Living in the Coast Series 2

Living in the Coast
PROBLEMS, OPPORTUNITIES AND CHALLENGES

Government of the People's Republic of Bangladesh
Ministry of Water Resources
Water Resources Planning Organization (WARPO)

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PDO-ICZMP project has initiated a series titled Living in the Coast to enhance knowledge base on communities, issues, development processes and dynamics of the coastal zone in Bangladesh. This document is the second in the series with focus on coastal problems, opportunities and challenges.

M. Rafiqul Islam and Mohiuddin Ahmad have jointly prepared the document. Other members who have reviewed and/or contributed to this document, during long period of its drafting, are Rob Koudstaal, Abu Md. Kamal Uddin, Md. Liakath Ali, Sharmeen Murshid and John Soussan. The research works by Md. Sayed Iftekhar and Afsana Yasmeen have been invaluable.

PREFACE

The coastal zone differs, in terms of its social and ecological settings, from the rest of the country. An important task is to improve the understanding of the development processes and dynamics in the coastal zone. This understanding is crucial to identify area specific interventions and relevant issues to design an appropriate and effective coastal development strategy.

This document is based on an analysis of existing information and experiences, including problems and issues raised in various documents. It is a result of collating information from previously conducted participatory stakeholder consultations under many projects and initiatives and also results from project's regional workshops, perception survey and coastal livelihood analysis. Meanwhile, a Profile of the Coastal Zone has been prepared that contains extensive description of the major coastal issues. Further, series of internal brainstorming sessions were held on the structure and contents of the document and on defining vulnerabilities and opportunities in the coastal zone. A synthesis of all these elements constitutes this document.

The document has been kept as short and simple as possible so that planners and practitioners find it convenient and useful in locating the coastal zone with its uniqueness in the development context of the country. This document is expected to help in conceptualizing the coastal zone as a total 'regional' entity.

Finally, this document will be used as a background document to support formulation of the Coastal Development Strategy (CDS). This is also being published in the backdrop of the national formulation of 'Poverty Reduction Strategy Paper' (PRSP).

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ACRONYMS

BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Center for Advanced Studies
BD	Bangladesh
BRRI	Bangladesh Rice Research Institute
CDSP	Char Development and Settlement Project
C	Centigrade
cm	Centimeter
CPA	Chittagong Port Authority
COFCON	Coastal Fisherfolk Community Network
DMB	Disaster Management Bureau
EEZ	Exclusive Economic Zone
EPZ	Export Processing Zone
ERD	Economic Relations Division
ESCAP	Economic and Social Commission for the Asia-Pacific of the UN
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
ha	Hectare (1 ha = 2.471 acre)
ICZM	Integrated Coastal Zone Management
IRRI	International Rice Research Institute
kg	Kilogram
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
km	Kilometer
MES	Meghna Estuary Study
MoDM&R	Ministry of Disaster Management & Relief
MoEF	Ministry of Environment & Forest
MoF	Ministry of Finance
MoWR	Ministry of Water Resources
NEMAP	National Environmental Management Action Program
NGO	Non-governmental Organization
NWMP	National Water Management Plan
PDO-ICZMP	Program Development Office for Integrated Coastal Zone Management Plan
PDSCL	Perception of Direct Stakeholder on Coastal Livelihoods
PETRRA	Poverty Elimination Through Rice Research Assistance
PL	Post Larvae
PSF	Pond Sand Filtering
SBCP	Sundarban Bio-diversity Conservation Project
SRF	Sundarban Reserve Forest
UN	United Nations
UP	Union Parishad
WARPO	Water Resources Planning Organization
WB	World Bank
WMC	Water Management Committee

GLOSSARY

Aman	Monsoon rice crop
Aus	Summer rice crop
Badakar	Grass cutter
Bagda	Brackish water shrimp
Bawali	Wood cutter/collector in Sundarban
Boro	Dry season rice crop
Char	Newly accreted land
Golda	Fresh water prawn
Golpata	Plant grown in Sundarban, used as housing material (*Nypa Fruticans*)
Ilish	Fish species, *Hilsa*
Khal	Canal
Khas land	Indisposed government land
Kutcha	Thatched, earthen (house)
Moual	Honey collector in Sundarban
Rabi	Dry season crop
Samaj	Traditional social coalition
Salish	Informal institution comprising community leaders for conflict resolution
Shutki	Dry fish
Taka	Bangladesh currency (58.5 taka = 1 US$)
Union Parishad	Local government at the union level

1. INTRODUCTION

Background

The coastal zone of Bangladesh, an area covering 19 districts[1] facing the Bay of Bengal or having proximity to the Bay, and the exclusive economic zone (EEZ) in the Bay, is generally perceived to be a zone of multiple vulnerabilities. The Govt. of Bangladesh has already identified the zone as ' vulnerable to adverse ecological processes' (ERD 2003) and as one of the three 'neglected regions' (MoP, 1998). The opportunities and potentialities of the zone have not received much attention. By harnessing and exploiting these opportunities, the coastal zone can achieve the goals of the national poverty reduction strategy. An attempt has been made in this document to understand the challenges ahead.

Objective

It is intended to produce a baseline document in order to delve into a common view on coastal conditions, especially challenges being faced and/or to be faced by coastal communities. The main purpose is to work out a basis for revealing priority issues. This document provides a synthesized picture of the coastal conditions that makes it distinct from rest of Bangladesh and hints at issues and areas that need to be addressed for well being of the coastal communities.

Methodology

The analysis is based on existing information, observations and experiences, especially on vulnerabilities and opportunities expressed by coastal communities and other stakeholders in various surveys, studies, consultation meetings and workshops in the recent past. Among these are:

- findings of the PDSCL (Perception of Direct Stakeholders on Coastal Livelihoods) survey on 104 coastal households and in-depth life stories (PDO-ICZMP, 2002a); through this survey and interviews, the people were asked to identify their main assets, the key vulnerability issues and the opportunities;
- results of the four regional workshops organized by the project (PDO-ICZMP, 2002b);
- findings of a gender vulnerability analysis, ' Women of the Coast' carried out by the project (PDO-ICZMP, 2004);
- findings of a vulnerability analysis of major livelihood groups in the coastal zone of Bangladesh (CEGIS, 2004);
- results from a community level vulnerability assessment conducted by the Reducing Vulnerability to Climate Change (RVCC) project of CARE, Bangladesh (RVCC, 2003);

[1] The districts are Bagerhat, Barguna, Barisal, Bhola, Chandpur, Chittagong, Cox's Bazar, Feni, Gopalganj, Jessore, Jhalkati, Khulna, Lakshmipur, Narail, Noakhali, Patuakhali, Pirojpur, Satkhira and Shariatpur (PDO-ICZMP, 2003a). Together these districts account for 32 percent of the area and 28 percent of the population of Bangladesh.

- ? results from 'Participatory Stakeholders Consultation Process' held in 2000 in the preparation of the National Water Management Plan (WARPO, 2000);
- ? results from an environmental planning exercise (the National Environment Management Action Plan) carried out by the Ministry of Environment & Forest in three phases between 1992 and 1994 (MoEF, 1995); a total of 23 grassroots level workshops and six regional workshops were organized;
- ? results from a series of stakeholder analysis meetings, mainly involving coastal farmers, conducted at three different levels under the Poverty Elimination Through Rice Research Assistance (PETRRA) project (IRRI/BRRI, 1999, 2000a and 2000b);
- ? results from a series of national and regional workshops organized in the coastal areas to identify fishers' needs and opportunities and to develop management recommendations (COFCON, 2001); the COFCON, a network of 26 NGOs, carried out these workshops; and
- ? findings of the district level consultations on the draft 'Coastal Zone Policy' organized in 19 coastal districts in September-October 2003 (PDO-ICZMP, 2003c).

Based on all these information and other secondary materials, an attempt has been made to identify vulnerabilities, opportunities and related challenges faced by communities of the coastal zone.

Layout

In order to get a sense of the coastal zone, its distinct characteristics have been summarized in Chapter 2. Chapter 3 includes a description of the vulnerability context. These two chapters provide a basis for having spotlight on the coastal zone as a special area. Distinct opportunities in terms of existing and untapped resources and potentials of the coastal zone are illustrated in Chapter 4.Chapter 5 briefly presents the future scenario. Lastly, Chapter 6 suggests strategic thrusts that appear as challenges and needs to be tackled.

2. IS COASTAL ZONE DIFFERENT

Context

The question that arises at the outset is why a zoning has been done and to what extent the coastal zone is different from the rest of Bangladesh. The Policy Note on ICZM of the Govt. of Bangladesh (MoWR, 1999) addresses this question in the following manner.

> *How is the coastal area different from the rest of the country that we need an ICZM program? The simple answer is that the natural resources of the coastal areas are so different from their terrestrial counterparts as to require different and special forms of management. Coastal areas are important ecologically, as they provide a number of environmental goods and services. They frequently contain critical terrestrial and aquatic habitats, such as the mangrove forests, wetlands and tidal flats.*
>
> *The other special feature of the coastal zone is its multiple vulnerabilities out of periodic cyclone and storm surges, salinity intrusion, erosion, pollution, and overall lack of physical infrastructure. Coastal natural-resource uses reflect primarily subsistence agriculture with an emphasis on food production, e.g., paddy rice along with some cash crops and coastal fisheries, which provide a major food and income source. Also important, in some areas, is aquaculture with an emphasis on shrimp production for the export market, and some salt production for domestic needs.*

The above-mentioned statement articulates the uniqueness of the coastal zone that points toward a host of natural and socio-economic conditions, realities and potentials.

Uniqueness

Though the coastal zone is similar to the rest of the country in some respect, it is also different to a considerable extent. These distinctions are elaborated in a number of PDO documents and are being pulled together in a base document, Profile of the Coastal Zone of Bangladesh (PDO-ICZMP, to be published soon). Some of the unique characteristics are summarized below:

Natural setting

- ? covers both land and the sea; in fact, it is the zone of interface between land and the sea;
- ? has one of the most hydro-morphologically dynamic estuaries; semi-diurnal tide is an important element;
- ? natural erosion and accretion cause an ever dynamic change in land form;
- ? has 50-60 coastal islands, some are very remote;
- ? has sub-ecosystems like mangrove, marine, estuary, islands, coral, sandy beaches, sand dunes;
- ? has both ecologically rich 'world heritage sites' and 'ecologically critical areas';
- ? has world's largest single tract of mangrove forest, Sundarban; and
- ? has world's longest single stretch of sandy beach in Cox's Bazar.

Social setting

- has lower population density and population with comparatively higher literacy rates;
- has comparatively better gender balanced population
- has special livelihood groups like marine fishers, salt farmers, *bawali* and *mawali*;
- has special disadvantaged groups like erosion victims, island dwellers; and
- has distinct ethnic communities like Rakhaine, Pundra-Khatrio, Munda and Mahato.

Vulnerabilities

- vulnerable to natural disasters; some occur only in the coast: cyclone, storm surge, drainage congestion, salinity intrusion and land erosion;
- faces extreme (possible) impact of climate change; and
- is the ultimate recipient of pollution load.

Opportunities

- has diverse coastal and marine resources, including mangroves, coastal and marine fisheries, coastal agriculture, shrimp, crab and salt;
- has land generated through accretion processes; provides new settlement opportunities for the growing coastal population;
- on-shore and off-shore oil and gas fields and other potential energy sources like wind and tidal energy;
- sea ports located at Chittagong and Mongla and surrounding industrial infrastructure; and
- tourism opportunities at coastal beaches, islands and in the Sundarban.

Livelihoods

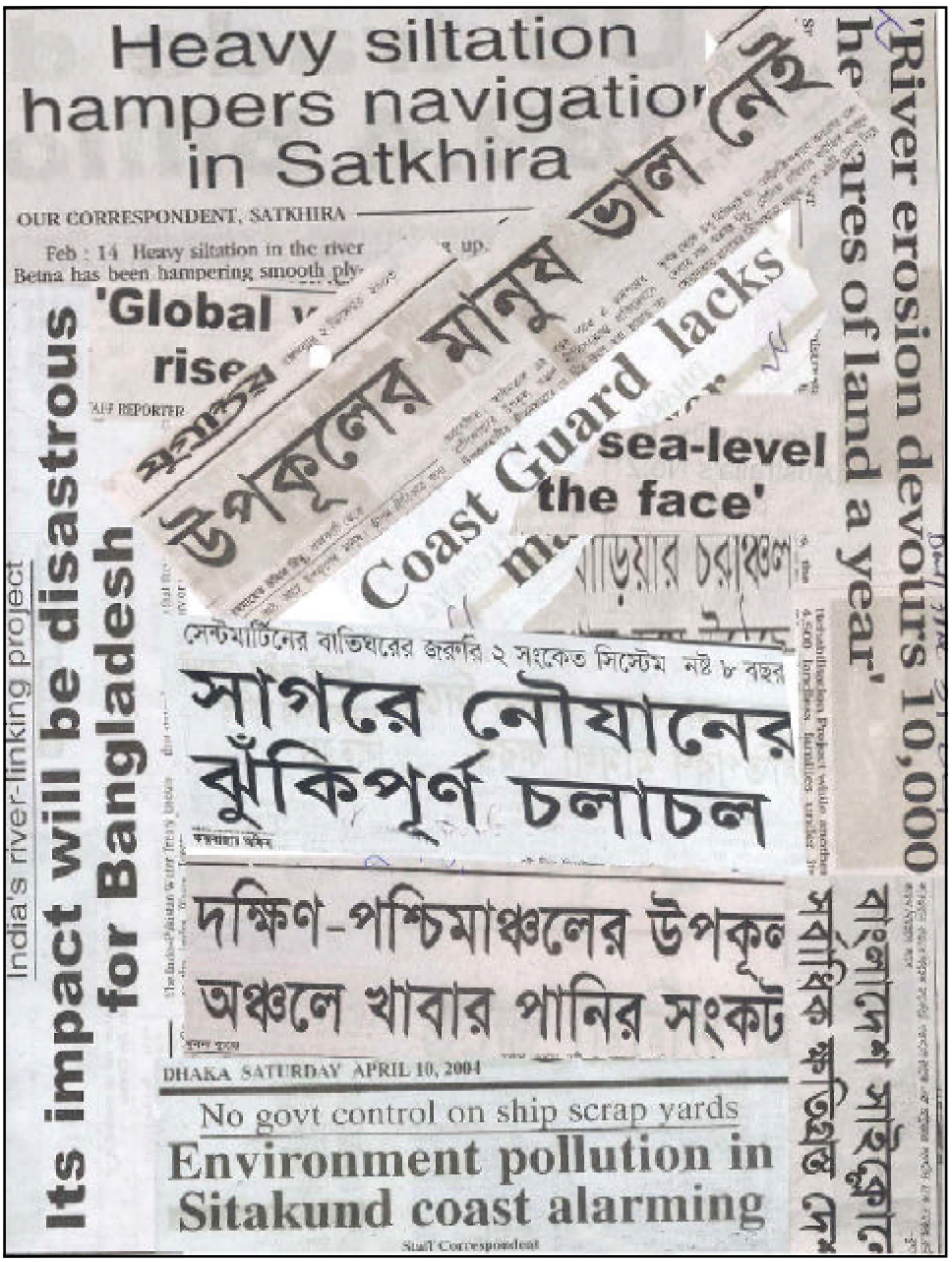
The uniqueness described above affects life and livelihoods of coastal communities. According to the 2001 population census, there are about 6.85 million households in the coastal zone with a population of 35.1 million. The pattern of household distribution in the coastal zone is also slightly different from the rest of the country: the proportion of non-farm households is lower and that of small farmers is higher.

Livelihoods of coastal people are also varied and some are very specific to the zone that is often influenced by different coastal conditions. Major livelihood groups are shown in Table 1.

Table 1: Major livelihood groups

Livelihood group	Estimated number of households (2001)[1]	Percentage
Rural	5,254,000	**76.7**
Farm laborer	1,744,000	25.5
Small farmer	1,724,000	25.2
Medium and large farmer	462,000	6.7
Fisher	514,000	7.5
Salt farmer	38,000	0.6
Shrimp fry collector	185,000	2.7
Forest resources collector	119,000	1.7
Other rural	809,000	11.8
Urban	1,596,000	**23.3**
Poor	798,000	11.7
Non-poor	798,000	11.7
Total	6,850,000	100.0

[1]Components may not add to 100 percent as some households of some groups (salt farmer, shrimp fry collecor and forest resources collector) may be included in other groups. Estimates are based on 1996 Census of Agriculture and 2001 Population census. Based on available data, salt farmers are from Cox's Bazar district and forest resources collectors are those who depend on Sundarban resources. Actual number of salt farmers and forest resources collectors would be more. Urban poor are assumed to be 50 percent of total urban population (PDO-ICZMP, 2004a).


Heavy siltation hampers navigation in Satkhira
OUR CORRESPONDENT, SATKHIRA
Feb : 14 Heavy siltation in the river Betna has been hampering smooth
'River erosion devours 10,000 hectares of land a year'
'Global rise
Coast Guard lacks
sea-level the face'
সাগরে নৌযানের ঝুঁকিপূর্ণ চলাচল
দক্ষিণ-পশ্চিমাঞ্চলের উপকূল অঞ্চলে খাবার পানির সংকট
DHAKA SATURDAY APRIL 10, 2004
No govt control on ship scrap yards
Environment pollution in Sitakund coast alarming
Staff Correspondent
India's river-linking project
Its impact will be disastrous for Bangladesh
বাংলাদেশ সাইক্লোনে সর্বাধিক ক্ষতিগ্রস্ত দেশ

3. VULNERABILITIES

The vulnerability context may be explained in terms of problems that people face, which affect their asset base and their choices and income. It has regional variations, as well as variations with respect to socio-economic conditions of the people.

One unique feature of the coastal zone is its distinct vulnerabilities that many people face. These are more varied and intensive than those faced by even poorer and more vulnerable inland communities. These vulnerabilities are important manifestations of the poverty found in the coastal zone.

People are vulnerable because they live in an extremely dynamic estuarine environment facing such threats as: cyclone and storm surge, land erosion, flood, drainage congestion, salinity intrusion, drought, tectonic process and deteriorating coastal ecosystems. Besides, there are threats of climate change and upstream land and water uses. These threats affect almost every aspect of life and limit livelihood choices of the people. These vulnerabilities create a context of insecurity, which in turn, discourage investments, limit economic activities and squeeze employment opportunities. Scarce public, private and community resources are consumed in mitigation efforts and not much is left for expanding economic activities and generating employment.

As elsewhere in the world, the coastal zone of Bangladesh has the highest concentration of natural hazards. Some of these are dreadful and devastating. Major vulnerabilities are described in Table 2.

Table 2: Overview of vulnerabilities

Vulnerabilities	Vulnerable areas	Present status	Risk of aggravation
Cyclone and storm surge	Islands, exposed upazilas	Devastating but seasonal	Increasing
Land erosion	Meghna and other estuaries, islands and coastal rivers	Serious, localized, seasonal	Increasing
Flood	Exposed upazilas	Serious, seasonal	Increasing
Drainage congestion	Khulna, Jessore, Noakhali	Localized, year round	Increasing
Salinity intrusion	Western exposed upazilas	Localized, seasonal	Increasing
Drought	Satkhira	Localized, seasonal	Increasing
Earthquake	Chittagong	Unpredictable	Increasing
Shortage of drinking water & arsenic contamination	All over	Serious, year round	??
Ecosystem degradation	Marine, Sundarban	Serious, year round, cumulative	Increasing
Pollution	Chittagong, Khulna	Serious, year round, cumulative	Increasing
Climate change	All over	Year round, cumulative	Increasing

Cyclone and storm surge

Records of last 200 years show that at least 70 major cyclones hit the coastal belt of Bangladesh. During last 35 years, nearly 900,000 people died due to catastrophic cyclones. The Noakhali-Chittagong coast received 40 percent of the cyclones, which is the most vulnerable area for the landfall of cyclones. The Chittagong-Cox's Bazaar coast received around 27 percent, while Khulna / Sundarban and Barisal-Noakhali coasts are relatively less vulnerable (Rahman, 2001). Some examples of severe tropical cyclones are the Barisal cyclone of 1584, the Bakerganj cyclone of 1876, the 12 November 1970 cyclone, the May 1985 Urir Char cyclone, and the April 1991 cyclone. High intensity storm surges jeopardize the expansion of energy-recovery activities in the coastal areas and supporting industries, especially in the offshore areas.

In order to minimize fatal consequences of cyclones, construction of cyclone shelters commenced in the 1960s and subsequently increased following the severe cyclone in 1991. In 2004, there are 2,133 multi-purpose cyclone shelters (MoDM&R, 2004). The existing shelter capacity can accommodate only about a quarter of the population at risk. In the backdrop of increasing population, 100 additional cyclone shelters are needed annually. Can the country afford this?

An effective disaster warning system is being developed. A comprehensive disaster management program (CDMP), under the auspices of the Disaster Management Bureau (DMB) and the Bangladesh Red Crescent Society, is being implemented.

Land erosion

Land erosion is a common natural phenomenon in the coastal zone. Massive changes have occurred in the coastline over the last two centuries due to land erosion, coupled with land accretion. Erosion is most severe in the Meghna estuary. A huge land of 86,366 ha eroded during 1973-2000 (MES, 2001). Most of these lands were inhabited and used for economic activities. Boundaries of islands undergo major changes due to land erosion and simultaneous accretion. Erosion victims are a disadvantaged group in coastal areas subject to both social and economic distress.

Besides the erosion of the riverbanks, the foreshore and the embankment systems are posing a continuous problem in the coastal areas. This exposes interior lands to the threats of cyclone surges and salt-water intrusion.

River erosion has taken a serious turn in Barisal, Patuakhali, Bhola, Barguna, Jhalkati and Pirojpur districts, and many families have become homeless. Some 30,000 houses, many commercial establishments, hundreds of educational institutions, and over thousands of hectares of cropland have been devoured by different rivers in the southern districts during last 10 years.

Measures against erosion are costly and are applied at few selected locations. Some low cost protection measures have been identified and some pilot exercises have been done. Comprehensive erosion control or protection plan does not exist.

Flood

There are various types of floods: monsoon or fluvial floods, flash floods and tidal floods. Monsoon floods usually do not cause much problem in the coastal zone compared to other parts of the country. Flash floods are a regular phenomenon in the foothills of Chittagong and Cox's Bazar districts due to constraints in drainage. In late July 2002, torrential rains caused flash flood in about 80,000 acres of land in eight upazilas of Chittagong and four upazilas of Cox's Bazar, causing human sufferings and damage to standing crops. About 100 villages in these upazilas were severely affected, and about 80 percent of the standing crops were submerged under 6-7 feet of floodwater.

An unprecedented flood in September- October 2000 from unusual heavy rainfall hit the western part of the coastal zone, especially Satkhira and Jessore districts. Satkhira experienced flood once again in July 2002. More than 5,000 *kutcha* houses were completely damaged, and at least 400 shrimp farms were washed away. The loss was roughly estimated at 20 million taka.

Tidal floods are typical for the coastal zone. Tidal fluctuations vary considerably across the coast, as well as vertically inward from the coastline. The fluctuations are the highest at Sandwip (7.65m) and the lowest at Barisal (2.81m).

In order to protect the coastal areas from tidal flooding, embankments are usually constructed. A total of 123 polders with about 5,017 km of embankment have so far been constructed.

Water logging and drainage congestion

Water logging is especially experienced in the southwest (Khulna-Jessore) and south- central (Noakhali-Lakshmipur) areas. In the southwest, Khulna-Jessore Drainage Rehabilitation Project (KJDRP) was taken to reduce drainage congestion. The concept of Tidal River Management (TRM) has been reinforced from this project. No comprehensive program has yet been taken for Noakhali-Lakshmipur area.

Localized drainage congestions are reported throughout the coastal zone. All congestions affect livelihoods because of crop damage, water borne diseases, etc. Most affected districts are Bhola, Patuakhali, Pirojpur and Barguna.

Salinity intrusion

Water and soil salinity is a common hazard in many parts of the coastal zone. Agricultural activities suffer greatly. Seventy percent of 2.35 million hectares within the Khulna and Barisal Divisions is affected by different degree of soil salinity (Rahman & Ahsan, 2001). This reduces the crop area. It restricts the cultivation of *aus* (summer rice), *boro* (dry season rice) and other *rabi* (dry season) crops. There is a seasonal salinity interface in the estuaries, with the threshold limit for agriculture moving further inward from the coast in May in the southern part of the coastal zone.

In the southwest region, surface water salinity has been accentuated by the reduction in the dry season upland flows entering the Gorai distributaries. Salinity now reaches as far as Khulna city, creating problems to normal agricultural practices and affecting the supply of clean water for industrial use. The proposed river link project in India will aggravate the situation further.

Coastal polders were designed to prevent salt-water intrusion. Many polders have lost their function because of both undesired breaching causing crop damage, and "desired breaching" facilitating shrimp farming. Land use conflicts exist in the area.

Salinity intrusion inhibits industrialization. For example, a number of industrial units in Khulna are facing shortage of fresh water during the dry season. As a consequence, no new heavy industry has been set up in the recent years in the Khulna region despite increasing infrastructure facilities (road, seaport, etc.).

Drought

Moderate drought risk prevails in the coastal zone with varying intensities and magnitudes over the seasons. Southwestern coastal districts except Sundarban are in risk of moderate drought during the dry season. All other coastal districts are susceptible to slight drought. Bagerhat, Khulna and Pirojpur are susceptible to severe drought during the *Kharif* season, while Satkhira is susceptible to very severe draught during that time.

Drought hazard poses serious threat to food security, as it brings down the yield of crops. No preventive measures are in place.

Earthquake

The coastal districts are less vulnerable to earthquakes than the rest of the country (Ali, 1998). Recently, however, earthquake incidents occurred in the Chittagong area several times, 40 registered during 2002 (DPF, 2003). The Chittagong earthquake of 27 July 2003 occurred with a magnitude of 5.6 in the Richter scale. Moheshkhali Island, of tectonic origin, has hills of tertiary age and has also experienced earthquakes in recent times.

Earthquake warning system is weak. Earthquake management measures are being identified but not yet in place. The ongoing Comprehensive Disaster Management Program will give special emphasis on urban earthquake.

Drinking water & arsenic contamination

Lack of safe drinking water has been identified as the number one issue in the daily life of the coastal population. The water supply sector has achieved commendable success over the last few decades; overall about 95 percent of the population now has access to water from tube-wells, taps or ring-wells. Rural water supply is mainly dependent on tube-wells. Pond water is also in use, especially where groundwater is either saline or beyond affordability. There are 316,686 tube-wells in the coastal zone, which is 29 percent of total tube-wells in the country. According to latest DPHE data (unpublished DPHE database), the tubewell-population ratio is slightly higher in the coastal zone: 111 persons per running tubewell, compared to 115 nationally. Districts with lower than average density of tube-wells are: Bagerhat, Barguna, Bhola, Cox's Bazar, Khulna, Patuakhali and Satkhira.

But in recent years, groundwater-based water supply in coastal areas is suffering from a number of major problems, main ones being arsenic contamination, lowering of the water table, salinity, and non-availability of suitable aquifers.

Most of the coastal districts are affected by arsenic contamination. The UNICEF-funded DPHE program tested 51,000 tubewells in 61 districts and found arsenic in 48 districts. Around 29 percent tube-wells were contaminated with arsenic above the permissible level. The study found that arsenic contamination is more evident in the central part of the country (BGS & DPHE, 2001). The tests show that at depths below 200m, the incidence of contamination falls off, and at 250m or more it is rare. Data were collected by DPHE during the dry season of 1998 from deep and shallow tube-wells around the country. Data were also gathered from deep tube-wells in 17 coastal districts (98 upazilas). Tube-well water in a number of coastal districts contains arsenic above the norm of 50 mg/l, but it also shows that the norm is exceeded here and there substantially. There are 12 districts with high arsenic contamination, of which seven are in the coastal zone: Chandpur Gopalganj, Noakhali, Satkhira, Shariatpur, Bagerhat and Lakshmipur.

It was estimated that in many parts of southern Bangladesh, one in ten adult deaths could develop from arsenic - triggered cancers of internal organs, such as the bladder and lungs. People are more vulnerable due to poor nutrition, the large volume of water they drink (typically five liters a day), and because they may ingest more arsenic through eating rice irrigated by and prepared in poisoned water (Pearce, 2001).

Box 1: Coping with arsenic menace

Arsenic menace has taken a serious turn in Babuganj upazila of Barisal district. At least six people died and 202 others attacked with arsenocosis in the upazila. Water of all 5,040 shallow tube-wells and four out of 1,220 deep tube-wells in six unions of the upazila was detected contaminated with arsenic beyond permissible limit. At least 202 people in all the 44 villages have developed arsenocosis. NGO Forum for Drinking Water Supply and Sanitation has so far installed 82 rain water harvesting system plants, 12 pond sand filter plants, three arsenic iron removal plants, one dug well and one community based rain water harvesting system plant at different villages of the upazila. Earlier, it was ascertained that the southern and coastal belts of the district are free from arsenic contamination. But later it was proved that the ground water, even at the seacoast, is contaminated with arsenic. Babuganj is the worst affected area while Uzirpur and Mehendiganj upazilas come next.
The Independent, 28 October 2003.

The Government has initiated extensive program of tubewell testing and public awareness of the possible danger. Low-cost preventive measures are known but yet to be available at the household level all over the coast. Rainwater harvesting and pond sand filtering (PSF) are being advocated and are practiced in some areas (see Box 1).

Ecosystem degradation

The coastal zone of Bangladesh experiences extensive ecosystem degradation. Some of the interventions to cause degradation are: drainage for agriculture; dredging and canalization for navigation and flood protection; filling for solid waste disposal; land use for commercial, industrial or residential purposes; conversion of land for aquaculture; construction of dykes for flood control and irrigation; discharge of pesticides and herbicides; domestic and industrial waste; agricultural runoff and sediment; deep channels and other structures; hydrological alternation by canals; roads and other structures; and subsidence due to extraction of groundwater.

Although the rate of destruction of mangroves is less as compared to the overall destruction of forests, comparison of aerial photographs from mid eighties to early nineties shows destruction at annual rate over 2,000 ha (UNEP website). Factors responsible for the destruction of the mangrove forests are the removal of forest products for fuel, high pressure of grazing, haphazard fishing activities, human settlement, salt production and shrimp farming.

Some initiatives have been taken for conservation and restoration of the ecosystems. But these are not linked with livelihoods of traditional users. Comprehensive ecosystem management plan does not exist.

Pollution

Of various types of pollution in the coastal zone, pollution with oil mostly draws public attention. Oil spills pollute coastal waters and ultimately intoxicates the soil. Negative impacts on flora and fauna are substantial, causing degradation of the ecosystems and also severe economic damage.

Examples of accidents in the Bay are numerous. There have been reports of oil slicks in the territorial waters of Bangladesh and in the upper Bay of Bengal (ESCAP/ UN, 1987).

Water pollution is increasing. A complex mixture of hazardous chemicals, both organic and inorganic, is discharged into the water. Besides, large cities drain enormous amount of domestic effluents. Chittagong and Khulna do not have adequate wastewater treatment facility, and are major sources of water quality degradation, resulting in coastal pollution. Chittagong, because of its situation in the coastal zone proper, and Khulna, directly linked to the estuary channel system of the western coastal area, have direct impact on coastal waters.

One of the most polluting is the ship-breaking industry. Many ship-breaking enterprises operate near Chittagong. The bottom sludge of residual heavy oil in the oil chambers of tankers, and other lubricants and engine oil from condemned tankers/ships, constitute a considerable amount of oil and chemical spill during washing and dismantling operations. In the course of dismantling old ships, on an average 90 vessels a year, poisonous chemicals are released in the environment.

Stringent rules and regulations to prevent pollution have been enacted. Enforcement remains a problem. Recently, separate 'Environment Court' has been established.

Climate change

Given the extremely low elevation of the coastal zone, the threat of sea level rise is high. The likely climate change scenarios for Bangladesh are presented in Table 3.

Table 3: Climate change scenarios for Bangladesh

Year	Sea level rise (cm)	Temperature increase (°C)	Precipitation fluctuation compared to 1990 (%)	Changes in evaporation
Based on 2nd IPCC projections (WB 2000)				
2030	30	+0.7 in monsoon; +1.3 in winter	-3 in winter; +11 in monsoon	+0.9 in winter; +15.8 in monsoon
2050	50	+1.1 in monsoon; +1.8 in winter	-37 in winter; +28 in monsoon	0 in winter; +16.7 in monsoon
Based on 3rd IPCC projections (Agarwala et al 2003)				
2030		+0.8 in monsoon; +1.1 in winter	-1.2 in winter; +4.7 in monsoon	
2050		+1.1 in monsoon; +1.6 in winter	-1.7 in winter; +11.8 in monsoon	
2100		+1.9 in monsoon; +2.7 in winter	-3.0 in winter; +11.8 in monsoon	

Possible impacts of are:

- ? change in water levels and induced inundation and water logging;
- ? increased salinity in ground and surface water, and corresponding impact on soil salinity;
- ? increased coastal morphological dynamics (subsidence, erosion and accretion); and
- ? increased incidence of natural hazards.

Drainage congestion may become an even more serious threat than higher flood risks. Due to siltation and poor maintenance of the drainage channel networks in many parts of the coastal zone, drainage congestion is already a grave problem, and the problem is likely to increase considerably.

Saline water intrusion is highly seasonal. It is at its minimum during the monsoon (June-October) when the main rivers discharge about 80 percent of the annual fresh water flow. In dry season months, the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent. Extreme weather events induced by climate change, especially low flow conditions in the dry season, will accentuate the saline intrusion in the coastal areas.

Climate change is expected to increase the intensity of cyclones, resulting in the penetration of storm surges further inland, causing higher damages.

Coastal polders offer the first line of defense against sea level rise. But maintenance of sea dykes of polders has to be continued.

Impacts of vulnerabilities on coastal households

All these vulnerabilities mentioned above affect the households and aggravate their hardship and poverty. The impact varies according to variation in the household and community resource base.

There is also regional differentiation of vulnerability issues. Some issues are more widespread than others. In the PDSCL survey (PDO-ICZMP, 2002b), it has been indicated that in islands, *chars* and eastern part of the coast, cyclone is the main vulnerability issue. In western part of the coast and in urban areas, lack of potable water has been found as a major issue. In the old upper Ganges catchments and urban areas, drainage has been mentioned as a major vulnerability issue, while health surfaced as an important issue in all areas.

Within a vulnerability context, households are affected in various ways. Sometimes, an incident is experienced as a shock, such as, sudden fall in income because salt is washed away from the salt farm because of heavy rain, or all the cows die in a cyclone, or occupational mobility is restricted because the fishing boat is stolen. Sometimes, situation of the people worsens because of long-term trends, such as, lack of potable water due to increasing salinity, deteriorating economic situation because of declining common access resources, etc.

The context and perception also vary between men and women. For example, women are more concerned about issues of potable water and sanitation, while men talk more about cyclone, declining resources and lack of capital. Vulnerability perceptions also vary among occupational groups. Among men, farmers mostly talk about (lack of) employment, fishers about declining resources, traders about law and order and daily laborers about cyclone, while their female counterparts consider salinity and (non-availability of) drinking water and (lack of) cash as main vulnerability issues. Table 4 summarizes responses based on the most important issues ranked by the respondents.

Table 4: Perception of issues

Main occupation	Male		Female	
	Main issue	2nd main issue	Main issue	2nd main issue
Daily labor	Cyclone	Employment	Drinking water	Sanitation
Farming	Employment	Drainage	Salinity	
Housework			Drinking water	Cyclone
Fishing	Declining resources	Employment	Drinking water	
Service	Drinking water	Low income		
Trading	Law and order	Lack of capital	Lack of capital	
Salt farming	Cyclone			
Fish drying	Lack of capital	Cyclone		
Industrial labor	Lack of capital	Debt	Drinking water	Drainage

Source: PDO-ICZMP, 2002b

Manifestations of vulnerabilities

The 1999 WB/NEDA/WFP Concept Paper on ICZM (PDO-ICZMP, 2002c) identified the following conditions that restrain coastal livelihoods and limit their coping capacity:

* widespread **poverty**, limited livelihoods opportunities (especially outside agriculture) and poorly developed **economic linkages**, including poor access to markets, that are even more severe than in other parts of rural Bangladesh;
* poor levels of **service provision** and very poorly-developed **institutional structure** (with both government and non-government institutions poorly represented in many communities) that make the **isolation** of many coastal areas worse;
* highly **unequal social structure**, with a small powerful elite dominating the mass of people, allied to high levels of **conflict** and poor **law and order**;
* changing patterns of **land use**, both in the coastal zone (including the growth of shrimp and salt production) and over the catchments as a whole that are affecting the coast's morphology and water resources characteristics; and
* poor **resource management**, including the unsustainable exploitation of fish resources and poor ground and surface water management (including drainage problems), the clearing of mangroves and other forests and soil fertility management.

These conditions have been analyzed in detail in a recent document (PDO-ICZMP, 2003a). These are summarized below.

Poverty

The coastal zone is relatively income-poor compared to the rest of the country. Average per capita GDP (at current market price) in the coastal zone was Tk 18,198 in 1999-2000, compared to Tk 18,291 outside the coastal zone. Districts of Chittagong and Khulna have higher GDP per capita, while Feni, Noakhali, Lakshmipur, Chandpur, Shariatpur, Gopalganj and Jhalkati have much lower GDP per capita. Among the livelihood groups, incidence of poverty is the highest among agriculture laborers (BBS, 2002b).

Extent of poverty in terms of calorie intake is relatively high in the coastal zone, where 52 percent people are poor and 25 percent are extreme poor. Corresponding figures for Bangladesh are 49 and 23 percent respectively. Extreme poverty is very high in Lakshmipur, Chandpur and Bagerhat, above 30 percent of the population (PDO-ICZMP, 2003a).

Poverty is aggravated by lack of employment. With increasing population, the situation will worsen further. To overcome this, a quarter of a million new jobs need to be created annually on the average, and about four-fifths of these jobs should be available in urban areas (PDO-ICZMP, 2004a).

Women are poorer among the poor. Gender gap is widespread in all spheres and at all levels, as statistics on health, nutrition, education, employment and political participation so clearly demonstrate (PDO-ICZMP, 2004c).

Economic linkages

Physical facilities with respect to market infrastructure are critically important for economic life. Out of 2,100 growth centers, 588 (28%) are in the coastal zone. The density of growth centers is relatively lower in the coastal zone. The average area per growth center in and outside the coastal zone is 80 km^2 and 66 km^2 respectively. Within the coastal zone, Bhola, Noakhali and Patuakhali have a lower density of growth centers, over 100 km^2 per center (PDO-ICZMP, 2003a). The lower density of growth centers is also a disincentive to women's market access, economic participation and mobility (PDO-ICZMP, 2004c).

Service provision

Services with respect to water, sanitation, health and electricity are poor (PDO-ICZMP, 2003a). Tubewells are the main source of drinking water. In the coastal zone, tubewell-density (number of running tubewells per km^2) is seven, which is less than outside the coastal zone (eight). Among the coastal districts, tubewell-density is very low in Shariatpur, Pirojpur and Feni (3/km^2). In the coastal zone, the proportion of choked tubewells is higher (5%) than in other areas of the country (4%), which is indicative of slightly poorer maintenance status of tubewells in the coastal zone.

The situation is also bad with respect to other amenities of life. In the coastal zone, 11 percent households possess water-sealed latrine, compared to 14 percent nationally. The situation is worse in Patuakhali, Bhola and Cox's Bazar. In order to achieve the government target of 100 percent sanitation coverage by 2010, about 0.7 million sanitary latrines are to be installed annually on the average (PDO-ICZMP, 2004a).

Health infrastructure is relatively scanty in the coastal zone. There is one hospital bed (run by the government) per 4,637 persons on the average in the coastal zone compared to 4,276 persons nationally. In order to make health services more accessible and to reduce the gap between the coastal zone and the country, more than 400 new hospital beds should be installed annually on the average (PDO-ICZMP, 2004a).

Access to the national electricity grid is limited with only 31 percent households having electricity connection. Worst districts are Shariatpur, Gopalganj, Pirojpur, Patuakhali and Bhola (below 15%). Some parts of the coastal zone, particularly the offshore islands, being remote and not easily accessible, will not be connected with the national electricity grid in the foreseeable future (PDO-ICZMP, 2003a).

Institutional structure

Access to local government is considered a valuable asset. Proximity to Union Parishad (UP) office is assumed to be positively correlated with services rendered by the UP in respective jurisdictions. In the coastal zone, the average area under a UP is 35 km^2, which is higher than outside the coastal zone (32 km^2).

Many households in the coastal zone consider membership of NGO groups an important asset. Within the coastal zone, however, their coverage is poor in Lakshmipur, Chittagong and Chandpur (less than 25% households), and quite high in Shariatpur and Gopalganj (above 50% households). Many remote areas like *chars* and islands remain outside the coverage of the NGOs.

Social structure

Social structures are mainly based on land holding. Overwhelming majority of rural households are landless and small farmers. In Cox's Bazar, Chittagong, Feni, Chandpur and Lakshmipur, their combined proportion is above 90 percent (PDO-ICZMP, 2003a).

Conflict and law and order

Char land related crime and violence mostly occurs in Barisal, Patuakhali, Noakhali, Bhola and Lakshmipur. Grabbing crops, land grabbing, loot and robbery are main types of crime. Sporadic and autonomous settlements in newly accreted land often lead to factionalism and skirmish. In land disputes and conflicts, many people are harassed, kidnapped, evicted and killed. Reasons are unsettled district boundary, isolation and vested interests of the power brokers. In recent months, Boyer Char (Noakhali) hit the news headline with incidents of rape, looting, house burning and killing.

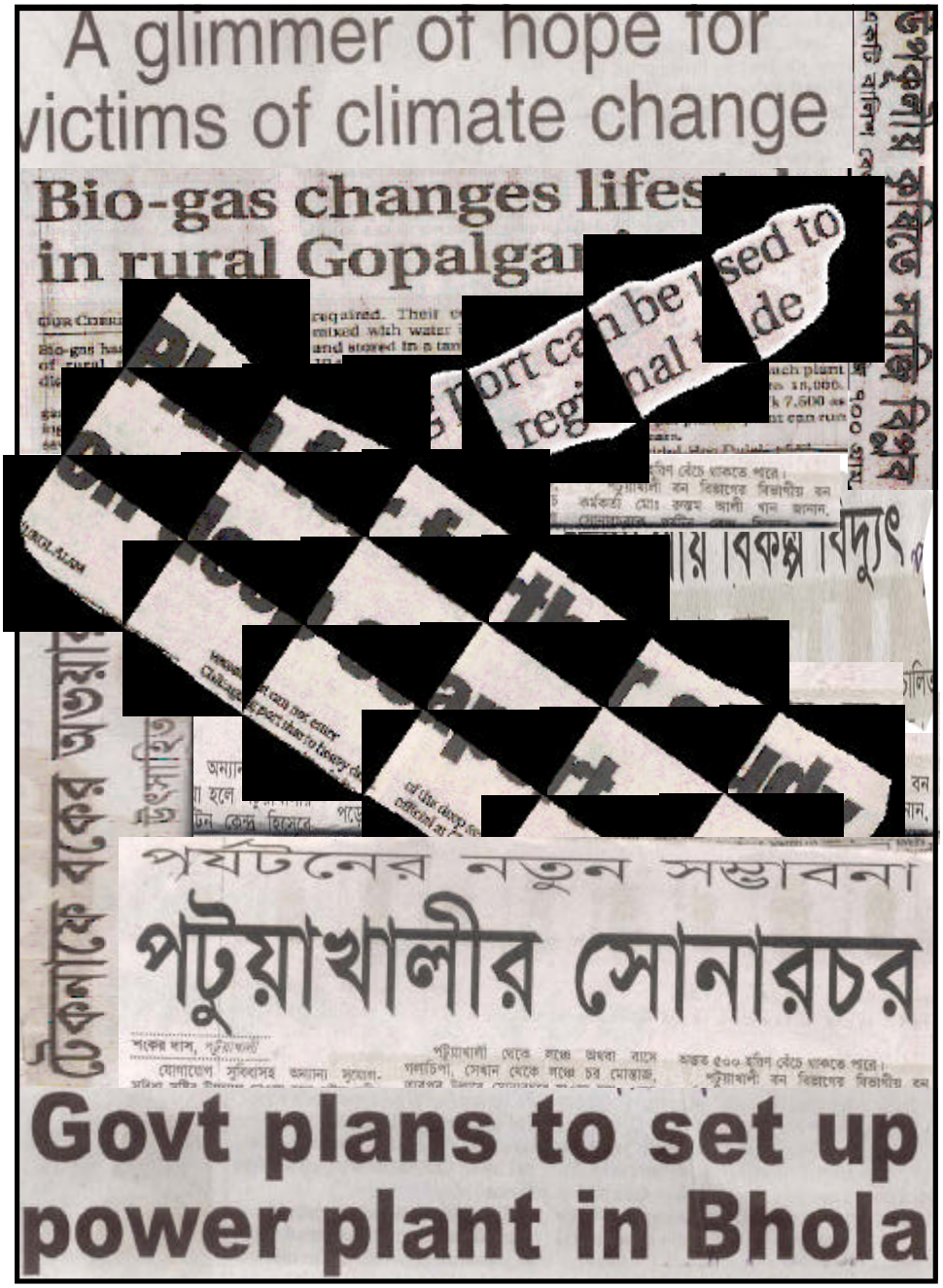
Violence against women is a common phenomenon in coastal zone that includes domestic violence, trafficking, rape and sexual abuse, acid throwing, etc. Family and land disputes, refusal of marriage proposals, rejection of sexual advances, political vengeance, and unmet dowry demand are some of the reasons behind violence against women (PDO-ICZMP, 2004c).

Land use pattern

Many framers in Cox's Bazar have switched over to salt production and those in Satkhira-Bagerhat-Khulna area to shrimp culture in the recent years from traditional agriculture, allowing more and more salt-water in the land. In 2003 alone, 38,328 salt farmers operated on 23,735 ha of land in Cox's Bazar district (PDO-ICZMP, 2004b). There are 37,400 *bagda* shrimp fields with an operated area of 170,000 ha (PDO-ICZMP, 2003b)

Resource management

Artisanal fishers crowd all along the coast and are engaged in over-exploitation of fish resources. Shrimp culture still depends on natural fry collection substantially. Various local initiatives add to poor ground and surface water management. Localized actions often create or aggravate drainage congestion. Extraction of forest resources recurrently occurs without their replenishment. Clear strategies for harnessing renewable and non-renewable resources are absent.


A glimmer of hope for victims of climate change
Bio-gas changes lifes
in rural Gopalga
পর্যটনের নতুন সম্ভাবনা
পটুয়াখালীর সোনারচর
Govt plans to set up power plant in Bhola

4. OPPORTUNITIES

The coastal zone contains distinctive development opportunities that can be instrumental in reducing the poverty of coastal communities and can contribute significantly to national economic growth. Some of these opportunities are untapped and some have significant expansion potentials. In spite of multiple vulnerabilities, available resources offer huge potentials for livelihood enhancement and economic growth. A range of opportunities is illustrated below.

Fish and related activities

In 2002/03, the fisheries sub-sector contributed 5.23 percent of the GDP. Total output includes 445,000t from marine fisheries, which is an important source of income and employment in the coastal zone. From 1995/96 to 2002/03, marine catch increased by about 65 percent (MoF, 2003), though *ilish* (*hilsa*) catch decreased by 25 percent during 1995/96-2000/01 (BBS, 2002b). This catch, at unsustainable level, is basically from shallow to medium shallow sea, while the deep sea remains largely untapped. Necessary infrastructure and capital support is needed to relocate fishers from shallow area to the deep sea.

Coastal zone also has inland fisheries potentials. There are natural rivers, canals, *beels*, flood plain, *baors* and ponds. Inland open water fish catch increased by 25 percent over the seven-year period (1995/96 to 2002/030), while closed water fish production has more than doubled, to the extent of 122 percent (MoF, 2003). The coastal zone accounts for 40 percent of total pond-fish production and 36 percent for inland capture fisheries (DoF, 2003). Inland catch can be sustained and further enhanced through better management practices and enforcement of conservation strategies. Pond aquaculture provides huge potential for farmers as alternative livelihood, which has not yet been fully exploited.

Shrimp farming is a major contributor to the economy of Bangladesh, currently accounting for 2.5 percent of global production. It is the second largest export item of the country after readymade garments. It is a key economic activity in the coastal zone. Shrimp farming is concentrated in the districts of Cox's Bazar, Khulna, Bagerhat and Satkhira. The sector generates US$ 301 million annually, from *bagda* and *golda* farms, US$ 243 million from *bagda* alone (PDO-ICZMP, 2003b).

Twenty shrimp landing and service centers have been established to maintain the quality of shrimp after collection (MoF, 2003). A hatchery industry has developed over the years

particularly to respond to shrimp and fish culture. *Bagda* hatcheries are mostly concentrated in Cox's Bazar that largely meets the demand of the *bagda* farms. The installed capacity of the hatcheries is adequate to meet even an expanding demand for PL.

The Fisheries Sector Review 2003 has predicted annual growth of 3.2 percent to 9.2 percent over the next decade for coastal aquaculture showing the potential of shrimp farming. The same study predicted declining growth of -0.6 to -1.6 percent for coastal/marine capture fisheries. This has not taken into account untapped marine fisheries potential from deep-sea fishing within the EEZ of Bangladesh.

Shutki (dry fish) is also an exportable commodity and has an expansion potential. Fish drying is mainly concentrated in Cox's Bazar, Chittagong and Khulna. Part of the catch from the Bay of Bengal, particularly from September through April, is generally dried in various coastal areas and islands: St. Martins, Moheshkhali, Sonadia, Dublar Char, Aftabiya Char, Rangabali, Korushkool, etc. During this period, the availability of marine fish is high and the weather for sun drying is ideal. It is estimated that about 20 to 40 percent of the total catch during this period is used for drying. About 600 small enterprises are engaged in this process. In 2002, the total production of dehydrated fish was about 400,000 metric ton (PDO-ICZMP, 2004b). Recently, few enterprises started fish drying using hygienic methods, which has large potential for marketing at home and abroad.

Box 2: Bright prospect of crab culture

Scientific farming of the mud-crabs in the country may earn more than Taka 10 billion a year. A recent study said that the demand of mud-crabs, usually seen in the coastal belts, had gone up in the recent years. The Institute of Marine Science of Chittagong University in cooperation with the SUFER conducted the study.Currently more than 1000 metric tons of crab worth about Taka 350 million is being exported. Researchers said that the production could easily be increased by three times by applying scientific methods. The mangrove coasts of Cox's Bazar, Noakhali, Hatiya, Khulna, Bagerhat, Morrelganj, Sharankola, Satkhira and some other coastal districts and islands are earmarked as the best areas for mud-crab farming.
The Bangladesh Observer, 23 April 2004.

Other related opportunities exist in shell collection, crab collection and culture, natural and artificial pearl culture, turtle culture, crocodile farming, production of fish feed, net making, boat building and transportation of fish and fry (see Box 2).

Expansion opportunities also exist in rice-fish culture and fish-duck culture. Rice-prawn culture has considerable potential in the greater Noakhali area. It is estimated that 40,000 ha of seasonally flooded land could be adapted with a 10,000t/yr prospective production accruing to the farmers (Future for Fisheries, 2003).

Forestry

Forestry sub-sector accounted for 1.9 percent of total GDP and 10.2 percent of agricultural income in 2002/03 (MoF, 2003). In addition to the traditional forest products like timber, fuelwood, pulpwood, wax, honey, *golpata*, etc., forests provide raw material for many wood based industries. Sundarban is the largest productive mangrove forest in the world. The Sundarban Reserve Forest (SRF) comprises 45 percent of the productive forest of the country, contributing about one-half of forest-related revenue and is an important source of wood and non-wood resources (Hussain and Karim, 1994). Production and revenue from various resources

from the SRF in 1995-96 was 4.12 million US$. The present SRF production plan (1998-2010) aims at wood production at sustainable level meeting the demand. Even at a sustainable level, forest and forest resources, especially those from the SRF, provide an important opportunity for the coastal zone.

Mangrove extraction, particularly in Sundarban, is a major source of living for about 20,000 *bawalis* (wood fellers) and 7,000 *mouals* (honey and wax collectors) of adjoining areas. Besides there are about 3,000 boats with *badakars* (grass cutters) operating in Sundarban (MARC, 1997).

Crab collection in the SRF is another activity where around 5,000-6,000 persons are presently engaged. Crabs can be caught throughout the year and are more easily available during the spring tides.

There is scope for mangrove plantation on newly accreted land. During 1992/93-1996/97, 18,700 ha of land were brought under coastal plantation (BBS, 2002b). This has been helpful in stabilizing new land, as a natural barrier against cyclone storm surge, as a source of biomass fuel to local people, as a habitat for wildlife and promoting tourism.

Livestock

The livestock sub-sector contributed 2.93 percent to the GDP in 2002/03 (MoF, 2003). It plays an important role in the coastal economy. Even now bullock power is extensively used in plowing and threshing. However, the coastal zone is not rich enough in livestock population compared to rest of the country. Number of cattle per holding is relatively high in Barguna, Patuakhali, Pirojpur and Khulna (PDO-ICZMP, 2003a). Char lands are used for cattle grazing before they are brought under rice farming. Once agriculture activities start, land is used for grazing in the dry season, as char lands are mostly single cropped (*aman* only). There are potentials for enterprises on dairy products. This necessitates improvement in healthcare services including vaccination.

Port and related activities

One important element of the coastal economy is its two seaports: Chittagong Port and Mongla Port. Bulk of the external trade is carried through these two ports. Total volume of imports and exports through Chittagong and Mongla in last 20 years increased by 110 percent and 30 percent respectively. In line with expanding trade relationship with other countries and growing national

economy, increased opportunity exists for both the ports (see Table 5). These potential will be manifold if agreement is reached for cargo handling for landlocked countries like Nepal and Bhutan through these ports.

Table 5: Trade forecast for Bangladesh

Trade	Volume (million metric ton)			
	2000/01	2005/06	2010/11	2016/17
Import	15.98	22.54	29.91	38.06
Export	3.03	3.54	4.16	5.06
Total	19.01	26.08	34.07	43.12

Source: CPA web, 2002

Bangladesh has 14 land ports (13 with India and one with Myanmar), of which three are in the coastal zone. Expanded opportunities exist in and around land ports with India at Benapole (Jessore) and Bholmari (Satkhira) and with Myanmar at Teknaf (Cox's Bazar).

Setting up of a deep seaport at Moheshkhali (Cox's Bazar) is under active consideration.

Opportunities exist for linkage services and industries like container/cargo handling and transport services, freight insurance, shipyard, etc.

Industrial development

Based on the existing ports, opportunities exist for industrial development in and around Chittagong and Khulna. The Chittagong Export Processing Zone, the first EPZ in the country, was commissioned in 1983. It has so far housed 111 operational industrial units drawing a cumulative investment of US$ 328 million. Its export amounted to over 641 million US$ in 2002/03, which was more than half of the total export earning from existing six EPZs in the country (MoF, 2003). The other EPZ in the coastal zone is at Mongla, commissioned in 1997. Privately managed EPZ is also being established. A new EPZ, targeting Myanmar market, can be established in and around Cox's Bazar.

Ship breaking

Ship breaking is a new industry and is saving a lot of foreign currency by reducing the import of steel materials. Faujdarhat coast in Chittagong is the site of ship breaking. The main users of scrapped iron are the local steel re-rolling mills producing MS rod, MS bar, angle and steel sheet for the domestic market. The garment manufacturing factories use the generators. The boilers are used mainly in rice mills, garments washing plants, knitting plants and other industries. The wooden planks/bars, furniture, electrical items, plumbing items, refrigerators, air-conditioners, navigation equipments, life-saving gears, etc, are used by domestic users and small enterprises including the shipping industry. The cold storages are used in various

small enterprises including ice-factory, chilling plants, etc. Oil and lubricants are used in various furnaces and other industries.

Around 250,000 people are directly or indirectly involved in this industry for their livelihood. At the same time, the industry is creating environmental pollution, irregularities and malpractices. The industry started without any appropriate formal government guidelines (PDO-ICZM, 2004b).

Transport

Potential exists in additional networks of road and railway. One of the proposed routes of the Asian Highway linking Myanmar/ Thailand goes through Chittagong and Cox's Bazar. Of seven operational airports of the country, four are located in the coastal zone (Chittagong, Cox's Bazar, Barisal and Jessore). These also facilitate the expansion of the economy. For example, shrimp hatcheries are concentrated in Cox's Bazar, while shrimp farms are concentrated in the greater Khulna district. Bulk of the PL is transported from Cox's Bazar to Khulna (via Jessore) by aircrafts. These airports, particularly Chittagong, Cox's Bazar and Jessore, also contribute to tourism by transporting tourists to important destinations that are in the vicinity of these airports, such as, Chittagong Hill Tracts, Cox's Bazar and Sundarban.

The Bay of Bengal has great significance for Bangladesh and neighboring countries like Sri Lanka, India and Myanmar. Cargo and passenger services with the regional countries have immense potential. Bangladesh and Myanmar have recently agreed to launch shipping service between the two countries soon, which would connect Bangladesh's ports of Chittagong, Cox's Bazar and Teknaf with Myanmar's Yangon, Akiyab and Maungdaw. It is learnt that through this arrangement, Indian exports can also be shipped to Yangon with transshipment at Chittagong. The Singapore-based Sea Consortium has also announced its interest to connect Bangladesh and Myanmar to expand the network in the region

Transport services between remote islands and mainland are poor, primitive and risky. Opportunities exist for improved and safer transport services. This again creates opportunities for many economic activities including fisheries and tourism.

Gas and oil

The discovery of petroleum and gas reserve in the Bay of Bengal is an important prospect. The Government has offshore and in-shore exploration plan. Negotiations are ongoing with international oil companies. It is estimated that about 20 trillion cubic feet of gas can be extracted from the Bay. Estimates of reserves in some gas fields are shown in Table 6. The most recent World Bank estimates show that Bangladesh is expected to receive more than a billion US$ FDI by 2004, most of which would come from investors in the oil and gas sector. Meanwhile, a $700 million Western Region Integrated Project (WRIP) has been proposed to develop

Shahbazpur gas field in Bhola, as well as installation of a 93-mile pipeline to Khulna, and construction of several gas-based power plants at Gopalganj, Bhola, Barisal and Khulna to serve southwestern Bangladesh. Gas-based electricity will open new opportunities for the people of these districts.

Table 6: Gas reserve in the coastal zone

Gas field	Volume (billion cft)			
	Total reserve (proven and probable)	Re-coverable	Cumulative production (June ' 03)	Balance reserve (June ' 03)
Sangu	1,049	734	221	513
Feni	165	116	40	76
Begumganj	46	32	-	32
Kutubdia	861	603	-	603
Shahbazpur	174	122	-	122
Total	**2,295**	**1,607**	**261**	**1,346**

Source: MoF, 2003

Other minerals

Various commercially important minerals have been found in the sandy beaches along Cox's Bazar, such as, monazite, limenite, rutile, zircon and cesium. There are newspaper reports on extraction of minerals from the beaches of Kuakata by using hand-held magnet. Opportunity exists for exploration of rare minerals from these beaches (see Box 3).

Box 3: Potential of beach sands

The country could gain economically and achieve significant progress in atomic energy sector for its peaceful application if full potentials of beach sands which contain valuable minerals as revealed earlier through scientific survey at the long stretches of Cox's Bazar coast. A number of radiometric survey, scientific research work and subsequent lab analysis to determine the stock and character of minerals carried out by the Beach sand Minerals Exploitation Center at Cox's Bazar under Bangladesh Atomic Energy Commission revealed that there are 17 deposits of economically viable minerals with an estimated reserve of 1.76 million tons in beach areas of Cox's Bazar, Maheshkhali, Babarmokam, Teknaf, Subrang, Inani, Kutubdia, Nijhum Dwip and Kuakata.

The Bangladesh Observer, 20 October 2003.

Moreover, there are peat reserves in Gopalganj and Khulna and limestone in Cox's Bazar. Sand mining is also an economic activity in and around Chittagong. All these have potential for industrial/commercial use. Estimates of some mineral resources are shown in Table 7.

Table 7: Mineral resources

Mineral	Location	Reserve
Peat	Chanda-Baghai (Gopalganj)	150 million t
	Kola Mouza (Khulna)	8 million t
Limestone	St. Martins Island (Cox' s Bazar)	2.8 million t
Beach sand mineral	Cox's Bazar	3.2 million t
	Nijhum Dwip (Noakhali), Kuakata (Patuakhali)	Yet to be estimated
Hard rock/ engineering stone	Chittagong (+ Chittagong Hill Tracts)	1 million m^3

Source: BBS, 1999a

Renewable energy

Remotely located coastal areas are not likely to come under national electricity network in the impending future. However, there exist opportunities to tap unexplored wind and tidal energy unique in the coast. Feasibility studies show positive indication for exploitation of such alternative energy sources. Pilot demonstrations have revealed their potential use and application.

In a recent study applying two technologies has showed possibility for tidal power exploration: low head tidal movements (2-5m head), and medium head tidal movements (> 5m head). Data have been analyzed with positive tidal power potential at Sandwip. Potentials also exist for tidal power using sluice gates in Khulna, Barisal, Bagerhat, Satkhira and Cox's Bazar. These are to be explored further. Such environment-friendly low-cost energy will open opportunities for many economic activities at the household and the community levels.

Salt production

Salt production areas are mainly confined in Cox's Bazar district and Bashkhali upazila of Chittagong district. The production of salt in 2003 was about 0.9 million metric tons. The current demand of the country is about 1.2 million metric tons. Large quantity of salt comes from India and Myanmar every year to fulfill the deficit. Government is trying to extend salt production area in Khulna and Satkhira. Thus the area under salt production is increasing day by day, at a rate of 455 ha per year (PDO-ICZM, 2004b).

The associated risk is degradation of land for other crops because of the intrusion of saline water, which is necessary for salt production. Better infrastructure and management practices will help in increased output without degradation of environment.

Tourism

Tourism is another important economic activity though its present contribution to GDP is not significant. However, it is one of the fastest growing sectors. For example, average annual growth rate for hotels and restaurants is about seven percent since 1998/99 (MoF, 2003). Tourism infrastructure has developed to some extent at Cox's Bazar, Kuakata and Sundarban. Potential exists for development of eco-tourism in Sundarban and other special environmental areas, including St. Martin's Island and Sonadia Island (Cox's Bazar), Nijhum Dwip (Noakhali) and Char Kukri Mukri (Bhola). A regional tourism infrastructure, in cooperation with Myanmar, can be built at Teknaf offering day trips to St. Martin's Island, cruising over Naaf river, visiting Myanmar and Bangladesh coast, etc. There is a great potential for this sector in view of the growing domestic demand.

Land accretion

Land accretion provides new opportunities for the growing coastal population. The net change in the period 1973-2000 shows an overall land gain for the Meghna estuary system as a whole of about 51,000 ha, the average annual gain being 1,880 ha. This provides opportunity for relocation of the victims of erosion, productive agriculture and aquaculture, afforestation and so forth.

Potential exists for increased land accretion through artificial land reclamation measures. This has already been demonstrated by Cross-dam 1 in Lakshmipur (1957) and Cross-dam 2 in Noakhali (1964). Small-scale accretion measures have been implemented in the downstream of the Daria Nadi (1983, Noakhali) and the Feni River (1985, Feni and Chittagong). The Char Development & Settlement Project (CDSP) is developing newly accreted lands for human settlement and productive use, which have ushered a new era for rehabilitation and development of the landless peasants.

Coastal agriculture

Agriculture, characterized by low productivity and low cropping intensity, is still a dominant activity of most households living in the coast. Scope for extensive agriculture has been exhausted in the backdrop of declining availability of cultivable land.

Potential exists for more salt-tolerant modern varieties. Possibilities exist for expanded coconut cultivation. Floating or soil-less agriculture is a traditional farming system around Gopalganj and Pirojpur. Potential also exists in unexplored bio-saline agriculture. Floating and/or bio-saline agriculture are possible adaptive measures to cope with the sea-level rise scenario.

Synopsis

Potentials and opportunities are summarized in Table 8. These, if utilized appropriately and judiciously, are destined to create a situation of enhanced security, which would attract investments, accelerate economic activities and expand employment prospects.

Table 8: Overview of opportunities

Opportunity	Coverage	Present status	Potential
Shrimp/Prawn	Local (Bagerhat, Khulna, Satkhira and Cox' s Bazar) New areas in Noakhali, Barguna and Pirojpur)	Being fully exploited	High
Marine fishery	Sea area	Near shore over-exploited Deep sea unexploited	High if relocated from near shore to deep sea
Inland fishery/ aquaculture	All over	Moderately exploited	Medium
Livestock development	Chars and islands	Moderately exploited	Medium
Sundarban	Local (Bagerhat, Khulna, Satkhira)	Over exploited	Low/sustainable
Other plantations	All over	Moderately exploited	Medium
Port	Local (Chittagong, Mongla/Khulna)	Moderately exploited	Medium
Transport & industrial development	Local (Chittagong, Mongla/Khulna)	Moderately exploited	Medium
Gas & oil	Unknown	Gas: slightly explored Oil: not explored	High
Alternative renewable energy	All over	Not exploited	Medium
Ship breaking industry	Local (Fouzdarhat)	Moderately exploited	Medium
Salt farming	Local (Cox' s Bazar)	Moderately exploited	Medium
Tourism	Local (Cox' s Bazar, Kuakata, Sundarban)	Moderately exploited	High
Sand mining & beach minerals	Local (Cox' s Bazar, Kuakata)	Not exploited	Low
Land accretion	Local (Meghna estuary)	Natural exploitation	Medium
Coastal agriculture	All over	Moderately exploited	Medium

5. COASTAL ZONE IN FUTURE

Based on the present trend, the future is sometimes foreseeable. On the other hand, the future is sometimes unpredictable because of factors beyond the grip. Future may grow without any flux. It may be twisted by erratic and exogenous factors. It may develop autonomously harnessing all the potentials. It can be shaped through planned interventions. In order to make a strategic decision, it is important to assess the present and comprehend the future scenarios. As people's well being is the central focus, it is necessary to know present and future contexts that influence their livelihoods.

Here three scenarios of population projections have been presented that should be considered for developing strategies and options. These are:

- 2001: the year of last population census that provides database for appraisal of the present situation and future projections;
- 2015: the year that has been agreed upon by the international community, as well as the government of Bangladesh to achieve the Millennium Development Goals (MDG); and
- 2050: the year that has been arbitrarily set to have a long-term perspective.

Table 9: Population projection

Year	Population in million								
	Total			Urban			Rural		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
2001	35.1	17.9	17.1	8.0	4.3	3.7	27.1	13.7	13.4
2015	41.8	21.1	20.7	11.6	6.8	6.2	30.2	14.3	14.5
2050	57.9	29.0	29.0	25.6	13.1	12.5	32.3	15.9	16.5

Source: PDO-ICZMP, Living in the Coast - Population and Livelihoods, March 2004.

2001

According to 2001 population census, the coastal zone of Bangladesh has 35.1 million people. They are 28 percent of the total population. Average size of household is 5.1. The density of population is 743 per km^2. Women are 49 percent of the population, the sex ratio being 105, while 23 percent (8 million) are urban-dwellers. Size of the labor force (population of 15-59 year age group) is 18.6 million who are 53 percent of the population. Population increased at an exponential rate of 1.36 percent annually during the inter-census period of 1991-2001.

Broad sectoral distribution of population shows that farmers are the largest group (11.3 million), followed by agricultural laborers (9.0 million), urban dwellers (8.0 million), non-farm rural (4.2 million) and fishers (2.6 million).

Resource endowment, infrastructure and service provisions are generally poor. Per capita availability of cultivable land is 0.056 ha. Average population per primary school is 1468, while 34 percent households have sanitary latrine.

2015

Based on projections, population of the coastal zone in 2015 is estimated at 41.8 million, and 28 percent (11.6 million) would be urban-dwellers. Women would be 49.5 percent of the population, the sex ratio being 102. The density of population would be 886 per km^2. The size of the labor force would be 22.1 million. Per capita endowment of cultivable land would decline to 0.43 ha.

By 2015, Bangladesh, like other countries of the world, would experience a decade under free market economy, and a global market without trade barriers. Private sector will play major role in the national economy through investments and employment generation.

Increased energy utilization, telecommunication and improved transportation will remove remoteness of the coastal zone. Asian Highway and/or Bangladesh-Myanmar Friendship Road will promote regional trade and commerce.

Improved disaster management will reduce the risk of living in the coastal zone and thereby enhance and facilitate investments. However, climate change impacts will be visible.

Bangladesh, through adoption of sustainable and wise use, will arrest depletion of natural resources and expand biodiversity base.

Bangladesh's adoption of long-term Poverty Reduction Strategy is expected to reduce poverty, increase economic growth and improve social development nationally as well as for the coastal zone.

Institutionalization of ICZM nationally, regionally (through SAARC Centre for Coastal Management) and internationally through many forums will contribute to better understanding and management of the coastal zone.

2050

Estimated population of the coastal zone in 2050 will be 57.9 million and 44 percent (25.6 million) will live in urban areas. Women would be 50 percent of the population, the sex ratio being 100. The density of population per km^2 would increase to 1,227. Size of the labor force would be 30.7 million. Per capita cultivable land would decline to 0.025 ha.

The coastal zone of Bangladesh will look more urbanized stretch of land, like most other coastal zones of the world. The country, by this time, would compromise many of its natural attributes and traditions but would reduce gender gaps and disparities to a point of equity.

Climate change impacts will be further visible but a number of mitigation and adaptation measures will reduce expected losses.

Governance is and will remain a key issue. Decentralization within the country at one hand and regional convergence through many proposed economic forums will shape the economy, social development and security, priorities and progress of the country. Coastal zone, managed in an integrated manner, will contribute immensely in this journey.

Shrimp exporters need to unite to m
global standards
workshop
THURSDAY OCTOBER 30, 2003
Mitigating Arsenic Crisis Needs An Integrated Approach
Kamrul Islam Sony
Arsenic with its dreadful effect the Harvard University of US demic manner in future, if appro- Besides with the support of
THE BANGLADESH OBSERVER
Policy needed for ship-scrapping to get industrial shape

6. CHALLENGES

At one side, there are issues that create vulnerabilities and impede development. On the other side, there are opportunities that brighten prospects for growth. A prudent path in this regard essentially involves two-prong approaches.

* There should be concerted efforts to enhance coping capacity of the people and institutions to reduce and/or withstand vulnerabilities.
* There should be resolute attempts to build on the opportunities offered by available resources and untapped potentials.

These two approaches should run parallel and have to be addressed in the backdrop of:

* increased population density;
* increased number of employable workforce;
* decreased per capita land;
* increased urbanization;
* increased women's participation in economy and governance;
* decreased role of public sector;
* increased private sector involvement with considerations of economic gains,
* increased globalization of trade and commerce;
* threatened coastal ecosystems due to reduced flow of fresh water and salinity intrusion; and
* climate change impacts with threats of sea level rise and prolonged inundation.

In the above scenarios, the challenges for integrated coastal zone management as a package to reduce poverty, to enhance livelihoods and to improve governance are:

* improved disaster preparedness;
* adaptation to declining natural resources: wise use;
* ensuring basic needs for increasing population;
* harnessing untapped and/or less explored opportunities;
* continued economic growth: increased non-farm employment generation;
* private sector involvement in service delivery;
* attention to growing coastal urbanization;
* investment in human development, specially women;
* area wise integrated planning including zoning and sub-zoning;
* decentralization: local government involvement with area based budgetary allocation; and
* institutionalization of coastal management: co-ordination at national level, resource mobilization and knowledge management.

The challenge is to respond to recurrent problems and potential threats and to pull all available knowledge and resources to overcome those problems and threats. These challenges are summarized in the following propositions.

Improved disaster preparedness

The coastal zone is prone to natural disasters like cyclone, storm surges, land erosion, saline intrusion, drainage congestion, etc, as elaborated in chapter 3. These obviously threaten productive capacities, disrupt livelihoods and discourage investments. In future, the extent and frequency of these disasters are expected to increase if one considers predicted impacts of climate change and reduced flow of fresh water. The challenge is to be better prepared by

evolving a long-term comprehensive disaster management program that minimizes risk and enhances coping capability. Better preparedness has paid dividends in reducing death tolls from recent cyclones.

Adaptation to declining natural resources: wise use

The natural resource base is shrinking fast. The domain of natural resource-based activities has already gone beyond a point of saturation. The challenge is to sustain the natural resource base for the future by reducing dependency on natural resources. Is this a possibility? Can we control or restrict natural resource use?

Shifting focus: Historically people have been depending on the extraction of natural resources for livelihoods. As population is increasing, the per capita endowment of natural resources is declining. With growing urbanization and aspiration for better living, communities often go for over- exploitation of natural resources in a free-for-all manner. This has resulted in the degradation and destruction of the natural habitats and ecosystems to an alarming extent. It is necessary to shift the focus from natural resource based activities to human resource and skill-based activities for livelihoods. This will not happen automatically–alternative has to be provided. Most resource harvesters understand the risk of overuse of natural resources. They continue to do so because of absence of alternatives. The challenge will be to adapt to declining natural resources through creation of alternatives, wise use of resources, restoration/regeneration of declining resources and to apply a control mechanism through zoning and sub-zoning.

Emphasis on value addition of products from natural resources: exploitation of natural resources will remain a key strength in foreseeable future in the economy of the coastal zone. Value addition processes of these natural resources should be gradually emphasized. This will give higher return from same or less quantities of natural resources.

Ensuring basic needs for increasing population

Increasing population and its expected composition has been dealt in Chapter 5. Despite all efforts of the Government, basic needs in terms of health care, safe drinking water, primary education, affordable housing and energy needs of the present population are yet to be met. Remote coastal islands and other places are yet to receive basic services through any service provider. Private sector and NGOs have emerged to provide some of these services. Two approaches can be taken, by increasing service provision and by increasing purchasing power of coastal communities. However, policy and capital support from the public sector will be needed in general, but specifically on following issues.

Maintaining food security: Bangladesh has recently achieved food autarky at the national level. Unless continued efforts are made, food needs cannot be met nationally. With increasing population and declining availability of productive land for agriculture, the state of food security is likely to be threatened. Import of food will again take away resources from national development budget. The coastal zone has high potential in crop, fish and livestock production. In order to maintain food security, the challenges are adopting appropriate technological means and intensive farming. Investments to support coastal agriculture, the marine fisheries and livestock development will maintain food availability. At the same time, food support to hardcore poor has to be maintained.

Maintaining water security: Water is the lifeblood of economic activities in coastal Bangladesh. This is facing grave threat due to reduced flow of fresh water, saline water intrusion and absence of wise use of water. Proposed river link project in India further threatens water security of Bangladesh. The challenge is, while negotiations continue for just sharing of water, it is also necessary to build up water security nationally. This can be achieved by adopting integrated water resources management, wise use of coastal groundwater, harvesting of rainwater, conservation and maximum use of available water. National Water Management Plan provides the framework.

Harnessing untapped and/or less explored resources

The coastal zone is richly endowed with resources. Some of these are untapped and some are not optimally utilized. For example, harbors operate far below their capacity. Tourism potential beyond few enclaves has hardly been explored. Potential natural gas reserve of the country is yet to be estimated. Renewable energy sources like wind and tide have not yet been tapped. The challenge is to develop knowledge base and infrastructures that would harness these resources. All these add up to huge potential for much needed non-farm employment. These can rejuvenate supporting and linked opportunities. New initiatives like deep seaport at Moheshkhali, gas based industries in Bhola and island tourism offer huge potential. Introduction of wind and tidal energy units can boost small and medium enterprises (SMEs) in remote places.

Continued economic growth: non-farm employment generation

Continued economic growth in the coastal zone is required with the objective of poverty reduction. While utilization of distinctive development opportunities in natural resources should continue, a shift has to be made in investment priorities and creating employment in both rural and urban non-farm sectors. There will be 22.1 million labor force in 2015 and 37.1 million in 2050. Agro-based value addition industries, tourism, service sector, transport, shipbuilding are some of the non-farm sectors that should receive attention for further investment. While pressing for continued economic growth, emphasis should be placed on pro-poor and pro-women economic growth, sustainable development and enhanced efficiency.

Pro-poor economic growth: The coastal zone is poorer in terms of infrastructure facilities. The extent of poverty is also higher among the people. Although development interventions are taking place, benefits do not necessarily trickle down to the disadvantaged groups. The challenge is to work out a development strategy that ensures pro-poor economic growth, specially investing in labor-intensive activities, diversifying investment in remote areas, etc.

Sustainable development: Economic growth is often in conflict with sustainable development. While there is a need to encourage more investments, to create more jobs and to generate more income, these are to be achieved in harmony with nature, without disturbing the critical

ecosystems that support life and habitat. For example, ship-breaking industry immensely contributes to the economy in terms of employment and supply of raw materials for construction and manufacturing. It also ruins the habitat of marine aquatic resources. Urbanization accelerates the pace of industrialization. It also replaces low value (cash) ecological production systems. The challenge is to ensure rapid economic growth in a sustainable manner adhering to conservation laws and regulations.

Enhancing efficiency and remaining competitive: Certain activities have developed over the years in response to global consumer demand for particular products. Among these are export infrastructure (port, freight insurance), shrimp culture, etc. These are highly susceptible to fluctuations in the global market. Any erratic behavior in the international economic environment would adversely affect these activities and, in turn, would disrupt livelihoods of many people. The challenge is to attain competence and efficiency to respond to fluctuating global market conditions and to evolve necessary coping capacity.

Private sector involvement in service delivery

The private sector is already playing a critical role in the development process for enhancement of coastal livelihoods. At least 70 percent of all investments come from the private sector. Areas of private sector involvement with high poverty reduction impact, such as development of small and medium-scale enterprises (SMEs) and business development to generate employment, income and production, should be identified and prioritized. The focus of the private sector can be geared towards economically viable and financially rewarding projects that have significant potential to impact livelihoods of the coastal people, such as power generation and transmission, transportation, telecommunication, fisheries, tourism, etc.

Private sector should also be encouraged to develop basic health care infrastructures, particularly those benefiting women and children.

Attention to growing coastal urbanization

From the present urban population of 8.0 million, it will be 11.6 million in 2015 and 25.6 million in 2050. This is 23 percent of the total population in 2001, 28 percent in 2015 and 44 percent in 2050.

An inevitable consequence of urbanization is the growth in demand for land for residential needs, and expansion of infrastructure and other associated urban attributes. There is a need for allocating space for a growing population of various income levels, including the need for services in the direct environment, such as fresh food production, water supply and sanitation, employment, health and education facilities.

Investment in human development, specially women

Investment in human development has higher rate of return. This will be more rewarding in investing for coastal communities, as that will create resilience to withstand vulnerabilities and enhance capacities to exploit opportunities. Women are engaged in productive activities (to some extent in cash earning and to a greater extent in cost saving) in no less proportion than men. Limited social mobility and occupational rigidity are deterring factors to larger women involvement. The challenge is to create an enabling environment in terms of favorable social attitude and woman-friendly job opportunities.

Area wise integrated planning including zoning and sub-zoning

Along with conventional sector wise planning, integrated planning has also been attempted. Benefits of sector wise planning are often not evident. People can correlate themselves easily with area wise planning. A gradual shift is needed from sector wise planning to area wise planning. Budgetary resource allocation can gradually be linked to area development plans. Upazila should be considered as the lowest unit of development. This will allow local level participation in planning, prioritization and implementation.

An immediate need of this planning will be land zoning and sub-zoning. Land zoning has been advocated since eighties. Because of competing and demanding land use, an attempt should be made to introduce land zoning in the coastal zone.

Decentralization: local government involvement

Decentralization of development efforts is a declared approach of the government. Different measures are being taken to promote local government involvement. But more concrete steps are needed. The need for local government involvement is urgent in the coastal zone because of its diverse vulnerabilities. There are examples of benefit of involving the local government in planning in Char Development & Settlement Project (CDSP). An understanding of resource availability and local resource mobilization will facilitate local government institutions in realistic planning and development of the locality. The challenge is to press for allocation of substantial resource in the national budget. This will strengthen local government and facilitate decentralization. Examples from a number of pilot exercises are available.

Institutionalization of coastal management

Institutionalization of coastal management has been attempted previously through a number of initiatives. The present initiative has been structured to formulate and operationalize the institutional process. A number of setups at different levels are being established and some are expected to continue for a longer time. An indicative institutional mechanism has been elaborated in the draft Coastal Zone Policy. The challenge is to operationalize co-ordination at the national level, resource mobilization and local government involvement at the local level, and supporting knowledge management activities with monitoring of indicator frameworks.

7. CONCLUSION

The paramount issue is to translate challenges into reality. This invariably entails a coastal development strategy that obviously follows from descriptions and analyses highlighted in the preceding chapters and very well fits in the *National Strategy for Economic Growth, Poverty reduction and Social Development* (ERD, 2003). Chapter 6 essentially boils down to the following major strategic thrusts:

? Accelerated pro-poor growth: Key elements are
  - ? shifting focus on employment generation in skill-based non-farm sectors;
  - ? targeted programs for vulnerable communities and areas;
  - ? investment in human capital;
  - ? harnessing untapped resources;
  - ? reducing vulnerability through disaster management; and
  - ? enabling environment for women's participation.

? Sustainable development: Key elements are
  - ? sustaining natural resource base;
  - ? promoting environment-friendly economic activities; and
  - ? provision and enforcement of conservation laws and regulations.

The task is to design an investment program in response to the above-mentioned priorities. A number of investable projects/programs have already been identified (PDO-ICZMP 2004d). This will be prioritized in terms of short, medium and long-term implementation framework.

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