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Economic Analysis of Vulnerability and Capacity: A Study of Water Logging, Bhobodah, Keshabpur, Jessore

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Abstract

Global environmental change and sustainability science increasingly recognize the need to address the consequences of changes taking place in the structure and function of the biosphere. These changes raise questions such as: Who and what are vulnerable to the multiple environmental changes underway, and where? This recognition requires revisions and enlargements in the basic design of vulnerability assessments, including the capacity to treat coupled human–environment systems and those linkages within and without the systems that affect their vulnerability. A vulnerability framework for the assessment of coupled human–environment systems is presented. (Turner. et.al).This study is related with economic analysis of vulnerability and capacity contextually Jessore's village.

Keywords: Economic Analysis, Vulnerability, Capacity, Water Logging, Jessore.

1. Introduction

Due to perpetual siltation in the rivers and as a consequence of unplanned development interventions on the river system, long-lasting water-logging in the human settlements is taking place in Keshabpur resulting in considerable loss and damage to dwelling houses, standing crops, shrimp farms, roads, educational institutions. The floods and prolonged water-logging have caused significant displacement presenting humanitarian challenges in safe water supply, sanitation, and shelter and food security.

Water logging at Bhobodah like BilDakatia as a matter of concern since about 25 to 30 years has become a national problem. The expansion and intensity of that water logging has exceeded of all previous records this year. Concerning on this matter if there would be taken any effective and permanent initiatives by the government it will be very difficult to live in the affected locality. A famine like condition is existing among the people. In addition with this starvation and unemployment problems create an unbearable condition. Cultivation of BORO, IRRI and other crops has been hindered. Considering this condition, people of that locality raise their voice for declaration as a disaster prone area and to provide relief, taking proper steps for rehabilitation to the concerned authority.

1.1 Water Logging Areas and Losses

Catchments of the Hari-Mukteswary and Aparbhaddra- Harihar rivers are generally considered as Bhabodah area. In terms of administrative consideration water logging of Keshabpur, Monirampur, Abhoynagar, sadarupazillas of

Jessore district and Dumuriaupazilla of Khulna district are of seized areas.

Table-1: Affected Sector: Water Logging Areas and Losses

No. of Affected Upazilla	No. of Affected Union	Affected Land area	Affected People	Migrant Family	Affected Sector
05	41	77346 hectares	708035	1003	• Households • Health & sanitation • Crops fields • Fishing projects • Roads & constructions • Educational & religious institutions • Socio-economic conditions

1.2 Reasons of Water Logging

In the decade of 60's, by the prevalent government established polder system which is known as wapda to protect salinity and sudden up surge from the rivers for producing huge food in the coastal areas .the locality , livelihood households , bils and cannels are surrounded by the embankment in this process . and many sluice gates were built to turn out saline water of the bils and cannels . Agricultural revaluation such as bumper production of agriculture , one time harvesting has found for instance . But the impact of this process water logging is followed within 10 to 15 years of its establishment because of silt deposition .

Before establishment of polder system , tide driven silt disseminated on the land area of bil and silt free water discharged by low laying wet lands of bil became up rise by siltation on the other hand navigation problem did not found in the rivers . But establishing polder silt oriented water did not disseminate on the field as a result silt depositions became started in the river . Successively silt deposition made the river comparatively high from the inter related cannel or bil and oppressed to discharge rainfall water and found water logging. Silt deposition ratio is high in the terminal point of the river. About 5 to 7 km of river is going into rise 1 miter becoming lost its navigation and unnatural death by siltation. Mean while the rivers of Hamkur , LoarVadra, Aprar Salta, Burivadra have become go into unnatural death and the condition of other rivers is crucial .As a result about 12-15 thousand acears of land submerged by water logging .

2. Research Methodology

The methodology for our study involved the implementation of vulnerability and capacity analyse through while information from previous studies conducted in these villages was used to profile the characteristics of the area. Community groups as well as *people of different sectors* participated in thisprocess. The problems and issues faced by each villager as a whole as well as those faced by villagers individually were discussed. Scoring and ranking methods were usedto identifying the most severe problems.

Participants were asked to priorities the problems that affected their village as a whole rather than those faced at

an individual or family level. The strategy we adopted assumes working with households, communities and other local entities is an effective mechanism for identifying those factors that preventor enables responses to events that could cause disaster. Without such consultations the problems faced by a small group of people or households within a community will be overlooked. In-depth discussions on the problems identified followed and social maps were used to analyse the causes and effects of each problem. This process is outlined in Figure 1& 2.

Step-1: Identifying potential Threats:

a). Problem Identification

b). Objective Elaboration

c). Questionnaire and FGD

d). Secondary data accumulation

Step-2: Identifying Vulnerabilities:

a). Focus Group Discussion FGD

b). Key Informant Interview

c). Vulnerability Assessment

Step-3: Assessing people's capacities to prevent or cope with Threats:

a). Exposure, Sensitivity, Adaptation capacity

b). Key suggestion generation in line to adaptation & mitigation

c). Sharing and feedback collection

d). Secondary data accumulation

e). Data Entry and Analysis

f). Key suggestion generation in line to adaptation & mitigation

g). Draft reporting

h). Final reporting

Vulnerability

• A set of conditions and processes resulting from physical, social, economic and environmental factors that increase the susceptibility of a community to the impact of hazards.

• Three dimensions: economic, social and ecological.

Regional vulnerability = damage potential + coping capacity

Vulnerability: Economic dimension

• Economic damage potential, which can be understood as anything concrete that affects the economy of a region and can be damaged by a hazard.

• Represents the risk to production, distribution and consumption.

All of the steps are accomplished by 2 FGDs, Interviews and Informant Questioners.

Source:	
FGD-1:	**15 persons**
FGD-2:	**15 persons**
Informal Interview:	**10 persons**
Informant Questioners:	**10 persons**
Total Participants:	**50 persons**
Male:	**30**
Female:	**20**

Study Location: Bharat Bhaina, Dohury, Kopalia
Upazilla: Keshabpur
District: Jessor

3. Data Analysis

Table: 2: People's perceptions on sensitivity of major sector/ activity associated with induced water stress and vulnerability by 2 FGDs, Interviews and Informant Questioners

Affected Sector/Activity Due To Water Stress	Response in Percentage (%) Over Study Area				
	FGD-1 (15 persons)	FGD-2 (15 persons)	Interview (10 persons)	Questioners (10 persons)	Total Average %
Impact on drinking water supply	**90**	**85**	**87**	**90**	**88.00**
Impact on Domestic water use	**85**	**91**	**83**	**85**	**86.00**
Standard of living	**75**	**85**	**80**	**85**	**81.25**
Cultivation	**100**	**95**	**87**	**93**	**93.75**
Navigation	**42**	**30**	**15**	**25**	**28**
Shrimp culture	**85**	**95**	**90**	**85**	**88.75**
Fishing	**75**	**85**	**80**	**85**	**81.25**
Women's home stead vegetable gardening	**80**	**83**	**78**	**75**	**79.00**
Rearing of livestock and poultry	**82**	**87**	**85**	**84**	**84.50**
Impact on water quality	**76**	**73**	**68**	**72**	**72.25**
Impact on water dependent ecosystem	**65**	**64**	**71**	**68**	**67.00**
Impact on water related diseases	**87**	**78**	**86**	**82**	**83.25**
Impact on communication	**78**	**76**	**86**	**81**	**80.25**
Impact on hygienic condition	**67**	**58**	**76**	**67**	**67.00**
Impact on health & sanitation	**67**	**72**	**82**	**75**	**74.00**
Impact on education	**75**	**78**	**76**	**77**	**76.50**

Impact on social strength	**67**	**63**	**60**	**65**	**63.75**
Impact on social economy	**78**	**76**	**83**	**78**	**78.75**
Impact on households (clay made/hut)	**87**	**90**	**85**	**88**	**87.50**
Impact on educational institutions	**56**	**65**	**70**	**60**	**62.75**
Migration trend	**45**	**52**	**47**	**45**	**47.25**
Salinity intrusion	**95**	**87**	**93**	**90**	**91.25**

3.1 Impact of Water Logging Induced Disaster on Livelihood Capital

The study didn't use complex scientific data to access water logging variability and change. The study was more focused on to gain people's valuable perception and tried to link that withexisting literature and scientific statements. Table 1 shows the people's perception on impact on water logging.

It was quite interesting to see that the most noticeablechange is the salinity intrusion (91.25%) and response was higher in comparingto other two study areas. About 94% respondents identified that there was increased intensity of water logging and most of the cultivable lands are inundated which causing problems to cultivation. Almost 93.4% respondents identified that water logging creates sever impact on natural resources and hamper income generating for along duration. Even, women's other gender differentiated roles like water and fuel woodcollection have become limited due to the onset of inundation events. They identified salinity intrusion as the second most hazardous incident. They further pointed out that salinity intrusion is not disaster event but it is an on setting gradual event due to long time water logging.

Table : 3. Possible adaptive measures to reduce climate change impacts on water resources

Adaptive measure related to water logging	**Response in percentage (%) over study area**				
	FGD-1 (15 persons)	**FGD-2 (15 persons)**	**Interview (10 persons)**	**Questioners (10 persons)**	**Total Average %**
Tidal River Management (TRM) establishment	**100**	**95**	**98**	**100**	**98.25**
Utilization in domestic activity	**89**	**96**	**98**	**88**	**92.75**
Digging of protected pond to preserve safety water	**100**	**97**	**97**	**98**	**98.00**
Change in traditional irrigation practice	**100**	**97**	**97**	**98**	**98.00**
Reduce shrimp cultivation	**87**	**78**	**77**	**79**	**80.25**
Reduce embankment	**100**	**98**	**90**	**96**	**96.00**
Improving drainage system installation to prevent water logging	**78**	**87**	**78**	**76**	**79.75**
Plantation of saline tolerant tree/paddy species	**98**	**96**	**94**	**95**	**95.75**
Plantation of water logging tolerant tree/paddy species	**96**	**96**	**98**	**92**	**95.50**

Reduce relief dependency	**86**	**80**	**65**	**78**	**77.25**
Divert in other occupation	**78**	**74**	**62**	**63**	**69.25**
Rebuilt households	**78**	**86**	**86**	**87**	**84.25**

Table 3 shows possible adaptive measures to water logging impacts on waterresources. Adaptive measures along with people's coping strategy could work in parallel toenhance their resilience and adaptive capacity to the water resources with time andopportunity that might benefit the resource and resource dependent community as a whole.They added that river erosion further builds up sand deposition inthe river bed and floodplain. Gradual salinityintrusion during summer season and abrupt salinity infestation due to storm surge and tidalsurge associated water logging is also critical phenomenon in the area. Besides these,increasing trend in temperature together with erratic rainfall is substantially damaging waterresource in the study area. To fully understand the impacts of climate change on waterresource, the socio-economic dimension needs to be analyzed parallel with environmentaland physical scenario.

4. Findings of the Study

Table-4: shows vulnerable condition and coping capacity of the people of that area.

	Vulnerabilities	Capacities
Physical/material	- About 87.50% of households mainly clay made affected by logging water - Around 77346 hectors of agricultural land is waterlogged - About 76% educational cntres do not function for using as shelter home and causes of inundation - About 90% people do not get pure drinking water - Hygiene and sanitation condition are severely affected - About 84% of people affected by different diseases - About 88.75% of shrimp cultivation projects damaged	- Establishment of TRM project by which about 99% people will be benefitted - About 90% of cultivable land is possible to use by using TRM - Govt. has taken initiatives to improve or repair roads and constructions - Govt. authority provide Saline and flood tolerant trees and paddy seeds - knowledge of building households increased - Diverting trend to other occupation
Social/organizational What are the relation and organization among people?	- 47% of households have members who migrate out, migration of youths is increasing - Social strength has been broken	- Decentralised roles and responsibilities in group work - Youth group strengthening - Building physical and moral strength to face rising condition
Motivational/attitudinal How does the community views its ability to create change?	-Water logging makes our lives difficult but we cannot get enough external support - We have got several assurance but have not executed yet - We have to depend on government authority for relief.	- Readiness to work together - Demand for new agriculture techniques - Participation in community meetings - Willingness to obtain new information - Readiness to contribute to resources

4.1 Loss or Damage Assessment

By applying the following measure we would able to understand the damage and loss per year for the required area.

$$AD = TD_{Ag} + TD_{Infra} + TD_{Ind} + TD_{Edu} + TD_{H}$$

Where

TD_{Ag} = Total Damage for Agriculture Sector
TD_{Infra} = Total Damage for Infrastructure Sector
TD_{Ind} = Total Damage for Industry Sector
TD_{Edu} = Total Damage for Education Sector
TD_{H} = Total Damage for Health Sector

$$TD_{Ag} = TD_{C} + TD_{F} + TD_{L}$$

Where

TD_{C} = Total Damage for Crop Sector
TD_{F} = Total Damage for Fisheries Sector
TD_{L} = Total Damage for Livestock Sector

Crop sub-sector

$$TDc = \sum_{i} (Q_i * P_i) + \sum D_{i'}$$

$$i = 1, \cdots, n \quad i' = 1, \cdots, n'$$

Where,

Q_i - Quantity of crop damage for i-th crop in metric ton
P_i - Wholesale price of the i-th damaged crop per metric ton in Taka
Di' - Lump sum damage estimate for i' th crop in Taka (crops for which data is available in groups and loss of seedbeds)

Fisheries sub-sector

$$TD_F = \sum D_j$$

$$j = 1, \cdots, m$$

Where,

D_j Lump sum damage for fisheries in j-th region (which includes loss of fishes, fingerlings and infrastructure)

Irrigation Canal

$$TD_{IC} = LxC$$

L - Length of irrigation canal damaged, km
C Cost of repair of canal in Taka, per km

Embankment

$$TD_{EM} = LxC$$

L - Length of embankment damaged, km
C Cost of repair of damaged embankment in Taka, per km

Residential Sector

$$TD_{RS} = \sum_{i} \sum_{j} H_{ij} * C_j + \sum \sum H_{ij} * I_i$$

where, $i = 1, \cdots, n$; $j = 1, \cdots, m$

H_{ij} Number of Houses of i-th type in j-th region
C_j Cost of Repair of per Houses of i-th Type
I_i Cost of inventory loss of per house of i-th Type

Estimating TD $_{Edu}$

The damage to Education sector TD_{Edu} has been estimated by

$$TD_{Edu} = \sum_i N_i * C_i$$

where, $i = 1, \cdots, n$;

N_i Number of damaged educational institute of ith category

C_i Cost of repair in Taka of damaged educational institute of ith category

Estimating TD_{HS}

The damage to Health sector TD_{HS} has been estimated by

$$TD_{HS} = C\sum_j H_i + \sum_i \sum_j P_{ij} * T_j$$

H_i Number of Damages of Health Centres in j-th region

C Cost of repair per centre

P_{ij} Number of population affected by i-th disease in j-th region

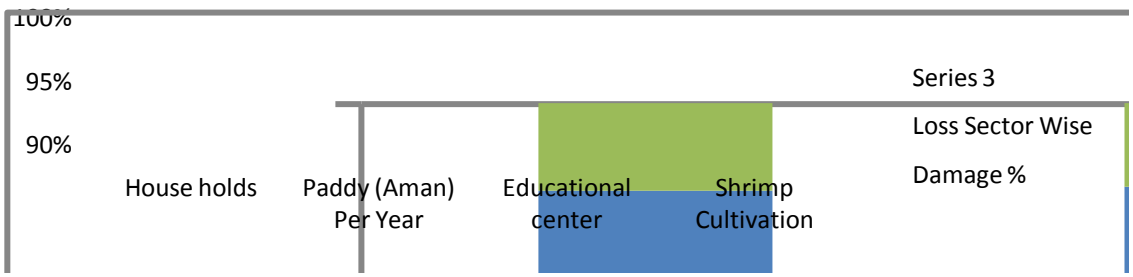
T_i Cost of Treatment per Person of i-th disease

4.2 Loss Assessment per year (Sector Wise)

According to the above mentioned data (Table: 5) in addition with the providing formula the following loss will be observed per year.

Table-5: Loss Assessment per year (Sector Wise)

Affected Sectors	Total Number	Total Cost Tk. (App.)	Estimated Damage (%)	Estimated Number	Estimated Cost (Tk.)	Lum sum damage Cost	Total loss Tk.
Households (Clay made)	12,000	30,000 tk. * 12,000 =36,00,00,000	87.50	10,500	10,500* 30,000= 31,50,00,000	1,00,00,000 Tk.	32,50,00,000
Crop (Paddy) Arable land Estimated only for (Aman Paddy)	85,000 ha	85,000* 14,000 = 119,00,00,000	93	77346 ha	108,28,44,000 Tk. Amount of Production = 10,200 mt Total price= 10,200*25,000 = 25,50,00,000 Tk.	50,00,000 Tk.	26.00,00,000
Educational Center	350	350*20,00,000 = 70,00,00,000Tk.	76	266	266 * 20,00,000 = 53,20,00,000 Tk.	80,00,00,000 Tk.	54,00,00,000 Tk.
Shrimp Cultivation	15,000 accr.	15,000 * 1,00,000 = 150,00,00,000	88.75	1,330	1330* 100000 = 13,30,00,000 Tk.	70,00,000Tk.	14,00,000Tk.
					Total loss per year = 227,26,00,000 Tk.		



Fiqure-1: Loss Sector Wise Damage

Conclusion

Before establishment of polder system , tide driven silt disseminated on the land area of bil and silt free water discharged by low laying wet lands of bil became up rise by siltation on the other hand navigation problem did not found in the rivers . But establishing polder silt oriented water did not disseminate on the field as a result silt depositions became started in the river . Successively silt deposition made the river comparatively high from the inter related cannel or bil and oppressed to discharge rainfall water and found water logging. Silt deposition ratio is high in the terminal point of the river. About 5 to 7 km of river is going into rise 1 miter becoming lost its navigation and unnatural death by siltation. Mean while the rivers of Hamkur , LoarVadra, Aprar Salta, Burivadra have become go into unnatural death and the condition of other rivers is crucial .As a result about 12-15 thousand acears of land submerged by water logging and losses about 227,26,00,000 Tk per year .

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