

The Alternative Thinking to Reduce the Risk of Crops Production in Bangladesh: Context of PPRR Framework

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Abstract:

This study tried to explore the challenging disasters which affect the crops production of Bangladesh. Bangladesh is vulnerable to the consequences of sea level rise, drought, flood, flash flood, cyclones, water logging, saline water intrusion into the main land etc. may directly affects the food security of the population of this country. This paper did clearly explores the crop calendar, crop production and the disasters which affects the agricultural productions and makes the country susceptible to food insecurity. This paper did also explores the disaster management in agricultural sector through Preparedness, Prevention, Response and Rehabilitation (PPRR) framework to reduce the losses of agricultural productions.

Keywords: Alternative, Reduce, Loss, Crop Productions, PPRR framework.

Introduction

Bangladesh is a highly disaster prone country over the world especially in the South Asian Subcontinent. The geographical location and geological formation of earth surface makes it vulnerable to natural disasters. These disasters are: floods, cyclones, tornadoes, heat wave, cold wave, saline water intrusion. Most of the disasters have adverse effects on the crop production. The floods of (with the extent of affected area in percentage)-1922(--), 1954 (26%), 1955 (35%), 1962 (26%), 1963 (30%), 1968 (26%), 1969 (29%), 1970 (30%), 1971 (25%), 1974 (37%), 1987 (39%), 1988(61%), 1998 (68%), 2004 (38%), and 2007 (42%) (Rasheed 2008) did severely affect the crop production and people's livelihood options. Catastrophic cyclones occurred in 1822, 1876, 1896, 1897, 1960, 1961, 1963, 1965, 1970, 1985, 1991, 1994, 1997(CARE, 2002), 2007, and 2009 which did also affect the crop land, cattle, domestics animals, human lives and livelihood options. On the other hand, severe droughts in 1951, 1957, 1958, 1961, 1966, 1972, 1979, 1981, 1982, 1989 and 1999 (WARPO 2000) had bad impacts on agricultural productions and the people's livelihood means. In terms of both area and population, Bangladesh is the third largest country among the SAARC nations. The total land area of Bangladesh is 147,570 sq km and the total population is about 16 cores (BBS 2017). Therefore, the people of this country are in the risk of food deficiency due to various natural disasters.

Agriculture is the main user of land, about 75 percent of the population being directly or indirectly engaged in the agricultural sector (Rasheed 2008). The principal determinants of agriculture are the monsoon climate, seasonal rhythm of water availability, flooding in large parts of the country, periodic droughts, cyclones and storm surges, which are compounded by high population pressure and human interventions in land and water management.

Table 1: PPRR framework at a glance

Pre-disaster phase			Post-disaster phase		
Prevention/ Mitigation			Preparedness	Response	Rehabilitation and reconstruction
Hazard assessment (frequency, magnitude, and location)	Physical/ structural mitigation works	Insurance and reinsurance of public infrastructure and private assets	Early warning systems and communication systems	Humanitarian assistance	Rehabilitation and reconstruction of damaged critical infrastructure
Vulnerability assessment (population and assets exposed)	Land-use planning and building codes	Financial market instruments (catastrophe bonds and weather indexed hedge funds)	Contingency planning (utility companies and public services)	Clean-up, temporary repairs, and restoration of services	Macroeconomic and budget management (stabilization and protection of social expenditures)
Risk assessment (a function of Hazard and vulnerability)	Economic incentives for pro-mitigation behavior	Privatization Of public Services with safety regulation (energy, water, And transportation)	Networks of emergency responders (local and national)	Damage assessment	Revitalization for affected sectors(exports, tourism, and agriculture)
Hazard monitoring And forecasting (GIS, mapping, and scenario building)	Education, training and awareness about risks and prevention	Calamity funds (national or local level)	Shelter facilities And evacuation Plans	Mobilization of recovery resources (public, multilateral, and insurance)	Incorporation of disaster mitigation components in reconstruction activities

Source: IDB, 2000

Objectives

The objectives of this study were:

- to explore the PPRR framework
- to know the affects of disasters on crop production
- to find the way of reducing disaster losses in crop production through PPRR framework

Methodology

This study was mostly subject to secondary data. To extract data from the sources an appropriate methodology had been used. Therefore, this study was mainly based on the data from published books, reports, scholarly articles, proceedings, survey reports etc. An organized checklist on different issues had been used for expected data.

Results and Discussions

Table 2: Major Crops Production in Bangladesh

Rice Production					
Year	AMAN Rice Production (Lac. M.ton.	AUS Rice Production (Lac. M.ton.	BORO Rice Production (Lac. M.ton.	Total Production Lac. M. ton.	
2010-11	127.91	21.33	186.17	335.41	
2011-12	127.98	23.32	187.59	338.89	
2012-13	128.97	21.58	187.78	338.33	
2013-14	130.23	23.26	190.07	343.56	
2014-15	131.90	23.28	191.92	347.10	
Jute Production		Potato Production		Wheat Production	
Year	Total Production (Lac. Bales)	Year	Total Production (Lac. M. ton)	Year	Total Production (Lac. M. ton)
2010-11	83.96	2010-11	83.26	2010-11	9.95
2011-12	80.03	2011-12	82.05	2011-12	12.55
2012-13	76.11	2012-13	86.03	2012-13	13.03
2013-14	74.36	2013-14	89.50	2013-14	13.03
2014-15	75.01	2014-15	92.54	2014-15	13.48

Source: Compiled from BBS, 2018

Schedule of Crops Production and Effects of Disasters

The impact of global climate change on agriculture had been studied extensively for various crops at the different scales in many countries of the world. Tropical and subtropical countries would be more vulnerable to the potentials impacts of global warming. Bangladesh likely to be one of the worst hit country being in Asian and Third World Countries (MoEFGoB 2009).

Agricultural activity in Bangladesh is spread over three cropping seasons- approximately coinciding with three meteorological seasons. The following Table 3 indicates the cropping seasons of Bangladesh associated with meteorological seasons.

Table 3: Cropping Seasons of Bangladesh

Crop	Time of sowing/transplanting	Time of harvest
Aus rice:		
Local broadcast	mid March/mid-April	mid-July/early August
HYV transplant	mid March/mid-April	July/August
HYV broadcast	mid March/mid-April	late July/August
Aman rice:		
Local transplant	end June/early September	December/early January
Local broadcast	mid March/mid-April	mid-November/mid-December
HYV transplant	late June/mid August	December/early January
Boro rice:		
Local variety	mid-November/mid- January	April/May
HYV	December/mid-February	mid-April/June
Wheat	November/December	March-mid/April
Maize	mid- October/late December	Early April/end May
Barley	mid-October/mid-December	mid-February/mid-April
Kaon (type of millet)	November/December in low lands and mid- March/mid- May in highlands	mid-March/mid-June and mid-June/mid-August
Cheena (type of millet)	November/mid- December	mid-February/mid-April
Jowar (sorghum)	mid-April/ June	mid-August/mid-October

Source: BBS 2005.

The country had about 8.5 mha of cultivable land of which 7.85 mha was under agriculture where the net cultivable area 37% was single cropped, 50% double cropped and 13% triple cropped. Aman was the leading rice crop, occupying about 56% of total rice areas followed by Boro (27%) and Aus (17%) (MoEFGoB 2009). Since 1986-87, the cropping intensity was gradually increasing from 150% to 176%. Due to environmental degradation and various climatic issues and diverse in development activities and different types of disasters nearly 1% of the cultivable land is lost every year. Climate change induces agricultural land degradation in the country and which severely affects our crop productions. The following Table 4 shows the cost of land degradation in Bangladesh.

Table 4: Cost of land degradation in Bangladesh

Type of degradation	Quantity of lost output (million ton/year)	Cost in million USD/year
Water erosion	Cereal productions loss=1.06	140.72
	Nutrient loss=1.44	544.18
Fertility decline	Cereal productions loss=1.44	566.84
Salinization	Total productions loss= 4.42	586.75
Acidification	Total productions loss= 0.9	11.95

Source: MoEFGoB, 2009

The consequence of climate affects the sea level. The sea surrounded lower countries and the geographically lower stream country like Bangladesh is mostly susceptible to rise of the sea level. Sea level rise is not a myth, it's an unbelievable reality.

Climate change and sea level rise cause more cyclones and storm surges resulting in higher salinity in the coastal zone. Bangladesh serves as the natural drainage for nearly 1.66 million-skm catchments area, of which nearly 92.5% is out of the country's territory (MoEFGoB 2009). Because of the sea level rise, backwater thrust will create hindrance in the drainage of the surface water flow (Table 5).

Table 5: Estimated inundation and loss of land under different SLR scenario of Bangladesh

Sea Level Rise (m)	Inundation (skm)	% of total country inundation	Loss of land due to erosion by SLR (ha)
0.10	2,500	1.7	7
0.30	8,000	5.4	21
1.0	14,000	9.5	71
1.50	22,320	15.2	107

Source: UNFCCC 2002; Anwar Ali 2000

Table-6 clearly identifies the higher sea level rise, the wider the area of inundation, the greater risk for food security.

Table 6: Grain production loss due to SRL

Grain Type	Total production in 2005-06	Value Mln Tk.	Production loss due to SLR in Mln Tk			
			Loss against 0.1m SLR	Loss against 0.3 m SLR	Loss against 1m SLR	Loss against 1.5m SLR
Rice	26,530,000	593,741.4	10,094	32,062	56,405	90,249
Wheat	735,000	14994	255	8097	1424	2279
Maize	400,000	16	0.27	0.84	1.48	2.37
Pulse	316,000	18.96	0.32	1.02	1.80	2.88

Source: MoEFGoB 2009

Alternative Thinking to Reduce Risk

In an average every year Bangladesh affects by any kind of disasters whether it is severe, moderate severe or not. The crops of Bangladesh experienced by flood, sudden or flash flood, monsoon flood, water congestion, water logging, unanticipated rain fall, cyclone, salinity, wind, tidal surge, drought, cold wave etc. The following Table 7 and Table 8 shows various crops, their cultivation schedule and affecting hazards.

Table 7: Rice cultivation schedule and affecting hazards

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Crop												
Boro	Irrigated , affected by Flood and Flash flood and Water logging or Drainage congestion											
Aus					Rain dependant, affected by Drought							
Aman								Rainfet, affected by Monsoon flood, Cyclone, Wind, Tidal surge and Drought				

Source: Field Study, 2018

Table 8: Jute and Rabi crops cultivation schedule and affecting hazards

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Crop												
Jute					Affected by Monsoon flood, Cyclone, Tidal surge, Drought							
Other Rabi crops	Affected by Flood and Flash flood and Water logging or Drainage congestion and Cold wave.											

Source: Field Study, 2018

PPRR Framework

Prevention

Water Logging: Water logging is the major threat of Bangladesh. It has been recommended that the natural existing drainage system to minimize the artificial drainage to control subsequent water logging as structural measure to reduce the risk. Geographical Information System (GIS) and Remote Sensing data sources has been appreciated for monsoon environment.

Flash flood: Flash floods takes place more frequently and less unpredictably in the Haor area of Bangladesh. Earthen embankment of low height along periphery of the wetlands with structure at intersection of embankment and remains under water during monsoon. Construction of strong earthen embankments for protecting people's lives and homes, agriculture and infrastructures.

Monsoon flood: Monsoon floods are occurred because of heavy rainfall in rainy season in Bangladesh. The upstream heavy rainfall such as rainfall into China and India increase the

volume of water, depth of water, catchment area, and intensity of current which affect the local rainfall water to produce extra flood risk. High height embankment with the highest strength should construct for both sides of rivers as structural measure and as non-structural measure have to invent various flood tolerant crops variety.

Tidal surge: Fixed barriers like polder and closure dams are a lower technology option which may be more appropriate in developing countries like Bangladesh. These are non-movable barriers across tidal inlets or estuaries. Gradual closure can be accomplished through land-based construction which gradually narrows the inlet, or by water-based construction which builds a barrier up, layer by layer, from the seabed. Alternatively, sudden closure blocks an inlet in a single operation, using pre-installed gates or by the placement of a caisson (a retaining, watertight structure).

Drought: Supplementary irrigation during dry season should provide to reduce the loss of production for the dryer area of Bangladesh. Bangladesh should reserve rain water into natural reservoirs by dragging the rivers. Alternative various drought resistant crop varieties should introduce as a non structural measure to reduce the losses of crops production.

Salinity: The coastal zone of Khulna, Satkhira and Bagerhat are preferred for cultivating shrimp which is valuable asset of Bangladesh. But it has a worth disadvantage to crop production. On the other hand, cyclonic storm surge and sea level rise are causes for the intrusion of saline water into the coastal zone. To prevent the natural event fixed barriers like polder and closure dams are need to minimize the loss. And hazard for shrimp cultivation may be solve by using different technologies such as invent saline water tolerant crops variety.

Cyclone: In Bangladesh context forest is the best barrier for protecting the coastal zone from cyclonic events which was proved in 2007's *Sidr*. So, forestation is appropriate for the protection of coastal zone to reduce unanticipated risk and loss of crops production.

Preparedness

All are non-structural measures. Forecast is more reliable for monsoon flood than tidal flood.

Cyclone, Drought and Monsoon flood: It has been recommended that the present forecasting system claim to be simple, usual friendly and accessible for the mass people. For the monsoon flood, not only forecasting but also prediction is more reliable. By using cell phone technology forecasting will be easier in the present context of Bangladesh.

Flash flood: Community and institutional mobilization (Bangladesh Water Development Board, Department of Public Health and Department of Agricultural extension).

Response

Floods and flash flood: Early harvesting and late transplantation may be alternative way to reduce the loss of crops production. Here it been recommended to re scheduling our existing crop calendar.

Recovery**Economic rehabilitation**

Loans: Loans from government bank and organizations, NGOs, INGOs for recovery of farmers
Free/ subsidies of seeds, fertilizer and fuel to the farmers

Embankment rehabilitation

-Repair, maintenance: Damaged embankment should be repaired and maintained as soon as possible after a disaster occurred.

Conclusion

A delta islander country, Bangladesh has the direct impacts of climate change on its agriculture and means of livelihood of the people due to the global climate change with increasing temperature and frequent changes in the variability in the climatic condition. Like a low lying country, Bangladesh is most vulnerable to climate change induced disasters. This is very important for future economic planning and design related to agricultural activities, promoting agro-based technologies for Bangladesh.

The impacts of the recent cyclone 'Sidr' and frequent flood is by far the most severe in the agricultural sector, at more than Tk. 23 billion (USD 333 million), which accounts for 89 percent of the total loss in value added (GOB-WB, 2008). With the output losses in agriculture, the share of the agricultural sector in GDP is expected to fall; this will result in falling employment and rising poverty in turn.

In order to undertake the early prevention program to meet the immediate need for food security that will provide the first opportunity for the affected agricultural sector. The other immediate attention needed to improve the crop cultivation system, such as, cultivate short time cultivable crops, change the agricultural calendar if needed, apply advance technology for raining, public awareness etc.

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