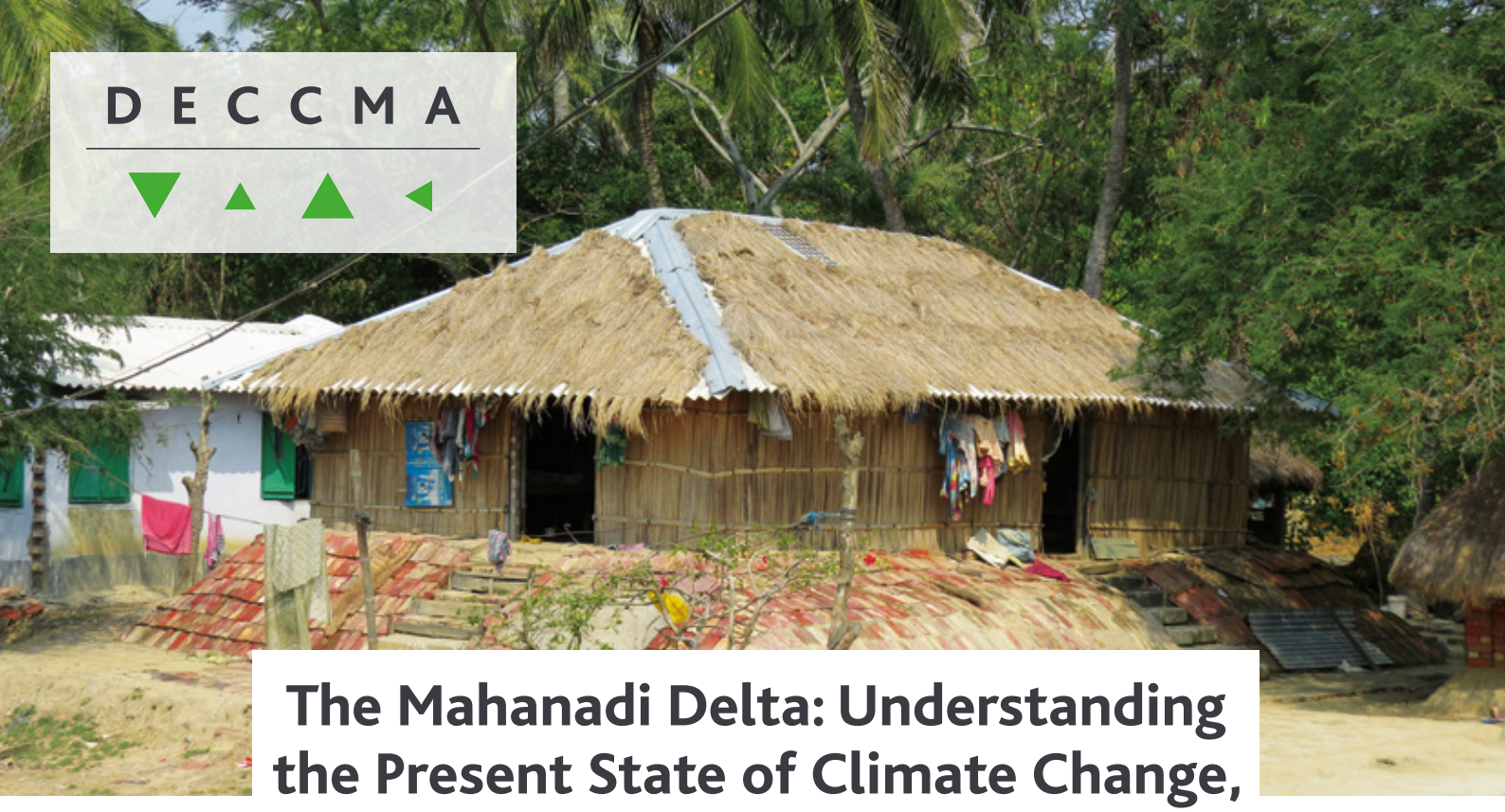
DECCMA



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

Introduction

The Mahanadi delta is formed by a network of three major rivers draining into the Bay of Bengal: the Mahanadi, Brahmhani and Baitarini. The coastline of the delta is approximately 200km long from near Chilika in the south to the Dhamra River in the north. The study area comprises over 13,000 sq.km which includes five administrative districts in Odisha state: Bhadrak, Jagatsinghpur, Kendrapara, Khorda, and Puri and 45 administrative blocks (sub-districts) (Figure 1).

The delta houses the Chilika Lake which is the largest brackish water lagoon in India; Bhitarkanika mangrove forest famous for crocodiles; Gahirmatha beach which is a natural habitat of Olive Ridley turtles; famous sandy beaches along the coast; the port of Paradwip; and the religious tourist destination of Puri.

Inhabited by 10.6 million (2011 Census) people, the population density is highest in Khordha (800 persons/ Km^2) and lowest in Puri (488 persons/ Km^2) among the five study districts. However exposure to monsoon flooding, tropical cyclones and erosion are compelling inhabitants to migrate out of the Mahanadi Delta. Under these circumstances, 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.

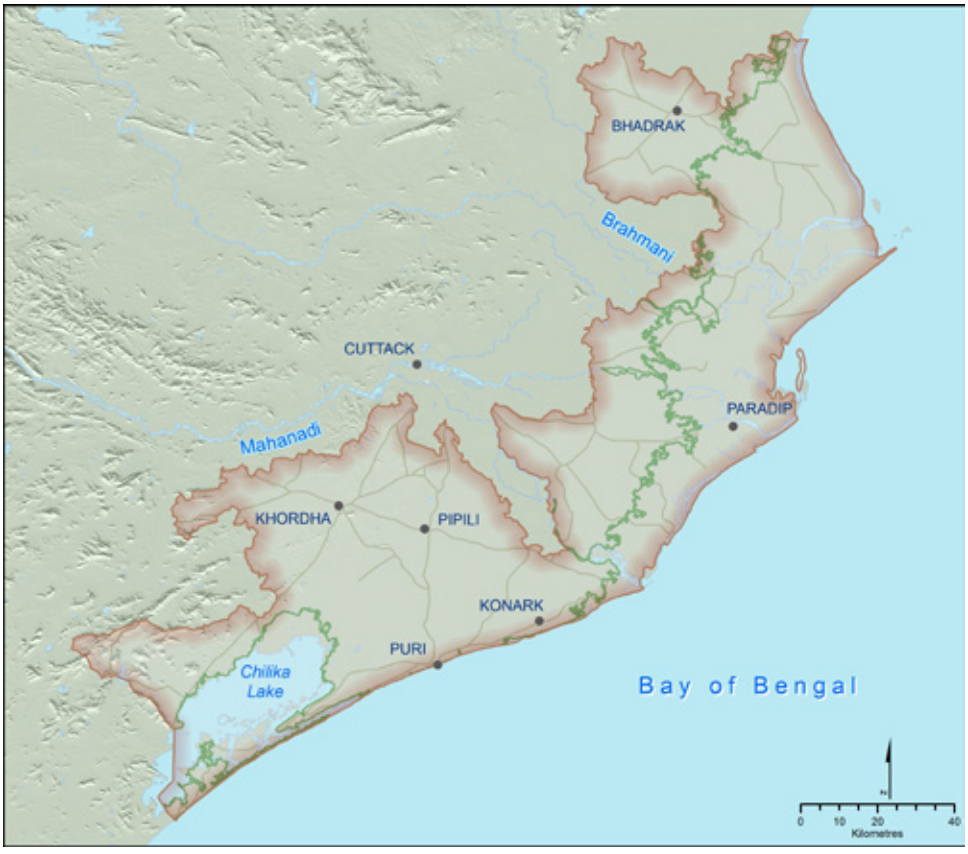


Figure 1: DECCMA Study Area for Mahanadi delta

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Mapping Land Cover Changes and Hotspots

Land Cover

Land cover mapping for 2011-12 showed agriculture as the most prominent category of land cover, occupying 64% of the land under single, double or triple crop type. This indicates that the delta economy is primarily agrarian in nature. A Land cover map for 2000-2001 is being created to identify any changes that have occurred.

Which is the most dominant hazard?

Monsoon floods and cyclones are the main hazards in the delta. While flooding is limited to smaller areas, cyclones affect wider areas. Erosion is more dominant across the lower reach of the delta. Districts have experienced an increase in flood disaster risk over the last three to four decades, with a consequential increase in economic losses reported. Village level multi hazards maps inform the design of our household survey (Figure 2).

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 sub-districts such as Dhamnagar, Tihidi, Chandabali, Marshaghai, Bhadrak, Ersama, Balikuda are at highest risk of climate change.

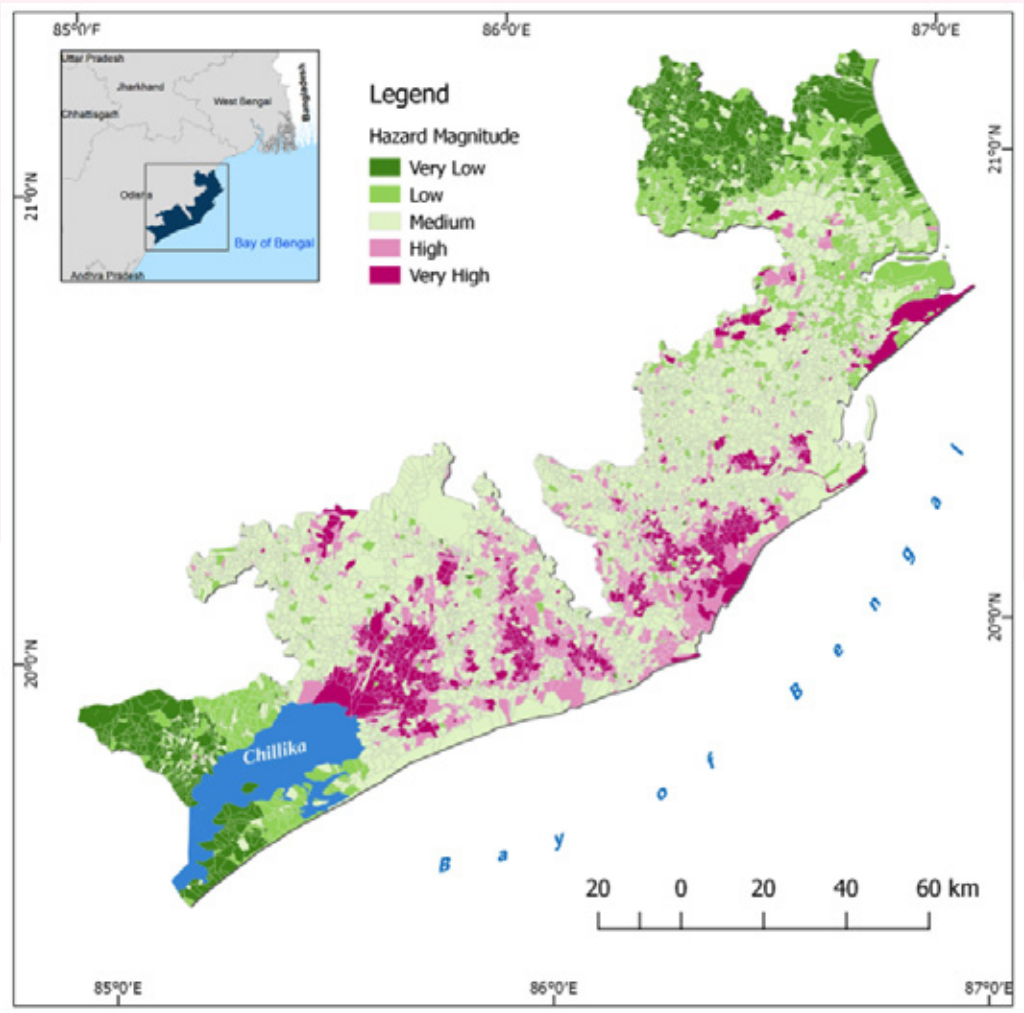

Figure 2: Village level multi hazards map for Mahanadi delta supporting the household survey stratification process

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 economic sectors in relation to climate change. Compared with the rest of the country (non-delta), trade-transport, services and construction emerge as important sectors (Figure 3). However, the most noticeable gap between the delta and non-delta economies is in the agriculture sector, notably the crop production sectors, livestock and fishing.

The embodied work of women in the delta is mostly present in services, manufacturing and fishing, and also in the construction sector, where large numbers of women labour intensive raw materials like cement and bricks. It is relatively less important in agriculture and energy. The main skilled work in the delta is embodied in the services while being relatively less important in agriculture, fishing and the construction sectors.

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.

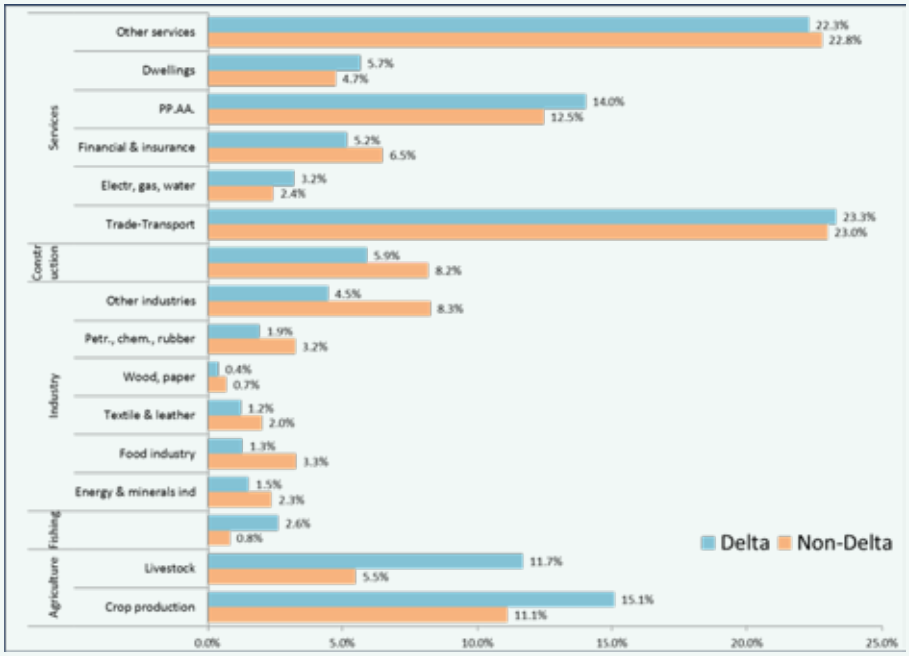

Figure 3: Distribution of Value Added in IO table by 16 main categories for MD

Migration

Who is migrating out of the delta?

1414 households were surveyed for the migrant sending area survey, of which 22% have sent migrants. Primary survey data shows that more incidences of male migration are occurring in the age group of 21-30 which corroborates our literature review findings. People with secondary and higher education are migrating more than those with lower levels of education. Female migrants mostly move with their family.

There is a positive correlation between the percentage of migrant sending households and the percentage of female headed households as mostly men migrate, leaving behind women as heads of the household.

Where are they migrating to?

Migrants are moving to other parts of Odisha such as Bhubaneswar, Puri, and Paradwip. Bhubaneswar is the capital city of Odisha, and the state's economic and educational centre and has witnessed rapid development during the past two decades. Other cities like Puri - famous for religious tourism and Paradwip – a port city on the Mahanadi River, attract many people from adjoining rural and urban communities for several aspects such as planning, sanitation, health, neighbourhood, education, civic laws, local-self-governance etc. Other parts of India, such as West Bengal, Karnataka, Tamil Nadu, and Gujarat are also the preferred destinations for migrants (Figure 4)

Why are they migrating?

Migration from the deltas is prompted by the need for employment, better education, family problems and housing problems. Female migrants mostly move to join their spouse or for marriage. From the perceptions of environmental stress of migrant households it emerged that hazard events like flooding and droughts act as 'stressors' and motivate individuals/households to consider migration as an option.

Is migration successful?

Most of the respondents felt migration is helpful for the migrant and very successful for family members outside household and friends. Remittances received by households have improved their standard of living by enabling them to pay for daily consumption (food, bills), and healthcare.

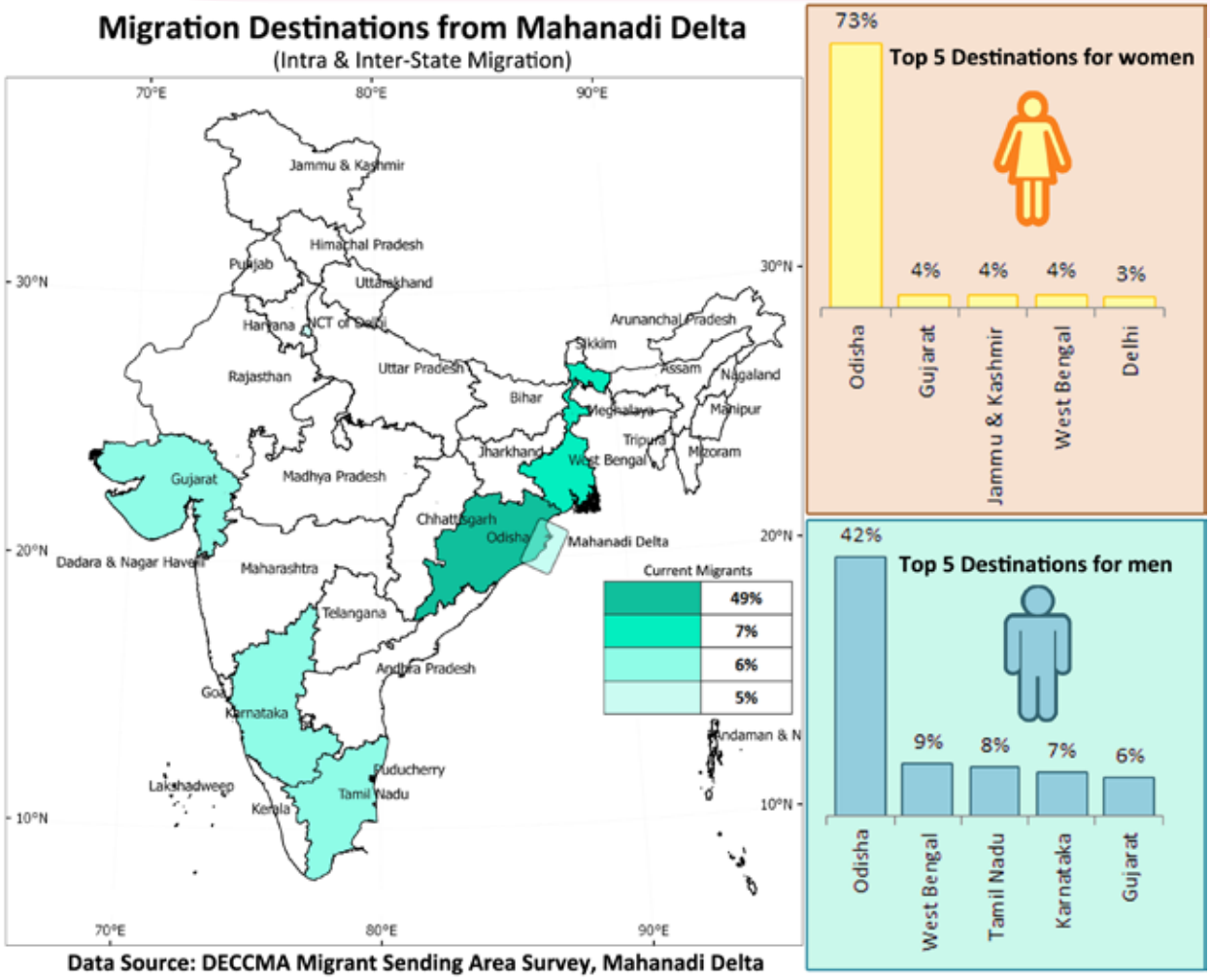

Figure 4: Migration Destinations (Intra & Inter-State Migration) from Mahanadi Delta

Governance Systems

Perceptions of migration and adaptation

Stakeholder engagement is integral to DECCMA's approach and we invited stakeholders from government departments, NGOs, CBOs and academic institutions to investigate perspectives of migration and adaptation. Both environmental and non-environmental reasons drive migration. On one hand where the delta has instances of adaptations enabling women to carry out income generating activities, but on the other hand there are instances of out-migration of young women from rural communities.

Challenges of effective adaptation policy implementation

The most satisfactorily implemented policies relate to early warning systems, reducing disaster risk, risk transfer, research and development, and water resource management. Policies that have been less well implemented for adaptation include livelihood diversification away from agriculture and marine or coastal management. In terms of social factors, religious practices have relevance in facilitating or hindering policy implementation in local level and gender norms have more relevance in national or state level than in the local level. In terms of political factors, policy implementation is hindered by a change in government and facilitated by international agreements.

Adaptation

What are the documented adaptations?

There are 14 documented empirical adaptations in the delta. These relate to disaster risk reduction, agriculture, water resources, capacity building, and alternative livelihood diversification. Some of them include construction of multi-purpose cyclone shelters, multipurpose flood shelters, capacity building of fire Services units, climate resistant farming and Integrated Rice-Fish Culture, restoration of Mangrove Forests.

Have these activities been helpful?

Adaptation activities have reduced disaster risks in the Mahanadi Delta. Through capacity building, the community has been empowered to reduce the disaster risk in their own locality. Problems of water logging could be reduced in areas. Loss of lives has been reduced due to early warning systems before cyclones. Plantation and restoration of mangroves are acting as natural protection from the cyclone and storm surge, which helps to reduce the vulnerability of the coastal communities.

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). At state level, key criteria of success relate to improvement in social development indicators, and reduction in vulnerability of the most vulnerable groups. There is more emphasis on economic development and autonomy in terms of disaster risk reduction and capacity to adapt. The only criterion that featured in the top five of both the State and Districts is the improvement of the capacity of the local institutions to manage environmental disasters and changes. Odisha is exposed to floods and cyclones, and this indicates the desire for enhancing capacity to be prepared at all levels across the 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 can assess the migration outcomes and adaptation choices in the delta under a range of climate and other scenarios. Combined with criteria for 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.

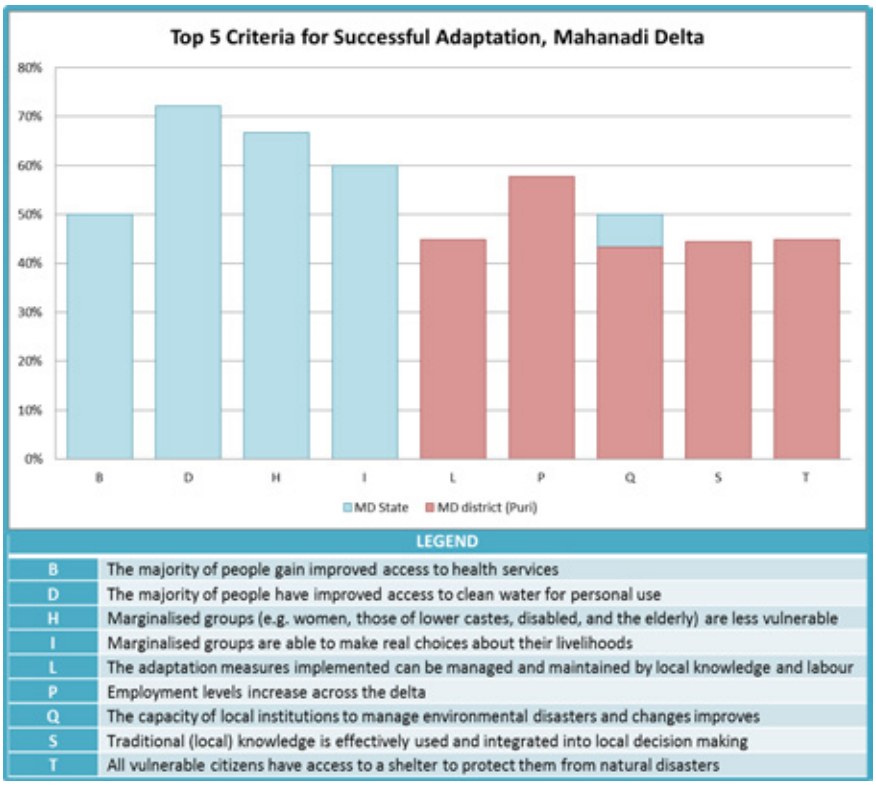

Figure 5: Top 5 Criteria for Successful Adaptation, Mahanadi Delta

Key findings and relevance for policy and practice

At State policy level, the Odisha Climate Change Action Plan, Agriculture Policy, Integrated Coastal Zone Management Plan and Disaster Management Policy are seen as the most important for climate change adaptation, based on multi-stakeholder input.

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, it runs the risk of increasing vulnerability of the delta population.

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

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 climate and environment-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.

Stakeholder feedback on priorities for successful migration and adaptation included making migration safe for the young women migrants and integrating gender in policies related to climate change. DECCMA has contributed to the Draft Odisha Climate Change Action Plan (2015-2022) and the Draft National Policy for Women (2016) to support the mainstreaming of gender and climate change.

An 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.

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