DECCMA

The Indian Bengal Delta: Understanding the Present State of Climate Change, Adaptation and Migration

Introduction

The Ganges-Brahmaputra-Meghna (GBM) basin spans across Bangladesh, Bhutan, Nepal, China and India, forming one of the largest estuarine regions of the world, the Sundarban delta. In DECCMA the seaward portion of this GBM delta, within 5m of mean sea level, is considered with studies in Bangladesh and India.

The Indian national study area is called the Indian Bengal Delta (IBD) (Figure 1). The total study area is 14054 sq.km and comprises of 2 administrative districts, (North 24 and South 24 Parganas); and 51 administrative Blocks (sub-districts). Inhabited by 18 million people (2011 census), the population density is 2463 persons/ Km^2 for North 24 Parganas and 819 persons/ Km^2 for South 24 Parganas.

A natural habitat of the Royal Bengal Tiger, the IBD presents a complex ecosystem formed by an intricate network of tidal waterways, mudflats, and small islands of salt-tolerant mangrove forests. Cyclones and flood/ waterlogging are the dominant local hazards and a considerable amount of land erosion is also prevalent along the long coast and islands. These climate and environment stresses are compelling inhabitants to migrate out of the delta. DECCMA explores whether migration is an adaptation option in such low lying deltaic regions and aims to provide policy support to create conditions for sustainable gender-sensitive adaptation.

Figure 1: DECCMA Study Area for Indian Bengal Delta (purple bordered section)

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Mapping Land Cover Changes and Hotspots

DECCMA identifies a new form of land cover in the delta

Our first attempt at land cover mapping for 2011-12 showed agriculture as the most prominent category of land cover. When ground truthing this during field visits, we came across significant brickfields, and so created this new category of land cover. Land-cover mapping for IBD shows that the number of brickfields has increased by about 18% and the area under brickfields has increased by about 16% between 2010-11 and 2016-17 (Figure 2). As an essential construction material, bricks are in high demand owing to urbanisation and real estate. Brickfields continue to grow at the expense of fertile agricultural land and aquaculture farms, emerging as one of the largest employment providers. This poses a serious threat to the environment by transformation of cultivable land to brickfields and ultimately rendering them "non-reusable", which may affect vulnerability given the dependence on the agriculture sector.

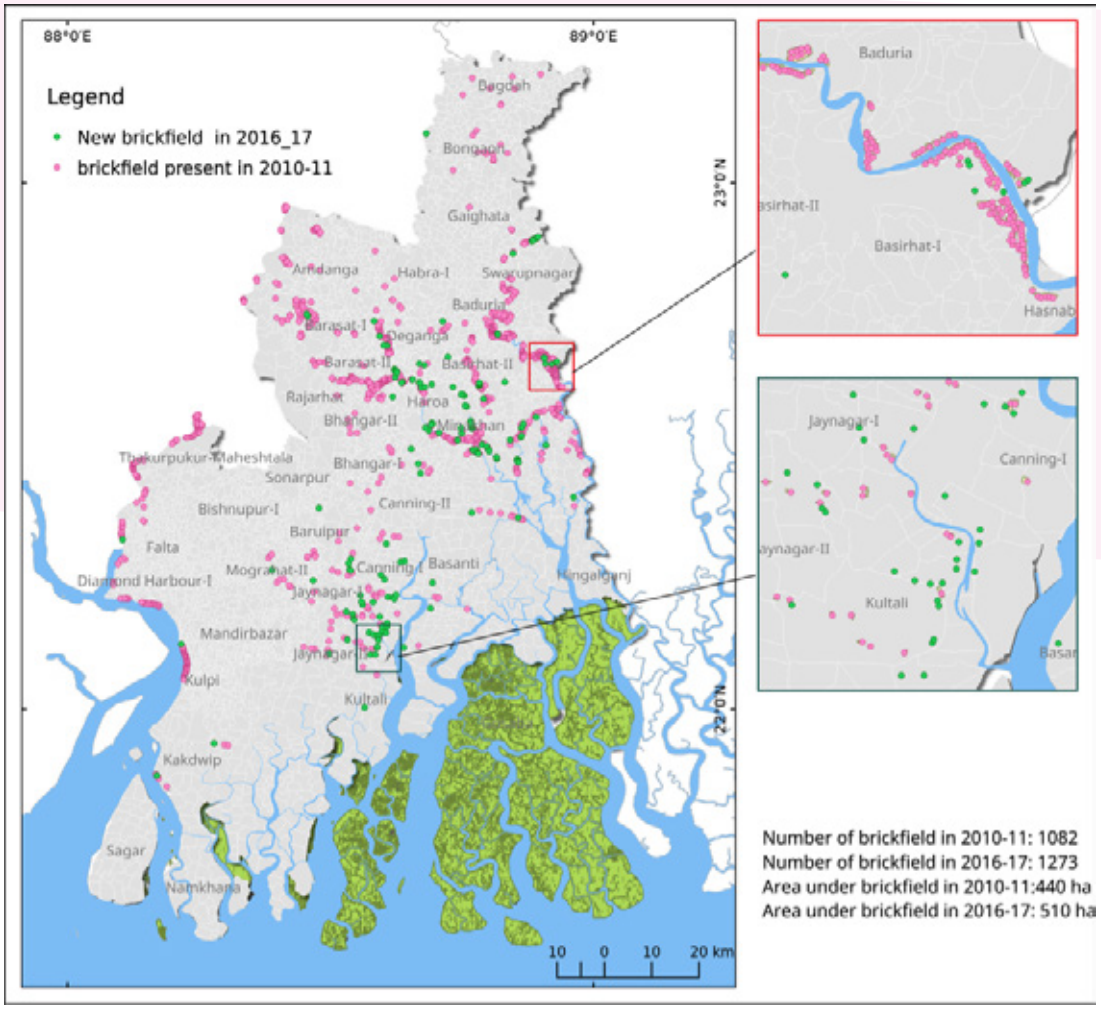


Figure 2: Brickfields in Indian Bengal Delta from 2010-11 to 2016-17

Which areas are at more risk?

Biophysical and socio-economic factors were categorised into hazard, sensitivity and adaptive capacity to determine levels of risk. Based on the risk score, the sub-districts were ranked and hotspots were identified. Coastal blocks such as Gosaba, Sandeshkhali-II, Patharpratima, Hingalganj, Sagar, Basanti, and Kultali are bio-physically and socio-economically at very high risk.

Village level multi hazard maps were prepared to support our household survey stratification process. Both flooding and cyclonic Hazards are dominant in the delta but flooding is limited to smaller areas while the spread of cyclones is over wider areas. Erosion is more dominant along the coastal part of IBD.

Economy of the Delta

A First Input Output analysis for the delta

We have conducted macro-economic analysis based on Input-Output tables to determine the important sectors in relation to climate change in IBD. Comparing with the non-delta parts of the country, trade-transport, services, and construction emerge as important sectors (Figure 3). However, the most noticeable gap between the delta and non-delta is in the agriculture sector, notably the fishing sector. The fishing sector in the delta is five times more prominent than the rest of the country.

The embodied work of women in the delta is mostly present in services, manufacturing, and fishing, while being relatively less important in agriculture, energy or construction sectors. The main skilled work in the delta is embodied in the services and energy sectors while being relatively less important in agriculture, fishing and the construction sectors. In agriculture and allied sectors fishing activity is comparatively more cost-effective than crop production.

Economic models will be developed based on these analyses to understand the economic effects of different dimensions of climate change on the delta and non-delta economic sector.

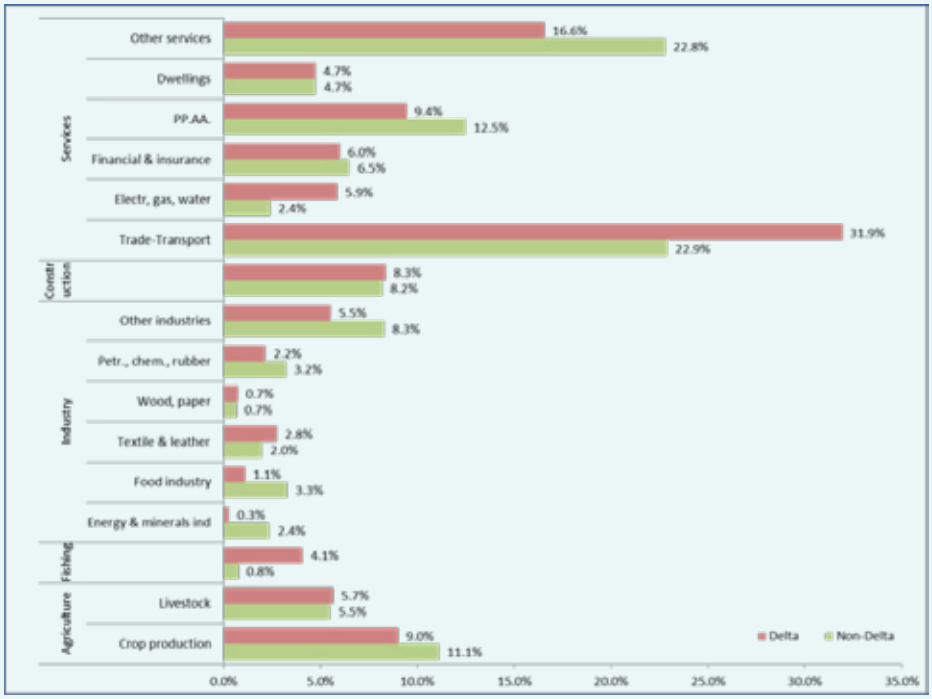


Figure 3: Distribution of Value Added in IO table by 16 main categories for IBD

Migration

Who is migrating out?

1315 households were surveyed for the migrant sending area survey in IBD, of which 18% have sent migrants. Greater incidence of male migration is occurring in the age group of 21-40 compared to other age categories. Male migrants with primary and secondary education are migrating more than those with no education and higher education. Female migrants with secondary and higher education mostly move with their family members.

Where are they migrating to?

Both men and women are migrating seasonally, mostly to Kolkata, West Bengal which is the nearest metropolitan area. Maharashtra, Tamil Nadu, Kerala, and Gujarat are the other Indian states attracting migrants from IBD (Figure 4). Based on the preferred destinations, we shall undertake a migrant receiving area survey as well.

Why are they migrating?

Increasing unsustainability of agriculture in the tidally influenced delta and lack of other economic opportunities are prompting people to seek employment opportunities outside the delta. Aspiration for better education is also encouraging migration. From perceptions of environmental stress of migrant households it emerged that hazard events like cyclones and flooding act as 'stressors' and motivate individuals/households to consider migration as an option.

Is migration successful?

Most of the respondents felt migration is helpful and somewhat successful. Remittances received by households have improved their standard of living by enabling them to pay for daily consumption (food, bills), healthcare, and education.

Governance System

Perceptions of migration and adaptation

Stakeholders have corroborated our initial findings that both environmental and non-environmental reasons prompt migration. Although adaptation options are active in the areas, there is a need for more. With respect to environmental hazards, they validated our findings that erosion and soil salinisation are damaging the delta. It was suggested that inter-departmental governance coordination can expedite processes and timely release of funds can ensure effective implementation.

What are the barriers to Policy Implementation?

Certain policies have been satisfactorily implemented in terms of adaptation. These include livelihood diversification within agriculture, research and development, early warning systems, education and awareness raising. In contrast, implementation has been less than satisfactory in livelihood diversification away from agriculture, social service delivery and requires prioritisation according to the policies. In terms of social factors, customary laws facilitate implementation at the National/State level and religious practices neither facilitate nor hinder policy implementation at the local level. In terms of political factors, prioritisation of other issues hinders policy implementation.

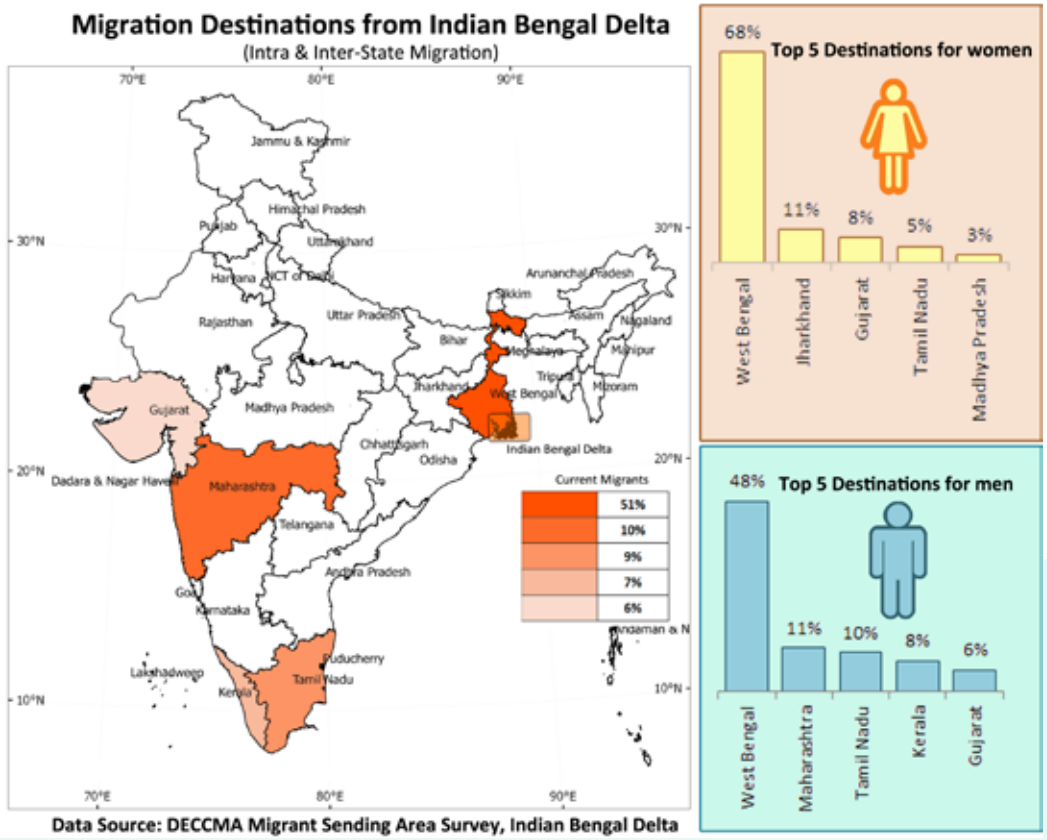


Figure 4: Migration Destinations (Intra & Inter-State Migration) from Indian Bengal Delta

Adaptation

What are the documented adaptations?

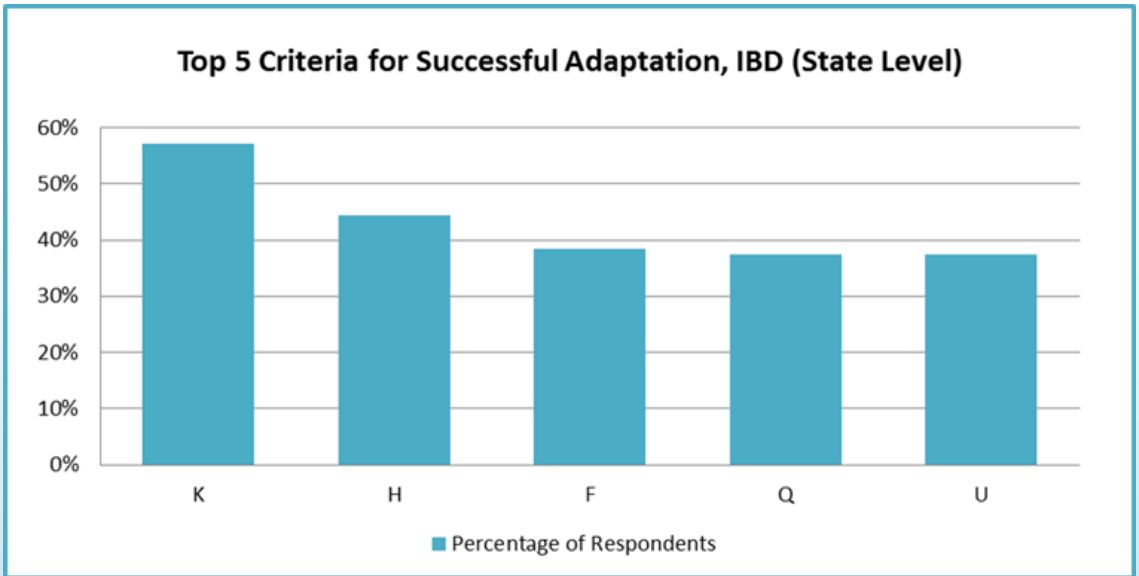
Based on an inventory of 93 documented empirical evidence on adaptation across the Indian and Bangladesh parts of the GBM delta, the most common examples relate to agriculture, fisheries, water resources management, coastal zone management, and disaster risk reduction. These include hard adaptation options relating to infrastructure, such as embankment reconstruction, rainwater harvesting and construction of cyclone and flood shelters; and soft adaptations, such as development of seed banks, climate-resistant farming and culture practices, regeneration of degraded mangrove forests, and development of alternative livelihood options.

Why were these activities undertaken?

The majority of the documented adaptation activities were undertaken as a result of prolonged environmental stress. The main causes of stress include cyclones and storm surges, breaching of embankments leading to coastal inundation, floods, coastal erosion, and salinisation (of soil and fresh-water fishery ponds). These are the major drivers of adaptation activity.

What are the criteria for successful adaptation?

Stakeholder consultation at State and District level took place to determine the top five criteria for successful adaptation (Figure 5). Ensuring that the adaptation measures implemented are sustainable in the context of long term anticipated climate change emerged as the most important criterion. The delta is affected by saline water intrusion caused by repeated breaching of embankments. This recurrent problem may be a reason why this long term sustainability is important. Other criteria of importance relate to reducing vulnerability – with particular importance placed on the most vulnerable groups; and risk reduction, through local capacity and risk-sharing mechanisms such as insurance.



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K	The adaptation measures implemented are sustainable in the context of long-term anticipated climate change
H	Marginalised groups (e.g. women, those of lower castes, and the elderly) are less vulnerable
F	The livelihoods of the majority of people are less vulnerable to damage from climate hazards
Q	The capacity of local institutions to manage environmental disasters and changes improves
U	All citizens have access to some form of insurance/risk sharing mechanism in the event of an extreme event

Figure 5: Top 5 Criteria for Successful Adaptation, Indian Bengal Delta

What will happen in the future? Modelling climate, migration and adaptation.

Results from our research on climate hotspots, migration, and adaptation will ultimately feed into an integrated model that will be used to assess the outcomes and adaptation choices in the delta under a range of climate and other scenarios. Combined with criteria of success, this will allow the success of different adaptation approaches and their influence on migration choices to be assessed. We are developing model components on forestry and riverine fisheries which will fit into the wider integrated model.

What does our policy analysis reveal about migration and adaptation?

A Review of national policies finalised between 1990 and 2016 has revealed that only six have references to adaptation. If adaptation is not properly addressed in all relevant policies, this will put the vulnerable population at greater risk.

Migration is becoming a more viable choice for men and women and thus there is a need for National/State Level Policy or Action Plan on the issue of environment and climate induced migration, and rehabilitation and resettlement of migrants. Migrants are often unskilled and lose monetary benefits in their destination areas. This can be avoided if the Ministry of Skill Development and Entrepreneurship arranges for specific skill development programmes for migrants.

The National Action Plan for Climate Change needs to be supported with timely release of estimated budget, to avoid delay in implementation and consequences for vulnerability.

The absence of gender equity in nearly two thirds of the policies has implications for reducing vulnerability of women compared to men. Ensuring gender equity in decision making is even more important in migration contexts, when out-migrants are typically adult males. Empowering women and transforming gender roles and relations will help in their adaptive capacity when they are left to care for the household.

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