Journal of Bangladesh Institute of Planners ISSN 2075-9363
Vol. 11, 2018 (Printed in June 2020), pp. 11-19, © Bangladesh Institute of Planners

Natural Disasters in Bangladesh: Impact Analysis Through Input-Output Model

Afsana Haque[*]
Sarwar Jahan[**]

Abstract

Flood, cyclone and storm surge, tornado, drought, river bank erosion are common natural hazards in Bangladesh. These hazards strike Bangladesh in regular interval and claim millions of lives, damage properties/assets and infrastructures, influence societal and daily life of people. The disaster caused by each hazard can be classified into direct damages, first-order losses and higher-order/induced losses. In Bangladesh disaster impact assessment are mainly confined with the estimation of direct damages and sometimes with the first-order losses. Assessment of induced losses are almost absent in the disaster related studies for Bangladesh. We argue that assessment of induced losses are necessary to determine individual and community vulnerability, and optimum level of disaster preparedness, mitigation and recovery. This paper demonstrates how Input-Output framework can be employed to analyze higher-order disaster impacts for Bangladesh.

Introduction

Bangladesh is a natural hazard prone country due to its geo-morphological placement. Flood, cyclone and storm surge, tornado, drought, river bank erosion are common natural hazards in Bangladesh. These hazards strike Bangladesh in regular interval and claim millions of lives, damage properties/assets and infrastructures, influence societal and daily life of people. Besides geo-morphological reasons, Bangladesh often experiences severe exposure to these disasters owing to its demographic and socio-economic character (Agrawala *et al.*, 2003). Literature reports, in the changing climate context, the country is more vulnerable in future to natural hazards of increased frequency and of greater magnitude and intensity. Rigorous analysis of disaster impact is thus necessary to suggest what might happen if any hazard strikes. Methodical estimation of disaster impact can aid designing disaster resilient development and developing adaptation strategy and mitigation plan.

It is helpful at this stage to clarify some key concepts and definitions of hazard and disaster. Otherwise, unclear terminology may create confusion about what the impact analysis should consider. Hazard is the occurrence of a physical event like flood, earthquake while disaster is the consequence of a hazard (Okuyama, 2007). Not all hazards lead to catastrophic consequences. However, each hazard is unique in nature and corresponding disaster may vary widely in effect. Research on hazard involves the means and/or prediction of occurrence of hazard events, while research on disaster

[*] Professor, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh. Email: afsanahaque@urp.buet.ac.bd

[**] Professor, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh. Email: sarwarjahan@urp.buet.ac.bd

investigates the impacts on society, estimates damages/loss and looks strategy for recovery (Okuyama, 2007).

Natural hazard causes both direct and indirect damages. Direct damages include destruction of physical and social infrastructure, transport network, assets etc. The direct damages often create interruption in economic activities, i.e. change in production and/or consumption behaviour, change in investment decision and so on. Such interruptions are called 'first-order losses' (Okuyama and Chang, 2004). There are also 'induced' or 'higher-order' effects, which arise from inter-sectoral linkages in an economic system. Albala-Bertrand (1993) though argues that induced effects are "more a possibility than a reality" (p. 104), the estimation seems necessary to assess individual and community vulnerability, determine optimum level of disaster preparedness, mitigation and recovery (Rose, 2004).

This paper demonstrates how Input-Output (IO) framework can be employed to analyze the 'higher-order' disaster impacts for Bangladesh. A wide range of economic models, like Input-Output (IO) model, Computable General Equilibrium (CGE) model, Social Accounting Matrix (SAM) and econometric models, are reported in literature to assess the induced impacts of disasters. Perhaps the most widely used model is the IO framework (for instance, Hallegatte *et al.*, 2011; Crowther *et al.*, 2007; Okuyama and Chang, 2004; Rose and Benavides, 1998; Cochrane, 1997).

In the following section, a brief description of usual practices and need for new approaches to disaster impact analysis in Bangladesh are summarized. Then the modelling framework of IO for disaster impact analysis is discussed. The final section includes concluding remarks with some future direction of research.

Disaster Impact Analysis in Bangladesh: Usual Practices

In Bangladesh disaster impact assessment is mainly limited in estimating direct damages. When a natural hazard strikes, soon after that usually government and/or any international organizations (World Bank, Asian Development Bank etc.) publish data on damages in different economic sectors namely agriculture, industry, infrastructure, housing, professional service and so forth (for example, JDNLA, 2008; MoFDM, 2007, 2008; MoEF, 2009; ADB and World Bank, 2005; World Bank, 2007). 'First-order losses' in terms of change in consumer spending and public/private investment pattern due to disaster impact are found in literature (Jahan, 2002; World Bank, 2011a,b; MoFDM, 2009; WFP, 2007; UNDP, 2011; Karim, 2011; Chowdhury, 2012). Assessment of these impacts is necessary for government and donor organizations in order to mobilize relief funds and recovery activities. Efforts are also dedicated to assess adaptation practices, options, constraints and capacities (Adger *et al.*, 2007; Alam and Rahman, 2008; Ali, 1999; Jahan, 1991; Karim and Iqbal, 2000; Ahmed, 2005; Ali, 1996; Chowdhury and Ahmed, 2005) to formulate disaster resilient development strategies.

However, a research gap is evident in the disaster impact analysis for Bangladesh. Here, disaster impact analysis is mostly done in sectoral level and in a disaggregated manner. Spatial dimension has remained almost overlooked. For example, the effects of flood particularly on agriculture sector have been reported in the work of several researchers (eg.: Banerjee, 2010; Brouwer *et al.*, 2006) may be because of the sector's importance in the country's economy. But the spatial variation and corresponding implication of such influences are quite unaddressed till today. The induced impact of agriculture sector

upon other economic sectors has also remained unaddressed. Paucity of data, resource constraint, absence of logistic support and limitation in perception of disaster impacts in terms of spatial and sectoral linkages might have restricted 'higher-order disaster impact' analysis in Bangladesh.

Need for New Approaches: Key Issues

Bangladesh has entered into its new era of development planning process. The Comprehensive Disaster Management Programme (CDMP) of Bangladesh has identified mainstreaming disaster risk management into development planning process as one of its key priorities. Disaster risk reduction (DRR) comprising different regulatory and non-regulatory measures have been argued to embed during land use planning to reduce vulnerability of people to hazards (UDD, 2013). Hence, more rigorous assessment of disaster impact is necessary. The following sub-sections identify some key issues that should be addressed during disaster impact assessment.

Natural Hazards and Their Spatial and Aspatial Dimension

In Bangladesh, not all districts/divisions/regions are equally vulnerable to all kind of hazards. For example, the North Bengal is more drought prone, whereas the coastal areas are more vulnerable to cyclone and storm surge. Flood affects almost all parts of the country. Each hazard affects geographical territory and economic structure differently. The damages caused by flood are not similar to damages made by drought. Even risk associated with any particular type of hazard, for example, flood is not equally distributed over the whole country and economy i.e. spatially and sectorally.

Again, a natural hazard with the greater magnitude and intensity usually create impacts that spread not only beyond geographical boundary but also across sectors. For instance, direct damages caused by flood in agriculture sector of Rajshahi region will definitely affect industrial production of Dhaka as economic sectors of regions are interdependent. Disaster impact analysis in Bangladesh should try to capture these kind of induced effects more systematically.

Haque (2005) argues that Bangladesh experiences serious regional imbalance in terms of per capita GDP (Gross Domestic Product) in different activity sectors. Hence, understanding of disaster impacts both spatially and sectorally may render two fold benefits. One, objective understanding of regional economic structure in response to disaster effect can help to retain region's economic capacity and ultimately the overall growth of the country during disaster. Second, incorporation of spatial dimension in disaggregated understanding of the country's economic structure can act as a leverage and seek necessary and adequate investment funding to ensure disaster resilient development. Such analysis can also be helpful for identifying the adaptation deficit for Bangladesh (Stern, 2007).

Model Selection and Data

Input-Output (IO) model, Computable General Equilibrium (CGE), and social accounting matrix (SAM) are the most widely used techniques for disaster impact assessment. Each model renders some advantages as well as disadvantages during disaster impact estimation. For instance, though IO model is a static model and it ignores the economies

of scale in production (Miller and Blair, 1985; Wilson, 1974); the model is simple, requires relatively less data during its application and most importantly it comprehensively shows interaction among different sectors of an economy. On the other hand, CGE models is dynamic but requires extensive data and often underestimates disaster impacts due to its flexible adjustment feature (Okuyama, 2007). SAM evaluates equity issues for public policies against disasters (Okuyama, 2007) but requires extensive data set.

While selecting a model for disaster impact assessment, researchers, planners and disaster management practitioners should have clear idea about the pros and cons of each model. They should know how each model usually response to the same damage data. For instance, while disaster impact assessment using IO framework produces upper-bound results, there CGE model yields lower-bound estimations. In addition, researcher should be very careful about quality of input data to obtain legitimate results/model outputs.

Disaster Impact Estimation in Bangladesh: Input-Output Approach

Based on the discussion made in the earlier section, we argue that IO framework can provide legitimate estimation about higher-order disaster impacts in Bangladesh. Section 4.1 first discusses the generalized framework of IO model for impact analysis. Section 4.2 focuses on data requirement for disaster impact analysis both spatially and aspatialy in Bangladesh through IO model.

Input-Output Model for Impact Analysis

An IO table is constructed for a particular economic area – a nation, a region (however defined), a state etc. for a certain time period (usually a year). As the economic activity of an area is divisible to a number of economic sectors or industries, the IO model is ultimately concerned with the inputs and outputs of these sectors and their inter-relationships. Table 1 shows a simple IO table for a three sector economy. In Table 1, an economy is divided into three sectors and X_i represents the total output (production) of sector i. Y_i and W_i are the total final demand and total primary input for sector i respectively and the observed monetary value of the flow from sector i to sector j is denoted by Z_{ij}.

Table 1: A Simple Input-Output Table for Three Sector Economy

		Purchaser Sector			Final Demand	Total Output
		Agriculture	Industry	Service		
Seller Sector	Agriculture	Z_{11}	Z_{12}	Z_{13}	Y_1	X_1
	Industry	Z_{21}	Z_{22}	Z_{23}	Y_2	X_2
	Service	Z_{31}	Z_{32}	Z_{33}	Y_3	X_3
Primary Input		W_1	W_2	W_3	-	W
Total Input		X_1	X_2	X_3	Y	X

Each economic sector produces some output that is distributed among other sectors and for final consumption. The final demand includes consumer (household) purchase, purchases for private investment purposes, government purchases and exports. At the same time some exogenous inputs are used by industries which constitute the primary factors of production like labor, capital, imports from outside the system, governmental subsidies and so on. In an IO model these inter-industry flows are arranged in matrix format and is measured in monetary terms.

Using the table, the equation reflecting the sales of output of each sector takes the following forms:

$$X_1 = Z_{11} + Z_{12} + Z_{13} + Y_1 \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$X_2 = Z_{21} + Z_{22} + Z_{23} + Y_2 \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$X_3 = Z_{31} + Z_{32} + Z_{33} + Y_3 \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

In the equations, the Z_{ij} can be replaced by technical co-efficient, a_{ij} which can be defined as the ratio of flow of input from i to j (Z_{ij}) to total output of j (X_j). Once the notation of a set of fixed technical coefficient is accepted, the equation can be rewritten, replacing each $Z_{ij.}$

$$X_1 = a_{11} X_1 + a_{12}X_2 + a_{13}X_3 + Y_1$$

$$X_2 = a_{21} X_1 + a_{22}X_2 + a_{23}X_3 + Y_2$$

$$X_3 = a_{31} X_1 + a_{32}X_2 + a_{33}X_3 + Y_3$$

If the equations are arranged in matrix format, then the unique solution is given by,

$$X = (I - A)^{-1} Y \qquad \text{if } |I - A| \neq 0$$

where,

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}, \qquad X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}, \qquad Y = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

I is the 3*3 identity matrix and $(I - A)^{-1}$ is the "Leontief Inverse".

After regionalization the matrix formulation that allows the general solution of the regional input-output system is given by

$$X = (I - R)^{-1} Y$$

Where 'R' is a square matrix of regional technical coefficients.

The national and regional tables can be used to estimate output, income and employment multipliers across national/regional sectors and to identify backward and forward linkage oriented sectors and key sectors (having both backward and forward linkage values greater than one).

For disaster impact assessment both at national and regional level the following formula can be used:

$$\Delta X = (I - A)^{-1}\Delta F \qquad \text{or} \qquad \Delta X = (I - R)^{-1}\Delta F$$

Here, ΔF is the induced change in final demand vector due to natural hazard. Estimated output change in different sectors can be multiplied by income and output multipliers to calculate changes in sectoral income and employment respectively.

The main importance of input-output analysis lies in the fact that it helps to estimate the multipliers, linkage coefficients and at the same time it is concerned with the effect that a change in final demand (i.e. sales to export, consumption and investment sectors) and/or output of an economic sector would have on the other industrial sectors of the economy.

Data Requirement for IO Analysis

Available National Input-Output Table for Bangladesh economy should serve the base line data for impact analysis. Ideally the model should be of the previous year of the occurred hazard event for which impact is going to be assessed. The national IO table can be disaggregated into several regions using national and regional GDP (Gross Domestic Product) or income or employment data. Depending on the purpose of impact assessment, the economic sectors can even be aggregated in national and/or regional IO table. However, absence of an inter-regional IO table for Bangladesh economy might limit the scope of spatial analysis during impact assessment.

An important challenge in disaster impact assessment for Bangladesh is the development of disaster scenarios. Data as reported by government and/or international donor organizations on sectoral direct damages and consumer spending and public/private investment during disaster recovery stage are necessary to develop such disaster scenarios. The more reliable and rigorous are the data, the more detail and legitimate are the impact assessment.

Conclusion

Simulation of disaster impact using various economic models is aimed not to forecast the disaster or of its consequences; rather, the models try to quantify effects over space once similar kind of mentioned hazard strikes. There is nothing to judge the accuracy of results in disaster impact assessment, because exactly same disaster will never occur again. Researcher's main concern is, however, to follow sound methodological approach for assessment of consequences to get prepared for what might happen.

The present paper highlights the use of IO table in its simplest form for assessment of disaster impact in Bangladesh. Efforts should be dedicated to overcome the inherent problems of IO model making it more dynamic and reliable to suit for impact assessment. Introduction of inter-regional IO table for Bangladesh economy will definitely act as a step forward during spatial assessment of disaster impact.

Note: An earlier version of this article published in Volume 8 of BIP Journal is withdrawn, and the full version is published in the current volume.

References

Adger, W. N., Agrawala, S., Mirza, M. M. Q., Conde, C., O'Brien, K., Pulhin, J., Pulwarty, R., Smit, B. and Takahashi, K. 2007. Assessment of adaptation practices, options, constraints and capacity. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson (Eds.), *Climate Change 2007: Impacts, Adaptation and Vulnerability --Contribution of Working*

Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 717-743). Cambridge, UK: Cambridge University Press.

Agrawala, S., Ota, T., Ahmed, A. U., Smith, J. and Aalst, M. V. 2003. *Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans*. Report no.: COM/ENV/ EPOC/DCD/DAC(2003)3/FINAL. Paris: OECD.

Ahmed, A. U. 2005. Adaptation Options for Managing Water-Related Extreme Events under Climate Change Regime: Bangladesh Perspectives. In M. M. Q. Mirza and Q. K. Ahmad (Eds.), *Climate Change and Water Resources in South Asia* (pp. 255-278). Leiden, The Netherlands: A.A. Balkema Publishers.

Alam, M. and Rahman, A. 2008. Adaptation to climate change: Beyond 2012. In Y. Kameyama, A. P. Sari, M. H. Soejahmoen, and N. Kanie (Eds.), *Climate Change in Asia: Perspectives on the Future Climate Regime* (pp. 195-209). Tokyo: United Nations University Press.

Albala-Bertrand, J. M. 1993. *The Political Economy of Large Natural Disasters: With Special Reference to Developing Countries* (Oxford, UK: Clarendon Press).

Ali, A. 1999. Climate change impacts and adaptation assessment in Bangladesh. *Climate Research, 12*, 109-116.

Ali, A. 1996. "Vulnerability of Bangladesh to Climate Change and Sea Level Rise through Tropical Cyclones and Storm Surges, *Water, Air, & Soil Pollution*, *92* (1-2), 171-179.

Asian Development Bank and World Bank, 2005. *2004 Floods in Bangladesh: Damage and Needs Assessment and Proposed Recovery Program*, Manila, Philippines.

Banerjee, L. 2010. 'Effects of Flood on Agricultural Productivity in Bangladesh'. Oxford Development Studies, 38(3): 339-356

Brouwer, R., Aftab, S., Brander, L. and Haque, E. 2006. Economic valuation of flood risk exposure and flood control in a severely flood prone developing country. PREM Working Paper, No. 06/02. Amsterdam, The Netherlands: Institute for Environmental Studies, Vrije Universiteit, Poverty Reduction and Environmental Management (PREM). Retrieved from http://www.prem-online.org/archive/16/doc/PREM06-02.pdf. accessed on June, 2014.

Chowdhury, E. H. and Ahmed, A. K. 2005. *Strengthening Disaster Risk Management in the Agricultural Sector in Bangladesh -- Study on Physical and Environmental Context, Institutional Analysis and Vulnerable Group Profiling in Selected Project Pilot Areas in the NW of Bangladesh*. Dhaka: Center for Environmental and Geographic Information Services (CEGIS).

Chowdhury, M. M. 2012. *A Comparative Study of Disaster Risk Reduction and Post Disaster Livelihood Recovery Program in Japan and Bangladesh*. Retrieved from http://www.adrc.asia/ aboutus/vrdata/finalreport/2011B_BGD_Final_Report.pdf, accessed on June, 2014.

Cochrane, H. C. 1997. Forecasting the economic impact of a Midwest earthquake, in: B.G. Jones (Ed.) *Economic Consequences of Earthquakes: Preparing for the Unexpected*, pp. 223–247 (Buffalo, NY: National Center for Earthquake Engineering Research).

Crowther, K. G., Haimes, Y. Y. and Taub, G. 2007. "Systematic valuation of Strategic Preparedness through Application of the Inoperability Input-Output Model with Lessons Learned from Hurricane Katrina" *Risk Analysis* volume 27, issue 5, pp. 1345-1364.

Haque, A. 2005. *Regional Development in Bangladesh: A spatial analysis through input-output model* (Unpublished Master's thesis). Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.

Hallegatte, S., Ranger, N., Mestre, O., Dumas, P., Corfee-Morlot, J., Herweijer, C. and Wood, R. M. 2011. "Assessing climate change impacts, sea level rise and storm surge risk in port cities: a case study on Copenhagen" *Climatic Change* volume 104, pp. 113-137.

Jahan, S. 2002. The Socio-Economic Impacts of the 1998 Flood in Dhaka City. In M. A. Ali, S. M. Seraj, and S. Ahmad (Eds.), *Engineering Concerns of Flood* (pp. 289-302). Dhaka, Bangladesh: Directorate of Advisory, Extension and Research Services, Bangladesh University of Engineering and Technology.

Jahan, S. 1991. Integrated Approach to Cyclone Disaster Management and Regional Development Planning: Lessons from the 29 April 1991 Cyclone. In H. Sazanami (Ed.), *Cyclone Damage in Bangladesh. Report on Field study and investigations on The Damage caused by the Cyclone in Bangladesh in 29-30 April 1991* (pp. 38-69). Nagoya, Japan: United Nations Centre for Regional Development

JDNLA (Joint Damage, Loss, and Needs Assessment Team), 2008. *Cyclone Sidr in Bangladesh. Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction*. Dhaka, Bangladesh: Government of the People's Republic of Bangladesh

Karim, Z. 2011. *Assessment of Investment and Financial Flows to Adapt to the Climate Change Effects in the Agriculture Sector*. Retrieved from http://ext.bd.undp.org/CCED/bgdp/BGDP Materials/Environmental Governance Related Documents/Bangladesh_Assessment_ Agriculture.doc, accessed on June, 2014

Karim, Z. and Iqbal, M. A. 2000. *Impacts of Land Degradation in Bangladesh: Changing Scenario in Agriculture Land Use*. Dhaka, Bangladesh: Bangladesh Agricultural Research Council.

Miller, R. E. and Blair, P. D. 1985. *Input-Output Analysis: Foundations and Extensions* Prentice-Hall, New Jersy

MoEF, 2009. *National Adaptation Programme of Action (NAPA)*. Dhaka, Bangladesh: Ministry of Environment and Forest, Government of the People's Republic of Bangladesh.

MoFDM, 2007. *Consolidated Damage and loss Assessment, Lessons Learnt from the Flood 2007 and Future Action Plan*. Dhaka, Bangladesh: Disaster Management Bureau, Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh.

MoFDM, 2008. *National Plan for Disaster Management 2008-2015 (Final Draft for Approval)*. Dhaka, Bangladesh: Disaster Management Bureau, Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh.

MoFDM, 2009. *Summary of Cyclonic Storm "AILA"*. Dhaka, Bangladesh: Disaster Management Information Center (DMIC), Disaster Management Bureau (DMB), Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh.

Okuyama, Y. and Chang, S. E. (Eds), 2004. *Modeling Spatial and Economic Impacts of Disasters* (New York: Springer).

Okuyama, Y. 2007. "Economic modeling for disaster impact analysis: Past, present, and future" *Economic Systems Research* volume 19, issue 2, pp. 115-124

Rose, A. 2004. "Economic principles, issues, and research priorities in hazard loss estimation", in: Y. Okuyama and S.E. Chang (Eds) *Modeling Spatial and Economic Impacts of Disasters*, pp. 13–36 (New York: Springer).

Rose, A. and Benavides, J. 1998. "Regional economic impacts", in: M. Shinozuka, A. Rose and R.T. Eguchi (Eds) *Engineering and Socioeconomic Impacts of Earthquakes*, pp. 95–123 (Buffalo, NY: Multidisciplinary Center for Earthquake Engineering Research).

Stern, N. H. 2007. *The Economics of Climate Change: The Stern Review.* Cambridge University Press, Great Britain.

UNDP, 2011. *UNDP Core Family Shelter Programme Value for Money Evaluation*. Retrieved from

http://www.undp.org.bd/projects/prodocs/ERF/Review%20of%20UNDP%20Sidr%20Shelter%20Programme.pdf

Urban Development Directorate (UDD), 2013. *Integrating DRR into Land Use Planning in Bangladesh*. UDD, Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh.

World Food Programme (WFP), 2007. *Food Security Assessment SIDR Cyclone – Bangladesh*. Retrieved on June, 2014 from:

http://www.lcgbangladesh.org/derweb/cyclone/cyclone_assessment/Food%20security%20assessment-SIDR%20cyclone%20by%20WFP%20and%20partners_December%202007%20.pdf

Wilson, A. G. 1974. *Urban and Regional Models in Geography and Planning* John Wiley and Sons, London.

World Bank, 2007. *Floods 2007 Damage and Needs Assessment Report*. Dhaka, Bangladesh.

World Bank, 2011a. *Climate Risk and Adaptation Country Profile for Bangladesh: Vulnerability, Risk Reduction, and Adaptation to Climate Change*. Retrieved from http://sdwebx.worldbank.org/climateportalb/doc/GFDRRCountryProfiles/wb_gfdrr_climate_change_country_profile_for_BGD.pdf accessed on June, 2014

World Bank, 2011b. *The Cost of Adapting to Extreme Weather Events in a Changing Climate*. Retrieved on June, 2014 from:

http://siteresources.worldbank.org/INTBANGLADESH/Resources/BDS28ClimateChange.pdf.