Sindh Resilience Project (SRP)
(Irrigation Component)

Terms of Reference

For

Risk Profiling for the Sea Level Rise in Sindh Coastal Area

TERMS OF REFERENCE (TOR)
Risk Profiling for the Sea Level Rise in Sindh Coastal Area

INTRODUCTION

Coastal areas are zones of economic significance, where socio-economic activities are highly concentrated. Sea level rise is a statistical distribution of ocean level variation across the globe. A significant sea level rise of 1 mm along coastal Sindh observed over hundreds of years has resulted in sea water intrusion inland. Intruding sea water has a strong impact on the coastal communities. Recurrence of cyclones both in increased frequency and intensity in the Arabian Sea over the past 50 years due to climate change has economic repercussions in urban communities like Karachi, Badin and Thatta. Economic importance of Sindh coastal region is evident and the cost of negligence with respect to this phenomenon will be huge. Results of climate changes are already costing around $14bn/ year which is 5% of Pakistan's GDP. Continued losses due to sea level rise will have a further negative impact on the fragile coastal economy. Karachi and the Indus Deltaic coastal areas are vulnerable to the threat of sea level rise. Thus, the need is to evaluate the trade-off between business as usual scenario, mitigation and adaptation options. Once damage to coastal recourses and structure has been done, then this will lead to capital loss.

Assessment of the vulnerability and expected socio economic losses over the coast due to the impact of sea level rise is required to be carried out in details. Impacts of sea level rise are evaluated quantitatively. If no action is taken, areas of coastal city and towns will be lost due to inundation, and several million people will have to abandon their homeland with loss of jobs resulting in colossal economic loss over the next century.

For tropical cyclones, there is an anticipated increment of 10-20% in the power of storms with an increase in ocean surface temperature of 2-4^{0}C in Asia. Karachi, one of the most populous cities of Pakistan located on the coast; impacts of sea level rise might trigger a calamity of gigantic extent. The city planners have ignored the knowledge of evading passing violent wind and sea water intrusion in low lying coastal areas in recent past. Other thickly populated seaside areas and towns, of coastal Sindh are Badin and Thatta in the same position of ignorance if any calamity strikes the coast.

FACTORS DRIVING SEA LEVEL RISE

1) Thermal Expansion

Thermal expansion phenomena occur as sea water become warmer, the top layers of ocean are in contact with atmosphere thus release some of its heat to the atmosphere but the layers below retain this heat with them for larger time and in larger quantity, thus leads to the temperature rise in sea water on longer run. According to IPCC, the contribution to sea level rise due to thermal expansion is around 1.6mm/ year since 1993 to 2003.

2) Fresh Water Inputs

Due to the increase in global warming a significant retreat has been seen in glacier layer, ice sheets and sea ice, this increases the fresh water input in sea. Second factor that increase the fresh water input is the result of hydrogen cycle due to rising temperature of oceans and surface. According to IPCC the contribution to sea level rise due to glacier retreat is around 1.19mm/ yr since 1993 to 2003 and if the present rate of glacier retreat continues then by 2035 most of the glacier will disappear.

3) Physical Forces

The tectonic activities like extraction for oil, gas and water create the scenario of subsidence and lifting which in actual do not change the volume of ocean but effect the sea level (Church & White, 2009)

4) Monsoon Variability

Climate change has a direct link with Monsoon rainfall variability; Pakistan has witnessed frequently excessive monsoon rainfall and flooding. The change in precipitation pattern has increased the intensity of rainfall thus this increase the water flow in lakes, rivers and oceans (Loo, 2014).

5) Ocean Current Variation

The regional ocean current which moves the large amount of water from one location to another location do not change the volume but definitely affect the sea level at different location (Brown et al., 2011). Like in normal conditions the trade wind drives the warm surface sea water towards the west moving all the way across the Pacific Ocean.

ECONOMIC IMPORTANCE OF SINDH COASTLINE

Karachi is considered as the budgetary capital of Pakistan; it represents the greater part of Pakistan's income era. It creates 53.38% of the aggregate accumulations of the Federal Board of Revenue out of which 53.33% are custom duties and taxes on imports. Karachi creates around 30% of worth and 20% of GDP of Pakistan.

Thatta and Badin coastal area is affected by sea water intrusion, 1.3 million acres of land in two regions has intruded on an average 80 acres of land a day (Rao & Maqbool, 2014). Six sub divisions of Thatta; Ghora Baari, Kharo Chaan, Keti Bunder, Shah Bunder and Jati are the most noticeably affected in Sindh. These regions were verifiably prosperous because of far reaching agribusiness and trade, now these territories are considered as one of the poorest parts of the country.

MAIN ACTIVITIES ALONG THE COASTLINE

A. Industries:

Karachi is the industrial hub of Pakistan. Around 70% of industries is located in Karachi. Total number of small and big industries is around 6000 units (Pakistan Economic Survey, 2013). No industrial activity of this massive numbers occurs anywhere else along the coast other than in Karachi. The main industrial manufacturing hubs are SITE, PQA, KITE and HUB. Another industrial activity that operates on the Gadani coast of Lasbella is the Gadani ship breaking industry.

B. Shipping and Trade:

Karachi Port Trust (KPT) and Port Muhammad Bin Qasim (PQA) are the principal sea ports of Sindh and serves as the major channel for countires imports and exports (Majeed at el., 2010). These two ports handle almost 95% of international trade of Pakistan.

C. Fisheries:

Pakistan coastal fisheries contribute 0.8% to country GDP and 3.7% of coastal agriculture (Khalil, 1999). According to statistics provided by Pakistan Economic Survey during the period 2013-2014 (July to March) Pakistan earned US$ 253.1 million by exporting 103,833 metric tons of fish. Fisheries provide direct employment to 300,000 people approximately and indirect employment to 400,000 individuals in fish related industries (Pakistan Economic Survey, 2013). Badin is also very important when it comes to fisheries, around 10% of all fish exports are instigated by Badin.

There is a possibility to significantly change fish nurture environments and fish nourishment supply and subsequently the richness of fish populaces in Pakistan Coast because of the reaction to future environmental change to the accompanying variables; sea momentums; ocean level; ocean water temperature; salinity and surface winds and intensity, upwelling; mixing of water and dissolved oxygen level.

D. Mangroves:

Dense mangroves plantations are available in Korangi, Phitti, Wadi, Khudi, Khai, Patiani, Dabho and the 17 major creeks of the Indus delta. The biological community gives a rich territory to natural life of physical and marine source. About 200 types of fish and crustacean etc have been accounted from the Deltaic region. Mangroves project against the environmental change. Till late seventies the mangroves spread was approximately 260000 hectares, which decreased to 160000 hectares in the nineties and after that the figure has dwindled down to around 80000 hectares in 2001 (Majeed et al, 2010).

E. Sociological Impact:

Sea level rise won't just lose valuable agriculture land but will additionally displace local inhabitants living there and the expense connected with resettlement could be significant. Karachi alone is a densely populated city with twenty million habitants. According to 1998 census population of Thatta and Badin district has around 1.113 million and 1.136 million (2010) respectively.

Another domestic economic issue will be flooding; if Karachi seizes its economic activities for one day, it will cost billions of rupees per day to our GDP. Higher seawater levels would likewise build the danger of flooding because of rainstorms and by diminishing coastal drainage. An ascent in ocean level would raise the water level and coastal drainage. All these accumulated impacts could be conceivably damaging, especially for infrastructure in low lying deltaic regions.

OBJECTIVES

Pakistan coast is facing major risks due to rise in sea level related to climate change. Before dealing with the phenomena by taking mitigating steps, it would first be necessary to quantify the risks involved if the scenario is left as it is.

SCOPE OF WORK

The services of reputed consulting firm are required to undertake risk profiling for the sea level rise in Sindh coastal area. The study would look into all avenues affected with socio-economic losses by rise in sea level over periods of 5,10,15 and 20 years hence. With advancing years, the shoreline would inundate areas more and more presently inland causing socio-economic damage. Risks to the following among others will be quantified in financial terms.

1. Industries
2. Shipping and Trade
3. Fisheries
4. Mangroves
5. Sociological aspects

The results derived from the risk profiling should enable the Government of Pakistan to devise strategies for mitigating risks as these enhance in time.

DELIVERABLES

Consultants shall submit the following deliverables

1. Inception Report
2. GIS Based Database of the Project Area
3. Economic and Social Assessment Report
4. Risks Profile over periods of 5,10,15 and 20 years hence.
5. Risk Management Plan
6. Final Report

TIME FRAME

The assignment will be completed within nine (09) months after signing the contract between Client and the Consultant Firm.

COORDINATION

The Consulting firm will report to the Project Director, Sindh Resilience Project (Irrigation Component) or any other staff designated. All work must be approved by the Project Director or the designated staff.

KEY STAFFING

Sr. No.	Position	No.
1.	Economic Development Specialist / Team Leader	1
2.	Engineering Structures Data Analyst	1
3.	Industrial Data Analyst	1
4.	Agricultural Data Analyst	1
5.	Fisheries and Mangroves Data Analyst	1
6.	Structural Civil Engineer	1
7.	Sociologist	1
8.	Coastal Survey Specialist	1
9.	GIS Specialist	1
10.	Data Enumerators	15

Selection Process:

Procurement will be completed following the Selection Based on Consultants Qualification (CQS) method in accordance with paragraph 3.7 of World Bank's Guidelines: Selection and Employment of Consultants [under IBRD Loans and IDA Credits & Grants] by World Bank Borrowers, January 2011 (revised July 2014).