IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Vol. 10, Issue.3, March 2022 E-ISSN: 2347-2693

The Role of Government in Disaster Risk Reduction (DRR) in the Coastal Areas of Bangladesh

Md. Alaul Kabir

Department of Disaster & Human Security Management, Bangladesh University of Professionals (BUP), Dhaka, Bangladesh

Author's Mail Id: alaul4387@gmail.com, Tel.: +88 01769004387

DOI: https://doi.org/10.26438/ijcse/v10i3.1318 | Available online at: www.ijcseonline.org

Received: 10/Feb/2022, Accepted: 10/Mar/2022, Published: 31/Mar/2022

Abstract— Bangladesh locates in disaster prone area in South Asia because of its geographical location. Various types of disasters like flood, cyclone, river-bank erosions, drought, salinity etc. are the common phenomenon in this land. Such natural disaster left huge people died or wounded and destroying valuable wealth's around the year. In the recent time, natural calamities have increased remarkably. This study follows qualitative research methodology and reveals that the people living in coastal areas are facing severe natural hazard that badly impact on their lifestyle. The study found that the government has been conducting various risk reduction programmes like prewarning signals, disbursing posters and leaflets, conducing knowledge sharing meeting, awareness rising training to mitigate the losses. Besides, some nongovernment organizations also have been playing vital role to face this calamity. This study also has drawn a conclusion with recommendations that will leave the scope to take effective action in this circumstance.

Keywords— Disaster, Flood, Risk Reduction, Bangladesh

I. INTRODUCTION

Bangladesh is a disaster risk hotspot, ranked 7th most vulnerable by Global Climate Risk Index- 2019. This unfortunate ranking reflects the very profound, multi-layered challenges and risks that the country face. Population density and poverty run hand in hand to increase vulnerability. This country is prone to floods, river-bank erosions and cyclones, and the risks of other disasters such as droughts, salinity intrusion, earthquakes, and tornados are increasing. The impacts are becoming more prominent at the local level, with greater impacts on poor and vulnerable communities. The Comprehensive Disaster Management Program has generated a wealth of resources over the last 10 years. There exist other innovations in community- based risk reduction, conducted by nongovernmental organizations and civil society bodies. The government has also implemented several programmers to reduce risk through preparedness training, awareness campaign, warning signals, posters, leaflets, discussions, knowledge sharing, meetings and demonstrations through dramas and film. A host of programs are now being implemented by the government to mitigate disaster risks and vulnerabilities such as Comprehensive Disaster Management Programs (CDMP I and II), Bangladesh Water Development Board (BWDB) studies on groundwater availability and found in some coastal districts saline water was found in aquifers at 200 meters. Cyclone Preparedness Programs (CPP) After the Bhola cyclone, the International Federation of Red Cross (IFRC) started Cyclone Preparedness Program (CPP) on early warning system which saved many lives in recent disasters. The Bangladesh Meteorological Department (BMD) monitors tsunami risk and early warning. The government implement implementing the LDCF adaptation (CBACC-CF) project, that are to reduce climate induced vulnerability and enhancing resilience of communities and protective ecosystems (Nandy and Ahammad 2012). Humanitarian Assistance Programs Implementation Guidelines 2012-13, World Food Programs (WFP), and Vulnerable Group Feeding Program (VGF)The current study attempts to identify the risk and vulnerability in the coastal zones.

II. ROLE OF GOVERNMENT IN DRR

Disasters are increasing day by day, and their impacts on people have become more vivid in recent years. In this respect, Bangladesh is well known for its innovations in disaster risk reduction at the global, national, local and community levels. Globally, the concept of disaster management has shifted from post disaster response to pre-disaster risk reduction. It is often said that US$1 investment in risk reduction measures save US$7 in recovery. The Hyogo Framework for Action (HFA: 2005–2015) and Sendai Framework for Disaster Risk Reduction (SFDRR: 2015-2030) have become accepted mechanisms of risk reduction globally, nationally, and locally, and the mid-term reports of these frameworks emphasize the need for local approaches and initiatives.

Bangladesh is one of the best examples in the world of praiseworthy achievements in disaster management, a result of long-term focus on the issue. The Government, United Nations and humanitarian partners have worked over 45 years to save lives through improved disaster management systems and risk reduction strategies to make the people resilient. Bangladesh fundamentally transformed its approach from relief to risk reduction, long before the global consensus on the risk reduction agenda was agreed under the Hyogo Framework of Action (HFA) in 2005. Bangladesh has moved from post disaster "reactive humanitarian relief" to pre-disaster "proactive risk management" and an emphasis on the combination of response and an early return to the development trajectory, immediately after a crisis or disaster.

In the long term, these collective efforts have clearly paid off in the reduction of disaster mortality associated with Cyclones: from almost half a million deaths in the 1970 Cyclone Bhola, to several hundred in Cyclone Aila in 2009. Cyclones Sidr (2007) and Aila (2009) offer specific examples of effective response and recovery. Improved institutional capacities and infrastructural development enabled the activation of cyclone early warning systems and the national preparedness system. Government has passed a significantly improved Disaster Management Act in 2012 which aims to secure legal empowerment for citizens vulnerable to disaster. Building on lessons learned from disaster response and humanitarian coordination in the past, the Local Consultative Group 3 on Disaster & Emergency Response (LCG DER) has been revitalized. LCG DER has enabled effective use of risk and damage assessment tools and created a tailor-made framework around existing development coordination structures to rapidly and systematically respond to emergencies. With the support of UN, training has been given to 27,000 government officials on disaster planning and management. Disaster management subjects have been introduced at primary and secondary schools and dedicated degree programmes are being taught across 22 universities and tertiary institutions. Innovation is an important element of how Bangladesh responds to disasters. Early warnings for cyclones and floods are disseminated through mobile phone alerts from the Disaster Management Information Centre (DMIC). Similarly, mangrove afforestation to form a green belt, first piloted in 2006 to trap sediment along the coastal belt, is now guarding vulnerable communities from the increasing severity and intensity of climatic events, such as cyclones and tidal surges, as well as creating greater areas of useable land in the long run that can provide diversified livelihood options for poor and vulnerable coastal people.

A. Cyclone Preparedness Program(CPP):

In 1970, around 500,000 people were killed in cyclone Bhola in coastal Bangladesh. After that, the International Federation of Red Cross (IFRC) started Cyclone Preparedness Program (CPP) on early warning system through Bangladesh Red Crescent Society (BRCS) in coastal region of Bangladesh, which saved many lives in recent disasters. On 1st July 1973, The Ministry of Disaster Management and Relief (MoDMR) in behalf of the Government of Bangladesh took responsibility of CPP when the IFRC had declared to leave the program. CPP activities were however continuing according to the direction of "Implementation Board" headed by Secretary of MoDMR as well as a "Policy Committee" headed by the Minister of MoDMR to provide policy support for guidance and improvement of the program.

At present, CPP has 55,260 volunteers (Male-36, 840 and female-18, 420) in 350 union areas across 40 Upazilas (Sub district) and 7 zones under 13 districts of coastal Bangladesh (MoDMR, 2016). All the volunteers come and join CPP on a voluntary basis and worked in a group under a unit at village level. However, CPP working area is divided into 3,684 units and each unit consists of 15 members (10 male and 5 female) from the same community. Each unit divided into 5 groups. There is a group leader along with two other members. One unit constituted around 3,000 peoples. Training is given to the volunteers on early warning dissemination, first aid treatment, shelter management and different cross-cutting issues to improve capability of the community for preparing themselves to face forthcoming cyclone hazard efficiently (MoDMR, 2016).

To strengthen cyclone management by upgrading and extending of the Cyclone Preparedness Programme (CPP) in all coastal areas and constructing more multipurpose and inclusive killas and shelters with adequate services in all coastal areas. 5000 shelters have been established in cyclone prone areas for evacuation in the coastal area for evacuating people in mega early warning which is assisted by local institutions and representatives as well as citizen volunteers.

B. Study on Salinity Intrusion

Salinity intrusion in the coastal areas of Bangladesh, posing a threat to ecosystems, livelihoods and public health and diminishing access to freshwater for household and commercial use which is increasing day by day. About 20 million people in the coastal areas of Bangladesh are affected by salinity in their drinking water. Bangladesh Water Development Board (BWDB) undertook studies on groundwater availability and found in some coastal districts there was no freshwater layer as deep as 300 meters; in many cases, saline water was found in aquifers at 200 meters. (National Plan for Disaster Management, 2016-2020, draft). Now a days, saline tolerant crop varieties are being cultivated in the coastal areas of Bangladesh.

C. Tsunami inundation risk assessment

The 2004 Indian Ocean Tsunami raised awareness of the tsunami hazard, though Bangladesh suffered relatively minor damages. The Bangladesh Meteorological Department monitors tsunami risk and early warning. A tsunami inundation risk assessment was undertaken with support from CDMP for the coastal areas of Bangladesh.

The assessment identified fault zones in the Bay of Bengal which could possibly cause tsunami inundation in many coastal areas. (National Plan for Disaster Management, 2016-2020, draft)

D. Bangladesh Disaster Risk and Climate Resilience Program

This program includes the following projects that are being run the Government of Bangladesh and World Bank:

1. The Coastal Embankment Improvement Project (CEIP)
2. The Multipurpose Disaster Shelter Project (MDSP)
3. The Urban Resilience Project (URP)
4. Weather and Climate Services Regional Project for Bangladesh
5. The Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)

Projects' Summary:

The Coastal Embankment Improvement Project (CEIP) (USD 400 million --375 IDA & 25 PPCR) approved by the World Bank Board June 26, 2013. Effective since November 24, 2013.

The $400 million Coastal Embankment Improvement Project (CEIP), has since 2013 helped Bangladesh to mitigate some of the large impacts from cyclones and flooding and improved emergency response in the coastal region. The project supports the rehabilitation and upgrading of protection polders to protect the areas from tidal flooding and frequent storm surges and includes improvements of agricultural production by reducing saline water intrusion in selected polders. Further, the project aims to enhance the Government of Bangladesh's capacity to respond more efficiently and effectively to natural disasters. The project aims to rehabilitate in total 17 polders in six coastal districts which will provide direct protection to the 760,000 people living within the polder boundaries and enhance the resilience of the coastal areas to cyclones, tidal and floods and salinity intrusion. This in turn will enhance people's livelihoods through increased agricultural production during normal weather and reduced loss of life, assets, crops and livestock in the event of a disaster.

The Multipurpose Disaster Shelter Project (MDSP) (USD 375 million) approved by the World Bank Board December 2014. Project signed on January 25, 2015. Effective since March 12, 2015.

The $375 million Multipurpose Disaster Shelter Project (MDSP) is a World Bank-led disaster risk mitigation infrastructure project to strengthen emergency preparedness and to reduce the vulnerability of the coastal population in selected coastal districts of Bangladesh to climate chance and natural disasters. The project supports the reconstruction and improvement of multipurpose shelters and builds on initial phases of interventions in multipurpose disaster shelters advanced under the Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP). The activities focus on financing of around 556 new shelters, rehabilitation of around 450 existing shelters, and the construction and improvement of around 550 kilometers of rural roads to improve access and communication networks to shelters. The project is expected to benefit nearly 14 million people living in the nine coastal districts of Bangladesh by improving access to safe havens in the event of a natural disaster. This would serve to build the resilience of local communities to such natural calamities and help to speed recovery by protecting critical assets. In addition, the project aims to construct multipurpose buildings, especially primary schools.

The Urban Resilience Project (URP) (USD 173 million) approved by the World Bank Board March 2015. Project signed on June 30, 2015. Effective since August 3, 2015.

The $173 million Urban Resilience Project (URP) was initiated to strengthen the capacity of the Government of Bangladesh agencies to respond to emergency events and to strengthen systems to reduce the vulnerability of future building construction to disasters in Dhaka and Sylhet. The project seeks to create an enabling environment for coordinated, locally managed disaster risk management based on three core pillars of disaster resilience in an urban setting: i) effectively respond to urban disasters; ii) reinforce existing infrastructure; and iii) ensure resilient construction. In this context, the project will support to reinforce the emergency management response capacity, facilitating 68 wards with decentralized emergency response services in Dhaka and respectively 20 wards in Sylhet. Project activities also include a vulnerability assessment of critical and essential facilities in Dhaka, Sylhet and other cities that is needed for informed longer-term investments reduce risk in the built environment. The project will as well support institutional infrastructure and capacity building to reduce long-term disaster vulnerability in Dhaka, through improved construction, urban planning and development.

The Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP) [USD 356.82 million (Original Credit USD 109 million + Additional Credit I USD 75 million + Additional Financing II USD 140 million +TF USD 32.82 million)] was approved by the World Bank Board on November 6, 2008. Project signed on November 23, 2008. Effective since December 24, 2008.

Following Cyclone Sidr in 2007 and Aila in 2009, the $356.82 million Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP) supports the Government of Bangladesh efforts to facilitate recovery from the damage to livelihoods and infrastructure caused by the Cyclone and aims to build long-term preparedness through strengthened disaster risk reduction and management. The project intends to restore the agriculture sector in Sidr/Aila-affected areas, improve existing multipurpose shelters and construct new shelters, support the rehabilitation of around 502 km of coastal embankments and to strengthen the capacity of the government's disaster risk reduction management. Further, it included support to the government in coordinating all project-related activities, strategic studies for the preparation of future operations for

the long-term disaster risk reduction program, and technical assistance and training, as well as providing emergency support for future disasters.

Weather and Climate Services Regional Project for Bangladesh (USD 113 million) –Approved by the World Bank Board by June 2016

Since 2016, the World Bank seeks to strengthen Bangladesh's capacity to deliver reliable weather, water, and climate information services and improve access to such services by priority sectors and communities through the $113 million Weather and Climate Services Regional Project for Bangladesh. The project includes improvements in forecasting of weather patterns and extreme events, development and provision of agro-met information services to farmer groups and plans to enhance access to early warnings for significant weather and water hazards by vulnerable communities. Through investments in monitoring systems, forecasting and services, the project will contribute to strengthening disaster preparedness and climate resilience in Bangladesh and contributes to the development of weather-based information services that are expected to support decision-making in key productive sectors in the country.

E. Innovative Coastal Land Use Pattern for Adaptation

Through enhancing resilience of communities and protective ecosystems, Bangladesh government is currently implementing the first global LDCF adaptation (CBACC-CF) project to reduce climate induced vulnerability in coastal areas (Nandy and Ahammad 2012). The project innovating coastal land use system for community to reduce climatic vulnerability and enhance adaptation. The project has selected khash lands (most of them are biophysically formed by sedimentation deposit, stabilized with mangrove plantation and shaped into char lands) and convert them into multiple resource generation. Mangroves stabilized part of these lands with vegetation, but a big part was unused because of less suitability for afforestation, exposure to soil salinity and tidal inundation of which only 40 % are cultivated with agricultural crop for single season (4–5 months).

Soil-salinity grew higher in the lands with inundation of neap and spring tides, as a result for significant months of a year that neither agricultural practices nor afforestation with mangroves and main land species are possible. In dry season scarcity of freshwater for irrigation for cultivating agriculture and salinity reached higher in groundwater of the coastal zones (Rahman et al. 2011). Less than 30 % of coastal lands can be irrigated which is lower compared to average 50 % of the country (Mia and Islam 2005). The project occupied these land type as otherwise underwent to encroachment by local elites and remain unproductive and inaccessible for marginalized and landless coastal people. The new land use approach successfully restores substantial size of vacant, illegally occupied and periodically inundated coastal lands into productive resource regime in two coastal districts of the project sites. Substantial parts of these fallow lands were open access govt. property without ownership title and captured by local elites through encroachment for further deforestation (CBACC-CF 2012; Nandy and Islam 2010). As coastal people are affected with climate change related risks and lower land productivity as well as inequality of land distribution, there has been possible to optimize the highest uses of limited lands and involve climate change affected vulnerable people. The newly practiced livelihood interventions in the land use system multiply social and economic opportunities and benefit landless communities. The significant part of the approach is multiplication of land uses for forestation, fish and agricultural cultivation and livestock rearing activities and eventually developing participatory ownership to provide adaptation practices (Nandy 2011). Most of the land use in coastal areas is dominated by horizontal expansion of agricultural practices or fish culture by shrimp farming, which are also threatened with changing climatic risks. The approach opens for vertical land management for ditch fish cultivation at the lower level and vegetation with horticulture and forestation on the top of dyke. Land use pattern is technically based on preparation of ditch and dyke structure by involving local communities. There are pro-active opportunities for involving coastal communities at the initial stage of consultation and motivation at local level for their initial engagement in land preparation works. The project has strong emphasis on community involvement in successive steps of land preparation as community provides 50 % of the cost through their labors. Two-way benefits are ensured in the development approach for immediate cash for work to subsistence families and subsequently long-term engagement with adaptation user groups.

The long-term land user groups are entitled to a one ditch and dyke after preparation for 10 years agreement with renewal opportunities depending upon performance. The connected ditch and dyke structure have reduced salinity ingress in the agriculture lands during high tide. Dyke vegetation with advanced agricultural crop and fruit varieties, and forest species renovated local land uses for sustaining provisioning services and conserving natural resources in environmentally constrained coastal areas. With the technical support of local govt. departments beneficiary families received training and improved crops, fruit seedlings, fingerlings and forest trees. All these are integrated with respect to seasons and suitability of land for cultivation. The combination of upper and lower land utilization is replacing one another for providing alternative livelihood measure to coastal communities, particularly for managing income risks in lean period or erratic shock appeared by heavy precipitation or tidal inundation. With the support of local institutions, community ownership on 112 ha of coastal lands (stabilized char lands behind mangrove forest) has been arranged for income generation of landless and marginalized families. The collaborative livelihood arrangement accommodates 8–10 families/ha and appears as rational land use (Nandy 2011). The level of association in the project implementation and competing interests

among local agencies influence their roles in land use integration. The implementing local govt. departments considered that the livelihood of people living surrounding mangrove plantation areas highly depends on climate sensitive sectors like agriculture, forestry, fisheries and livestock. The impact of climate change to these sectors contributed to the low adaptive capacity of these coastal communities. Though about 60 % of people are directly involved with agricultural activities in coastal areas, 30 % of them have only homesteads or no land.

This newly developed land use practices explored options for income generation and sustaining flow of resources (Nandy and Ahammad 2012). The new land use technique increased manifold production from agriculture in raised dyke system over traditional and highly rain fed cropping. Given the land use pattern, a family increases household adaptive capacity through generating at least $1,000 USD/family/ year additional income in addition to their routine livelihood activities. There are currently used these fallow lands for short-term, mid-term, mid to long term and long-term basis. While considering time variation for protection of land use is contributing to the recurrent income generations that ultimately leads to the livelihood sustainability and increase the adaptive capacity of these poor coastal communities. Since the project begins land ownership has been transferred to coastal communities with tenure for diversified livelihood practices. The land use model is framed for diversifying livelihood in ditch and dyke system to promote adaptation practices. In each hectare of lands, eight (8) ditches and nine (9) dykes are developed and distributed to 8 families for ten (10) years land ownership agreement with renewal opportunities depending upon beneficiary performance. The significant part of this approach is community providing 50 % of the labor cost by working themselves in earth excavation for ditch and dyke development.

F. Coastal Ecosystem Based Adaptation and creating Green Belt

Due to the impact of climate change, the coastal zone of Bangladesh is extremely vulnerable. The people living in the coastal are mostly poor, some of them are landless and they earn their livelihood through agriculture, fishing, shrimp farming, salt farming etc. As the poor groups they are severely affected by climate related disaster and hazards. Climate change induced disasters destroy their livelihood options and increase people's vulnerabilities. (Islam et al,2015)

The devastating cyclone that occurred in 1991, Sidr in 2007, Nargis in 2008 and Aila in 2009, that killed thousands of people and destroyed inhabitation and infrastructures in the coastal areas of Bangladesh. Creation of mangrove and non-mangrove plantations along the coastal belt is highly desirable for reducing vulnerabilities and hazards of extreme weather events like cyclone and storm surges as green shelterbelt. Bangladesh Forest Department has already been raised large scale plantations mainly with *Sonneratia apetala* in all along the coastal belt to create a green shelterbelt. But these established plantations are facing tremendous pressure due to insect infestation, rising forest floor and lack of inundation resulted large gaps inside plantations. (Islam et al,2015)
From the available research findings, some of the other mangrove species are found suitable for planting inside the gaps of these plantations. Moreover, some of the non-mangrove species are found promising for planting in the raised coastal lands and embankment. Therefore, the selected promising species can be planted in the accreted lands, roadside, embankment and marginal lands for creating dense vegetation which can reduce the impact of all-weather events resulting from climate change. Multi-species mangrove plantations can also be established in the accreted lands for long term sustainability of coastal ecosystem. The coastal community can be incorporated to the afforestation programmes for the sustainable development of coastal forestry. Thus, they will be socially and environmentally benefited. (Islam et al, 2015)

III. CONCLUSION

There is much work to be done to reduce the scale and scope of urban risks in Bangladesh. It is heartening to note that a UN supported Urban Community Volunteer Program, 64,000 volunteers from the Fire Service and Civil Defense (FSCD) were trained, nationwide, to better serve as the "frontline" in the face of disasters. As important as these efforts are, they are little compared to what is urgently needed to reduce disaster risks to an acceptable level in Bangladesh. Towards that lofty objective, Government must provide leadership, not only in terms of a long- term focus on managing and reducing the risks associated with natural disasters and climate change, but in creating an enabling environment for innovation in the private sector, for research and development coming out of But even with all this good news, it is very clear that Bangladesh faces some real challenge in managing and reducing risk, in sustainably addressing the climate change threats, and in ensuring highest quality preparedness and response. Even when response to a disaster is well coordinated and effective, able leadership is required to transition the country from the humanitarian approach, back to a sustainable development path. And if the country's high vulnerability isn't enough, new and/or emerging problems add further complexity to it. Slow-onset disasters, such as water logging, which remain for months or even years, have a pervasive impact on livelihoods, access to food, shelter, water, sanitation and healthcare. Rapid and unplanned urbanization exponentially increases the number of people and property at risk. Low and mid-level tremors in recent years remind us of the seldom addressed earthquake risk in urban canters such as Dhaka city. Bangladesh's highly regarded think-tanks and universities, as well as for NGO's that have traditionally been a pro-active force for sustainable development in Bangladesh. With a renewed sense of urgency and determination, it is encouraged among all walks of people in this great country to get

involved, to work together in making Bangladesh a strong, resilient and disaster-ready nation.

REFERENCES

[1]. Aldrich, D.P., The externalities of strong social capital: post-tsunami recovery in Southeast India. *Journal of Civil Society*, **7(1), pp.81-99, 2011.**

[2]. Allen, K.M., Community-based disaster preparedness and climate adaptation: local capacity-building in the Philippines. *Disasters*, **30(1), pp.81-101, 2006.**

[3]. An Introduction to the Risk Governance Framework. Geneva: IRGC, **2008.**

[4]. Beck, U. The Risk Society: Toward a New Modernity. London: Sage. **1992.**

[5]. Biermann, F., K. Abbott, S. Andresen, K. Bäckstrand, S. Bernstein, M. M. Betsill, H. Bulkeley, B. Cashore, et al. Navigating the Anthropocene: Improving Earth System Governance. *Science* 335 (6074): **1306–07, 2012.**

[6]. CBACC-CF (Community Based Adaptation to Climate Change Through Coastal Afforestation), **2012**

[7]. Global Facility for Disaster Reduction and Recovery (GEDRR), ACP-EU Natural Disaster Risk Reduction Program. International Disaster Portfolio and Project Database. Washington, DC, **2012.**

[8]. Government of the People's Republic of Bangladesh (GoB). Cyclone Sidr in Bangladesh: Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction, 2008. Available online accessed on 21 October, **2019.**

[9]. Ikeda, K. How women's concerns are shaped in community-based disaster risk management in Bangladesh. *Contemporary South Asia*, **17(1), pp.65-78, 2009.**

[10]. IRGC (International Risk Governance Council). Risk Governance: Towards an Integrative Approach. White Paper No. 1. Geneva: IRGC, **2005.**

[11]. KHAN, M.M.I. The impact of local elites on disaster preparedness planning: the location of flood shelters in northern Bangladesh. *Disasters,* **15(4), pp.340-354, 1991.**

[12]. Khan, M.R. and Rahman, M.A. Partnership approach to disaster management in Bangladesh: a critical policy assessment. *Natural Hazards*, **41(2), pp.359-378, 2007.**

[13]. Mia AH, Islam MR, Coastal land uses and indicative land zones. Working Paper, WP040. Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP), Bangladesh. **2005.**

[14]. MoDMR, Unpublished official document. Dhaka: Ministry of Disaster Management and Relief, Government of the People's Republic of Bangladesh. **2016.**

[15]. Nandy P, Ahammad R., Navigating mangrove resilience through the ecosystem-based adaptation: lessons from Bangladesh. In: Macintosh DJ, Mahindapala R, Markopoulos M (eds) Sharing lessons on mangrove restoration. *Mangroves for the Future and land/IUCN*, Bangkok/ Switzerland, **pp 243–254, 2012.**

[16]. Nandy P, Islam MA., Climate resilient coastal zone development in Bangladesh: participatory governance for common resources management. In: Ramanathan AI, Bhattcharya P, Dittmar T, Prashad MBK, Neupane BR (eds) *Management and sustainable development of coastal zone environments.* Capital Publishing Company, New Delhi, **pp 58–72, 2010.**

[17]. Nandy P., Forest, Fish and Fruit: new model of climate change adaptation in Bangladesh. In: Abstract, 5th international conference on community-based adaptation to climate change (CBA5), held at Dhaka, **p 188, 2011.**

[18]. Rahman MH, Lund T, Bryceson I., Salinity impacts on agro-biodiversity in three coastal, rural villages of Bangladesh. *Ocean Coast Management* **54:455–468, 2011.**

[19]. Reflexive Governance: Politics in the Global Risk Society, In *Reflexive Governance for Sustainable Development*, edited by J. VoB, D. Bauknecht, and R. Kemp, **31–56, 2006.** Cheltenham: Edward Elgar Publishing.

[20]. Renn, O., A. Klinke, and M. van Asselt. Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis. AMBIO 40 (2): **231–46, 2011.**

[21]. Risk Governance Deficits: An Analysis and Illustration of the Most Common Deficits in Risk Governance. Geneva: IRGC, **2009.**

AUTHORS PROFILE

Md Alaul Kabir is a Military Officer serving in Bangladesh Army for last 30 years. During his long career in Bangladesh Army, he has successfully qualified in Masters in Defence Studies (MDS) from National University of Bangladesh. He is also a graduate of the Defence Service Command and Staff College from Mirpur, Bangladesh. He has completed Masters in Business Studies (MBA) from South East University, Dhaka, Bangladesh. In addition, he has also successfully completed another Masters in Information and Communication Technology (MICT) from Bangladesh University of Professional (BUP). He had thesis in this Masters on Internet of Things (IoT) on the Management of Health Care System in the hospital of Bangladesh. At present, he is pursuing Doctor of Philosophy (PhD) from Bangladesh University of Professional (BUP) in the field of Disaster Risk Reduction (DRR). He has also served as the Head of the Department of Disaster and Human Security Management of Bangladesh University of Professional (BUP). He had long experiences in the field of Disaster Management while serving in the Army in the Care of flood, cyclone etc. He is also experienced in the nation building activities in the overseas while serving in the United Nation Peace Keeping Mission in the African State of Mali, Sierra Leone and Democratic Republic of Congo. At present, he is serving as Principal in one of the Central School & College Administrated of Bangladesh Army. He has 11 years of teaching experience and 03 years of research experience.

