Challenges towards sustainable port development in India: the adverse effects of port development on coastal ecology and community in Ennore: case study

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WORLD MARITIME UNIVERSITY
Malmö, Sweden

CHALLENGES TOWARDS SUSTAINABLE PORT DEVELOPMENT IN INDIA:
The Adverse Effects of Port Development on Coastal Ecology and Community in Ennore: A Case Study

By
BALAJI BALASUBRAMANIAN
India

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE
In
MARITIME AFFAIRS
(OCEAN SUSTAINABILITY, GOVERNANCE AND MANAGEMENT)
2018

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

(Signature):
(Date): 18.09.2018

Supervised by: Dr. Murray Rudd
Supervisor's affiliation: OSGM
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Abstract

**Title of Dissertation:** Challenges towards sustainable port development in India: The adverse effects of port development on coastal ecology and community: A case study

**Degree:** MSc

Ports and shipping play a crucial role in the coastal development, however, it possesses numerous potential risks to the marine environment and the coastal community. Sustainable development is a key concept which integrates the triple bottom line: economic, environmental and social elements into all aspects of decision making. This paper explores and analyses the challenges towards the progression of sustainable development of Indian ports, taking the Ennore port in India as a case study. My objectives in this research were to highlight the lack of consensus on the importance of the two pillars, environmental and social in the concept of sustainability and explore varying degrees of limitations in the implementation of the existing framework of sustainability in India. I report the results from the port operators and coastal community, who are involved and directly affected by the Ennore port development. My analysis found that the tools like EIA and CRZ, to achieve the sustainable development of ports in India, have failed to achieve its desired results due to the biophysical and organizational uncertainties. The lack of public hearing process in the EIA leads to the overlook on social issues. The stakeholder engagement, especially the coastal community engagement is crucial in the sustainable development of ports. The ignorance of coastal ecology and potential threats due to port development leads to the socio-economic impacts of the fishermen and coastal community and adverse effects on the marine environment. The uncertainties of sustainability may be reduced by understanding the importance of the ecology and social issues and by effective community involvement during all stages of the process of development. This article concludes with some suggestion and recommendation to improve the sustainable port development in India.

**Keywords:** Sustainable development; Triple bottom line; Biophysical and organizational uncertainty; Socio-economic impact; Adverse effects; Effective community involvement
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<tr>
<td>BPL</td>
<td>Below Poverty Line</td>
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<tr>
<td>CDF</td>
<td>Community Development Fund</td>
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<tr>
<td>CRZ</td>
<td>Coastal Regulation Zone</td>
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<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>EAC</td>
<td>Expert Appraisal Committee</td>
</tr>
<tr>
<td>EC</td>
<td>Environmental Clearance</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Act</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GOI</td>
<td>Government of India</td>
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<tr>
<td>GRI</td>
<td>Global Reporting Initiative</td>
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<tr>
<td>HTL</td>
<td>High Tide Line</td>
</tr>
<tr>
<td>IAPH</td>
<td>International Association of Ports and Harbors</td>
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<tr>
<td>IBEF</td>
<td>India Brand Equity Foundation</td>
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<tr>
<td>IPA</td>
<td>Indian Port Association</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>LTL</td>
<td>Low Tide Line</td>
</tr>
<tr>
<td>MOEF</td>
<td>Ministry of Environment and Forest</td>
</tr>
<tr>
<td>MSP</td>
<td>Maritime Spatial Planning</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>PIANC</td>
<td>World Association for Waterborne Transport Infrastructure</td>
</tr>
<tr>
<td>SAGAR</td>
<td>Security And Growth for All in the Region</td>
</tr>
<tr>
<td>SDC</td>
<td>Sagarmala Development Company</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goals</td>
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</table>
SEAC - State Expert Appraisal Committees
SEIAA - State Level Environment Impact Assessment Authority
SPCB - State Pollution Control Board
TBL - Triple Bottom Line
UN - United Nations
UNCTAD - United Nations Conference on Trade and Development
1.0 Introduction

Maritime shipping is one of the important modes of transport carrying over 80% of world trade by volume and 70% of its value (UNCTAD, 2017). The ports function as gateways for global supply chains and stimulate economic growth globally. Although worldwide the shipping sector is considered as one of the least harmful transportation methods from an environmental perspective, it still possesses high risks due to the magnitude of shipping and port activities. Which requires it to meet on its potential role in sustainable development conditions (Peris-Mora, Orejas, Subirats, Ibanez, & Alvarez, 2005).

Besides their major role in ocean and coastal development, ports and shipping also possess numerous direct and indirect impacts on oceans and coasts (Bailey & Solomon, 2004). The impacts caused due to the port construction and expansion on the coastal habitats and biodiversity are potentially broad. There are also potential adverse effects such as oil pollution, air emissions, ballast water transfer of harmful aquatic organism from one region to another are demanding the integration of issues of boundaries from maritime to marine (McConnell, 2002). The anthropogenic threats caused due to these adverse effects including climate change, habitat destruction, biodiversity loss, invasive species are numerous and are harmful to the coastal and marine ecosystem (Halpern, McLeod, Rosenberg, & Crowder, 2008). That requires a need for continuous review of environmental standards and an assessment of the impacts (Munn, 1979).

Generally, port construction, expansion, operation, and other activities related to the port area are assessed for any plausible environmental impacts and risks (Peris-Mora, Orejas, Subirats, Ibanez, & Alvarez, 2005). Despite such assessments, the impacts caused by the maritime sector are increasing either intentionally or accidentally, which results not only in the substantial damage to the coastal ecology but also affecting the economic activities along the coastline (Ng & Song, 2010). The concept of sustainable port development address and improve the issues related to the port development and operations and also provide the capacity-building and development of the society by port-related training capacities in the local region.
around the port. Those programs commonly aim to simultaneously develop both the 
port and local area by addressing their specific needs through a holistic approach 
(Kim & Chiang, 2014).

As per Brundtland report, “Sustainable development is a development that meets the 
need of the present without compromising the ability of future generations to meet 
their own need.” (World Commission on Environment and Development, 1987, p. 8). 
The sustainable development is the integration of three key elements: economic, 
environmental and social into all aspects of decision making (United Nations, 1987; 
Gimenez, Sierra, & Rodon, 2012) and the concept of sustainable port development is 
now being widely recognized. OECD (2011), has developed a new strategy ‘Green 
Growth’ for the sustainable development, which fosters the economic growth and 
development but at the same time ensures the conservation of natural assets and 
environmental services. It is achieved by propelling investment and innovation and 
also paying special attention to social issues. The logic is that of greening the 
economy will enhance sustainable growth.

The challenges and opportunities faced by the developed, emerging, and developing 
countries are, however, different as it depends on the varying economic and political 
situations and circumstances. That is a typical attention that needs to be concerned 
in all context. The World Association for Waterborne Transport Infrastructure (PIANC, 
2014) focuses on the sustainable development and green growth of ports and other 
value-added activities. It provides guidance regarding the proactive measures and 
strategies for achieving development and future operations sustainably and also 
promotes a conceptual shift of thinking towards a long-term vision. According to 
PIANC (2014), the key elements of the “green port” concept are:

- Long-term vision over tolerable footprint on nature and environment.
- Transparent stakeholder engagement and their full involvement in process 
  and growth.
- A conceptual shift of thinking, that sustainability as an economic driver rather 
  than as a legal obligation.
- Active information sharing, and cooperation between other stakeholders and 
  ports, and steady growth in innovation and technology.
Pauli (2010) argued that the world is under the crisis of food, fuel, economy, and environment. Biodiversity loss and ecosystem destruction lead to the emerging natural resource disaster and climate crisis. A “Blue Economy” can be a solution for these issues by not only dealing with these challenges but also creating opportunities (Pauli, 2010). World Bank (2017), also defined that “Blue economy” is a great concept which adheres the triple bottom line principle on sustainable use of ocean resources for economic growth at the same time achieving the livelihoods and jobs, and the health of ocean ecosystem (World Bank, 2017; Spalding, 2016).

The port structure is a complex system with numerous internal and external actor, who are stakeholders in a port community and who hold interests and objectives in the process of development. However, as of 2006 in Europe, only 17% of ports involved local communities as a stakeholder in the port development plans, an issue that many other countries also face (Henesey, 2006). Ports cannot act alone, the involvement of the stakeholders is very important and crucial in achieving and implementing the green port strategy, which needs the collaboration of different players including the community (Lam & Van De Voorde, 2012). The stakeholder engagement during planning provides more comprehensive information inputs, which can enhance the quality of the environmental decisions. The integration of both scientific and local knowledge provides an extensive understanding of the complex and dynamic socio-ecological processes (Reed, 2008).

India with a long coastline of 7500 km, has a high concentration of population living near the coasts. The transition of India’s escalation in globalization and industrialization have a severe threat to the environment and sustainable development. The Indian economic development has largely exploited and destructing its natural resources and led to a disastrous effect on the marine environment (Duraisamy & Latha, 2011). The Indian coasts and their associated biodiversity are under serious threat by numerous stresses like human-induced pressure, which includes ports and harbours (Neumann, Vafeidis, Zimmermann, & Nicholls, 2015; Rani, Satyanarayana, & Bhaskaran, 2015). India presently has 12 major ports and 200 non-major ports, and the Indian government has initiated a project called Sagarmala, under which a number of new port development and the modernization of existing ports are planned and commenced (GOI, 2018). It is
essential that the Indian government must integrate the consideration of sustainability into the port development and expansion, which have been acknowledged worldwide that the need for sustainable practices, since the expansion of port functions, are central to industries engaged in international trade.

This paper aims to assess the challenges towards the progression of sustainable development of Indian ports, taking the Ennore port in India as a case study, and identifying its key challenges towards their sustainable concept of Triple Bottom Line (TBL) principles of achieving all the environmental, economic and social dimensions (Gimenez, Sierra, & Rodon, 2012). In order to enhance the strength of the findings, the semi-structured interviews were organized that composed of the three groups of people: port operators, fishermen surrounding the port and the coastal community people near the Ennore port area. The objectives are to 1) highlight the lack of consensus on the importance of the two pillars, environmental and social in the concept of sustainability and 2) explore varying degrees of limitations in the implementation of the existing framework of sustainability in India. I hope that the findings are to be considered for the future improvement as well as for further research on sustainable port development.

2.0 Background

2.1 India’s Vision towards the Port development under Blue Economy

India with the GDP growth rate of about 7.5% in 2018, is one of the fastest growing large economies in the world (World Bank, 2018) and the ports and shipping are playing a crucial role in the overall economic development of the country, about 95% of India’s trade in volume is transported through seaports (IBEF, 2018). India considered the Blue Economy as a new platform of economic activity in the Indian coastal areas and connected hinterlands through sustainable use of ocean resources
and publicized his vision of blue economy through “Security And Growth for All in the Region” (SAGAR) (GOI, 2015). The focus of the Indian government is now to enhance the existing capacity of fishing, modernisation of maritime infrastructure such as shipbuilding, ports and harbours, the exploitation of mineral resources and the associated industries of the private maritime sector (Sakhuja, 2015).

![Fig 1: Prominent port of India. Source: Indian Port Association (IPA)](image)

The government of India has introduced the ‘Sagarmala Programme’ in March 2015, a port-led development project that attempts to harness the potential of India’s coastline and inland waterways (GOI, 2018). The Government is pitching this development plan within the scope of the maritime and logistics arm of the blue economy, implies that it gives equal importance to economic growth and environmental sustainability (Alagar, Premkumar, & Ishita, 2017).

The Four Pillars of Sagarmala Programme as shown in figure 2 (GOI, 2018) are:

- **Port Modernization & New Port Development**: Improving port operational efficiency, expanding the capacity of existing ports and developing new ports
- **Port Connectivity Enhancement:** Improving the coastal and inland shipping to enhance the connectivity to the hinterland, optimizing cost and time through multimodal logistics solutions like coastal berths, national waterways, rail & road connectivity, pipelines connectivity.

- **Port-linked Industrialization:** Developing port-proximate industrial clusters near the coastal areas. Coastal Economic Zones such as smart industrial cities, coastal districts, and other spatial economic regions to reduce logistics cost and time export, import and domestic cargo.

- **Coastal Community Development:** Promoting sustainable development of coastal communities through skill development & livelihood generation activities, fisheries development, coastal tourism, etc.

![Fig 2: Four pillars of Sagarmala programme. Source: GOI (Sagarmala)](image-url)

In this development plan, the coastal community development is one of the important element (Fig 2), which achieves the social element of sustainable development. In the community development plan around ten projects have been identified and that will
be funded by the community development fund (CDF) and the Sagarmala Development Company (SDC), which provides a cost of approximately USD $145 million to $220 million for the community development projects. Various departments of the government will achieve the implementation of these projects, including Ministries of Agriculture and Fisheries, Tourism, Shipping, as well as port trusts and maritime boards (Indian Ports Association, 2016). It is envisaged that this port-led development plan will generate about 10 million jobs, which includes 4 million direct jobs related to the port and logistics sector (Ministry of Shipping, 2016). The coastal community development is planned to achieve improvement and development in three different sectors coastal regions (figure:3); fisheries and fishermen community development; and coastal tourism (GOI, 2018).

2.1.1 Coastal Community Development

Around 14.2% of India's population lives in the coastal districts (Institute for Ocean Management, 2017) and these people are crucial stakeholders in the Sagarmala ‘port-led development’ program. The government of India has adopted this community development program as one of the key objectives, so as to ensure their socio-economic wellbeing of these people. The state of socio-economic development differs in different coastal states of India regarding infrastructure, poverty reduction, per capita income and also some fishermen community are poor and lacks some basic facilities. Therefore, it is crucially important for the integrated and sustainable development of the ports along with coastal communities in India (Ministry of Shipping, 2016). It is essential to analyze and address the environmental and social impacts of the Sagarmala related projects to ensure sustainable development of the coast.
As per the (Central Marine Fisheries Research Institute, Kochi, 2010), the total population of the fishermen is 4 million, comprising of 864,550 families, of which 61% of the fishermen families were living under below poverty line (BPL) category. Thus they are very dependent on the informal money market and vulnerable to natural resource-based impact (especially the small-scale fishermen). An integrated governance approach is essential to improve the condition and the status of the fishermen community to ensure their basic needs such as healthcare, housing, transport service, electricity and to promote the sustainable fisheries management (Jentoft & Chuenpagdee, 2009). The Community Development Fund (CDF) and the Sagarmala Development Company (SDC) of this program will cater funds for the fishermen community in various projects. Such as project of other sectors (new skill training programs and small business development like handicrafts, agriculture, etc.), projects within fisheries sector that generates opportunities for their livelihood (new fisheries process and in the development of value-added product), projects related to
the social welfare of the community, and the projects which promotes the sustainable fisheries management (e.g., aquaculture promotion, ocean and fish quality literacy, sustainable fishing practices, and progressing facilities for fish handling and landing). Besides the CDF, for the sustainable development of fisheries, a scientific and well-designed strategy is essential. For example, such an intention might provide desired solutions throughout the coastline of India, like the deep sea and nearshore fishing, modern fishing gears and fleets, and also inland fishing. Which also includes the provision of larger vessels that allow for sustainable deep sea fishing. Eventually, a holistic approach is required for the management of the natural resources and to foster the socio-economic development with active stakeholder participation (Ministry of Shipping, 2016).

2.1.2 India’s Green Port Initiative

Considering the importance of environment in the sustainable growth, the government of India has initiated ‘Project Green Ports’ that concerns the transition of major ports of India into greener and cleaner ports. This Project has two elements one is ‘Green Ports Initiatives’ related to environmental issues and the second is ‘Swachh Bharat Abhiyaan’ (GOI, 2016). This Project includes 12 actions that will be periodically implemented to accomplish all the targets. Those actions involve:

- construction and monitoring plans for environmental protection;
- securing necessary equipment for the monitoring of environmental pollution;
- procuring dust eliminating and suppressing system;
- establishing wastewater treatment plant, sewage plant, and garbage disposal plants;
- establishing renewable energy production projects in the ports;
- Improving Oil Spill Response (OSR) facilities;
- Control and prohibit waste disposal into the sea.
Under Swachh Bharat Abhiyaan, there are various initiatives considered in timely action to promote cleanliness at the ports, such plan will be qualified by regular training and awareness and are initiated in all major ports of India.

2.2 Legal Framework related to Port Development

2.2.1 Coastal Regulation Zones of India

The Coastal Regulation Zone Notification, 2011 (CRZ) helps in the protection and conservation of the coastal region and its critical environment and marine biodiversity, as well as the livelihood security of the fishermen and the coastal communities residing in the coast. Thus it promotes the sustainable development of the coast and its infrastructures depending on the scientific principles considering the risk of natural threats to the coastal areas and the sea level rise due to climate change (Panigrahi & Mohanty, 2012). The Ministry of Environment and Forests (MOEF) by the notification of the Government of India declared certain coastal stretches as CRZ area, under the Environmental Protection Act, 1986 (MOEF, 2018). It applies to the areas,

(i) The land area 500 metres from High Tide Line to the landward side along the seafront.
(ii) The land area 100 metres, which revised to 50 metres as per the Coastal Regulation Zone Notification, 2018, but yet to be approved, between the HTL or width of the creek along the tidally influenced water bodies, whichever is less on the landward side that is connected to the sea.
(iii) The intertidal zone i.e. the land area between the High Tide Line and the Low Tide Line.
(iv) The water and the seabed area between the LTL to the territorial sea (12 Nm), if banks present between the sea then the LTL of both the banks, of the tidal zones.

The Coastal Regulation Zone is classified three different zones as shown in table 1,
Table: 1 Coastal Regulation Zone Notification, India

<table>
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<tr>
<th>Category</th>
<th>Definition</th>
<th>Regulations</th>
</tr>
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| CRZ 1 A  | • Ecologically sensitive and important areas  
          • Coastal Habitats such as coral reefs, mangroves, salt marshes, and sand dunes, biologically active mudflats  
          • Areas rich in biodiversity  
          • Historical and heritage areas  
          • Protected areas such as marine reserve, national parks wildlife habitats | • No new construction permitted within 500 m of the HTL other than Ecotourism. |
| CRZ 1 B  | • Areas between the LTL and high tide line HTL | • Only specific activities allowed such as ports, harbours, projects for security and defence, non-traditional energy sources, maintenance of waterways, etc., |
| CRZ 2    | • The area that has already been developed up to the shoreline  
          • Areas within the municipal limits, which is previously built up | • No buildings promoted on the seaward side of the existing roads or of the planned roads  
          • Existing structures are subjected to local town and country planning |
and connected with drainage, roads and other infrastructure regulations under the consultation/public hearing process and also subject to environmental safeguards as per CZMPs.

| CRZ 3 | • Land areas that are relatively undisturbed and those do not fall under CRZ-II | • Few activities are allowed in this zone. |

### 2.2.2 Environmental Impact Assessment for Port development

Environmental impact assessment (EIA) is the assessment of any consequences and effects significantly on the environment, likely to arise from any action or project (Jay, Jones, Slinn, & Wood, 2007). India introduced EIA Notification in their legal framework in 1994, under the Environmental Protection Act (EPA), 1986. The EIA is mandatory for several highly polluting activities, including the development and expansion of ports and harbours in India (MOEF, 1994). After the introduction, there were many amendments adopted to enhance the environmental clearance process (EC) and to shape it an important tool for decision making and to achieve sustainable development (Rajaram & Das, 2006).

The ports and harbours development or expansion projects require prior environmental clearance from the concerned regulatory authority. The Ministry of Environment and Forests (MOEF) categorized the projects or activities for obtaining the Environmental Clearance (EC) in two categories: category A and category B. For the ports and harbours, capacity handling more than 500 million tonnes per annum excluding fishing harbours comes in category A and those less than 500 million tonnes per annum falls under category B. For the category A projects the central government in the MOEF will provide the environmental clearance and for the category B the State Level Environment Impact Assessment Authority (SEIAA) is involved in the process (MOEF, 2006).
Fig:4 Process of EIA in India. Source: MOEF, India
The EIA process consists of three basic elements: (a) preparation of the EIA report, from scoping to documentation, (b) review and decision-making and (c) post-project monitoring (Paliwal, 2006). Moreover, the Environmental Clearance process (EC) consists of four stages, Screening, Scoping, Public Consultation, and Appraisal carried by the Expert Appraisal Committees (EACs) at the Central Government and the State Expert Appraisal Committees (SEACs) at the State or the Union territory level (MOEF, 2006).

- ‘Screening’ process determines whether such a project requires an environmental study depending on the type of project and the location specified for the project to conduct an EIA. Besides, other activities that require EIA are specified by the MOEF on those projects planned in coastal regulation zones and an ecologically sensitive area.

- ‘Scoping’ identifies all the relevant environmental concern and issues related to the project or activities for the preparation of an EIA report of that project.

- The ‘Public Consultation’ involves public hearing, which provides an opportunity for the local community people who are affected or others, who hold strong stakes in the environmental impacts of the project, and consider their issues and concerns into the decision-making process. The advertisements of the public hearing are provided in two local newspapers by the State Pollution Control Board (SPCB), one in English and the other in the regional language of the state, containing place and date of hearing and also it provides the location of the executive EIA summary report of the project. The public hearing panel also engages additional authority or public agency, which is not subordinate to the regulatory authority, to complete the process.

- ‘Appraisal’ involves the comprehensive study of all the documents like final EIA report, public hearing proceedings, Environmental Management Plan, risk assessment and emergency preparedness plan by the Expert Appraisal Committee or State Level Expert for the approval or rejection of environmental clearance. Post project monitoring follows after the completion of the project in a periodical fashion, yearly and six monthly.
2.3 Ennore port: A case study

My study area, Ennore port (Fig 5) also called as Kamarajar Port, is one of the major ports of India and is located on the coast of Bay of Bengal coast, and the first port in India which is a public company (Kamarajar Port Limited, 2018).

Fig 5: Location of study area Ennore. Source: (Seshan, Natesan, & Deepthi, 2010)
The Ennore creek (Fig 6) adjacent to Ennore port is located in Tamil Nadu (13° 10’ N; 080° 20’ E). It is a fresh/brackish water creek situated in between the Kourtaliar river and the Bay of Bengal. The creek comprises of lagoons, salt marshes, and mangroves and covering a total area of 2.25 km², and is nearly 400 m wide. The depth of the creek is about 1 to 2 m. About 3219 fishing families, settled in the nine nearby villages have been supported by this creek (Parasuraman, Sivakumar, Shilpa, & Mithrason, 2016). The flow of both fresh water and salt water intrusion provides a unique condition for the rich biodiversity and it provided a good supply of food that supports both the marine species and the coastal fishing communities but at the same time, it is a very fragile ecosystem. The creek was rich in fauna and flora, including
mangroves providing numerous sources of fisheries especially mullets and prawns, but in recent years, due to effluents discharge from the industries and the operations of the major harbour Ennore port possessed severe threats and stresses on the estuarine ecosystem. It is observed that once the flourished mangrove swamp is now found degraded patches in the fringes (Shanthi & Gajendran, 2009; Jayaprakash, Srinivasalu, Jonathan, & Mohan, 2005).

The construction and expansion of the Ennore port caused changes in coastal morphology and also it affected the ecosystem. The dumping of the dredging materials associated with the port deepening and the reclamation of the creek has degraded the mangroves of the Ennore creek (Environmental Justice Atlas, 2017). The port associated Ennore power plant uses the river as the coolant system and dumbs their hot coolant water in the creek, which leads to the algal bloom, affecting the fisheries and the people dependent on the marine life (Shanthi & Gajendran, 2009). The dredging involved in development of Ennore port has caused large-scale changes in the area both north and south of the port, severe erosion suffered on the northern part of the port, a series of groynes has been built to mitigate and save the coastline and, on the southern side of the coast it causes accretion, this accretion frequently results in the closure of the mouth of the river (Pandian & Dharanirajan, 2007; Kudale, 2010).

The fisheries depletion in the creek has reflected in the decline of the fish catch which eventually affected the artisanal fishers and their income. There is a significant decline in tiger prawn and crap threadfin fish, which were the rich source of the creek. The current fish stock has reduced well below the carrying capacity of the lake, at a low rate of about 200 kg of seafood per ha. In the fishermen community living around the creek about 49 % of the artisanal fishers depend on the Ennore estuary alone for fishing and around 29.4 % depends on both the sea and the estuary and the remaining depends only on the sea. Hence the destruction of the ecosystem in the creek and the sea coast had a severe impact not only on their livelihood and also other functions due to coastal erosions (Shanthi & Gajendran, 2009). Due to diminished income in the fishing, the fishermen were compelled to change their traditional occupation (Parasuraman, Sivakumar, Shilpa, & Mithrason, 2016).
3.0 Methodology

Sustainability involves three principle elements: economic, environment and social. To identify and organise my analysis that how the two elements environment and social elements are conceptually perceived and to identify the limitations in the existing framework of the sustainable port development, my strategy was to conduct semi-structured interviews (Longhurst, 2010). The interview involved different expert groups, who hold interest and those affected by the Ennore port development. This interview allowed the participants of the different expert groups to express their views and issues they perceived as valuable. The interview questions were developed from the study and recommendation of sustainable development strategy by various organisation and also from the practice of different ports from different regions. The questions were designed to facilitate the identification of factors that affect the sustainability of Ennore port development and impact on the surrounding environment and the coastal community especially fishermen community. The following are the questions which guided me for the semi-structured interviews,

- How is the sustainable port development addressed under the ‘Blue Economy’?
  By the definition of blue economy, it is addressing the triple bottom line of the sustainable development (World Bank, 2017), which give me the performance of India’s port development initiatives towards the sustainable development. Also this question was specifically designed to ask only to a particular discipline people who are involved in the port operation and management or those who are expert in the academics related to the port and development sector.

- How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
  The coastal community is the vulnerable people, directly impacted by the port development or operation and they are the critical part of the social element in the
sustainable port development. So it is crucial to understand their involvement in the decision making of any port development (Lam & Van De Voorde, 2012).

- What are the impacts to the society and environment due to the Port Expansion? How do you determine it? What is the compensation or support provided? The answers help me to understand the procedure of EIA carried out and the impacts suffered by the community in reality and the progress of the measures to help the community.

- What are all the challenges for the Sustainable development of Ports and Harbours in India?

The result provides me with the limitations of the practice that have been followed in India in the sustainable and some new recommendation from the participant’s perception on the inadequacy of the present framework.

I have selected this case study of Ennore port deliberately to help and understand the present situation and the issues of the coastal community, especially the fishermen community, who depend on the Ennore creek, have lost their livelihood because of the degradation and destruction of the creek and its biodiversity. After selecting the case study, potential interviewees were contacted via email and the coastal and fishermen community people were contacted in person in Ennore. My criteria for choosing interviewees depended on their relationship with the port operation and development either in the involvement of the port development or those who are affected from the port development and I have also contacted the academic researchers in coastal management. The Ethical Review Committee of the World Maritime University, approved the interview questions and procedures in April 2018. The information sheet and the consent form were issued and signed by all the respondents and the documents were saved on my personal device. For the purpose of confidentiality, the respondent’s names are not used and instead mentioned as numbers R1, R2, etc.,

In data analysis, the interviews were transcribed and coded by identifying themes and sub-themes. Theme identification is an important method to identify and to merge the repetitive unified statements from the collected data (Boyatzis, 1998).
4.0 Results

Of 24 people contacted from various disciplines in Ennore, Chennai and also in other parts of India, only eight people responded. Number of port operators and the academic researchers have been contacted, however only two port operators have accepted for the interview and others did not respond to the mail. The interviews were conducted between May to July 2018 via WhatsApp call and two of the interviews were in person. In the total eight completed survey: two from port operators, four from fishermen community people dependent on the Ennore creek and two from coastal community people living in the neighbouring villages of the Ennore port. Each interview lasted between 20 to 60 min, resulting in 4 hours 56 minutes of interview recordings, that were subsequently transcribed for the analysis. To retain confidentiality, I refer to the port operators as R1 and R2, the fishermen from R3 to R6 and the coastal community people as R7 and R8. Full transcripts of the interviews included as supplementary material in this dissertation. The themes and the responses from my respondents are given below in Table 2.

4.1 Prospects of India in Sustainable Port development

Two of the respondents R1 and R2 said that the prospects of Indian ports in the sustainable development under Blue Economy are initiated through ‘Sagarmala programme’. They emphasized that as per the legal framework of the Indian government the rules and regulations are well achieving the sustainability concept of the port development or expansion. They stated that the coastal regulation zone notification (CRZ) and the environmental impact assessment (EIA) are the key tools which adhere to the two elements of sustainability, environmental and social. Both R1 and R2 reported that the mission and vision of this port-led development project of the blue economy are to enhance the domestic trade and reduce the logistic costs by building new ports and modernising the existing ports, which enables the economic
element of the sustainability. R2 also said that the capacity building is one of the components of the port led development plan of the Sagarmala, which includes the skill development of the coastal community people, fisheries development and coastal tourism development.

Table 2: Summary of the results.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Specific Statement</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coastal community participation</strong></td>
<td>The Coastal community was adequately involved or engaged in the port development or expansion project</td>
<td>2  -  6</td>
</tr>
<tr>
<td><strong>Public hearing outcome</strong></td>
<td>Public hearings are effective and appreciated for community responses and future study and consideration.</td>
<td>2  3  3</td>
</tr>
<tr>
<td><strong>Degradation of Environment</strong></td>
<td>There is a loss of biodiversity in the Ennore creek due to port development or expansion.</td>
<td>5  3  -</td>
</tr>
<tr>
<td><strong>Livelihood</strong></td>
<td>There is a loss of livelihood for fishermen community dependent on the Ennore creek.</td>
<td>6  -  -</td>
</tr>
<tr>
<td><strong>Coastal erosion</strong></td>
<td>Coastal erosion occurred in the area around Ennore due to the port construction.</td>
<td>7  -  -</td>
</tr>
<tr>
<td><strong>Compensation or Support</strong></td>
<td>No adequate compensation or support provided so far for the loss of livelihood due to the direct impacts, such as fisheries development or monetary fund.</td>
<td>6  2  -</td>
</tr>
</tbody>
</table>
The jobs provided is not sufficient for the people affected in the fishermen community.

Environmental impact assessment tool as per MOEF provided a comprehensive study of both environmental and social impacts and the mitigation measures are achieved.

<table>
<thead>
<tr>
<th>Issues</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal community engagement is essential for the port development</td>
<td>8-4-1</td>
</tr>
<tr>
<td>The public hearing is conducted in the port development project</td>
<td>5-6-3</td>
</tr>
<tr>
<td>The public hearing is effective in the port development project</td>
<td>2-6-3</td>
</tr>
</tbody>
</table>

4.2 Community Participation

Table:3 Coastal community participation in the port development

The respondents R1, R2, R4, R5, and R8 informed that the engagement of the coastal community is achieved through public hearing (Table 3). Also, R1 and R2 said that such public hearing is recorded for further consideration, to analyse and mitigate the issues raised by the local community as well as fishermen community. However, the R4, R5, and R8 stated that there is a lack of knowledge for the community people on the impacts speculated in the future. They emphasized that in the public hearing the port officials address only about the technical information about the project and not the envisaged impacts such as erosion or biodiversity loss, with a minimum
environmental consideration in line with the work of (Sinclair & Diduck, 2000) and also mentioned that the issues raised towards some effects are said to be avoided and considered by the port officials, however, when it comes to operation, no action was taken and their involvement remains meaningless as stated by (Diduck, Sinclair, Pratap, & Hostetler, 2007). Also, other respondents R3, R6, and R7 are not aware of the public hearing (Table 3), which becomes evident that the advertisement through the newspapers alone is not sufficient to reach people who might be illiterate or not a reader of the newspaper.

4.3 Ecological Impacts

Table: 4 Ecological impacts: Degradation of habitats and biodiversity

<table>
<thead>
<tr>
<th>Issues</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are a loss of fishes and prawns in the Ennore creek after port development</td>
<td>6</td>
</tr>
<tr>
<td>The mangroves were destructed in the creek due to port expansion</td>
<td>5</td>
</tr>
<tr>
<td>There is a loss of biodiversity in the creek</td>
<td>6</td>
</tr>
</tbody>
</table>

There were several ecological impacts reported by the respondents in the Ennore creek due to the development of the Ennore port. Respondents R3, R4, R5, R6, R7, and R8 stated that there is a substantial loss of biodiversity in the Ennore creek and the sea closer to the Ennore (Table 4), they admitted that there were high abundance of fishes and prawns in the creek before the construction of the port and the industrial clusters and the respondents R3, R4, R5, R6, and R8 said that a large number of mangroves habitats were destructed in the Ennore creek as studied in the work of (Shanthi & Gajendran, 2009). They also said that the river was wide and deep earlier but now due to the reclamation project for the port clusters, the port expansion and the dumping of dredged materials from the port made the river narrow and the depths have reduced extensively. The R3 and R5 informed that due to these reductions in river the boats cannot pass up the river during low tide, as well as these dumped dredged materials and the materials used for the bridge construction for the
connection of the port had degraded some of the patches of mangroves as supported by the (Environmental Justice Atlas, 2017). The respondents R3, R4, R5, R6, and R7, added that the coolant water discharge from the coal power plants belongs to the government electricity board has possessed a severe damage to the fisheries resources. R3 stated that the discharged water is too hot that even a human cannot touch the waters a few metres near to the discharge outlet. All the respondents of fishermen community R3, R4, R5, and R6 reported that before the degradation of mangroves and pollution from the industries, the estuary was serving as a good nursery ground for various types of fishes and prawns especially tiger prawns, one of the expensive fish food in the Indian market.

4.4 Socio-economic Impacts of the Coastal Community

Table:5 Socio-economic impacts of the coastal community

<table>
<thead>
<tr>
<th>Issues</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal erosion occurred after the construction of breakwaters of the port</td>
<td>7</td>
</tr>
<tr>
<td>There is a loss of livelihood of fishermen dependent on the creek</td>
<td>6</td>
</tr>
<tr>
<td>There is a loss of livelihood of small-scale fish seller dependent on the creek</td>
<td>2</td>
</tr>
<tr>
<td>Oil pollution affected the fisheries in the sea around Ennore</td>
<td>6</td>
</tr>
</tbody>
</table>

The Respondent R3, R5, R7, and R8 reported that due to the reduction of river width and depth and also increased construction of bridges and conveyers passing through the river which obstruct the flow of water, causing floods to the villages during the heavy rainfall season. Respondent R2, R3, R4, R5, R6, R7, and R8 said that the port development had caused coastal erosion (Table 5) around the Ennore port as stated by the (Pandian & Dharanirajan, 2007). The community people and fishermen respondents R3, R4, R5, R6, R7, and R8 have reported that few of the houses were lost during the monsoon season in the area around Ennore port due to coastal
erosion, now the construction of groynes by the government along the coastal stretch for few kilometres is acting as a barrier. However, the respondents R4, R6, R7, and R8 claim that these groynes have affected the landscape of the beach and other activities such as boat parking and entertainment of the people in that area.

R3 and R5 informed that the average distance from the shore the artisanal fisherman sail in that community is around 4 to 5 miles. The respondents R3, R4, R5, R6, R7, and R8 admitted that now due to all these adverse impacts on the Ennore creek due to the port and industries have caused the livelihood of fishermen (Table 5) as mentioned by (Shanthi & Gajendran, 2009). Also the respondents R4, R6, R7, and R8 reported that many of them have left the fishing jobs and joined some other jobs, mostly labour jobs which do not yield a good income that was earned while fishing. However, due to the minimum formal education R6 has stated that they have reduced the ability to find a job he reported that he continually struggles to make money for his family daily expense. The respondents R5 and R7 informed that these impacts have not only affected the fishermen but also some of the small-scale fish selling people (Table 5) mainly the women who are having a limited opportunity concerning employment.

Respondent R3 and R6 have highlighted that the increased traffic of ships to the Ennore port also affected them in various means, the sailing ships and the anchored vessels have been damaging their fishing nets very often. R3 said that the ships bound to Ennore port do not follow a specific anchoring ground or sailing routes. Also, all the fishermen and the coastal community respondents R3, R4, R5, R6, R7, and R8 reported that there was a recent collision of two ships next to the Ennore port had caused a severe oil pollution which affected the entire coast and the fisheries resources in that area, the fishermen respondents R3, R4, R5, and R6 reported that after the incident the availability of fishes near the coast has extremely reduced for a long time and the customers have reduced vastly due to the fear of contamination of local fishes.
### 4.5 Compensation or Support

Table: Compensation or Support provided to the people affected

<table>
<thead>
<tr>
<th>Issues</th>
<th>Responses</th>
<th>Positive</th>
<th>Neutral</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation provided for accidental pollution for oil spill</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Skill training program conducted for the welfare of the community</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No efficient compensation for the loss of livelihood of fishermen</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Contractual jobs provided for the coastal community</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

All the respondents R1, R2, R3, R4, R5, R6, R7, and R8 stated that the government provides compensation for the pollution incidents, that causes disaster in the surrounding areas, however, the respondents R3, R4, R5, and R6 reported that the compensation was minimum, which didn’t overcome the losses faced during that time. The respondents R3, R4, R5, R6, and R7 stated that, however, for the loss of livelihood of the fishermen, no compensation or support has been provided, which can improve the status of the fisheries like monetary funds for deep sea fishing or bigger fishing boats, who are directly affected due to the port development. The respondents R2, R3, and R7 stated that the port united with other industries has provided a short skill development program and also issued a certificate of attendance. However, the respondents R3 and R7 said it does not help them to secure a job. The respondent R3 emphasized that “the government of India and the port authority has to consider the livelihood of the fishermen and they should open at least one door if they shut the other door.” The respondent R5 stated that no skill training program was conducted in their village.

All the respondents R1, R2, R3, R4, R5, R6, R7 and R8 stated that the port administration provided some contractual jobs to the local community people, and the respondent R2 explained that the port development provides both direct and indirect
employment and the local community has been given preference in the nonskilled direct jobs, but he said it is not known whether it is sufficient for all the coastal community. R1 stated that there is large number of jobs created by the port and also been provided in the ports for the coastal community. However, the respondents R3, R4, R6, R7, and R8 admitted that the jobs provided were not enough in numbers and they urged that the retention rate of these contractual jobs are less.

### 4.6 Review of EIA

**Table:7 Review of the EIA process in Indian port development**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA provided a comprehensive study of both environmental and social impacts, and the mitigation measures are achieved.</td>
<td>2 Positive 6 Negative</td>
</tr>
<tr>
<td>EIA consists of intermediate audits in six monthly basis</td>
<td>2 Positive - Neutral - Negative</td>
</tr>
</tbody>
</table>

My findings offered some insights into the challenges and the obligation or suggestion given by the respondents for the sustainable development of ports. The respondent R1 and R2 stated that the environmental impact assessment (EIA) provides a comprehensive study of the environmental and social impacts to achieve the sustainable development of ports. Also, they informed that during the EIA process there is regular monitoring of the issues and impacts and also after granting the environmental clearance (EC) there are intermediate audits to be carried in a six monthly basis and the respondent R2 said that status report has to be submitted to the pollution control board. R1 and R2 stated that every port needs to have an environmental management plan which allows them to monitor the situation of the environmental impacts during the port operation. However, the respondent R2 mentioned that there is a need for effective stakeholder management in the EIA system. Also, he admitted that the EIA must develop a guideline on identifying the ecologically sensitive areas and critical socio-cultural zones.
The respondents of fishermen and the community people R3, R4, R5, R6, R7, and R8, however, opposed that the environmental impact assessment of the Ennore port had outperformed in the study of ecological areas and social impact assessment, and they also stated that there is a lack of implementation on the pollution measures to be carried out as advised in the public hearing. The respondents R3 and R6 emphasized that there need to be an opportunity for permanent jobs from the government or port officials for those fishermen and other people entirely dependent on the Ennore creek for their livelihood or they must provide compensation or support in enhancing the capacity of deep sea fishing by providing bigger boats or provide subsidies in buying boats and nets for deep sea fishing. Also, R4 and R8 exclaimed that there must be an awareness building program conducted by the EIA team on the positive and negative impacts of the port development project to all the local community and the fishermen before their participation in the public hearing.

5.0 Discussion

Reducing biophysical and organisational uncertainty is crucial in the sustainable development of ports. The keys to reducing the uncertainties, in this case, is the integration of local knowledge throughout the process of decision making with the knowledge of experts involved in the process and the integration of green port strategy in the port development. I found that the principle tools, CRZ notification, and the EIA are to achieve the sustainability practice of any project successful. However, my analysis highlighted that there is a gap in the implementation process of the application of the regulations. I found in various instances that the EIA and CRZ notification have failed to perform in the case of Ennore port development both concerning the ecological and social issues. The issues expressed by the
respondents provided us that there needs to be an improvement in the engagement of the local community in the process of the public hearing under EIA.

5.1 Direct Issues of port development

5.1.1 Public Hearing Limitations

My analysis found that the process of the public hearing under EIA have limitations and a need for improvement is required, to manage the issue of the organisational uncertainty on the public hearing process. Public hearings are generally advertised in newspapers of both English and local regional language (MOEF, 2006), however, the respondents R3, R6 and R7 stated that they were not aware of the public hearing, which becomes evident that the advertisement through the newspapers alone is not sufficient to reach people, where literacy rate among fishermen community is low (Maddox, 2007) or not a reader of newspaper. Improved methods of advertising the public hearing like posters in the public places such as fishing harbour, bus station, and other common places, allow a broad reach to people. The community people engagement is so crucial, which provides a various aspect of understanding such as complexity of ecosystem, compatibility or conflicts of multiple uses of a coast, the complexity of the ecosystem, identify existing use or interaction and in resolving the areas of conflict (Ramirez, 1999).

The public hearing in India is generally conducted only once before the decision-making process, unlike in Netherlands and USA, where the public engagement is achieved at various stages throughout the process such as screening, scoping, report preparation and decision making (Wood, 1995). Moreover, the public hearing in India is meaningless due to the lack of environmental awareness of the community people engaged (Sinclair & Diduck, 2000), Which was even stated by the respondents R4, R5 and R8 that there is a lack of knowledge for the community people, especially fishermen on perceiving the environmental impacts. As well as the issues raised are not appreciated or attended during planning and decision making in the Ennore port development project, similar to the case study mentioned in the work of (Paliwal, 2006).
Since these activities, port development and fishing involve conflict between each other. Therefore a need for Marine Spatial Planning (MSP) is required, which provides a holistic ecosystem-based approach to manage the human activities in the marine environment and improves the decision making (Ehler & Douvere, 2006). The engagement and involvement of stakeholder including the local community in the MSP process should be early, often and maintained throughout the process of planning, evaluation, implementation, and post-implementation (Pomeroy & Douvere, 2008). Therefore, it enhances the quality of the environmental and social decisions by providing a comprehensive understanding of the complex and dynamic process (Reed, 2008).

5.1.2 Dredging effects

Dredging is required for port deepening, maintain navigational channels and for development of coastal structures, however, such excavation, disposal of the soft bottom and dumping on the sensitive area lead to numerous adverse impacts on the marine and coastal environment (Erftemeijer & Robin Lewis, 2006). This Dredging activity cause increased turbulence increased concentrations of suspended matters and sedimentation (Wolanski, Fabricius, Spagnol, & Brinkman, 2005). These sediments of the Ennore creek with high contents of organic matter, contaminants, heavy metals (Jayaprakash, et al., 2008) lead to effects on water quality and affect the organism. The effect of turbidity affects the light availability for the micro-organism and the suspended material can lead to death due to clogging and smothering of the aquatic organism, especially in filter-feeding organisms such as oysters, bivalves, and mussels (Erftemeijer & Robin lewis, 2006; Henley, Patterson, Neves, & Lemly, 2000). Dredging activities can also cause the change in the currents and waves, and such change may also lead to change in the pattern and cause coastal erosion (Wal & Pye, 2004).

The EIA process should access the potential direct and indirect impacts of the dredging and shall try to mitigate those (Jay, Jones, Slinn, & Wood, 2007), however, in the Ennore creek the dumping of dredged materials caused a severe impacts on the sensitive estuarine ecosystem (Environmental Justice Atlas, 2017) as reported by
the respondents R3, R4, R5, R6, and R8. The port of Rotterdam, a leading port in green growth and sustainability, developed a big pit called ‘Slufter,’ where the contaminated dredged materials are dumped, to preserve flora and fauna of the marine and coastal area (Port of Rotterdam, 2018). Such an initiative to be adopted by the Ennore port, depending on the financial feasibility, to preserve and conserve the biodiversity of the creek, where numerous fishermen depend on their livelihood.

5.1.3 Coastal Erosion

Construction of ports and harbours and the breakwaters for the channel can significant affect the currents, local wave conditions, and sediment transportation (El-Asmar & White, 2002). These changes affect the configuration of the adjacent coastal shoreline, especially if the area experiences strong long-shore currents and high energy conditions. In such cases, the breakwater blocks the long-shore currents and cause severe erosion of the coast on the down-drift side and soil deposition on the up-drift side (Dean, Chen, & Browder, 1997).

It is necessary to understand the coastal processes and identify the likely adverse effects before port development or breakwater construction, however, sometimes it may be different than expected because of the complex nature of the coast and the hydrology. The coastal erosion issue can be mitigated by the groynes as placed in Ennore. However, sand nourishment is considered as an environmentally admissible method of coastal management (Hanson, et al., 2002), which has widely been recognized in the USA and European countries (Hamm, et al., 2002). Such method nourishment will upkeep the value of the coastal people views on the beauty of the shore and used as a recreational area. The design adopted by the port of Rotterdam by rounding off the fairway and the oblique design of the structure closer to the mouth of the channel have the least impact on the change of the circulation of the water and less effect of erosion (Port of Rotterdam, [n.d.]).
5.1.4 Reclamation and Pollution Issues

The port construction generally requires reclamation of land, but such reclamation need to be as per the regulations of the CRZ notification, however there is a breach of the regulation in the Ennore port, due to the reclamation of the Ennore creek which will fall under the CRZ area and also there were reclamation of mangroves in the creek, which is an ecologically sensitive area as per CRZ notification (MOEF, 2018), where there are no construction activities are allowed to be carried out. These cause a potential impact on the degradation of the biodiversity in the creek especially the fishery resources (Shanthi & Gajendran, 2009).

Port operations are also a very complex system with a broad range of environmental and social issues: deterioration of air and water quality, toxic waste production and pollution (Darbara, Ronza, Stojanovic, Wooldridge, & Casal, 2005). Hence there is a need for the environmental management plan, which can determine and identify the source of pollution and control the disposal of waste and hazards and also enhances the assessment of development, and monitoring of operation. The Ennore port has adopted the Environmental management plan as per ISO 14001:2004 standards and monitoring the environmental issues (Kamarajar Port Limited, 2018). However, there is a lack of assessing and identifying the environmental issues, which causes the dumping of dredged materials and the reclamation of sensitive areas in the creek.

5.2 Cross-Cutting Issues

5.2.1 Dependency and Importance of Coastal Habitats

The Ennore creek with patches of mangroves, which is to be regarded as the ecologically sensitive area, falling under CRZ 1 have been reclaimed for the port development, and also unsustainable dumping of dredged materials has been carried out during the expansion project. The estuary, which is home to unique species of plants and animals, is one among the most productive ecosystem in the world. Even though the estuaries cover only 8% of the total oceanic area, the estuaries and the coastal seas provide about half of world fisheries harvest (Kennish, 1992). The mangroves, one of the significant coastal habitats of India, provides various
ecosystem goods and services for the welfare of the highly populated coastal community. Those good and services include habitat protection serving as a nursery, breeding and spawning grounds for the commercial fish species and to maintain the biodiversity; regulating the flood and flow control, cyclone protection, groundwater recharge, and sediment and nutrient retention; and also cultural services (Giri, et al., 2011). The ecologically and economically essential mangroves forests are highly productive ecosystems with a high carbon production rates equal to that of humid tropical forests. They absorb more carbon below the ground than terrestrial trees, stored in the dead roots and large pools in soil. Although the mangroves constitute only 0.5% of the coastal area worldwide, but they account for about 14% of carbon sequestration by the global ocean as a coastal habitat, which is approximately 1% of carbon sequestration by the world’s forests. These are perceived as a means for conservation and restoration by helping alleviate the greenhouse gases in the atmosphere (Alongi, Carbon sequestration in mangrove forests, 2012; Alongi, Carbon cycling and storage in mangrove forests, 2014).

Despite the fact that the mangroves ecosystem provide economically valuable services, which cannot be directly compared against the economic value of any other government investment, the importance of mangroves as a natural capital tends to be ignored (Brander, et al., 2012). Although increased efforts to encourage the protection of such ecologically sensitive areas and the areas of rich biodiversity exist in the legislation of the government of India as per the CRZ notification, the degradation of the estuarine ecosystem and the mangroves destruction in the Ennore creek is attributed to the implementation failure of the regulations. However, such ignorance on the environmental protection is the opportunity cost of the development. Adopting methods for the valuation of environmental goods and services and the socio-economic impact of the fishermen community will offer a more comprehensive valuation of the estuarine and mangrove ecosystem services provided by the Ennore creek and thereby contribute informed decision making (Spaninks & Beukering, 1997). Increased importance and valuation of Corporate Social Responsibility (CSR) activities of the port may also enhance their social reputation (Fombrun, 2005).
5.2.2 Socio-Economic Issues

In our case study area, Ennore, as reported by our respondents R3, R4, R5, R6, R7 and R8, the loss of biodiversity and fisheries in the Ennore creek have affected the livelihood of many fishermen and the small-scale business (fishing selling) people, who are dependent on the creek. The fishermen community respondents stated that many fishermen were dependent on this Ennore creek and most of the fishermen from the villages around the Ennore port are artisanal fishers, who do not go deep into the sea for fishing. Although there is a coastal community development program under Sagarmala programme, which also includes the fishermen community welfare (GOI, 2018), however, no support or development in the fisheries are provided so far.

Since the Sagarmala programme is a new initiative, started in 2015, it is concentrated only on the newly developed port led projects, omitting the people affected in Ennore area which was developed earlier. There is a need to consider the livelihood of the Ennore coastal fishermen and other people, who are directly affected by the adverse effects of the port development. Eventually the social element, the least recognised and the weakest ‘pillar’ of the sustainable development (Lehtonen, 2004)

It has been reported that the government has conducted the skill development programs, however not sufficient enough to get jobs. The skill development program of Sagarmala programme may need to use the workforce and the availability of the coastal people for the skilled and unskilled labour jobs required for the new port projects. And there need to be more opportunities in the existing ports for the coastal community, which will enhance the welfare of the community and attain the social concept of sustainability.

To ensure the environmental values and to preserve the nature, compensation can be introduced to evade and elevate the impacts caused in the natural capital (Kuiper, 1997). As per the European Union legislation, there is a compensation for the environmental loss of nature and ecosystem (European Union, 2004). The countries like Sweden and Netherlands have adopted a sustainable concept of environmental and social compensation for the damages that have occurred due to the port development project. In the port of Rotterdam, Netherlands, due to the new expansion project Maasvlakte 2, which causes impact on the marine ecosystem, they
established a new seabed protection area to compensate that habitat loss occurred entirely and also the reclamation of the dune system for the port project has also been compensated by the development of a new dune system, as a sustainable way of development (Port of Rotterdam, 2009). In Gothenburg port, Sweden, there is a loss of eelgrass bed due to the construction of a new port terminal at Arendal and Älvsborg, the port authority is offering compensation for the natural and cultural assets to maintain the biodiversity of the area (Port of Gothenburg, 2015). The government of India needs to consider and understand the importance of natural asset and adopt the compensation concept in the EIA system. The adoption of environmental programs is expected to have a positive effect and improve the social element of the sustainability (Gimenez, Sierra, & Rodon, 2012).

5.3 International Standard of Sustainable Port Development

Sustainable development becomes a widely acceptable and key concept of development in recent times, the (United Nation Sustainable Development Goals) SDGs gave it a universal recognition, which is perceived as global goals to end poverty, protect the planet and enhance the peace and prosperity among countries and people. These goals are interconnected; one may help in achieving the issues related to the other goals (UN, 2016).

Several international organisations have actively involved in promoting the sustainable development of ports. The International Association of Ports and Harbours (IAPH) has decided to start a World Ports Sustainability Program (WPSP), which enhances and coordinate the future sustainability efforts and cooperation of the ports globally (IAPH, 2018). This program builds on the World Ports Climate Initiative that was adopted by IAPH in 2008 and evolved to the sustainable development. This program aims to demonstrate global leadership of ports and committing to the Sustainable Development Goals of the United Nations, by empowering both the port community and the societal stakeholders of the local community. As per the OECD (2011) and PIANC (2014) the green growth strategy of port development, helps in achieving the concept of sustainability by improving and developing: innovation of new technology, active sharing of knowledge, transparent stakeholders participation,
increased social concern in the development, long-term vision for the nature and actionable policy framework.

Global Reporting Initiative (GRI), an international organisation helps governments and businesses worldwide to recognize and report their impact on sustainability issues such as governance, social well-being, human rights and climate change. In which many major ports worldwide are being a member of the reporting system, that enhances the sustainability concept and provide an overall achievement of the triple bottom line of sustainability. The GRI has provided sustainability reporting standards, organised with valid multi-stakeholder inputs and established in the public interest (GRI, 2018). Such practice of reporting helps in identifying and managing the risk, protecting the environment and improving the society and economy, by improving governance and stakeholder relationship.

The government initiative of ‘project green port’ only address the issues related to the pollution and its control measures. Also, the ‘Sagarmala Programme’ addresses the key issues such as capacity building of coastal community and fisheries development. However, it does not include the active and transparent involvement of the coastal community. Therefore, India needs to accept and recognize the global standards and the guidelines on sustainability provided by the international organisation such as OECD, PIANC, IAPH, and GRI on sustainable techniques to pioneer in the sustainable development of ports and harbours.
6.0 Conclusion

Development needs to be in all directions, without destructing the natural assets or affecting the society. My research explored the uncertainties in the existing system and the need for improvement for the sustainable port development in India. India, a fast-growing economy with the increased number of port projects, need to adhere to the sustainable development, thus providing the life-supporting natural assets, on which the human being and other species are dependent. The stakeholder engagement is crucial to the effectiveness of the sustainability. There is a need for more effective and integrated co-operation of all the stakeholders, especially the coastal community during all stages of the process as well as regular monitoring of the impacts during the operation and expansion of the sector.

It is evident that the tools for the sustainable port development in India, EIA and CRZ, have failed at multiple levels, in my case study, Ennore port. My key findings of the research raised issues regarding the compliance with the legal regulations laid by the government and also the lack of analysis and identification of the environmental and social issues related to the port development. Although rules and regulations are in place, the compliance and the enforcement to the core of the sustainability is a common challenge experienced by the developing nations, which perceives only the importance of economic values than the environmental and societal values. Understanding the critical importance of the environmental goods and services provided by the coastal ecosystem will offer a comprehensive and cumulative valuation that provide to the economic development. The coastal fishermen community, the most vulnerable people in the port development project, are also playing a role in the country’s economy, who needs to be developed and supported along with the port development.

Reducing the biophysical and organisational uncertainty is crucial for the sustainable port development. To reduce the uncertainty and to establish the sustainably developed ports, the fundamental concepts are: conceptualizing the sustainability as a key economic driver, effective and transparent community participation, improved knowledge integration by capacity building of actors, green growth, innovation,
sharing knowledge, more profound commitment and long-term vision on the environmental and societal issues.

The findings in the paper were based on only one port, which may involve different officials and also surrounded by different environmental features. And also the results are composed of a fewer respondent. So it is necessary to carry out a comparative study of different ports in India, with enhanced survey of various respondents, which allows a comprehensive approach and idea to analyse the challenges and the complications in achieving the sustainable port development in India.
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Appendix

Transcription of the Interview Results

**Respondent 1:**

1) How is the sustainable port development addressed under the ‘Blue Economy’?
   - Blue economy development of ports ‘Sagarmala’ considers a broader and a holistic approach by accounting for all the concerns related to the port.
   - EIA: Includes proper and comprehensive study of the environment. There is stringent and regular monitoring during all stages of development. An internal audit system is in the establishment which produces a status report to the pollution control board detailing them on the progress and development status.
   - CRZ: Coastal regulation zone notification by the central government and state pollution control board considers the location and also the environmental issues

2) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
   - All the framework and guidelines have been complied with by the port development and expansion projects. For social issues, the involvement is essential, and it is done through public hearings, which involves the local population who put forward their problems and those issues are subsequently recorded. Complete transparency is maintained. The environment is always considered as a major concern.
   - The public hearing process involves both, port-related authorities and the other non-port related government authorities. Such events are advertised in the newspapers. And the concerned issues are recorded and addressed by MOEF.
   - Stakeholders engagement includes all the potential investors and agencies related to crew and port-related jobs. The local communities and the fishermen community are involved only in the public hearings. The corporate social
responsibilities of the port help the communities to increase their standards and also provided with some jobs.

3) What are the impacts to the society and environment due to the Port Expansion? How do you determine it? What is the compensation or support provided?
   - All the areas around the port project are adequately studied and examined; the plan is developed keeping a sufficient amount of time in hand, mainly to do detailed studies about the critical habitats.
   - Every port is required to have pollution response equipment and sufficient infrastructure. There also exists inter-agency collaboration which also deals with pollution response.
   - As said above the EIA is a tool to identify, and all the impacts are determined and proper measures taken by the state pollution control board.

Compensation for the causes or objection of the public:
   - In case of pollution, the local administration comes into picture and funds are issued for the affected people. Such acts are under caution if some occurrence takes place the insurance will take care of that.

In case of reclamation of the land or any livelihood associated places:
   - The consent of the residents is required to reclaim their land, and if unavoidable then they are paid proper compensation, they are explained about the benefits of such decisions. The local people also find scope for employment.
   - Social impact assessment is also studied and examined during the initial stages and even during the public hearings.
   - Associated industries around the port are called port clusters, they do not fall under the port administration. They have their own control measures and EIA.
   - Employment opportunities are provided for residents of the coastal community when a port is established, and enough jobs are created and also offered to them on contractual basis depending upon their capabilities.
4) What are all the challenges for the Sustainable development of Ports and Harbours in India?

- Implementation procedures work as per the existing robust legal framework, the only challenge often encountered is undue delay in the operations.

**Respondent 2:**

1) How is the sustainable port development addressed under the ‘Blue Economy’?

- Sustainable port development in India: It’s a new initiative of the Government of India. Projects such as the establishment of new ports and modernisation of existing ports has been carried out basically for enhancing domestic trade and reducing logistics cost.
- De-bottlenecking existing ports, Improvement in capacities of the ports, development of new ports. Six new major ports are planned, as well as the capacity increase of existing ports. Debottlenecking is enhancing the connectivity of the logistics in all roads, rails and inland waterways. An increase in industrial clusters and the coastal economic zone. Coastal community development, which includes coastal skill development, marine fisheries development, and marine tourism development. These are the main scope of the Sagarmala development project.

2) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?

- Engagement of stakeholders: It is important and well appreciated, especially in port development and the expansion projects. Presently effective stakeholder engagement by the management is required to be developed. The government and the individual port authorities are working for the improvement of that, which helps in managing environmental issues, to increase the corporate social responsibility. To encourage support of stakeholders and improve the relationship.
- Society engagement of port development: All the port-related developments have multiple impacts on environment and society, including erosion related issues. The issues of the society are being addressed under the EIA, develop
clean guidelines and terms of reference on identifying the sensitive and ecological areas and also important socio-cultural zones. There should be a buffer zone (which is at present laid as no development zone by the MOEF under CRZ). All state should carry out pre-feasible social and environmental studies on port site identification and planning. No SEZ should be planned in the CRZ area.

- As per the EIA, there should be a study conducted for a particular port and relevant details advertised in the newspapers by the district administration including date and time for a public hearing for the port development project. The idea is to ask public concern on the issues related to the anticipated project. This is generally conducted by the collectorate and the port authority. Public hearing(s) is attended by the coastal community, including other government organisations and NGO’s, it is also attended by the fisherman community. Their views and suggestions are taken into account and are recorded. It is then sent to the MOEF for further review and study. This gives full opportunity to the public to give their views, opinions, and suggestions regarding any relevant concerns. In such meetings, the details must be explained to the public by the port authority.

3) What are the impacts to the society and environment due to the Port Expansion? How do you determine it? What is the compensation or support provided?

- EIA: Before approval of the project, preliminary study to be conducted and also after providing Environmental Clearance further study is required to be done, there are six monthly audits to be submitted as per the regulations of the MOEF. Monitoring also required to be done as per the terms of reference given by the MOEF.

- Social impact assessment, also a sub-sector of EIA, identifies the hazards related to the operation of the port, pollution of the port and ships, air pollution and other hazards due to transport. The state pollution control board is responsible for a complete study of social impact assessment.

- Job opportunities: It is being considered one is direct employment and the other is indirect, depends on the eligibility criteria. For semi-skilled and unskilled labour related jobs preferences are given to the coastal community
residents. Indirect jobs such as cargo cleaning and maintenance works which don’t require a concerned rule of the project proponent most of it on a contractual basis. No allotment rate is laid so far.

- Compensation: Provided for the pollution incidents and it is also as per the guidance of Sagarmala capacity building plan

4) What are all the challenges for the Sustainable development of Ports and Harbours in India?

- The CRZ 1 is well taken into consideration for the approval of project approval, and its crucial importance is given by the project proponent.

- Improvement of sustainable development: Well laid by the blue economy development and the present regulation are well achieved its importance which implies the sustainable development. More concerned towards the economic importance of it, increasing the capacity of the ports.

**Respondent 3:**

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?

- Stakeholders engagement: Reported that they were not informed about the port development project. But also reported that they were not aware of the impacts contemplated to arise from such development. And if such impacts are affecting the community people and they become aware of the situation and raise a voice against it, then there will be interference of the local police and politicians who try to persuade them by saying that this does not affect the local population.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?

- The river was rich with biodiversity and it was quite deep before all these constructions, there were a lot of fishermen who were dependent only on the
river and not the sea. And those dependent on the river doesn't have the
capacity and experience to go to sea for fishing.

- There was good yield obtained, especially prawns in that area before. The
dumping of dredged materials which they used, had affected the depth of the
river too, and due to the dumping activities, which had a lot of ash contained
in it has degraded the bio-diversity and the fishes. Due to these reasons the
boats which could pass through the river freely before passing with difficulty
now, and it can only pass during high tides.

- The river is too long and the fishermen used to go a long distance to the
neighbouring state for fishing through the river, but now due to the reduction
in depths in most of the places due to the reclamation of the ports and the
associated industrial clusters, the boats cannot be move easily through the
length of the river.

- Now the population of prawns and fishes have reduced considerably. Only
during the heavy rainfall seasons when the river water flows more we can find
some prawns which were never the biggest catch like earlier.

- Impacts- Due to the construction of bridges passing through the river, has
damaged the river bed and lot of dumping has been put on it for the basement
which has affected the depth of the river. And that caused flooding during
heavy rainfall season

- There were some kind of capacity building programmes like training skills were
provided. But they were not so much appreciated because it was provided to
only a few people of that society. And also there were no job opportunities
provided after the training programme, they were only provided with a
certificate of excellence which was not appreciated, especially by the
fishermen who don't have any educational background.

- These have affected some fishermen so badly, that they were forced to find
some other job for their livelihood and they also had to struggle to find a good
job.

- When the port was initially established, there were some jobs offered to the
local people on daily basis in the port sector and also in the industrial clusters
around the port.
- But during that time the fishermen were earning more than the amount provided on the daily basis in the fishing alone. Those people were forced because of the reduction of fisheries to join those contractual jobs for a period of about 6 months, the retention rate was also less of that workers.

- The Ennore creek functioned as a good breeding nursery ground for fishes and tiger prawns earlier before the degradation of the habitats and destruction due to pollution. After the contamination and the pollutants mixed from the water, all these fisheries have reduced drastically.

- The dust from the port operation and the conveyor going to the coal plant, is polluting the air in the area, which causes allergic and breathing-related issues for the people living around.

- The anchoring ships also don't follow specific anchoring grounds, which affect the fishing nets of the fishermen since most of the artisanal fishers in that area don't go beyond 4 to 5 nm from the shore. These anchored ships are in the place of their regular fishing places and don't follow any particular place and they anchor everywhere. And if the fishing nets fall over the anchor of the ships then it gets entangled and damaged, which causing a huge loss for the artisanal fishermen.

- The hot coolant waters related by the coal plants around the Ennore port which makes the Ennore creek water an unsuitable for the fishes and prawns, which not only affected the creek but also affected the fisheries in the estuary and the sea area around. The coolant water is so hot that a human cannot touch it closer to few metres from it. The environmental issues and social issues were never given importance which causes all the problems to our society.

- Compensation: No compensation or support is given for enhancing the fisheries development so far. There were some jobs provided in the electricity board of Tamil Nadu when they started the project, few jobs for the number of villages around.

- When the project started, people were not totally aware of the impacts of those projects.

- After the last expansion, nothing has been provided in terms of capacity building or support for fishermen community.
- For oil pollution, the compensation was provided almost after 1.5 years and that was retrieved with struggle. That amount was little for our loss.
- After the oil pollution due to the ship accident in Ennore, there is a further reduction in the fisheries resources in the sea around Ennore and Chennai. Especially the Pomfret in that area has totally displaced after that incident. It was a high-income yielding fish for the fishermen around that area during the seasonal time from January to March.
- The mangroves in the Ennore creek has been degraded due to the dumping of dredged materials from the harbour. Around the mangroves, there was a lot of prawn availability earlier.
- Large areas of mangrove forests had been reclaimed for the Ennore power plant.
- And also, there was severe erosion observed in many parts of the shore around the Ennore port after the construction of the port. It also affects the normal functions of the people and also eroded 4 houses in that area.
- This socio-economic impact on the fishermen not only affects them but also their whole generation due to the challenges of the world in economic classes. Many fishermen who have cultural background towards fishing are still struggling with their livelihood not leaving this job and holding on to the smallest yield they are getting.
- The government of India and the port authority has to consider the livelihood of the fishermen and they should open at least one door if they shut the other door.
- The fishermen community has to be involved in decision making. Permanent jobs to be provided in the port, who is directly affected of their livelihood because of the port development or expansion. Or else they should help in the fisheries capacity building, like equipment, boats for deep sea fishing or subsidy for boats and nets. There are many jobs given to people from other places but not encouraged for the people surrounding who are affected by them.
Respondent 4:

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?

   - The public hearing was conducted through the public hearing. Which was advertised through newspapers in their regional language but however everyone in the fishermen community doesn’t read the newspaper, so sometimes community people have to spread the news to their friends and neighbours.
   - And in the public hearing, the fishermen and also the coastal people failed to understand or predict what can be the impact caused due to this development or expansion.
   - In the public hearing the port officials inform about the expansion, the need of it and what such project will favour the port and the economy but the proposal and speech are so technical at times that the fishermen were completely unaware.
   - In some cases, even if they raise issues like coastal erosion and dumping of materials the officials approve that will not happen but when it comes to operation these impacts always persists.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?

   - There are a lot of impacts because of this port development and the industries surrounding it. The fishes and prawns, which was highly available in that creek and the sea closer have reduced enormously.
   - The river depth has reduced badly that there used to be lots of fishermen dependent on it but now many don’t have any yields so need to look for some other jobs. Earlier in this village, about 80% of the people were dependent on the creek for the livelihood. But due to these pollutants and the other dumping, all these nursery-fishes are greatly reduced and they lose their livelihood. And they only retain during the monsoon season to a better yield yet not the same as earlier before the damage has done.
- The coolant water from the power-plant is so hot and toxic that the biodiversity in that area is totally damaged. There was a lot of mangroves forest in the creek, which was removed for the development and also some of them started dying due to the heavy pollution of the water.

- The estuary was serving as a good breeding ground, where during the time of his father, most of the family were living a very good and wealthy life because of the fisheries richness of the Ennore. Now the people cannot even recognize the richness in the river due to all the impacts caused by the ports and industries.

- The number of fishermen dependent on the creek reduced to 5 fold in the recent times. Now due to all these issues and mainly after the port development, many have lost their livelihoods and doing labour jobs because many of the fishermen in there are not having a good educational background. And those jobs never get the money they were earning in fishing.

- It became a big question for the next generation to take their cultural job of fishermen

- The construction of breakwater has turned the flow of water and slowly there were a lot of changes in the coast occurred. There was erosion happened in many parts of Ennore, some houses also went down in erosion.

- Then the government after the loss started building those groynes, which was built in the complete coastal stretch, which affected in parking our boats closer to the house, which we were practicing earlier. And now everyone has to bring to the estuary, so the diesel cost is more for the consumption of our travel. And our kids have lost the beaches which we enjoyed when we were young.

- Air pollution affects the houses and the vehicles because of the coal sediments on top of everything.

- There was an oil pollution about a year back that caused a very serious impact on the fisheries in that area, many people are affected because of people were afraid of the contaminated fishes and the avoid buying for few months from their markets. No social studies have been carried out in that and there was some test conducted in the creek but no measures have been taken yet.
Compensation:

- The government has provided little money for the oil pollution very recently almost a year. But other than that no other compensation was provided earlier. There is no development in fisheries or any support provided to improve the fisheries in Ennore.
- There were some contractual jobs provided, which were not much in numbers to accommodate all the fishermen and also they were rejected due to skills related reasons.
- The government needs to give the fishermen community an importance on their livelihood and to improve their situation. There is a requirement of capacity building in the society for their improvement.

**Respondent 5:**

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
   - The engagement of the coastal community was through the public hearing. Which was advertised in the newspaper. The public hearing process involves many officials where there is very little importance given to the environmental impacts and also the information shared was not about the effects of the project and any problems raised never attained by the officials.
   - Majority of the coastal community people not interested to participate in participating in these events due to their lack of knowledge about the issues concerned about the environment.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?
   - The fishermen were affected mainly due to the loss of fisheries in the creek. The creek provided livelihood to a large number of fishermen earlier but now due to all the effects of pollution and dumping and the degradation of the biodiversity in the creek. The fishermen have lost their livelihood. There were a lot of fisheries resources before the construction of the ports and the coal...
plant, where the fishermen leave behind the fishes if the catch was more in their nets.

- The creek was rich with fisheries before the industrial growth in that area but now due to the combined effect of port and the industrial pollution, the creek has lost its biodiversity. The hot coolant water from the power plant has also caused the creek water unsuitable for the fishes and prawns, especially the small nursery-fishes.

- Since most of the fishermen in the nearby villages are artisanal fishers who usually fish in the creek and those who are fishing in the coastal sea sails in a range of about 5 miles

- The loss of fisheries has affected the small-scale fishing selling people, especially the women sellers who totally depend on the fishermen of the creek.

- The river depth and width have reduced due to the construction of structures and the dumping for the basement, the dredged material caused mangroves depletion in the creek. Due to the reduced depth, the boats are touching the bottom at several places in the creek. Due to these reasons there occurs heavy flooding in the village during the rainy season

- The dust pollution from the ashes and the coal of the port and the industries also causing problems with the cleanliness of the house and the boats.

- The oil pollution caused in the area due to the ship collision has affected the fisheries and the coastal people greatly, some fishermen had stopped fishing for a couple of months due to the reduction of fishes in that area and also the people avoided to buy the fishes from the oil-affected area.

- The coastal erosion also was caused due to the port construction, which has damaged 4 houses in the village due to erosion during heavy monsoon season. The government has built groynes in the coast of the Ennore and Royapuram but such structures affect the parking of the boats for many artisanal fishers and also the landscape of the beach has affected greatly, which was a recreational place of the coastal people.

- The government has paid all the fishermen and the coastal community people the same amount, which was least for the impact occurred to the fishermen.
- However, there is no compensation for the fishermen livelihood impacts for the improvement of fisheries or providing support to deep sea fishing or any other support for the fisheries development.
- No skill development programs were conducted for their loss of livelihood their village.
- There were some contractual jobs provided during every development or the phase of expansion provided to coastal community people.
- The government needs to provide some support or compensation for the fishermen who are directly affected by the port development and there must more studies on the environment and social impacts concerned with the port development.

**Respondent 6:**

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
   - There was no community involvement in the Ennore port development. He said that they never get a chance to talk with the port officials. If they are aware of any issues related to the port or industrial activities. They usually take the issues to the local politicians of their village, but the politicians try to persuade him by saying that he will attend with the issues, but no improvement has ever happened in the case.
   - Due to the reach of local people in the government and political approach is very minimum, we entirely dependent on their decision towards our issues. However, there is no measures have been taken so far.
   - The involvement is very essential for them to involve in the process of the coastal development along with the port.
   - The people have protested for the latest expansion of the port and the reclamation of the creek to take the matters to the attention of the government.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?
• The fishes and tiger prawns and mullets were the rich resource of the creek and now due to the heavy pollution in the creek due to all the industrial pollution and port expansion, a lot of damages has occurred in the creek.
• This biodiversity loss of the creek of the fisheries and the mangroves have caused a serious impact to the livelihood of the fishermen.
• The river depth has reduced due to the dredged materials dumping which also caused the loss of mangroves in the creek.
• The coastal erosion has caused due to the port development, which caused damages to some houses in the area.
• The coolant water discharge and the other pollutants from the industry surrounding the ports have caused a huge impact in the fisheries of the creek and the nearshore waters. Due to that pollution of the water, the people are experiencing skin allergy when they take a swim in the creek water.
• This coastal erosion was mitigated by the construction of groynes on the coast, but such rocks have degraded the beauty of the landscape and other normal functions of the people.
• Due to the livelihood impact, the fishermen are forced to look for other labour jobs where they never earn such good money, which they were earning earlier in fishing. He informed that he was earning around 20000 Indian rupees in a month while fishing but now he is making only 12000 almost half of what he earned and he struggles to take care of the family expenses. Since many fishermen don’t have a good education, they don’t secure a good job in their life.
• Due to high traffic of ships in the Ennore port, the fishing nets are getting damaged of the ships sailing over their nets and also due to the heavy currents taking the nets on the anchor of the ships. In the event of such an incident, we tried to approach the ports for the compensation, but they never allowed us to hear all our complaints and issues.
• The oil pollution of the Ennore port has caused serious damage in the fisheries on that area. There was compensation paid by the government for the pollution disaster, but the compensation was minimum to overcome the loss of fisheries.
• There was no compensation or support provided for the development of fisheries by the government or port officials
• The port has offered contractual jobs for the coastal people during the new development but the number of jobs is not sufficient for the fishermen affected, and due to the case the job is contractual the retention rate of the people is very low.
• The government need to address the societal needs of the fishermen and may help in the development of the fisheries by providing deep sea fishing gears and boats or offer subsidies for the purchase. And also for the future of the youngsters, they need to provide permanent jobs and must appreciate the people of the coastal community in building the skill development for the port-related jobs.

Respondent 7:

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
• No such involvement of fishermen or coastal people has achieved in the port development projected. They are not aware of any development project until the construction or reclamation work starts. It is so essential to involve local people in making a better decision without affecting our environment.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?
• There is a biodiversity loss in the creek, the fishes and the mangroves have degraded very badly, which caused the loss of livelihood of many fishermen in the Ennore area
• The Ennore creek was very rich in fish resources and many fishermen were dependent on it for their livelihood but now due to the degradation caused by the industrial pollution and the port development they lost the fisheries resources, which not only affected them but also the small scale fish selling people dependent on them.
Due to the loss of livelihood the fishermen and the coastal people who were directly affected need to look for some labour jobs which could not able to sustain their livelihood.

The coolant water discharged from Ennore power plant next to the port has caused a serious impact for the fishes in the creek.

The mangroves were also reclaimed in the creek due to the port and power plant expansion.

The reclamation project has led to the reduction in the river depth and the width, which caused the flooding during the rainy season. The water clogging usually a major problem in their area but now due to these increased effects it causes more damage than usual.

The pollution caused by the industries and the ports such as coal dust and ashes from the chimneys affected them in health issues and breathing problems.

The coastal erosion caused due to the port development has damaged around 4 houses in the Ennore area.

Due to the measures were taken by the government of filling of rocks on the shore has degraded the beauty of the landscape of the beach.

The recent oil pollution caused due to the ships’ accident near the Ennore port has affected the fisheries resources and also the coastline.

There was a small amount of compensation provided for the oil pollution that occurred in the Ennore area. The oil pollution has taken a long time to clean, which caused a huge loss to the fishermen.

But no such compensation has been provided for the development of the fisheries.

There were skill development programs and contractual jobs provided by the government and the port, however, it was insufficient.

There needs to be a transparent system in the governance of the port development. And a proper engagement of the coastal community to understand their importance of livelihood.
Respondent 8

1) How well the engagement of community stakeholders achieved in the decision of Port expansion or development, especially the fishermen community?
   - The coastal community participation has been achieved through the public hearing. The public hearing was advertised in the newspapers. However, there is a lack of understanding the technical information provided by the port officials and also unawareness of environmental issues related to the port development. In cases where the issues addressed in the public hearing was not attended by the port officials.
   - Due to that, there was the latest protest made by the local people to abandon the reclamation projects on the creek.

2) What are the impacts to the society and environment due to the Port Expansion? What is the compensation or support provided?
   - There is a heavy loss of fisheries in the Ennore creek which has affected the livelihood of many fishermen who were dependent on the creek. The creek was rich in fisheries before the development of the port.
   - Due to the reclamation of the port and industrial clusters in the stream of the Ennore creek has caused a severe reduction in the depth of the creek and such reclamation projects degraded the mangrove forests of the creek. Such reclamation projects never came to the attention of the people before any construction.
   - Reduction in a depth of the creek resulted in flooding of the villages around the creek in the monsoon season.
   - Due to the growth of the port, there is increased traffic of the vehicles in the area, which leads to air pollution and the several accidents occurred due to the movement of a large number of trucks.
   - Severe coastal erosion was caused due to the port development. Due to soil erosion many other groynes which were made. And in the northern side of the port, it was claimed that 4 houses have been damaged due to erosion.
   - Depletion of fisheries resulted in the scarcity of job opportunities which stood as a challenge for the fishermen community to sustain their livelihood.
• A recent impact of oil pollution caused due to the collision of the ships have resulted consequentially to both the fishermen and coastal community.

• Contractual jobs were provided by the port as compensation, which was not enough to support all the fishermen who lost their livelihood. And due to the illiteracy of the people, they are not very capable to get the permanent jobs in the industries and the retention rate is very low too.

• The people are not having a good educational background, which is a major cause that the people are deprived of their resources and the welfare programs. Preference for the women workers to be given by the government on the port-related jobs, which don’t need much of a physical work.

• The port development is good for the country and for the people also, but such development should not affect our community. There should be an equal development of the fishermen community together.