to exist because of the periodical cyclone hits of 1960, 1963, 1965, and 1970.

Some also indicated to the geographical position of the place from where the sea is directly to the west as a cause of frequent cyclone hits.

After 1970 the study area has not been attacked by any big cyclones but in 2007 a mighty cyclone “Sidr” passed the areas where Rakhains live. It hit the coast on 15th November, 2007 which is in the winter season (*Mo-radi*). According to Rakhain calendar which should not be a time for cyclone creation. Because of these two reasons Rakhains believe the Cyclone “Sidr” was a result of previous sins. A resident of Patuakhali District describes his perception about extreme weather events like big cyclones as following:

“People are dishonest these days, they don’t have any religion, for this reasons there is drought, flood, excessive rains and at last this “Sidr”. If people do not become ‘good’ these will not end and we will have to suffer”, Male: 65

Before the cyclone “Sidr” hit the coast, it was raining all day and wind was blowing from south-east but this happens every year and they did not consider the situation much and never thought the situation could be the way it turned out eventually.

But the reason why cyclone “Sidr” did not hit the *Kuakata* coast directly according to some people is ‘land mitigation’ (*cho*) (width about .5 kilometer and length about 4.5 km) into the deep sea of the Bay of Bengal. This is located, according to a Rakhain respondent, about 1 km deep into the sea (south to north) from the coast in an east-west direction. They believe the cyclone travel through the deep sea and went to Khulna and Sundarban through the deep sea. They have seen in last few years that cyclones avoid the *kuakata* coast most of the times.

2.2 Indigenous Predicting Indicators

When the Rakhains were asked whether they can anticipate and predict occurrences of cyclones, most of them replied positively. It is perceived that older members of the community are most knowledgeable about history and development of a particular system of knowledge, including past successes and failures (Mustafa, 2000). Thus, most of the responses came from the older generation, that is, 50 years and above but for comparative analysis people of different age and sex were also approached. Respondents were asked if they could anticipate and predict occurrences of cyclones. The responses are tabulated according to age and gender of the respondents:

Table 2.2: Age and Gender based list of the respondents and their ability to anticipate and predict cyclones

Age (years)	Male		Female		Total	
	Yes	No	Yes	No	Yes	No
Below 20	-	2	-	1	-	3
21-30	-	2	-	3	-	5
31-40	2	3	1	1	3	4
41-50	9	1	2	4	10	6
51-60	11	1	3	5	15	6
Above 60	7	-	2	-	9	-
Total	29	9	8	14	36	24

Fieldwork, 2008

It can be seen from the above table that 60 percent of the respondents (36 out of 60) responded positively when they were asked if they could anticipate and predict occurrences of cyclones. It was further observed that all most all of the positive response belongs to age groups above 40 (34 out of 36 i.e.: almost 95%) and there was no one in the age groups below 30 who could anticipate or predict cyclones. Looking from a gender perspectives, only 36.6 percent of the females answered affirmatively, i.e.: 8 out of 22; and they too belong to the mid-aged and older age group. But among the men the percentage of positive responses was much higher i.e. 76.4% or 29 out of 38 respondents.

Predicting indicators of cyclone depends on several factors. People do not take a single indicator to predict the cyclone. All the indicators as a whole give the definite direction. The indicators that are operative in their process of anticipation and prediction of a cyclone are indexed in the Figure 2.2:

Box 1

Women are mostly ignorant of predicting indicators of cyclones

Maten Ae, Female: 35, is a housewife of the Kerani Para, *kuakata*. According to her cyclone “Sidr” was the first mighty cyclone which she experienced. Although it was raining all day before the cyclone hit, with wind blowing from the east she did not perceive a mighty cyclone, the reluctance she says was due to lack of experience and though she knew wind blowing from east side is more likely to create a cyclone she did not perceive it as a signal for cyclone because of experience of the last few years. She came to know about the formation of the cyclone “Sidr” from radio broadcasting and miking but did not pay attention to them also she was sure about a cyclone when her father-in-law said a mighty cyclone is coming and do all your work before sunset. She could not mention any other predicting indicators and she says she has not got the ability because she is always busy with household works and don’t have time and necessity to pay attention to identify indicators related to cyclone formation. When she was saying about the cautionary measures taken during the cyclone “sidr” she said most women and children were sent to nearest cyclone shelters or other safer places while a male member remained at home in every households.

Source: Case Study in *Kuakata*, 2008

Figure 2.2: Predicting Indicators of Cyclones

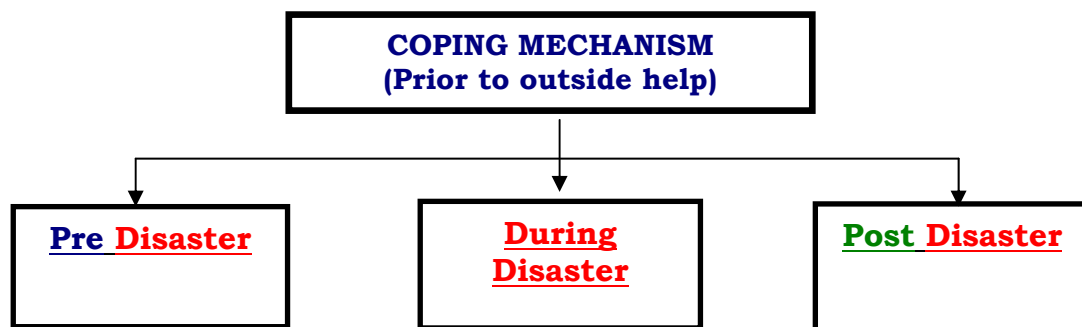
<i>Perception</i>	<p><i>Tulong</i> (cyclone)</p> <p><i>leingri</i> (cyclone with high intensity of tidal surge)</p> <p><i>laeingshi</i> (cyclone with lesser intensity of tidal surge)</p> <p><i>le mundai</i> (cyclone with tidal surge)</p>
<i>Prediction</i>	<p><i>Kachong/ Naeung</i>(April/May) and</p> <p><i>Tachong mong/ Na-ddo</i> (Oct/ Nov)</p>
<i>Wind Direction</i>	<p><i>acche tong da-ong</i> (South east) : High intensity</p> <p><i>mrao acche da-ong</i> (North east) : Low intensity</p>
<i>Warmth of Wind</i>	<p><i>Hot during cold season</i></p> <p><i>Cold during hot season</i></p>
<i>Weather condition</i>	<p>Drizzling and gloomy sky with wind blowing from south east</p>
<i>Sound</i>	<p>Huge roar of the sea is heard</p> <p>No sound of thunder storm</p>
<i>Appearance of cyclone</i>	<p>Wind blowing in circle can be seen in the deep sea from the coast</p>
<i>Water</i>	<p>Abnormally Hot</p> <p>Dark color</p> <p>Bitter taste of rain water/ salinity of rain water</p> <p>Water increases in the river if cyclone is heading towards the shore</p>
<i>Availability of fish</i>	<p>increased</p>
<i>Cloud</i>	<p>Rainbow color</p> <p>Rainbow shape</p>
<i>Living Barometer</i>	<p>Human with special type of disease (sufferings of the people having skin problems and breathing problems are increased)</p> <p>Insects (moving out of their nests and move to higher places)</p> <p>Fish (jumping of a certain kind of fish in the ocean, locally called “cheowa”)</p>

(Fieldwork, 2008)

2.3 Indigenous Survival Strategies at the Pace and Face of Cyclones

Rakhain are living in the coastal area of Bangladesh for years and have faced numerous mighty cyclones. Cyclones in different times killed many Rakhain but many survived and are still living. Through the experience of facing many cyclones the Rakhain of the coastal areas have developed various strategies to survive at the pace and face of cyclones: to save life, to protect their houses, cattle, grains, valuable items, live the post disaster period when there is no food, no water, no medicines for the injured.

Hassan (2000) has developed a framework to analyze survival strategies of people to face cyclones as:



2.3.1. Pre-cyclone Adaptation

LONG-TERM ADAPTATION

Structural Preparedness: *Eing*: A structural Protection

All most all indigenous people around the world have their own distinctive housing pattern which protects them from all types of natural and environmental hazards. The eco-friendly house (*eing*) of the Rakhains' helps them to sustain against major damages during cyclones. The Seminoles of the North America also have a special housing structure (*Chickee*) that protects them from hurricanes (Hassan, 2004).

The Rakhains have their own system of building and constructing houses which is environmentally and ecologically safe and sound. For several hundreds of years Rakhains are strictly following their indigenous prescription of house constructions.

Rakhain houses are constructed at 65 inches above the base platform. This was primarily because Rakhains had to face various wild animals and snakes when they first settled in the coastal areas. This type of houses on higher platform helped them keeping themselves away from the ground and such wild animals.

As time passed Rakhains observed this housing pattern is very well adapted to the local environment to sustain against such geo-climatic factors as flood, cyclones and tidal surge. As the Rakhains living in the coastal belt are familiar with recurrent cyclones, the Rakhain houses are constructed in a way that allows the strong wind to freely pass across and ventilate out without obstructions. The Rakhains of the study area are very aware of the fact that if the wind flows easily without any obstructions there is less chance of house damage and the house platform being higher than the ground help them to survive during tidal surge. They can hold on to the logs and tie their children with the logs and during

higher tidal surge they can dismantle some parts of the roof and take shelter over the roof to survive. This is evident from the following comments:

”When cyclone “sidr” attacked we all went to the second floor and opened all the windows so that winds can easily pass through”, Male: 70.

“during the cyclone of 1965 my father tied me with a log on the 1st floor of the house and was saved during tidal surge”, Male: 56

From the above statements it is well evident that the traditional Rakhain houses give the Rakhains a structural advantage in facing cyclones. This knowledge passed on from one generation to another and they are very reluctant to make such houses.

All Rakhain houses are found to be two storied irrespective of financial strength but some houses are three storied (houses of wealthy persons) and there are also one storied houses like traditional Bengali houses and the Rakhain people who build such houses said that they are not making traditional houses because it is very expensive too build such houses and the other reason is that the traditional logs for example: “loha” (Prain) or “Shal” (dosti) which were used to build houses are not easily available these days.

Photo 2.3.1 (a): A Three storied Rakhain House



Photo 2.3.1(b): Rakhain House constructed like Bengali Houses



In the study area one more type of Rakhain houses (govt. sanctioned) were found which are structurally like the traditional Rakhain houses but not in terms of material of the house (photo: 2.3.1 (c)). This type of houses are made out of concrete, steel and wood. This new type of house gave some structural advantages like their traditional houses but the space utilization is not the same as like the Traditional houses like for example: previously they had a cooking place at the first floor of their house but not in this new type whereas they have attached toilet at the first floor now which they did not have previously.

Photo 2.3.1 (c): New style of Govt. Sanctioned Rakhain House



The Scientific validity of traditional Rakhain housing technology is evinced by certain similarities with the cyclone shelters in the coastal area of Bangladesh. The following two Photos will illustrate:

Photo 2.3.1(d): Traditional Rakhian House



Photo 2.3.1(e): A Cyclone Center in Kuakata



Through an accurate perception and prediction of a cyclone always reduces the extent of loss, particularly human lives, to escape from huge loss due to cyclone Rakhains are prepared structurally.

Aepong Re: Trees around Rakhain houses

Traditional Rakhain houses help to survive them at the face and pace of cyclones but the trees (*Aepong Re*) (Photo: 2.3.1 (f)) around their houses gives the following advantages:

Photo 2.3.1 (f): *Aepong Re*: Trees around Rakhain Houses



Photo 2.3.1 (g): Trees around Human Settlements in Coastal Areas



- Trees around the houses reduce the wind speed that hits the house.
- It prevents the water to hit directly during tidal surge.
- Some times when people gets into the water due to huge tidal surge these trees helps them to survive if someone can hold on to the trees.
- Especially coconut trees help them with drinkable water during water crisis after cyclones.

Rhakhains’ knowledge about the advantages of planting trees around houses is evident from the following comment:

“I was in water when the first wave hit our house and I saved myself holding a coconut tree”., Male: 76

“If some one falls into the water during tidal surge there is no way to survive if someone cant find any tree or any other material to float or just to hold on” ,Male: 74

“During cyclones of 60 and 65 lots of people were died but during sidr of 2007 lesser number of people died, one of the reason of this are the trees around the whole village which were not present earlier”, Male: 65

The validity of this knowledge is supported by the tree plantation around coastal region by forestry department of Bangladesh Government (Photo 2.3.1 (g)). The Practical use of such trees around houses and villages was exemplified in 2007 during cyclone “Sidr” when The Mangrove Forest “Sundar Ban” reduced the intensity of the cyclone and helped on a large scale to reduce human causality and other damage when it reached human settlements.

SHORT-TERM ADAPTATION

Traditionally, Rakhains have used their indigenous knowledge to understand weather and climate patterns in order to make decisions about survival at the pace and face of cyclones. But with the development of communication systems, spreading of government safety nets and other socio-economic circumstances they evolved some of their coping strategies.

Survival strategies taken in pre cyclonic period are to minimize loss and to ensure that they could survive the ‘during’ disaster and ‘post’ disaster phases well. The problems and their strategies can be seen in the following figure 2.3.1 and a detail description is given in the following sections.

Figure 2.3.1: Pre Cyclone Adaptation

<i>Problem</i>	Valuable items, domestic animals, food, women and children, crop in the fields,
<i>Strategy</i>	Hiding valuable items under earth, letting the domestic animal free, keeping foods in higher places of house, harvesting crops, moving women and children to safer places

Source: Fieldwork, 2008.

2.3.2 Coping with During Disaster Period

Rakhains have strong group cohesiveness and when a cyclone strikes they not only think about personal safety but also try to protect family and sometimes give shelter to community members. But when in disastrous situation, for example: when the tidal surge hit them and suck them into water personal survival strategy dominates because according to them if personal safety is not ensured how will they help others. But sometime although they are in troubles themselves they tend to try to save their children. These findings are somewhat consistent with the people of Maheskhali who themselves face numerous cyclones themselves (Hassan, 2000). The mixture of their egoistic and altruistic behavior will be more evident from the sections below.

Figure 2.3.2: Coping With During Disaster Period

<i>Strategy</i>	Self-protection, or, protection of own family, gives shelter to others mostly relatives
<i>Shelter</i>	Higher places, strong traditional house, trying to leave for safe places at inner & higher part of land, roof of the houses, cyclone centers
<i>Problems</i>	In accuracy of warning signals, Dress/hair, Swimming, huge tidal surge, different types of material coming with great speed with the water, problem of robbery.

Source: Fieldwork, 2008.

2.3.3 Coping with Post Disaster Period

After a cyclone normally the whole area is destroyed. So at this stage the strategies are more concerned about surviving. These strategies are qualitatively different than the *pre* and *during* disaster period. Whereas in during disaster phase self protection instinct dominates in this stage one can see their group cohesiveness.

The following figure 2.3.3 will give an idea of what are the problems of post disaster period and how the Rakhains resolve them. Detail description will also be given below.

Figure 2.3.3: Coping Post Disaster Period

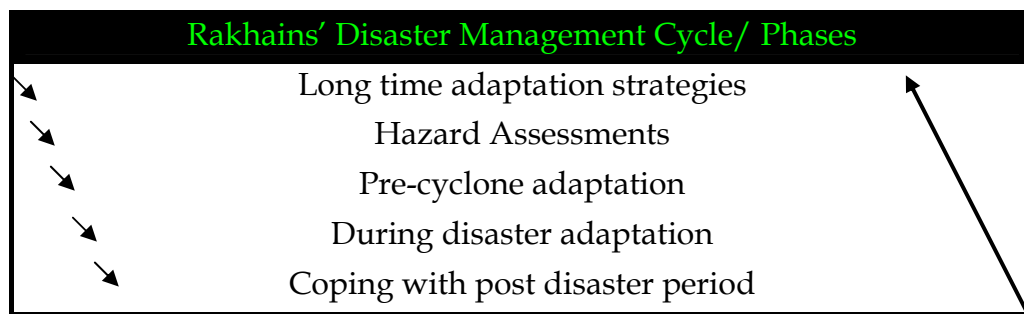
<i>Problems</i>	Lost relatives Water crisis Disease/Injury/Food/Shelter
<i>Resolve</i>	Looking for kins Coconut, Banana tree, tubewell, river water, collecting water from distant places, water by digging sandy sea beach. Home made medicine/Medicinal plants/fruits/ till outside help All problems are solved by the community together

Source: Fieldwork, 2008.

2.4 Disaster Management Cycle

Rakhains in the study area possess and follow a disaster management cycle which can be defined as following:

Figure 2.4 (d): Rakhains' Disaster Management cycle /phases



(Fieldwork, 2008)

In the study area among the Rakhains a well-developed disaster management strategy is identified. They make hazard assessments and adapt with the pre-cyclone period accordingly. During the disaster phase Rakhains having their traditional indigenous knowledge are more apt to survive and has some distinctive advantages over others to survive. Their adapting strategies with the post disaster situation are also very useful which has been proved by their survival of many mighty cyclones and their long time adapting strategies have some scientific validity also.

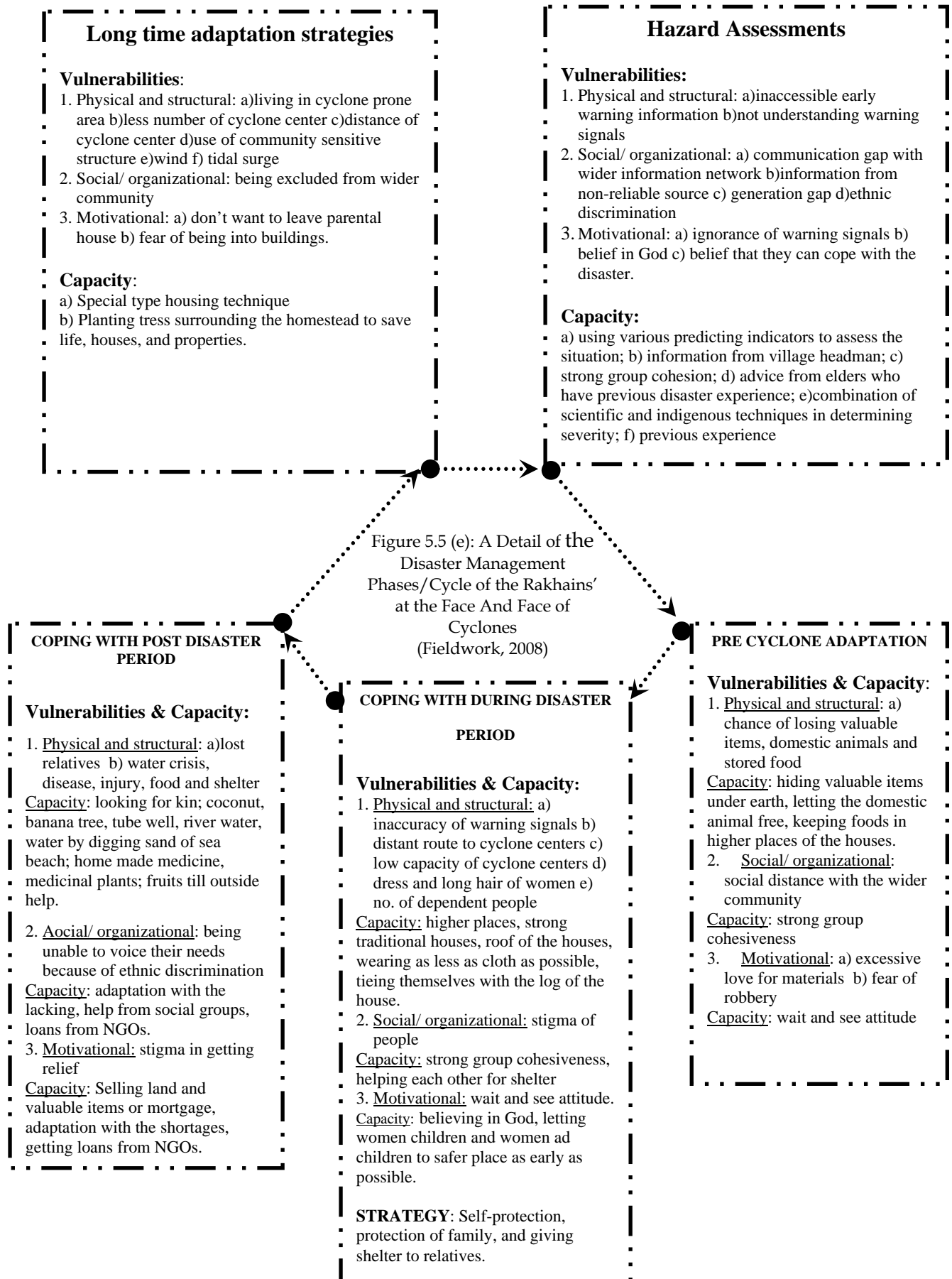
Box 2

Surviving a Cyclone

Aung La Chin, Male: 76, He has memories of previous cyclones such as of 1960, 1965 and 1970. During 1960s there was no embankment around the area where he lives so any cyclone and tidal surge badly affected the area. During the cyclone of 1960 he says first two waves of tidal surge dismantled his house and with the third wave he was into the water and to survive he put off his clothes early before the tidal waves hit the area. When was in water he said he had to attentive to miss all the material that are coming with the water because any of those could kill him if he got hit. And finally he survived holding on a coconut tree. When the cyclone was over he says what he wanted most was drinking water and as saline water contaminated all available water sources nearby he had to chew on the bunch of a banana tree to get the liquid and survive.

Source: Case Study in *Kuakata*, 2008

Figure 2.4 (e): A detail of Rakhains' Disaster Management Cycle/ Phases is presented in the following:



2.5 Rakhains' Knowledge about Cyclone and Transfer of Indigenous knowledge to the Following Generations

Rakhains are the early settlers of the coastal areas of Bangladesh (Khan, 1999). They started living in this area when there were no modern technologies available. Living in a cyclone prone area gifted them with a unique knowledge to read weather. These traditional skills have been acquired by later generations from distant ancestors and being transmitted from generations to the next through oral tradition.

"This is the age of machines, people have different machines to read weather but we have learnt through experiences when to get ready for cyclones", Male: 54

"When cyclones occurs wind starts from north east and gradually turns towards south east, I have learnt this from my grandfather", Male: 65.

2.6 Generation Gap in Perceiving Cyclone

Almost everyone can anticipate cyclones when there is wind blowing from the east regardless of age and sex but in Mashekhali this knowledge only possessed by males. (Hassan, 2000). There are a lot of other indicators which are used by the Rakhains to predict before cyclones which are not familiar to women and to young males also. Women depend on male members of the family for decisions.

"We are always busy with work so only can anticipate cyclone if wind blows from east": Female: 35

"We did not know how a cyclone looks before Sidr": Female: 32

"No cyclone occurred for many years so people could not imagine something like "Sidr" could happen": Male: 25

"On the day "Sidr" attacked my husband said: today a cyclone may hit do your work quickly and go to cyclone center": Female: 60

"Young people have not seen cyclones of 1960, 1962, 1965, they don't know what happens during cyclone only we elders know": Male: 74

Because there was no big cyclone hit in *kuakata* in recent past people are becoming ignorant about the various indicators by which previous generations used to predict cyclones. And also as many young people have not seen any big cyclone before the "Sidr" so they don't usually have any regard for other indicators of cyclone forming other than the wind from east which they see generally during smaller storms and learnt from elders. But there is little evidence that it is being passed on to younger people, who have not had experienced a really serious disaster before cyclone "Sidr".

The Indigenous techniques which the Rakhains used during cyclones in the early years of their settlements and afterwards, when communication system was not good and relief did not appear long after the cyclone hit are perceived as obsolete by others now a days. This type of indigenous predicting indicators and their uses are regarded as 'old- fashioned' and being superseded by newer scientific system in other coastal chars of Bangladesh too (Howell, 2003). But the validity of their weather predicting knowledge and survival

strategies is evident in their everyday living in a place where cyclone hits are so common for many centuries.

2.7 Rakhains' Belief in their knowledge and Perception about Warning Signals

Rakhains are living in this cyclone prone area for centuries (Khan, 1999) that has enabled them to predict cyclones. They have learnt from the ancestors and they believe in their knowledge. But because cyclone "Sidr" crossed the coast after long years since the last big cyclone hit they did not observe the weather change that closely. But later they realized all the changes in the environment were taking place.

Older people in the study area don't generally believe the cautionary warning signals because there were some signals in the past too which did not come out to be true. So although various organizations like Red Crescent and Heed Bangladesh were disseminating warning signals and pursuing people to go to cyclone centers they were reluctant to go to cyclone center because they believed it will be also like other cautionary signals but when the sea water was about to cross the "wapda" embankment they hurried to safety.

"People were not conscious of the warning signals but when water started to come over the embankments we tried to go to safety": Male, 25

Young people on the other hand although depend on cautionary signals to know about the condition of weather also don't have high regard because of the poor accuracy to predict cyclone hits. On the other hand women of all age do not bother at all about warning signals whether they hear the cautionary signals or not. They depend on the male members who took decision to go to safety, whether in cyclone centers, or to other big strong house or remain at home.

Another important aspect is that most of the Rakhains said:

"warning numbers depend on the gravity of the cyclone and the number lowers as the gravity of the cyclone decrease".

It has been found that the sequential numbering makes confusion. Rakhains believe that warning signal no. 8 suggests a lower intensity of storm than warning signal no. 9 as warning signal no. 9 suggests less intensity than 10 expect but in reality the only change is in wind direction (Dr. Ainun Nishat *cf* Montu R. I. 2008). In many case people do not take seriously signal 8 or the signal less than 8. This confusion makes the loss of property and lives higher.

Section 3

3.1 Impacts of Cyclone "Sidr"

Cyclone "Sidr" inflicted heavy damage on property and infrastructure in up to 30 districts in Bangladesh on 15 November 2007. The destruction affected approximately 8.9 million people, resulting in large-scale humanitarian needs in the country (MoFDM, 2008).

Hazardous process of all types can have primary, secondary, and tertiary effects (Nelson, Stephen A., 2007).

Primary Effects occur as a result of the process itself. For example water damage due to a tidal surge, and collapse of houses due to a cyclone, earthquake, landslide, hurricane, or tornado.

Secondary Effects occur only because a primary effect has caused them. For example, damaged infrastructures and other facilities due to cyclone and tidal surge, fires ignited by earthquakes or volcanic eruptions; disruption of electrical power and water services as a result of an earthquake or flood, and flooding caused by a landslide moving into a lake or river.

Tertiary Effects are long-term effects that are set off as a result of a primary event. These include things like loss of houses caused by a cyclone, permanent changes in the occupation etc.

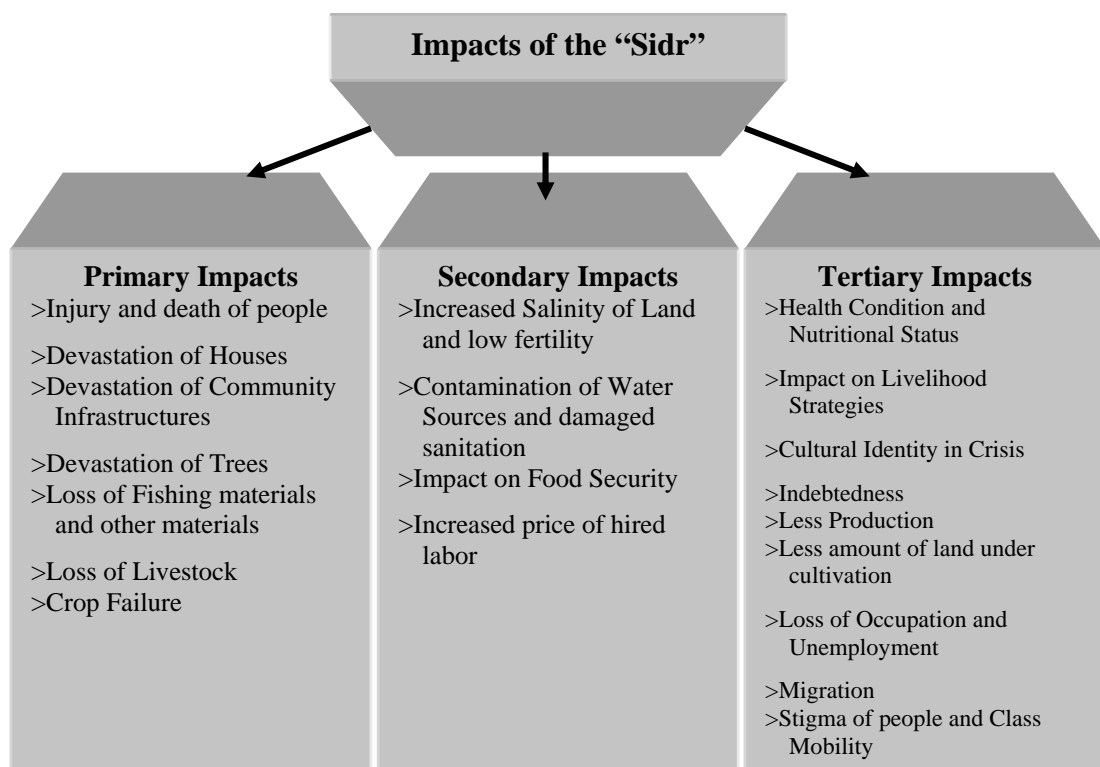
Effects of the “Sidr” will be described following the framework below:

Figure 3.1 (a): Impacts of the “Sidr”
(Fieldwork, 2009)



The following figure 3.1 (b) gives a detail of the primary, secondary, and tertiary impacts of the “Sidr” on the Rakhains:

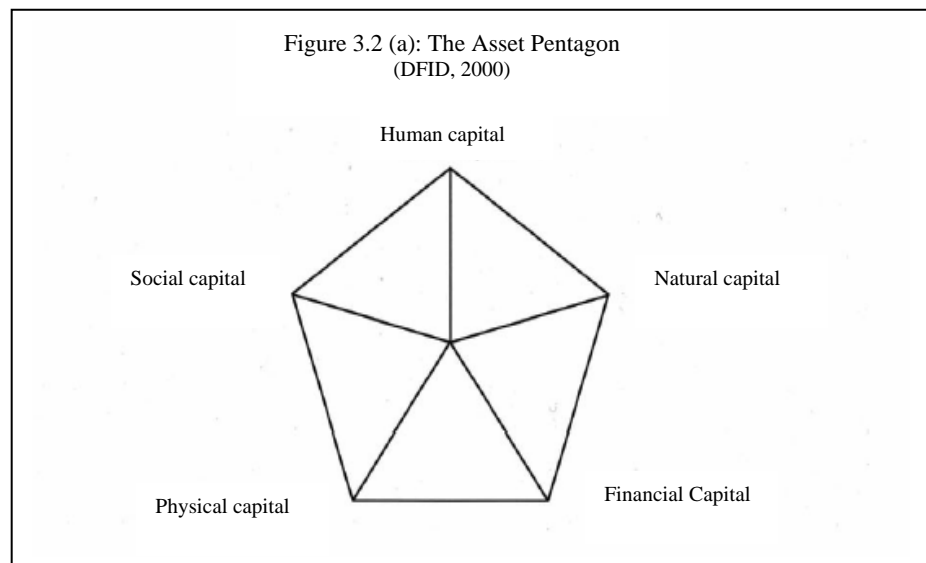
Figure: 3.1 (b): Primary, Secondary and Tertiary Impacts of the “Sidr”
(Fieldwork, 2008)



3.2 Impacts on Livelihood Strategies

A livelihood comprises of the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover form stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resources base (DFID, 2000).

The livelihood assets can be visually expressed as an asset ‘pentagon’ showing the different types of assets and important interrelationships between them. The cyclone “Sidr” had a direct impact upon Rakhains’ assets and livelihood options that are open to them.



Cyclone “Sidr” had directly affected natural, physical, and financial assets of the Rakhains’ as following:

Mostly Rakahins are agriculturalist and fishermen. Cyclone “Sidr” directly affected both. Firstly due to the wind and water surge many fishing boats were destroyed and fishing nets were lost. When cyclone “Sidr” attacked saline water and sand with the surge came and damaged the agricultural fields. And they did not get the only crop of the year (Damage of natural assets). Financial assets were damaged because of damage of houses, because they lost crop and had to buy foods to feed themselves (despite relief), crop failure resulted in loss of investments made in the production process. Also physical assets were directly affected by the cyclone as loss of livestock, equipment such as: tractor, other infrastructures as damaged embankments and roads.

Following Figure 3.2 (b) will illustrate the impacts of the “Sidr” on Rakhains’ livelihood assets:

Figure 3.2 (b): Damage to Livelihood assets

Capital	Impact of the “Sidr”
<i>Human</i>	<ul style="list-style-type: none"> • Injury • Weak physical state • Mental stress
<i>Social</i>	<ul style="list-style-type: none"> • Everyone is affected so none is there to help
<i>Physical</i>	<ul style="list-style-type: none"> • Loss of fishing boats, nets and other materials • Damaged crop land due sand which comes with storm water • Loss of standing crop • Damage of agricultural tools and livestock
<i>Natural</i>	<ul style="list-style-type: none"> • Contamination of water resources • Damage to trees • Loss of soil fertility due to water surge
<i>Financial</i>	<ul style="list-style-type: none"> • Damage of houses, and other materials • Had to spend money on treatment • To payback loan • To buy foods • Loss of investment in agriculture, fishing, and other livelihood strategies

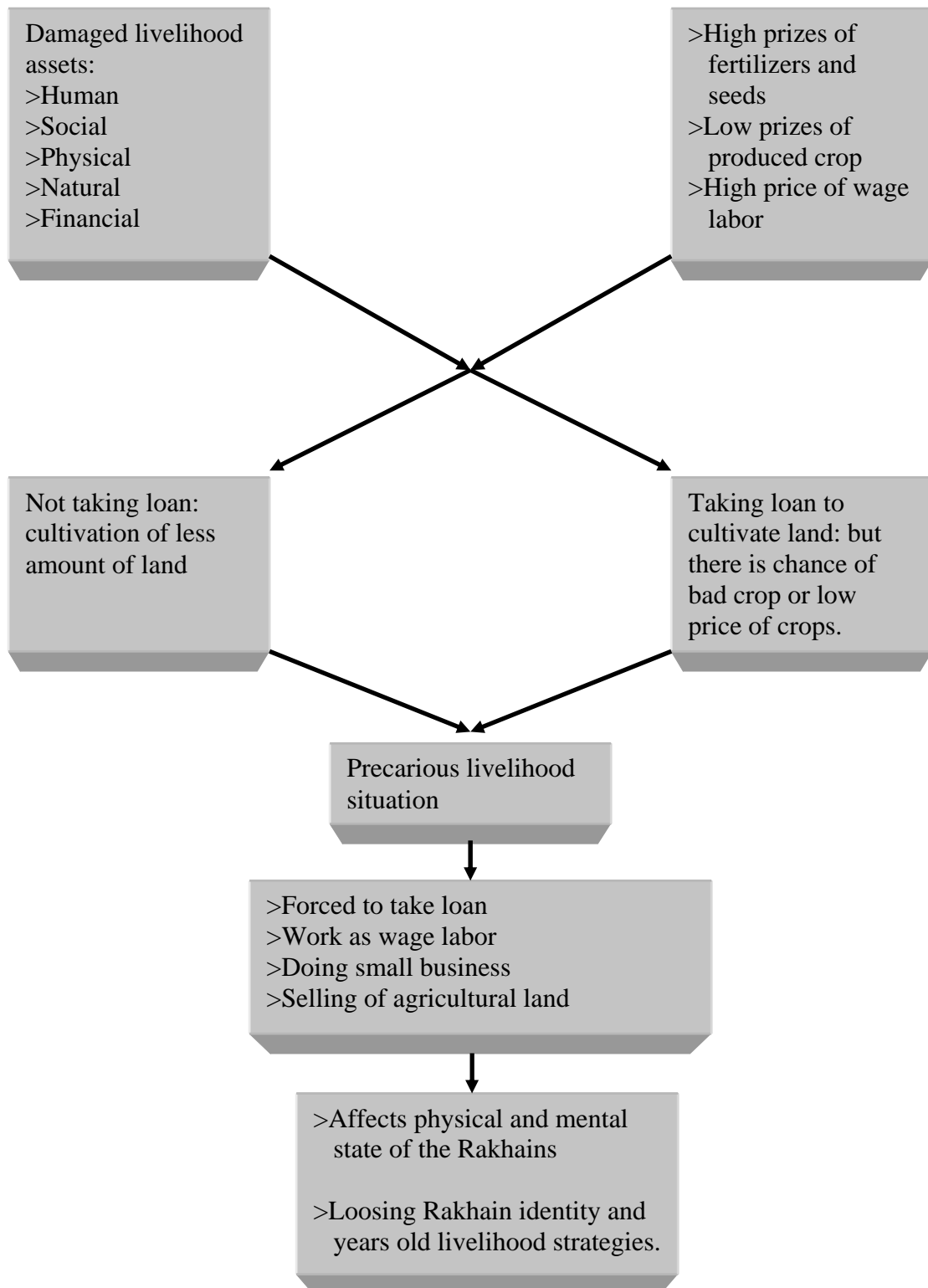
(Fieldwork, 2008)

But this damage are not separate they are interrelated and making the Rakhains more vulnerable in terms of their livelihoods day by day: for example at first due to the “Sidr” they first lost their crop and fertility of land (natural assets), also physical equipments for production, and were in financial crisis due to severe loss of properties. This was the immediate situation but after more than one year this situation is becoming worse instead of improving.

Firstly due to saline water next crop was not good. But the rate of fertilizers and other important materials for production were costly but the rate of rice got down so their financial assets were damaged again. After Cyclone “Sidr” human labor for cultivation becomes expensive because due to relief the poor people started to raise their daily working rate but the Rakhain farmers needed human labor for cultivation. Now they are in short of both financial and human capital and there was damaged natural capital already. Their social capital was also damaged because of the cyclone “Sidr” because everyone was affected by the cyclone. They can get loan from various NGOs which started micro credit program after the cyclone. But they don’t want to get loan because due to the higher working rate of the laborer and fertilizers and lack of good seeds (due to the cyclone) they feel its risky to cultivate, they might not get their investment back so they are reluctant not to cultivate lands.

And they are also in danger of loosing lands as they took loans through mortgages they will start loosing lands as a result of not being able to return installments on due time. After the cyclone “Sidr” their remains a precarious situation which is affecting Rakhains’ livelihood severely. The whole process is described in the following figure 3.2 (c):

Figure: 3.2 (c): Process of Change among the Rakhains' in livelihood Strategies and Identity after the "Sidr"



(Fieldwork, 2008)

Box 3
Precarious livelihood

Chan Than, Male: 40; lives in the *Monu khe para* of Taltali. He did not see any big cyclones before the “Sidr”. He said cyclone had devastating effect on his livelihood strategy. He is an agriculturist and also does fish farming. He said cyclone the “Sidr” pushed him into a downward spiral of poverty. Firstly when cyclone the “Sidr” attacked saline water and sand with the tidal surge damaged the agricultural fields. And he did not get the only crop of the year. Financial assets were damaged because of damage of houses, because he lost crop and had to buy foods to feed themselves crop failure resulted in loss of investment made in the production process. But this damage are not separate they are interrelated and making him more vulnerable in terms of his livelihood day by day: for example at first due to the cyclone “sidr” he first lost their crop and fertility of land , also physical equipments for production, and were in financial crisis due to severe loss of properties. This was the immediate situation but after more than one year this situation is becoming worse instead of improving. Firstly due to saline water next crop was not good. But the rate of fertilizers and other important materials for production were costly but the rate of rice got down so his financial assets were damaged again. After the cyclone “Sidr” human labor for cultivation become expensive because due to relief the poor people started to raise their daily working rate but the Rakhain farmers like him needed human labor for cultivation. Now he is in short of both financial and human capital and there was damaged natural capital already. His social capital was also damaged because of the cyclone “Sidr” as everyone was affected by the cyclone. He like many others can get loan from various NGOs which started micro credit program after the cyclone. But he don’t want to get loan because due to the higher working rate of the laborer and fertilizers and lack of good seeds (due to the cyclone) he feels its risky to cultivate, he might not get his investment back so he is reluctant not to cultivate lands. And now he is also in danger of loosing lands as he took loans through mortgages and will start loosing lands as a result of not being able to return installments on due time. He says after the cyclone “Sidr” there remains a precarious situation which affecting Rakhain livelihoods severely.

Source: Case Study in *Kuakata*, 2008

3.3 Cultural Identity in Crisis

Traditionally Rakhains have their own distinctive housing pattern which protects them from all types of natural and environmental hazards. Their special type of housing structure helps them facing flood and cyclones and also performing economic and professional activities. But after cyclone “Sidr” which damaged most of the houses. They were provided houses by different NGOs. But the NGOs did not consider their traditional housing tradition while constructing new houses for them. The houses that were provided are mostly like Bengali tradition.

The Rakhain houses constitute four principal clusters with three sub-clusters. The four principal clusters, ordering from entrance to kitchen, are:

1. *chowa*: Drawing room
2. *produng*: prayer room
3. *angthay*: bed room only for young girl or newly married couple
4. *negphoi*: master bed where generally parents of the family live.

The other clusters of Rakhain house are:

1. *Khuikkadon*: A little place for keeping shoes.
2. *Berenda*: a room for drying cloths and gossiping place for leisure time which is connected with the *chowa*.
3. *taamusake*: kitchen that is usually connected with the Nagphoi.

Generally, the toilets are kept outside the main premise, which is called *Chepontha*.

But the newly built Rakhain houses don't possess these special features. The new houses are built on a mud base not on a high platform of wooden logs. In the inside also there is no such distinction between different parts. The houses have got two parts and a dining place.

And one more thing to be noted, according to Rakhain tradition all children have equal right to their parents wealth and assets. But after cyclone “Sidr” mostly the houses were sanctioned on women's name.

Photo 6.1.3.3: Traditional Rkashain House on the Right and Newly Built House on the Left



3.4 Rakhains' Struggle to Cope with the Vulnerabilities Created by the “Sidr”

The vulnerabilities and capacities of the Rakhains are to cope with the existing vulnerabilities after the Sidr e following Figure 3.4:

Figure 3.4: Vulnerabilities of the Rakhains Due to Cyclone “Sidr”

	Vulnerabilities	Capacities
Physical/material	Damaged embankments	Govt. started to rebuild in some areas
	Damaged infrastructures	Govt. started to rebuild in some areas
	Land Erosion	No specific measures taken yet
	Uprooted Trees	Planting new trees
	Salinity of land	Specific varieties of crop cultivation
	High rate of hired labor	Working on land by themselves, less amount of land under production
	Crop failure	Loan from various NGOs, land mortgage, land selling
	Indebtedness	Selling land or taking more loans from various NGOs
	Unemployment	No specific capacities
	New type of housing	Adjusting to the new type, losing their own cultural identity
Social/ organizational	Ethnic discrimination	Strong group cohesiveness
Motivational/ attitudinal	The thinking that cyclone will strike again	Building cyclone resistant houses and belief in their ability to survive cyclones in the future.

(Fieldwork, 2008)

Section 04

4.1 Recommendation

To reduce the damages from cyclone, counter measures are in practice. But the interrelationships of all the problems related to cyclone disaster mitigation are so complex that needs an integrated approach. One of the objectives of this paper is to make suggestions to increase the effectiveness of the counter measures in the future, incorporating the indigenous knowledge of cyclone prediction and disaster management.

To mitigate the sufferings of the people from the devastation of cyclone and tidal surge several approaches such as: (a) Cyclone Forecasting and warning, (b) Cyclone Shelters, (c) Post Cyclone Relief and Rehabilitation are currently in practice in Bangladesh.

On the basis of the findings of this research the following recommendations for taking structural and non-structural measures are made, which can be utilized to reduce cyclone damages:

Forecasting and Warning System

One of the most effective countermeasures for the reduction of cyclone is the establishment of early warning system. By predicting the possible occurrence of cyclone its destructiveness may be minimized. In Bangladesh the cyclone forecast is generally the responsibility of Meteorological Department. The forecast is transmitted to the radio and television station and the Warning is spread through a comprehensive cyclone preparedness programme (CPP). This programme is jointly operated by the Bangladesh Red Crescent Society and the Ministry of Relief and Rehabilitation.

The cyclone warning system, which is prevailing in Bangladesh, based on signal numbers up to 10. This system is cumbersome. It has been found that nearly all the Rakhain people in the study area had heard the cyclone warning at least 8-10 hours before the cyclone of November 15, 2007 struck. But, very few responded in any way before escaping was difficult because of cyclonic winds or the water was upon them. People had no clear idea of the meaning of the signals. For those who have experienced previous cyclone in the area, previous signal 10 storm warnings were associated with some flooding at a level not much above normal so special behavior was not required. The ability to motivate people to respond to a once in a decade event is a major challenge. The group who decided to stay at home was at the highest risk of deaths and injuries from the cyclone, the factors responsible are: no information or late information regarding the impending cyclone, relative distance of the shelters from home and lack of cyclone experiences. More research is needed to establish all the reasons for ignoring warning, which may relate to religious and traditional beliefs but sometimes are for practical reasons such as fear of robbery.

The warning system on the basis of forecast should be disseminated in a language that can be easily understood by the general people. Because it is commonly believed that public in general does not respond to warning signals during cyclones and do little to prepare themselves in advance. If experts want to change the way people prepare for natural hazards they must make a greater effort to understand community perceptions and expectations, so as to be able to target different sectors on the community with appropriate information.

Cyclone Shelters

To prevent or mitigate the loss of human lives and probably livestock and poultry, the cyclone shelters can play the most vital role probably more than any other means. After the cyclone of 1971 a number of cyclone shelters were constructed in the coastal areas. These are not sufficient in number and are not properly designed and located (although nowadays situation is improving). But many people could not use these shelters because the access roads were flooded.

In the study area along with usual cyclone centers many other pueblo buildings (*e.g.* schools, clinics, mosques) and private brick built homes served to shelter people during the cyclone. But the Rakhain people face problems in these too as for ethnic discrimination they could not take shelter along with the Bengali Muslims in many

cyclone centers, private cyclone resistant houses and mosques. It has always been a problem for the Rakhains and because of these they sometimes exclude cyclone centers as an option for safety.

Drinking Water and Sanitation

Similar to other infrastructures the cyclone normally causes serious damages to the water supply and sanitation system. The tube-wells are broken, partially damaged and becomes unusable due to submergence. Ponds have been contaminated by the onrush of saline water and sludge. And the Rakhains traditionally use pond water for drinking. Therefore, after the cyclone there is a serious crisis of drinking water and an outbreak of waterborne diseases is very common. People in the affected areas use water from this contaminated pond indiscriminately. As a result, they have become vulnerable to diarrhea and other water borne diseases. Therefore, post cyclone diarrhea and other common water borne diseases are the major causes of death casualties associated with the cyclone.

A large number of casualties occur from the post cyclone water borne diseases. To mitigate the post cyclone sufferings and loss of lives the water and sanitation sector should be given proper care. The tube-well installation should be made in such a place and elevation that these will not go underwater during the cyclone and can be recovered immediately after the cyclone. A provision should be made to store the drinking water on the basis of early cyclone forecasting and warning for use during *post* cyclone period. Ponds should be protected by raising the embankment of the ponds at the level of storm surge.

Relief and Rehabilitation

Extensive relief and rehabilitation programme from the part of Government, NGO's and International Organization has been launched after the November 15, 2007 cyclone. But initially the programme suffered from poor transport and communication due to severe damages of roads and telecommunication system. The transport system in the coastal areas should be planned in such a way so that during the storm surges the system faces minimum damages and can help in breaking the impact of water flow during the tidal surge.

Sufficient amount of relief material came into the locality from various government and non-government organizations. But there were lacks in the distribution processes. For instance: all the rehabilitation programs were launched to help the extreme poor but the people (most of the Rakhains are agriculturalists and some are involved in other activities) who lost the most were out of focus. If it is said in their voice it will be heard as follows: *the people who can ask for help got help, those who had nothing gained more, those who does not lose anything but gain everything wants more and more cyclones on the contrary the people who had something lost everything and got nothing and now has nothing to live upon and they are always out of focus.* Thus Bangladesh needs a better plan to incorporate all the sufferers from cyclones under a well managed relief and rehabilitation programme. And the higher officials should take into account two more facts in relief distribution and programming: (a) when there is lot to give through relief to the sufferers it has to be properly monitored as it was found that local NGOs were accused of taking bribes in distributing relief products especially in case of house construction because the houses were of around 50-60 thousand taka. and they took some

money in return of sanctioning the houses; (b) the other this which need to be taken into account is that all the ethnic communities have their traditional cultural heritage and this can be evident from the special structure of houses but after the cyclone hit November 15, 2007 the Rakhains were provided with houses which are not as their traditional houses and were more like the Bengali Muslim houses. So to keep protecting the cultural tradition of the Rakhain the government needs to take proper initiatives.

4.2 Concluding Remarks

Rakhains' perception, prediction and survival strategies were area of interest in this paper. The ways in which the natural disasters (cyclones) are perceived, predicted and responded are part of their unique social, economic and cultural situations in which the Rakhains find themselves. Rakhains take all aspects of their social, cultural and environmental circumstances into account as well as a series of risk-related factors in responding to cyclones. And their perceptions have geographical, social, economic, cultural and factors such as the magnitude of the consequences of the hazardous event, the cost and availability of alternatives, the degree of the perceived control over the consequences, the degree of personal exposure and other social costs and benefits. Thus it is important to explore the rationale of their actions for effective disaster management planning and programming input at local and national level.

Annex - 1

Selection of the Study Area

There were three main predefined priorities: (a) Indigenous ethnic communities (b) coastal region; and (c) impact of the “Sidr”. Keeping these in context, on the basis of secondary information *Rakhain* of the Patuakhali district was selected for intensive in-depth investigation. The selection of the study was done following the information below:

- a. This area was having the experiences of cyclones repeatedly for long time. Almost every cyclone that passes Bangladesh damages the selected area.
- b. Among the indigenous ethnic communities of Bangladesh only the Rakhains live in the coastal region with a considerable number.
- c. The Rakhains are living in the selected area since 1789 (Khan, A. M, 1999:50) thus, it is assumed that facing numerous cyclones they have gathered extended knowledge about cyclone prediction and survival strategies.
- d. The selected study site were almost on the coast which made it vulnerable for living and the Rakhains have maintained their unique lifestyle to cope with cyclones and determined indigenous survival strategies.
- e. The Rakhains are also dependent on the sea for their living, being fishermen for long and this made them more experienced in reading sea behavior before and during cyclones.

Method of data collection

The study mostly relied upon qualitative data and information. In order to achieve the objectives of the study, data have been collected from both primary and secondary sources. Primary data have been collected through field visits which are mostly qualitative. Secondary data are obtained from reports, journals, research papers, and book. Information on relevant issues is collected from websites available on the internet.

Relevant information on the concerned issue has been collected through in-depth, key informant interviews and group discussions with the local people were also carried out. Primary data and information collected through questionnaire have been summarized and analyzed for the purpose of the study.

Method of data processing

Qualitative data collected from in-depth interviews have been analyzed to identify the indigenous knowledge used by the Rakhains in predicting the occurrences of cyclone and also to survive the post disaster phase before any institutional help arrives. Associated case studies were incorporated to describe survival strategies and the impact of cyclone “Sidr”.

Annex –2

Interview Schedule

- ❖ Socio-economic condition of the Rakhains
- ❖ Rakhains perception of cyclone
- ❖ Perception about the causes of the cyclone “Sidr”
- ❖ Predicting indicators used by the Rakhains to predict cyclone formation
- ❖ Indicators used by the Rakhains to predict the formation of the cyclone “Sidr”
- ❖ Survival Strategies at the pace and face of a cyclone
 - Strategies to protect life
 - Strategies to protect assets
 - Strategies to survive the impact of cyclones
- ❖ Sectoral impact of the “Sidr” on the Rakhains
- ❖ Vulnerabilities created due to cyclone “Sidr”
- ❖ Rakhains’ perception of warning signals

References

- Department for International Development (DFID) (2000) *Sustainable Livelihoods Guidance Sheets*, London: DFID
- Hassan, S. ([2000] 2002) 'Indigenous Disaster Management Culture: A Comparative Study between Cyclone Affected People of Bangladesh', *Journal of Human Sciences*, Vol.26. No. 3. 2000: 251-263
- Hassan, S. (2004) 'Seminole and Hurricane: A Hidden Transcript of Knowledge', *Social Science Review*, The Dhaka University Studies, Part- D, Vol.21, No. 1, June 2004: 155-158
- Hossain, M.S. (2001) 'Biological Aspects of the Coastal and Marine Environment of Bangladesh', *Ocean & Coastal Management* 44, pp.261-282
- Howell, P. (2001) 'Knowledge is Power? Obstacles to Disaster Preparedness on the coastal chars of Bangladesh', *Humanitarian Exchange*, Vol. 18, Humanitarian Practice Network, London
- Howell, P. (2003) *Indigenous Early Warning Indicators of Cyclones: Potential Application in Coastal Bangladesh*, London: Benfield Hazard Research Centre
- Khan, A. M. (1999) *The Maghs: A Buddhist Community in Bangladesh*, Dhaka: The University Press Limited
- Ministry of Food and Disaster Management (MoFDM) (2008) *Super Cyclone Sidr 2007: Impacts and Strategies for Interventions*, Bangladesh: Government of People's Republic of Bangladesh
- Montu, R. I. (2008) *Sidr: Biponno Upokul'er Biborno Rup* (Published in Bangla), Bangladesh: BARCIK
- Mustafa, M. M. (2000) 'Towards an Understanding of Indigenous Knowledge' in P. Sillitoe (ed.) *Indigenous Knowledge Development in Bangladesh: Present and Future*, Dhaka: The University Press Limited.
- Nelson, S. A. (2007) *Natural Disasters & Assessing Hazards and Risk*, Tulane University, (Online document) Available at HTTP: [http:// www . tulane .edu /~sanelson/geol204/introduction.pdf](http://www.tulane.edu/~sanelson/geol204/introduction.pdf)
- Schmuck-Widmann, H. (2000) 'An Act of Allah: Religious Explanations for floods in Bangladesh as Survival strategy', *International Journal of Mass Emergencies and Disasters* 18 (1): 85-95