CHAPTER-VI

TOURISM AND ENVIRONMENT
6.1) **Introduction:**

Tourism and Environment are two interactive components and have a complex interaction between them. Tourism has large impacts upon the environment. These can be positive or negative. The vast expansion of tourist activities creates the complexities of tourism and environment. The unscientific, unplanned and uncontrolled conventional tourism growth often may result into the deterioration and degradation of the environment. These also put on an enormous pressure on the natural areas and may create a potential threat to the area. The negative impacts on environment resulting from tourism development are as follows:

- Land degradation
- Natural habitat loss
- Loss of biodiversity
- Depletion of water resources
- Increasing pollution of air, water and soil
- Increased sewage pollution
- Disposal of solid waste and littering
- Deforestation and impacts on vegetation
- Siltation of water bodies
- Loss of wetlands

Depending on the environmental factors tourism can be divided into two broad categories, viz. (1) mass tourism (2) sustainable tourism. The unplanned or unscientific way of tourism development gives birth to mass tourism that results into scattered development affecting environment while sustainable tourism i.e. environmental friendly tourism deals with the development that has been carefully planned and managed. Sustainable tourism also focuses upon of the carrying capacity of the tourism destination. Carrying capacity is the point beyond which the tourism of an area becomes unsustainable posing threats for environment. Every tourist region has a carrying capacity. The longevity and the sustenance of tourism rely on the environmental sustainability.

In the present chapter, the tourism development scenario in the coastal belt of Purba Medinipur district and its impact on coastal environment with reference its vulnerability issues have been dealt with.
6.2) The Coast and its Environment:

The coastal stretch of West Bengal extends from the mouth of the river Subarnareka on the west (bordering the state of Odisha) to the mouth of river Hanribhanga of the east (bordering Bangladesh) with a length about 350 km comprises of two districts – Purba Medinipur and South-24-Paragana.

Beaches and shorelines are the assets of great economic value and also having great recreational value and holiday making places all over the world. Its floral and faunal diversity makes the area as a great economic importance. So, it is necessary to conserve the environment of the coast. Sustainable tourism is a conservative tool for the coastal environment. To ensure the conservation of the coast, Govt. of India has takes up a regulation, i.e. Coastal Zone Regulation Act for the necessary action.

6.2.1) Beaches:

Medinipur coast (i.e. the coastal stretch of Purba Medinipur district) is characterized by different lines of beach ridges, beach dunes, beach-belts and marine terraces. Aeolian dunes of low heights are more common in the region.

In case of Digha coast, straight and flatten smoothness surface of the beach are shown (Figure no. 6.1). In case of Junput, it is shown that wave dominated beach and that characterized by several ridge and runnel system. Here found multiple barrier bar, lagoon, salt marshes that have dominated the coastal outgrowth. The sediments of Junput area are finer than the Digha area. It is noteworthy that

- Digha-Junput coast is low laying, mesotidal tropical coast.
- On the basis of erosion accretion the entire coast can be divided into two parts (Chakraborty, 1990) i.e. –
  1. Digha to western portion of Dadanpatrabar - Erosional regime.
  2. Eastern portion of Dadanpatrabar to Junput - Accretional regime.
- The coast is still in its formative stage.

The beach profile of the Medinipur coast is larger flatten coast associated with beach face, rip channels, beach beam, ridge and runnel, low tide terrace, long shore through, long shore bar.
Based on the nature of tidal range the beach is remarked as macro tidal to mesotidal coast.

![Beach slope character of the coast](image)

**Figure no. 6.1: Beach slope character of the coast**

(Paul, 2002). Several sediment structures and active bioturbations are found in the area. The beaches of Medinipur coast have gentle foreshore slope accompany with fine sand provide a remarkable experience of safe walking beach, playing, bathing and also can driving. Simultaneously, the Digha coast has been suffering from a problem about reduction of beach volume by the increasement or attrition of silt and clay in extensive tidal flats of the lower foreshore region.

6.2.2) Dunes:

Dunes are the common geomorphological features and act as a barrier to protect the coast from tide, wind and wave actions as well as to protect the environment of the coast. In Digha dunes are retreated and erosion has been taken place continuously.

6.2.3) Floral Diversity and Faunal Diversity:

57 species of mangroves and their associated plants, 28 species of benthic algae and 8 phytoplankton species have been found in the marine zones of Medinipur coast and recorded (Chakraborty, 2010). Plants like Ipomea, Spinifex, Pandanus, Casuarinas etc. are growing on the dune surface that play major role to stabilize dunes.

A diversified habitat and niche of faunal components have been formed in Medinipur coastal belt. 17 species of zoo-plankton, 48 molluscan species, 12 actinarian species, 68 arthropod species, and 51 soil micro arthropods have been found and recorded (Chakraborty, 2010). The red-crab species are also found in Digha-Talsari, Mandermoni-Tajpur intertidal flats. A total number of 51 fish species have also been recorded (Chakraborty, 2010).
Huge amount of eroded sediments, fly ash and industrial discharge are the major problems that make the area unsuitable for living species. Introduction of tourism in vulnerable sites leads to their extinction.

6.2.4) Sea Level Rise and Erosion:

Due to the huge sedimentation load of the suspended sediment of Ganges and Brahmaputra Rivers, the sea level is being considerably raised and it would be expected that the net rate is 3.14 mm per year (Chakraborty, 2010). Frequent storm surges have been identified as another seasonal causative factor for the abrupt sea level rise associated with considerable erosion.

It is been observed from historical records that the shoreline of Digha has been retreated increasingly at the rate 17.5 meter per year (Chakraborty, 2010). To prevent the erosion, Govt. of West Bengal constructed 4.7 km long sea wall that was able to stop the retreat but beach lowering could not be prevented (Chakraborty, 2010). In some parts the rate of erosion has been found at about 17 meter per year. About 15 to 20 cm per year beach lowering occurred due to the submergence of the coast (Bhattacharya, 1992).

The following factors have been found responsible for coastal erosion of Digha – Junput coast. These are:-

- Wave actions
- Storms
- Removal of sand for construction of roads and hotels.
- Diminishing sand dunes.
- Exploitation of the casuarinas plantation on the dune tops.

The constructions of sea wall and embankments have a strong detrimental effect on the coast. The erosive power of waves has increasing to intensity. As a result the backwash returns with more power causing severe beach erosion and also effects on stability.

6.2.5) Coastal Pollution:

Increasing urbanization results into the load of sewage which is high and the industrial waste discharge into the water is the major pollutant factor of the deterioration of the sea water following advance consequences of fish farming. Natural habitats and snaps have also been affected seriously.
The indiscriminate installation of tube wells on the dune bank and excessive withdrawal of ground water has led to the collapse of sub-soil layers that result into seepage of saline water into drinking water.

6.2.6) Urbanization:

Urbanization and development of tourism industry have been closely related to each other. At present, indiscriminate expansion of tourism industry and associate urbanization often leads to the deterioration of the environment of tourist destinations. There is an inverse relation between urbanization and degree of environmental quality. Tourism is acting as an agent of urbanization in destination areas and thereby brings environmental degradation.

6.2.7) Vulnerability Status:

- The report of Geological Survey of India envisaged that the Digha Coastal Belt has been suffering an active process of erosion and accretion and that have been more accelerated by man-made interventions including removal of sand dunes, the mushrooming construction near the coast, and also continuous dumping of solid waste and raw sewage in the coastal water.
- The Digha – Junput coastal tract has also been eroded by sea water resulting in lowering the beach and recession of the beach.
- The beach extends from Digha to Dadanpatrabar is under severe erosional threat due to cyclonic storms, waves, tides and longshore drifts and also human activities like construction of hotels diminishing the sand dune and destruction of dunes for open sea vistas and sand transportation.
- The Bay of Bengal coast is very much prone to cyclonic storms. Probably, it may occur 2 to 3 times in a year.
- The embankment constructed in Digha Coastal Belt has strong detrimental effects on the coast as it accelerated the erosive power of the waves. The backwash returns with more power that eroding the embankment much faster and lowering of the beach profile.
- The rate of retreat of Digha sea beach becomes faster because of the partial construction of sea wall.
- The lateritic embankment boulders are small in size as compared to the impacted wave energy. As a result the embankment boulder are easily displaced and broken down affecting upon the beach sand budget.
- The discharge of hotel sewage on the embankment disintegrates its base material that disrupts stability and also creates pollution.
- Water pollution crosses its threshold limit due to the mixing up of pollutants from the hotel sewage in a few pockets.
- The sand dune diminishing is caused by some anthropogenic activities like tourism development, road construction, recreational activity, human trampling, off road vehicles and large scale urban development.
- The shoreline of the study area changed continuously due to cause of erosion and accretion. The erosion rate is excessively high than accretion rate. It is found that the 837.03 ha coastal surface eroded in the year 1950 to 2005 where only 33.77 ha accretion of coastal surface was found (Mitra et. al., 2013). The estimated sea level rise about 1.06 – 1.75 mm per year in near to Digha – Sankarpur coast that helps to accelerate the coastal erosion (Mitra et. al., 2013). Construction activities also have strong detrimental effects on the coast which also impacts upon the erosive energy that accelerate erosion.

6.3) **Coastal Tourism and Vulnerability:**

Coast can be defined as the land portion from the low tide line upto which the tidal influences are active as a direct contact to the sea or indirectly influence by tidal activity. Coastal environment or coastal ecosystem comprises of sand dunes, beaches, wetlands, mangroves, estuaries, back water lagoons, coral reefs and also settlement of traditional people.

Coastal tourism, also known as beach tourism is a very popular tourism product in all over world. The following three ‘S’ factors are the resource bases of beach tourism-

- ‘Sea’
- ‘Sun’
- ‘Sand’

Close proximity to the sea, the experience of sand and to observe the magnificent view of sunrise and sunset are the basic attractions of coastal or beach tourism. The coastal belt of India from west to east becomes a popular hub of tourist destination, both domestic and international.

But in recent time the coastal ecosystem or coastal environment has been suffering from a lot of problem that results into degradation of coastal environment because of high rate of
increasing population growth, development of various industries, mining, fishing, industrial waste effluents, discharge of municipal sewage and different natural factors that also leads to the development of coastal hazard. Also a number of impacts of tourism already noticed are very much alarming.

So, it is necessary and urgent need to protect the coastal environment or coastal ecosystem and habitat. For the protection of the coastal zone environment and to regulate the developmental activities along the coast, the Coastal Regulation Zone (CRZ) notification was first introduced in 1991 using the provision of the Environment Protection Act (EPA), 1986. As for the difficulties of its proper implementation, the notification amendments have been changed throughout several times and finally in 2011, the notification was reintroduced named Coastal Regulation Zone (CRZ) notification, 2011.

Extracts of the guidelines on coastal tourism (in CRZ notification, 2011):

- Construction shall not be allowed in No Development Zone (NDZ) or beyond hazard line (the landward boundary line of NDZ).
- Construction of beach resorts and hotels shall be permitted in CRZ-II and CRZ-III areas.
- Stabilization and flattening of sand dunes shall not be permitted.
- No permanent structures for sports facilities shall be permitted.
- Ground water shall not be tapped within 200 meter of the High Tide line.
- No effluent or solid waste shall be discharged on the beach.
- At least a gap of 20 meter width between two beach resorts and hotels shall be provided to allow public access to the beach.
- Clearance from proper authority shall be required for diversion of forested land to non-forested purposes.
- In ecologically sensitive areas (such as mangroves, coral reefs etc.) construction of beach resorts and hotels shall not be permitted.
Photo 6.1: Concrete Embankment at Digha    Photo 6.2: Beach Erosion at Sankarpur

Photo 6.3: Violating CRZ at Mandermoni

Photo 6.4: Fresh construction on Sand dune at Tajpur    Photo 6.5: Beach Resort at Mandermoni at Tajpur
The occurrences of coastal hazards are very much unpredictable i.e. where and when they will occur. So it is very much important to be prepared. There are two main categories of coastal hazards i.e. natural disaster and man-made disaster. Natural disasters include storm, tsunamis, flooding, tides, waterspouts and storm surges. Storms are one of the major hazards which may simultaneously associate with storm surges, flooding and erosion. Storm surges are more vulnerable if they occur in high tide that can exerts greater impact in terms of loss of life and property causing erosion and flooding at a greater scale on the coast. Man-made disaster includes fertilizer runoff, industrial waste, oil spills, dumping of hazardous materials into the ocean, dredging, drilling and mining. Human lives and properties in the coastal zone become very much insecure when coastal hazards arise. Construction in coastal zone (NDZ areas) is extremely detrimental to devastation by powerful storm and flooding. In recent past several powerful storms have been taken place in Bay of Bengal and directed to West Bengal coast and Bangladesh coast. The frequency of such occurrences makes the coastal West Bengal more vulnerable and a disaster prone zone. A number of news paper reports (Appendix 3.2) have came up recently about Bengal coastal belt, regarding their growth as tourism hubs (like Digha, Sankarpur, Tajpur, Mandermoni and Junput) in the coastal belts of West Bengal (figure no. 6.2). For promotion of tourism, the developmental processes are going on along the coastline violating the CRZ norms. Beach resorts and hotels have come up.
in highly disaster prone NDZ area which makes the area much more vulnerable and alarming for disaster.

6.3.1) CRZ and Tourism:

The land within the NDZ areas is highly vulnerable and within this area, no construction is permitted according to the CRZ notification, 2011. In spite of it, the maximum number of the beach resorts and hotels are found in the NDZ area violating the CRZ norms. Construction of new hotels and beach resorts is still continuously going on by digging, flattening and stabilizing sand dunes. Sand dunes function as a structural barrier against the coastal hazards.

![Figure no. 6.3: CRZ violation at Digha](image)

By stabilizing and flattening the sand dunes, the area becomes vulnerable to coastal disasters. Coastal ecosystem is also affected by such activities. Floor occupancy is the quantitative expression of the occupancy status of hotels and resorts in relation to the total area available in the respective study units. A long beach profile has been drawn to demonstrate the beach landuse pattern (figure no. 6.6).
In case of Digha coastal belt (figure no. 6.3), in NDZ area where no construction should be permitted, about 42.86% of beach resorts and hotels are situated. In CRZ-II and CRZ-III (area between 200 meter to 500 meter) area, 33.03% beach resorts and hotels are found while only 24.11% beach resorts and hotels are found outside CRZ area (figure no. 6.5). In enumerating the floor occupancy status (figure no. 6.4), the land aggression by tourism entrepreneurs (from new Digha to old Digha) is evident. In case of old Digha sea beach, the maximum number of hotels and beach resorts are situated in NDZ of Digha with an increasing rate whereas in new Digha sea beach there is found about 85.39% of beach resorts and hotels are situated in entire CRZ area within it only 22.65% are in NDZ area.
The long profile (figure no. 6.6) represents the tourism scenario up of the coast in relation to its morphological characteristics. It reveals that developmental activities concentrate in fragile part of the coast and makes it more vulnerable.

In case of Sankarpur coastal belt (figure no. 6.8), in NDZ area, about 40.00% of beach resorts and hotels are situated. In CRZ-II and CRZ-III (area between 200 meter to 500 meter) area, 20.00% beach resorts and hotels are found while only 40.00% beach resorts and hotels are found outside CRZ area (figure no. 6.7). In enumerating the floor occupancy status (figure no. 6.9), it is seen that hotels and beach resorts (about 25.85% in respect of total hotels and beach resorts in entire CRZ areas are 25.85%) are situated in the eastern part of the NDZ area in Sankarpur coastal belt.
The long profile (figure no. 6.10) shows the tourism scenario of the Sankarpur coast in relation to its morphological characteristics. Beach erosion as well as sea aggression is the major problem of Sankarpur.
Figure no. 6.10: Long Profile of space uses at Sankarpur

Figure no. 6.11: CRZ violation at Tajpur
In case of Tajpur coastal belt (figure no. 6.11), the new resorts are found constructed in NDZ area in eastern part by digging and flattening the sand dune where no such construction should be permitted. About 21.05% of beach resorts and hotels are situated in NDZ area and 42.11% of beach resorts and hotels are found in CRZ-II and CRZ-III (area between 200 meter to 500 meter) area while 36.84% beach resorts and hotels are found outside CRZ area (figure no. 6.13). In enumerating the floor occupancy status (figure no. 6.12) of Tajpur, the situation is somewhat peculiar as NDZ area is affectively the construction process is on the eastern part of the beach where 21.05% of resorts are grown in the NDZ area by digging and flattening the sand dunes.
Figure no. 6.14: Long Profile of space uses at Tajpur

The long profile (figure no. 6.14) represents the tourism scenario of the coast in relation to its morphological characteristics. The nature of destructions Tajpur is very much alarming.

Figure no. 6.15: CRZ violation at Mandermoni
In case of Mandermoni coastal belt (figure no. 6.15), most of the hotels and beach resorts are designed in such a way that high tide water can reach to the resorts boundary wall. In NDZ area where no such construction should be permitted, about 82.93% of beach resorts and hotels are situated. In CRZ-II and CRZ-III (area between 200 meter to 500 meter) area, only 17.07% beach resorts and hotels are found while outside CRZ area, there is no such construction (figure no. 6.17). Maximum violation of CRZ norms is found at Mandermoni as compared with other tourist resorts in the study region. In enumerating the floor occupancy status (figure no. 6.16) the NDZ of Mandermoni shows how ecology of a coast could be affected by the aggression of tourism entrepreneurs.
The long profile (figure no. 6.18) represents that the morphological characteristics of the coast. Tourism set up violating CRZ makes the beach vulnerable for disasters which are increasing day by day with further recreational activities on the beach. Paragliding, Beach Riding, Jet Ski etc. are recently introduced as attractions of Mandermoni.
In case of Junput coastal belt the scenario of the coast and the coastal landuse is something different from other tourist places. It is also a fishing zone. Figure no. 6.19 depicts landuse pattern of the coast. The long profile shows the ups and downs of the landform whereas veryies (ponds) and creeks are found. Here also found the beach resorts are developed in NDZ area about 40.00%, where no such construction should be permitted. In CRZ-II and CRZ-III (area between 200 meter to 500 meter) area, 40.00% beach resorts and hotels are found while only 20.00% beach resorts and hotels are found outside CRZ area (figure no. 6.21).
The long profile (figure no. 6.22) represents that the tourism scenario of the coast in relation to its morphological characteristics. The developmental activities concentrate in the fragile part of coast and make it prone to disaster.

6.3.2) Perception of hoteliers on Disaster Preparedness:

A special investigation was conducted to quantify the level of sensitization of the tourism entrepreneurs operating at the CRZ area of Digha, Sankarpur, Mandermoni, Tajpur and Junput. Figure 6.23 is representing of the result of such survey for Digha.

Figure no. 6.23: Perception of Hoteliers at Digha
In case of Sankarpur, the scenario of perception of hoteliers is shown in figure no. 6.24.

In case of Tajpur, the perception survey reveals that the hoteliers more conscious about the vulnerability issue of disaster (figure no. 6.26).
The largest violation of CRZ is found at Mandermoni. The entrepreneurs of the area are least conscious about the disaster vulnerability (figure no. 6.26).

In case of Junput, the scenario is similar like other destinations (figure no. 6.27). From disaster preparedness point of view, there is lot to do for the study area concerned.
6.4) APPLICATION OF LEOPOLD MATRIX:

Leopold Matrix (LM) is a method developed by Leopold et.al. (1971) and used as a tool for Environmental Impact Assessment (EIA). Leopold Matrix is used for the impact identification of the several developmental factors and also to identify the major factors which are very much responsible for changing the environment. A sum of Leopold value is used to assess the stress on environment of different factors. In the present context, the Leopold Matrix method is used to analyze the environmental impacts of different tourism developmental activities in the coastal zone of Purba Medinipur district.

The coastal zone of Purba Medinipur is a well known and popular tourist destination in the entire study area. As it is a popular tourist destination, the tourism developmental activities are simultaneously going on in the entire coastal area. The growth of tourism developmental activities however are not carried with in a controlled and planned way and have also imprints upon the environment. The environmental impacts of such tourism developmental activities have been analyzed applying the methodology of Leopold and others. The tourism developmental activities including building construction, road construction, concretizing embankment, vehicular movement, waste disposal, water usage, landuse transformation incorporating beach recreational facilities and urbanization and its impacts on land environment, aquatic environment and air and noise environment have been incorporated in the modified Leopold Matrix table (Table no.- 6.1):

It is shown from table no. 6.1 that the tourism developmental activities have negative impacts upon the destination environment. The sum Leopold value indicates the impact of different tourism developmental activities along its horizontal axis individually whereas vertical axis shows the individual impact level of environmental factors. From the Leopold value it is said that the activities like building construction, road construction, concretizing embankment, waste disposal, landuse transformation incorporating beach recreational facilities and urbanization are among the major significant activities which are negatively affecting upon the land, aquatic, air and noise environment of the aforesaid destination. In case of land environment the environmental issues include landuse and land cover, habitat loss, loss of species, deforestation, land degradation, changes in ground water level, beach erosion and vulnerability. Among them, vulnerability issue is the prime concerning matter which is caused by the activities like building construction, road construction, concretizing embankment and also landuse transformation incorporating beach recreational facilities.
Table No. 6.1: Modified Leopold Matrix to study the environmental impacts in the coastal region of Purba Medinipur

<table>
<thead>
<tr>
<th>Environmental effects</th>
<th>Tourism Developmental activities</th>
<th>Land Environment</th>
<th>Aquatic Environment</th>
<th>Air &amp; Noise Environment</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Landuse and Land cover</td>
<td>Habitat Loss</td>
<td>Loss of Species</td>
<td>Deforestation</td>
<td>Land Degradation</td>
</tr>
<tr>
<td>Building Construction</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Road Construction</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Concretizing Embankment</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vehicular Movement</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waste Disposal</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Water Usage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Landuse Transformation incorporating Beach Recreational Facility</td>
<td>-2</td>
<td>-2</td>
<td>-1</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>Urbanization</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>-9</strong></td>
<td><strong>-7</strong></td>
<td><strong>-6</strong></td>
<td><strong>-8</strong></td>
<td><strong>-8</strong></td>
</tr>
</tbody>
</table>
The parameters of the aquatic environment are deterioration of water, loss of species, impact on fisheries and water pollution. The aquatic environment retrogrades due to the effects of water disposal and excessive water usages. The status of air and noise environment has been calculated by using air pollution and sound pollution data. The air environment degrades due to the effects of vehicular movement, waste disposal and road construction activities whereas noise environment is affected due to vehicular movement mainly.

From the above analysis, it is evident that the vulnerability issues (among the other environmental issues) are the most concerning. The overall tourism developmental activities make the coastal destinations vulnerable and very much prone to disaster. Overall, it may be said that the unsustainable growth of tourism has its detrimental impacts upon the environment of the coastal region in Purba Medinipur which is to be addressed soon in order to avoid disaster in the coast.

6.5) **SWOT (Strength, Weakness, Opportunity and Threat) and AHP (Analytic Hierarchy Process) ANALYSIS:**

SWOT (Strength, Weakness, Opportunity and Threat) analysis is a very effective tool to analyze the internal and external advantages and disadvantages of a system. Among the four factors, strength and opportunity are considered to be the positive factors, whereas weakness and threat are considered as negative factors. SWOT is an analytical method commonly used for strategy formulation and decision-making. The environmental analysis carries by SWOT method integrates the internal strengths / weaknesses and external opportunities / threats (Kuo-Liang and Shu-Chan, 2007).

In the present context of tourism and environment, the SWOT factors of the coastal region of Purba Medinipur are taken into consideration as follows (Table no.- 6.2):

6.5.1) **The SWOT – AHP Calculation :**

AHP (Analytical Hierarchy Process) is a multi-criteria decision making method to derive the ratio scale from the pair-wise comparison matrix. A pair-wise comparison matrix of SWOT groups has been calculated. CI (Consistency Index) and CR (Consistency Ratio) have also been calculated from the pair-wise comparison matrix by using the ‘AHP Calculation Software’ developed by CGI. A final pair-wise comparison matrix of SWOT factors with CI and CR value has also been calculated to fulfill the objectives of the study.
<table>
<thead>
<tr>
<th>SWOT</th>
<th>Strength</th>
<th>Weakness</th>
<th>Opportunity</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Popularity as a beach resort</td>
<td>1. Beach recreational facilities not sustainably developed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Shallow gradient and gentle slope beach character</td>
<td>2. Unsustainable sewerage system</td>
<td>2. Availability of virgin beaches to diversify visitors through planned development</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Average 5000 tourists visit in a week</td>
<td>3. Unplanned development of hotels and lodges</td>
<td>3. Huge potentiality to introduce circuit tourism</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Famous as weekend destination site</td>
<td>4. Lack of safety and security for visitors</td>
<td>4. Availability of fund to develop tourism infrastructure and superstructure</td>
<td></td>
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<tr>
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</tr>
<tr>
<td></td>
<td><strong>Strength</strong></td>
<td><strong>Weakness</strong></td>
<td><strong>Opportunity</strong></td>
<td><strong>Threat</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Opportunity</strong></td>
<td></td>
<td><strong>Threat</strong></td>
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</tr>
<tr>
<td></td>
<td><strong>Threat</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Coastal erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Exceeding tourist carrying capacity in popular destinations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Violating of CRZ norms</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>4. Beach pollution and depletion of forest</td>
<td></td>
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</tr>
</tbody>
</table>
Table No. 6.3: Pairwise Comparison Matrix of SWOT analysis

<table>
<thead>
<tr>
<th>SWOT Groups</th>
<th>Strength</th>
<th>Weakness</th>
<th>Opportunity</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>1</td>
<td>1/2</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td>Weakness</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1/2</td>
</tr>
<tr>
<td>Opportunity</td>
<td>1</td>
<td>1/2</td>
<td>1</td>
<td>1/3</td>
</tr>
<tr>
<td>Threat</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SWOT Groups</th>
<th>Weights (Eigen Vector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>0.161286</td>
</tr>
<tr>
<td>Weakness</td>
<td>0.270066</td>
</tr>
<tr>
<td>Opportunity</td>
<td>0.143784</td>
</tr>
<tr>
<td>Threat</td>
<td>0.424863</td>
</tr>
</tbody>
</table>

Maximum Eigen Value = 4.04582
C.I.= 0.0152731, CR= 0.0169701

Source: Result derived from SWOT – AHP Combined Methodology, after Saaty (1990)

In case of SWOT Groups study, the result shows (Table no. - 6.3) that among the four components of SWOT, threat is most significant having weightage of 0.424863 (CI=0.0152731 and CR=0.0169701) for the environmental analysis of coastal region of Purba Medinipur in relation to its tourism development. The weakness is the next (0.270066) followed by strength (0.161286) and opportunity (0.143784).

Table No. 6.4: Final Pair-Wise Comparison Matrices for SWOT Factors:

<table>
<thead>
<tr>
<th>SWOT Groups</th>
<th>Pairwise Comparison Matrix</th>
<th>Priorities of SWOT factors/Local Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength (S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1: Popularity as a beach resort</td>
<td>S1 1 2 1 1/2</td>
<td>0.232185</td>
</tr>
<tr>
<td>S2: Shallow gradient and gentle slope beach character</td>
<td>S2 ½ 1 1/2 1/2</td>
<td>0.140424</td>
</tr>
<tr>
<td>S3: Average 5000 tourists visit in a week</td>
<td>S3 1 2 1 1/2</td>
<td>0.232185</td>
</tr>
<tr>
<td>S4: Famous as weekend destination site</td>
<td>S4 2 2 2 1</td>
<td>0.395206</td>
</tr>
</tbody>
</table>

Maximum Eigen Value =4.06065, C.I.=0.0202157 , CR= 0.0224619
### Weakness (W)

<table>
<thead>
<tr>
<th>Weakness</th>
<th>W1: Beach recreational facilities not sustainably developed</th>
<th>W2: Unsustainable sewerage system</th>
<th>W3: Unplanned development of hotels and lodges</th>
<th>W4: Lack of safety and security for visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1 1 1/2 1/3 1</td>
<td>W2 2 1 1/3 2</td>
<td>W3 3 3 1 3</td>
<td>W4 1 1/2 1/3 1</td>
</tr>
<tr>
<td></td>
<td>Priorities of SWOT factors/Local Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.136409</td>
<td>0.232185</td>
<td>0.494997</td>
<td>0.136409</td>
</tr>
<tr>
<td>Maximum Eigen Value</td>
<td>4.06065, C.I. = 0.0202157, CR = 0.0224619</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Opportunity (O)

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>O1: Locational advantage in catering visitors</th>
<th>O2: Availability of virgin beaches to diversify visitors through planned development</th>
<th>O3: Huge potentiality to introduce circuit tourism</th>
<th>O4: Availability of fund to develop tourism infrastructure and superstructure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O1 1 1/3 1/3 2</td>
<td>O2 3 1 1/2 1</td>
<td>O3 3 2 1 2</td>
<td>O4 ½ 1 1/2 1</td>
</tr>
<tr>
<td></td>
<td>Priorities of SWOT factors/Local Weight</td>
<td></td>
<td>Priorities of SWOT factors/Local Weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.166474</td>
<td>0.261352</td>
<td>0.407132</td>
<td>0.165042</td>
</tr>
<tr>
<td>Maximum Eigen Value</td>
<td>4.32131, C.I. = 0.107103, CR = 0.1190033</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Threat (T)

<table>
<thead>
<tr>
<th>Threat</th>
<th>T1: Coastal erosion</th>
<th>T2: Exceeding tourist carrying capacity in popular destinations</th>
<th>T3: Violating of CRZ norms</th>
<th>T4: Beach pollution and depletion of forest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1 1 2 1/3 2</td>
<td>T2 ½ 1 1/3 2</td>
<td>T3 3 3 1 4</td>
<td>T4 1/2 1/2 1/4 1</td>
</tr>
<tr>
<td></td>
<td>Priorities of SWOT factors/Local Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.226185</td>
<td></td>
<td>0.510417</td>
<td>0.103984</td>
</tr>
<tr>
<td>Maximum Eigen Value</td>
<td>4.08127, C.I. = 0.0270911, CR = 0.0301012</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Result derived from SWOT – AHP Combined Methodology, after Saaty (1990)

The final pair-wise comparison matrices show (Table no.- 6.4) the factor-wise weightage value of the different SWOT factors – strengths, weaknesses, opportunities and threats. In case of four strength factors of the coastal region of Purba Medinipur, the result is showing that the S4: Famous as weekend destination site is the most revelatory strength factor (having the weighted value – 0.395206) followed by S3: Average 5000 tourists visit in a week (0.232185), S1: Popularity as a beach resort (0.232185) and S2: Shallow gradient and gentle slope beach character (0.140424).

In case of weakness factors, W3 factor: Unplanned development of hotels and lodges is most significant weakness factor with and weightage value 0.494997 among the four weakness
factors. The respective weakness factors are W2: Unsustainable sewerage system (0.232185), W1: Beach recreational facilities not sustainably developed (0.136409) and W4: Lack of safety and security for visitors (0.136409).

The result of the matrix shows that among the four opportunity factors, O3: Huge potentiality to introduce circuit tourism with an weightage value 0.407132 has proved itself to be the most significant factor followed by O2: Availability of virgin beaches to diversify visitors through planned development (0.261352), O1: Locational advantage in catering visitors (0.166474) and O4: Availability of fund to develop tourism infrastructure and superstructure (0.165042).

In case of threat factor, the four important threat factors have been identified. The result of comparison matrix shows that within these the T3 factor: Violating of CRZ norms with the weightage value 0.510417 is the most significant threat factor. The other threat factors are T1: Coastal erosion (0.226185), T2: Exceeding tourist carrying capacity in popular destinations (0.159414) and T4: Beach pollution and depletion of forest (0.103984).

Finally, it is proved from the above SWOT-AHP analysis that the coastal zone is a very much popular tourist destination in West Bengal having a great opportunity to develop as a most popular tourist destination in the eastern part of India. In spite of that the coastal zone of Purba Medinipur has been suffering from a lot of crucial problems in environmental point of view. The most significant problem or weakness of that area is the unscientific and uncontrolled tourism growth that creates a mass tourism hub in the coastal zone of Purba Medinipur makes the area unsustainable. The unplanned growth of tourism, mostly the hotels and lodges are developed in the hazard zone violating the CRZ regulation is the most responsible factor to turn into the area as a disaster prone area. Besides that, sand dune diminishing, coastal erosion, sea encroachment, have also negatively impacted upon the environment.

6.6) Conclusion:

EMP (Environmental Management Plan) is required to cope with the hazards like storm surges and flooding having potentials to devastate the area. The EMP should include:

1. Sensitization of hoteliers regarding their loss (life and property) with the setting of a disaster.
2. Designing of a sound rescue plan for implementation when disaster takes place.

3. Provide necessary training to local youths so that they can respond in rescue and relief operations during and after the disaster.

4. Monitor the entire commercial activities in the vulnerable zone involving the local community not directly involved in tourism business.

5. Continuous effort to remove super structures from the vulnerable areas with the help of law along with banning of vulnerable activities in the name of adventure tourism / sports in order to ensure the sustainable tourism principles.

All the coastal resorts of West Bengal under study are waiting for disaster which is almost inevitable. The vulnerability as revealed from the analysis with floor occupancy status in NDZ particularly and the long profile of the coasts represent the geomorphological characteristics in relation to its cultural landscapes expose the area as disaster prone and its impacts in field level. If the present situation continues, tourism would appear as a blight in the long run, particularly with the onset of a disaster in West Bengal coast.