

CONCEPT NOTE

100

COASTAL

WARRIORS

By
Maritime Research Center



100 COASTAL Warriors

Lead Proponents: Shlok Nemani, Dr. (Cdr.) Arnab Das

Co-proponents: J Catherine, Romit Kaware, Nishtha Vishwakarma, Shridhar Prabhuraman

India's 8000 km (approx.) of coastline provides rich fishing grounds, feeding millions and supporting livelihoods. Approximately 30 million people [1] in India depend on marine fisheries and aquaculture for their livelihood. Bustling ports facilitate trade, boosting the economy, and in significance of IOR where 95% of trade (in terms of volume) happens through the water [2]. Breathtaking beaches draw tourists, generating income [3] which is significant considering the EU's coastal tourism contribution of 26% to the Blue Economy GVA [4]. Coastal communities have lived in harmony with the sea for centuries, harnessing natural resources for their sustenance. Their well-being is intricately linked to the health of the marine environment.

The Government of India, launched the flagship **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** program, in 2020. This government initiative aims to achieve a "Blue Revolution" by promoting sustainable and responsible development in India's fisheries sector. The PMMSY promises to double fishery export earnings to Rs. 1,00,000 crore and create roughly 55 lakh direct and indirect jobs within the fisheries sector over the next five years [5].

A thriving coastline with flourishing communities is vital for a prosperous and sustainable future for India. We believe in continuously improving coastal infrastructure to empower communities, strengthen economies, and protect the natural environment. This should be achieved while respecting traditions, cultural heritage, and ensuring equitable access for all.

Our plan of action with the deployed coastal warriors revolves around revitalizing coastal communities through practical solutions. The aim is to strengthen the pillars of social, economic and ecological sustainability [6]. These warriors will follow a sequential procedure, where firstly they involve the engagement of coastal community to **identify their needs and the challenges** they face. Based on the identified problems, scope of **intervention of Digital Transformation** in the space needs to be understood. Our ground deployment warriors will be involved in building the desired infrastructure (deploying hardware sensors, etc) and engaging community to carry out the implementation of the solutions, thereby empowering the coastal people.

Digital Transformation of coastal infrastructure, fisheries and aquaculture is currently a futuristic vision, and embracing this potential future offers a clear path towards a world free from hunger, with thriving ecosystems, and strong economies that provide decent work & livelihood opportunities for all. While talking about the **Digital Transformation**, the key concern is its adaptability and reach to the local communities in the remote coastal areas. The *inclusivity of tech* is another important aspect because it is significant to make sure no marginalised community is left out because of their past lives, access to education, and knowledge. [7]

We identify the need for 100 such brilliant and innovative candidates with enthusiasm to connect to the ground reality of the coastal lives and a strong desire to improvise the same.

These are the areas of responsibility for the chosen candidates:

Policy Intervention (20): These warriors with their critical thinking on policy implementation are responsible for initiating talks with the stakeholders to determine:

- Problem identification and analysis: Thoroughly investigating and defining the problems hindering growth and potential in coastal infrastructure
- Stakeholder engagement: Initiating and maintaining dialogues with relevant stakeholders, including community members, industry experts, and policymakers, to get their perspectives and build consensus among local communities (especially marginalised groups) and people from the governance.
- Monitoring and evaluation: Continuously assessing the effectiveness of existing policies and interventions to ensure they meet the desired outcomes.

Based on the identified challenges plaguing the growth and potential along coastal infrastructure, they need to curate documentations along the lines of policy building that identify the limitations of existing policies, and current problems in the enforcement of such policies.

These candidates are expected to offer what is called a policy brief [8] to address all the concerns they have noticed and can be brought up to the policymakers. The points in the policy brief should broadly encompass the following ideas:

- Lives of coastal communities, presented as specific case studies: Presenting case studies that illustrate the real-world impacts of policy issues on these communities.
- Required policy developments: Identifying necessary changes or additions to current policies to better support coastal infrastructure growth.
- Effective policy formulation strategy: Proposing strategies for creating and implementing policies that are both effective and sustainable, ensuring long-term benefits for coastal regions.

People, Economy, and Nature (10): The project will be developed along the lines of People, Economy, and Nature elaborated in the multi-faceted Underwater Domain awareness framework developed by Dr. (Cdr.) Arnab Das [9].

The people should identify the threats to people (any short-term or long-term consequences of their actions and/or marginalization), the economy (growth plagued due to any certain personal benefits), and nature (environmental impacts).

The warriors should be keen in framing what is known as an EIA or Environmental Impact Assessment that would holistically look at the impacts on the environment while also considering the socio-economic factors. The EIA provides systematic process used to evaluate the potential environmental effects of a proposed project or development before it is undertaken.

Technology Intervention (40): As per my understanding, these people should ideate the possibility of digital technology to help and improvise the state of the current coastal activities:

- **Identify problems where technology can be a solution:** This can be understood as scoping, or filtering, where the problems with feasible technological solutions are chosen. Conducting thorough assessments to pinpoint specific issues within coastal activities that can be effectively addressed through technological solutions. This involves understanding the unique challenges faced by coastal communities and industries.
- **Integrate technology into existing systems:** Ensuring that new technological solutions are seamlessly incorporated into current systems and practices. This includes upgrading existing infrastructure, training personnel, and creating interoperability between old and new technologies.
- **Develop or implement technology solutions:** Ensuring that new technological solutions are seamlessly incorporated into current systems and practices. This includes upgrading existing infrastructure, training personnel, and creating interoperability between old and new technologies.
- **Promotion of the Marine Spatial Planning schemes for data-driven policy making:** Ensuring that new technological solutions are seamlessly incorporated into current systems and practices. This includes upgrading existing infrastructure, training personnel, and creating interoperability between old and new technologies.

These warriors have the required domain expertise and high-end data analytics understanding for required data processing to carry out predictive analysis, recommendation analysis, classification, and other modeling aspects.

Capacity and Capability Building (20): They are involved in the groundwork and curation of action programmes for Skill training and knowledge transfer to the farmers. Promoting existing material on the blue economy, government policy and schemes and making communities more responsible towards the use of technology for their good.

- **Skill Training and Knowledge Transfer:** Designing and delivering targeted training programs that equip aquaculture farmers with the necessary skills and knowledge to enhance productivity, sustainability, and profitability in their operations. This involves imparting practical skills in areas such as aquaculture techniques, resource management, market access, and financial literacy.
- **Promotion of Blue Economy Principles:** Advocating for the principles of the blue economy, which emphasize sustainable resource use, ecosystem conservation, and equitable economic development. This includes disseminating information on best practices, innovative technologies, and market opportunities that align with the principles of the blue economy.
- **Government Policy and Scheme Promotion:** Facilitating access to government policies, programs, and schemes that support the development of the aquaculture sector. This involves educating farmers about available incentives, subsidies, and regulatory frameworks that can help them improve their operations and access financial support.
- **Community Empowerment through Technology Adoption:** Empowering communities to embrace technology as a tool for their advancement and well-being. This entails promoting the adoption of appropriate technologies, such as digital platforms for market access, weather forecasting tools, aquaculture management software, and sustainable farming practices enabled by IoT devices and sensors.

To See, To Understand, To Share (10): These people will work along the lines of To See, To Understand, and To Share as described by Dr. (Cdr.) Arnab Das [10]. These people will mainly be employed to work with the communities towards the deployment of any hardware infrastructure that supports the study for the researchers towards the development of any tech infrastructure.

- The **“To SEE”** candidates or our **deployment team** while focusing on the ground deployment, will be crucial for making sure that all the data is securely transmitted to the *data analytics* team.
- The data analytics team or our **processing team**, consisting of mathematicians and machine learning engineers, is the crux of **“To Understand”** where they are responsible for carrying out required data cleaning, transformation, and processing. These engineers, with their domain of expertise in Linear algebra, statistics, and Machine learning, work with data to train *mathematical models, and machine learning* to build models that draw important inferences from the data.
- The drawn inferences act as input for **“To Share”** where the **development team** will carry out application development (android app development, and web development) to disseminate necessary information to the masses.

The table below describes key challenges associated with coastal communities and methods of overcoming these challenges.

Sr	Key Challenges			
	Problem Statement	Description		
1	Mangrove Destruction	<p>Mangroves are highly efficient carbon sequesters and are among the most carbon-rich ecosystems. These underwater forests serve as nurseries for fish, filtering water and storing carbon. However, human activities like development and shrimp farming destroy these vital ecosystems, jeopardising coastal communities and the health of our oceans.</p> <p>The issue of mangrove destruction is getting more visibility over time, with initiatives like the Blue Carbon Initiative (coordinated by IUCN, CI, and IOC-UNESCO) coming up [11]. Most of the loss of mangrove forests has been attributed to the rapid expansion of coastal infrastructure [12, 13, 14]. With the engagement of coastal communities, we aim to promote sustainable techniques like Integrated Mangrove Aquaculture [15] that allow a combined culture of shrimp aquaculture and mangrove forests. Digital Transformation techniques like satellite imagery and image processing must be in place to keep a check on the constant balance of aquaculture farms and mangrove plantations. Enhanced productivity from a single pond can reduce the demand for farm expansions.</p> <table border="1" data-bbox="427 952 1485 1193"> <tr> <td data-bbox="427 952 917 1193"> <i>Promotion of Silvoaquaculture (Integrated mangrove systems) and Silviculture (rehabilitation of the mangroves) on the abandoned land from rhizophoras</i> </td> <td data-bbox="917 952 1485 1193"> <ul style="list-style-type: none"> • Policy Intervention: 5 warriors • Technological intervention: 8 warriors • To See, To Understand, and To Share: 2 warriors • People, Economy, and Nature: 1 warrior </td> </tr> </table>	<i>Promotion of Silvoaquaculture (Integrated mangrove systems) and Silviculture (rehabilitation of the mangroves) on the abandoned land from rhizophoras</i>	<ul style="list-style-type: none"> • Policy Intervention: 5 warriors • Technological intervention: 8 warriors • To See, To Understand, and To Share: 2 warriors • People, Economy, and Nature: 1 warrior
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2	Coastal Environment Impact Assessment (CIA)	<p><i>Coastal environments are delicate. Anthropogenic activities and climate change are the main attributes to how marine life has been degraded [16]. These activities include mangrove destruction for land expansion, saline water discharge into freshwater resources, and groundwater, which can create scarcity in freshwater resources [17]. Conducting an effective CIA (Coastal impact assessment) can clearly outline these ecological problems along with the challenges faced by farmers in traditional fisheries. The saltwater intrusion leading to groundwater availability along the southwest coast is also covered in [18].</i></p> <table border="1" data-bbox="427 1556 1485 2018"> <tr> <td data-bbox="427 1556 917 2018"> <i>Understanding the guidelines by the NATIONAL CENTRE FOR SUSTAINABLE COASTAL MANAGEMENT (MOEFCC) for Coastal Environment Impact Assessment (CIA) and initiating a strict enforceable policy framework for the same. [17] E.g., Identification of areas of saltwater intrusion in coastal aquifers and those areas need to be prevented from further harm and/or remediated</i> </td> <td data-bbox="917 1556 1485 2018"> <ul style="list-style-type: none"> • 4 warriors from the People, Economy, and Nature to lead this Task. The task should be performed in terms of a committee formation to carry out an understanding of the problem, carry out documentation, and share relevant details with our researchers. • 1 warrior can head the committee. </td> </tr> </table>	<i>Understanding the guidelines by the NATIONAL CENTRE FOR SUSTAINABLE COASTAL MANAGEMENT (MOEFCC) for Coastal Environment Impact Assessment (CIA) and initiating a strict enforceable policy framework for the same. [17] E.g., Identification of areas of saltwater intrusion in coastal aquifers and those areas need to be prevented from further harm and/or remediated</i>	<ul style="list-style-type: none"> • 4 warriors from the People, Economy, and Nature to lead this Task. The task should be performed in terms of a committee formation to carry out an understanding of the problem, carry out documentation, and share relevant details with our researchers. • 1 warrior can head the committee.
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3	Social Conflicts	<p>Coastal land is a battleground. Aquaculture, agriculture, and salt production all crave this precious real estate. Allocating land to one industry limits what's available for others, sparking competition over resources like water [19]. The economic benefits are also uneven. Aquaculture can be profitable, but agriculture often supports more families. This disparity, along with environmental concerns like pollution from shrimp farms harming fisheries, creates tension and social conflict.</p> <p><i>As highlighted in [20], the over-intensification of coastal farming can hamper the growth of other industries, which is the main cause of increased conflicts. Similarly, [21, 22] showcases that a justified allocation of land and water resources for Agriculture & Aquaculture will often allow combined economic prosperity and reduce the chances of conflicts.</i></p> <ul style="list-style-type: none"> • Policy intervention: 5 warriors to understand how the communities engaged in different sectors can exist together supporting the economic and social needs of each other. • Technological Intervention: 5 warriors to ideate technological solutions that can enhance productivity in the region so dependence on land is reduced
4	Digital Transformation	<p><i>With India boosting coastal aquaculture, Marine Spatial Planning (MSP) is vital. MSP maps suitable areas for fish farms, minimizing conflicts with traditional fishing, sensitive ecosystems, and tourism. This ensures sustainable growth, protecting marine resources and fostering a thriving blue economy. MSP is a holistic framework for conducting Socioeconomic, oceanographic, biological, and habitat analysis. This MSP is aimed to drive the data-driven policy framework scheme (for effective management of the marine resources to minimize conflicts) for enhancing the fisheries and aquaculture sector in the country.</i></p> <p><i>Includes an array of technologies:</i></p> <ul style="list-style-type: none"> • <i>Real-time understanding of characteristics of coastal waters like SST, salinity & pH</i> • <i>Aquaculture and agriculture (and salt plains) open-pond mapping using GIS and remote sensing</i> • <i>Shrimp and Seaweed Growth modeling and APY analysis of farms</i> • <i>Integrating all these technologies as a part of MSP</i> <ul style="list-style-type: none"> • Technological intervention: 10 warriors for working on MSP as a tool • To See To Understand To Share: 8 warriors. The team deployment on the team for receiving ground data, analytics team obtains models by capturing relations from the data. Share team develops required applications to disseminate information to the end user. • Policy Intervention: 5 warriors can introduce these interventions to include them as a part of the policy framework and promote faster implementation of them

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5	Water quality management	<p>The Water quality management here refers to the Water quality management for the aquaculture farms and the discharge of the water quality. As highlighted in [22] there are a lot of chemicals involved like bicarbonates (liming), nitrite and nitrate buildup, phosphates, and sludge formation. The discharge from aquaculture can cause rampant eutrophication, in the adjacent areas. The saltwater (carbonates, phosphates) intrusion from the ponds into the groundwater also needs to be checked. Proper discharge treatment facilities should be looked upon. [23]</p> <p><i>RAS (Recirculating Aquaculture systems) and seaweed cultivation are the programmes that needs a strong promotion and significant boost in India's coastal region. These enhance the sustainability of the practices but also offer less usage wastage of water, and water treatment is an inherent plus in IMTA leading to better growth results [24].</i></p> <ul style="list-style-type: none"> • Capability building: 6 warriors for Knowledge transfer of the APY analysis to the farmers. Conducting regular workshops for better farm practices and inputs for APY tool development are key responsibilities.
6	Inequality between small-scale and large-scale fisheries and farms	<p>Small-scale operators in the aquaculture and fisheries sectors worldwide face numerous obstacles that hinder their ability to engage in responsible and sustainable value chains, ultimately threatening their livelihoods. These challenges include inefficient supply chain processes, inadequate environmental management practices, lax food safety and nutritional standards, and overall weak planning [25]. The suboptimal value chains, coupled with poor waste management and lack of stringent quality controls, prevent these smallholders from fully participating in and benefiting from responsible and sustainable value chain activities, consequently putting their livelihoods at risk. [26]</p> <p><i>In [27] it is clearly highlighted how economies at scale, as well as productivity, favor large-scale farmers. Also [28] showed how small-scale fisheries operate differently than large-scale ones.</i></p> <p>Human factor and coherence between the thoughts of large-scale and small-scale farmers. The idea of sustainable cooperation between small-scale and large-scale farmers needs to be ingrained within the communities. To allow small-scale farmers to participate equally, Increasing the funding for small-scale value chain participants engaged in aquaculture and fishery, as well as more equitable access to financing is an important aspect.</p> <p>Capability and Capacity building: 4 warriors to lead the task of planning the roadmap to achieve the listed aspects and also curate other opportunities to bring small-scale farmers to the forefront of policy-making.</p>

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7	Climate Change Impact and Global Warming Effects	<p>Extreme climate events and climate variability have been increasing over India (and evidently over most parts of the world). Fisheries and aquaculture are also significantly affected by climate change impacts. Rise in SST can lead to Sea level rise (Satabhaya village story [29]) which poses challenges for the coastal communities like loss of livelihood, and displacement, migration issues. This leads to the loss of their true identity. Fisheries are affected due to changing potential fishing zones with changing temperatures (which in turn also affects salinity, alkalinity, conductivity, chlorophyll, and photosynthesis rate).</p> <p><i>Increasing information dissemination to fisheries to switch to mariculture and aquaculture to increase their productivity. This will involve teaching aquaculture as a way to adapt to changing climate and Sea surface Temperature rise. This should be assisted by having a policy that ensures effective Disaster Management techniques are in place.</i></p> <ul style="list-style-type: none"> • Policy Intervention: 5 warriors to curate policy developments that can safeguard coastal communities from migration due to natural calamities. • Technological Intervention: 5 warriors for Effective Alert Systems and Advance Dissemination of Information Using Predictive Systems • Capability building: 5 warriors making sure all systems are in place, effective, and in working condition.
8	Skill Training	<p>Coastal communities rely on healthy oceans and skilled people. Training residents in sustainable fishing, tourism, or maritime industries creates jobs, boosts the local economy, and fosters a connection between people and the precious environment they live by. Farmers needs to be taught about IUU regulations and laws they need to abide by, and productive farming by following best aquaculture practices. Farmers need to adopt seaweed farming and IMTA for better returns. Farmers also need to be made technologically friendly to intervene in digital technologies in fisheries and aquaculture. [30]</p> <p><i>Skill, either it is the knowledge of how to stock the culture, or knowledge of the feed quality (and quantity), the breeding period, or the water quality parameters, as well as the wastewater treatment, is an invaluable part of farm operations. This way the farmer can make sound decisions to enhance productivity and revenue, while also being able to understand all the policy aspects that are enforced by the state to support the aquaculture sector. The idea of Skill Farmer is a huge objective of the Capacity and capability building programme.</i></p> <ul style="list-style-type: none"> • Capability Building: 9 warriors. The major responsibility of the capability-building initiative is on the warriors who will work along the lines of Engage, sustain, Outreach. This holistic overview encompasses how the warriors engage the major stakeholders of aquaculture in India (i.e. farmers) and develop their interests in policy and technological aspects. The aim is to make aquaculture as a sustainable source of income for the marginalized coastal communities. These warriors will have the responsibility to also record the challenges and barriers the coastal communities need to face in their day-to-day operations.

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9	Overfishing	<p>To deal with overfishing concerns, the Food and Agricultural Organization (FAO) initiated combating the IUU (Illegal, Unregulated, and Unreported fishing) fishing by bringing into effect, what is known as IPOA-IUU (International Plan of Action – IUU). European Commission stance on this is very strong with the introduction of IUU Regulations and Catch Certificate scheme. This scheme makes sure all the imports of seafood are duly certified and defers any practice that involves over-exploitation of habitat or indulges in practices marked as IUU. Similarly, the USA SIMP (State Import Management Programme), JCDS scheme by Japan, India’s Blue Economy Policy draft 2020, ASEAN Blue Economy Framework 2023 (Indonesia chair) all highlight the need to combat IUU Fishing.</p> <p>Despite this, as [31] states very recently, that stocks of commercially important fishes have been on the decline on the India’s Southwest coast. India very recently at WTO negotiation session [32], remarked that current approaches at addressing the overfishing are flawed. This is attributed to ‘Distant Water Fishing nations’ providing subsidies to fisheries to fish beyond their EEZ boundaries.</p> <p><i>Making farmers aware about existing policies in action and why they should abide by it. Making them understand the idea of Nature, and how personal benefits in the short term can harm the community in the future.</i></p> <p><i>Helping fishers switch to aquaculture for higher productivity and better returns on investments. This is in sync with India’s Blue economic vision to be driven through aquaculture [33] to help combat the overfishing issue.</i></p> <ul style="list-style-type: none"> • People, Economy and Nature: 5 warriors to be deployed to check what is working and what is not. How much are farmers aware of what are the regulations set for them? What are the challenges they are facing due to these regulations or if there are any long-term threats to their livelihood for the same
10	Seaweed cultivation and Integrated Multi-trophic Farming	<p>Integrated Multi Trophic Aquaculture, interleaves the organisms from different trophic levels in the same aquaculture ecosystem. The ones at the lower trophic levels act as feeders that feed on the waste organic and inorganic compounds (sludge) and thus make the water cleaner. On the other hand, these feeders can be considered as they feed themselves to the main organism thus supporting the growth. For example, fishes with worms and shrimp with Sea urchins and seaweeds are examples of Integrated Multi Trophic Aquaculture. [34]</p> <p><i>Realizing India’s Push to Mariculture, Seaweed Farming. The Kori Creek project started by the former union minister of fisheries, P. Rupala Ji is a game changer in this regard. In the project specifications, it was mentioned that despite having a rough environment in the Kori Creek region in the Rann of Kutch, India possesses specialized and robust floating rafts that can be deployed to withstand those conditions. [35] This is in alignment with India’s set target of harnessing the potential of 9.7 Million metric Tonnes of seaweed. [33]</i></p> <ul style="list-style-type: none"> • Technology Intervention: 10 Warriors to lead the task of formalizing the methodology to obtain higher yields. Demarcating the regions for the most optimum growth patterns in the seaweed.

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www.maritimeresearchcenter.com

Dr. (Cdr) Arnab Das
Founder and Director, MRC

 +91-96650-33463

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 director@maritimeresearchcenter.com

**Address: Maritime Research Center, Koregaon Bhima,
Pune, Maharashtra – 412216**

