E-Learning Modules for Digital Transformation for Coastal & Riverine Communities

The tropical waters of the Indo-Pacific strategic space, present significant potential for growth and prosperity. The region holds global significance, particularly in terms of biodiversity, mineral resources, transportation and more. Even the demography is young and aspirational, seeking better opportunities. However, the socio-economic and socio-political factors have kept these communities trapped in their traditional practices, far away from the modern means. The coastal and riverine communities are not able to get support from the financial institutions to scale up their activities. Governance push for development has kept these communities at the receiving end and largely deprived them of their traditional practices. The fisheries and aquaculture in the Small-Scale Enterprises (SSE), employ approximately 12 million people whereas the Large-Scale Enterprises (LSE), employ less than 0.5 million people. However, the SSE only earns 10% of the total revenue. The SSE relying on artisanal and traditional practices is sustainable, but does not get support from the government and financial institutions as it cannot be scaled up and also is extremely vulnerable to the uncertainties of nature and climate change risk. Most of these communities engaged in SSE, are encouraging their next generation to move away from their traditional professions. The governments in an effort to enhance the output of this sector ends up encouraging the LSE, through subsidies and incentives that further alienates these communities. In the absence of any local enterprises with indigenous technologies and know-how, the LSE is unable to provide jobs to the local communities. Their technologies and know-how are far damaging to the local environment and the governance mechanism is unable to regulate this sector effectively.

Digital transformation is a known governance tool to bring transparency and also enhance productivity & sustainability. Digital transformation will facilitate marine spatial planning both in the marine as well as freshwater systems to ensure effective resource mapping and encourage sustainable exploitation. In agriculture APY has been a well-known formulation to enhance productivity and sustainability. The Area under Cultivation, Productivity and Yield (APY), are the three factors that determine the effectiveness of agricultural efforts. Any intervention should maximize the APY effectiveness, based on the inputs on the factors that impact productivity. The governance mechanism should incentivize or penalize the interventions based on the local data. Digitizing the APY mechanism can be a game changer, in terms of minimizing the uncertainties of the environmental factors with prompt interventions. The local factors like temperature,

salinity, water quality, etc., and also the species-specific factors of metabolism and growth related to the environmental factors can be fed into a digital tool and the algorithms can drive the APY tool. Such a digital transformation will ensure that both the SSE and the LSE can coexist and thrive. The financial institutions can support even the SSE and bring equality in growth. Digital transformation can truly democratize the governance support across the sector.

Unequitable growth and deprivation of the local communities from the development process, makes them vulnerable to the extra-regional powers and non-state actors looking to destabilize the region, geopolitically. The Indo-Pacific region has become a focal point for global strategic interaction, marked by heightened geopolitical and geostrategic attention, accompanied by mobilization efforts and security concerns. This focus underscores the need to leverage the economic and political potential inherent in these tropical waters, spanning the Indian Ocean and the Pacific Ocean. Positioned geopolitically and geo-strategically, India has the potential to take a leadership role in the Indian Ocean Region (IOR) through platforms like the Indian Ocean Rim Association (IORA), Bay of Bengal Initiative for Multi-Sectoral Technological and Economic Cooperation (BIMSTEC) and many more.

The Maritime Research Centre (MRC) Pune is actively progressing the Underwater Domain Awareness (UDA) framework, strategically poised to address challenges and opportunities arising from Government of India's significant strategic initiatives. This framework holds the potential to facilitate cooperation among regional nations and act as a deterrent to external powers. India, by positioning itself as a partner in acoustic capacity and capability building, can strengthen its leadership role in the region. The effective implementation of the UDA framework will contribute to transparency and governance in both marine and freshwater systems. It is imperative to ensure that the nation's decision-makers and stakeholders are well-informed about the associated challenges and opportunities.

The Capacity Building Commission (CBC) is leading an endeavor to unlock the full potential of the blue economy in the tropical waters of the Indian Ocean Region (IOR) and beyond. This initiative is pivotal for realizing the SAGAR vision. The Underwater Domain Awareness (UDA) framework, incorporating policy and technology interventions, as well as the development of acoustic capacity and capabilities, will be the driving force behind this endeavor. The preceding ten modules were dedicated to understanding the extensive UDA framework and its primary application areas. This series of twelve advanced modules will specifically address digital transformation for the coastal & riverine communities to ensure effective governance in these unique tropical waters.

Proposal
Commencing this initiative, it is imperative to educate stakeholders and policymakers on the significance and intricacies of *Digital Transformation for the Coastal and Riverine Communities* spanning across fisheries and aquaculture. In line with this objective, a

series of E-learning modules is set to be introduced, providing a convenient and efficient platform for knowledge enhancement. These modules will comprehensively cover various aspects related to building capacity and capability for the advancement of governance mechanisms in tropical coastal and freshwater systems. The target audience for these modules includes policymakers at the national, state, local levels, community representatives, support organizations, on-ground foundations, regulatory bodies, and enforcement agencies. The following is an enumeration of all twelve modules:

(a) **_Fisheries & Aquaculture in the Indo-Pacific Region_** The Indo-Pacific region has a unique socio-economic and socio-cultural structure. The coastal and riverine communities present a lot of diversity that reflect on their socio-economic and socio-cultural manifestations. They face unique challenges and opportunities related to the fisheries and aquaculture practices. Their demography and the shifting geopolitical, geoeconomics and geostrategic realities have a serious impact on their wellbeing. This module will deal with the challenges and opportunities of fisheries and aquaculture in the region and what could be the way ahead.

(b) **_Global regulations and Laws_** Among nation-specific regulations, the European Union (EU) stands out for its stringent approach to aquaculture regulation. The EU's Illegal, Unreported and Unregulated (IUU) Regulation is a testament to their dedication in safeguarding marine ecosystems and combatting unlawful fishing practices in aquaculture. Implemented in 2010, the IUU Regulation continually adapts to evolving practices and remains pivotal in combating illegal fishing. Illegal fishing not only depletes fish stocks and disrupts marine environments but also jeopardizes the livelihoods of lawful fishermen. The module deals with how the IUU Regulation employs strict measures to curb unlawful fishing and ensure the sustainability of marine resources. This module showcases the EU's commitment to sustainable aquaculture, preserving marine ecosystems, safeguarding legitimate fishing, and ensuring overall sector sustainability.

(c) **_Tropical Challenges and Opportunities_** The tropical waters of the Indo-Pacific region have their unique political, economic and physical characteristics. Any attempt at managing the fisheries and aquaculture sector will require us to appreciate the uniqueness. The entire governance mechanism has to factor the tropical waters and its uniqueness. Attempts at importing the technology and knowhow have failed and we need to pay attention to the local conditions. We can certainly learn the technology and best practices from the west, but the local site-specific realities have to be factored to customize for the ground realities. This module will first identify the challenges & opportunities and then formulate the way forward.

(d)   ***Traditional Knowledge & Practices***   The local communities in these regions have been engaged in fisheries and aquaculture for a few centuries. The region boasts of a civilizational legacy dating 10,000 years. The local connection with nature needs to be established before we plan the future. The communities have lived in complete harmony with nature for centuries. The modern tools have to enable scaling up of the traditional practices, rather than try to replace them. There is significant merit in building a deeper appreciation of the traditional ways and then attempting to map them to the modern tools for scaling up to meet the present requirement. Articulating the modern requirement and strategizing the way forward will pay rich dividends. This module will articulate the traditional knowledge and practices of various communities and then provide a nuanced way forward.

(e)   ***Small Scale Enterprises (SSE) Vs Large Scale Enterprises (LSE)*** The new global order is inter-connected and there is significant influence of the geopolitical and geostrategic realities in local governance. The globalized world demands interconnectedness in thoughts and action. Local policies are impacted by the global trends and it is imperative that communities are able to keep pace with changing global order. SSE have merit in retaining traditional practices and most importantly, they are in sync with the local site-specific characteristics to ensure sustainability. However, they suffer from lack of scaling up potential. The LSE, enjoy rapid scaling up possibilities and are highly efficient in terms of Return on Investment (RoI). However, they are largely unsustainable, if not regulated appropriately. In a capitalistic global order, the LSE enjoy significant political clout and are able to tilt the governance framework in their favor. This module will elaborate on the SSE and LSE, for their dynamic role in the present global order and provide a nuanced way forward for effective governance.

(f)   ***Environment Impact Assessment (EIA)***   The farming for fishes and aquaculture has its own pros and cons. Any governance mechanism has to first carry out the EIA in a holistic manner, prior to incentivizing or penalizing the proposed activity. The EIA has to factor people, economy and nature to make sure that the long-term impacts are assessed appropriately. In this module we will deal with the people, economy and nature aspects of the fisheries and aquaculture activities in the tropical waters. The parameters for evaluation and the final qualitative and quantitative analysis will be discussed.

(g)   ***APY Tool***   The Area under cultivation, productivity and yield are the three main factors that determine the success or failure of any farming activity. The governance mechanism should bring policy & technology interventions to ensure balance in this triad. The APY is a digital tool that takes the underwater medium parameters and uses the knowledge of the species-specific metabolism and growth inputs to predict the productivity and yield. The APY tool can be a powerful digital means to manage the fisheries and aquaculture efforts effectively. The

modules will elaborate on the basic APY tool and its successful implementation in other sectors. The implementation of the APY tool for the fisheries and aquaculture sector will be discussed for the tropical waters. The final sub-module will cover how it will impact the governance mechanism in the Indo-Pacific region.

(h)   ***Modelling & Simulation (M&S)***   Any new activity faces several challenges and the actual on ground implementation may face several failures. The digital systems require massive amounts of data for training and testing, and it is well known that the real data is never available for all the scenarios and field experimental data collection is extremely cost intensive. Thus, M&S is always used to build such systems and field experimental validation is undertaken only for certain critical data points for enhancing the efficacy of the models. The module will elaborate on the basics of the M&S formulation and its generic challenges and opportunities. The second sub-module will discuss the challenges and opportunities of M&S implementation for fisheries and aquaculture in the tropical waters. The final sub-module will present the way forward.

(i)   ***Shrimp Farming***   We will discuss a case study of Shrimp farming that is one of the most lucrative commercial species in the tropical waters. However, the Shrimp farming is also known for being extremely vulnerable to disease outbreak and high feeding cost if not being managed well. The Shrimp farming activity is also known for having a high negative impact on the sustainability of the environment. The module will discuss the digital transformation for managing Shrimp farming in the tropical waters, the challenges & opportunities and the way ahead.

(j)   ***Seaweed Farming***   The seaweed has been found to be extremely high on the sustainability index and has several commercial benefits as well. The governments are prioritizing seaweed cultivation across the globe to meet the sustainability targets. The seaweed cultivation targets are close to 10 million tons by the Government of India, whereas the present level of output is 35,000 tons. This massive gap can be bridged with digital transformation and a nuanced approach. This module will present the digital transformation for seaweed cultivation in the tropical waters, followed by discussing the challenges & opportunities and then the way ahead.

(k)   ***Integrated Multi-Trophic Aquaculture (IMTA)***   The poly cultivation is being seen as a viable alternative to mitigate the sustainability concerns of Shrimp farming. Integrated Multi- Trophic Aquaculture combines Shrimp with Seaweed cultivation to average out the nutrient demand & supply stress. This module will discuss the basic framework of IMTA, the challenges & opportunities of implementation in the tropical waters and the way ahead.

(l)   ***Common Carps in Freshwaters***   The Common Carps are a popular and commercially known set of freshwater species. The growing riverine communities can benefit, if we can provide enhanced productivity for these species. The digital transformation will benefit these communities to manage these species more effectively. In this module we present the digital transformation for three Common Carp species and also discuss the challenges & opportunities along with the way ahead.

(m)   **To See, To Understand and To Share**   The M&S has to be field validated in the specific site locations. The field experimental validation has its own nuances. To See, To Understand and To Share are the three-step formulations for field experimental validation. In this module we will discuss the basic framework, challenges & opportunities and finally the way ahead.

(n)   **Digital Transformation & Marine Spatial Planning (MSP)**   The global community has accepted digital transformation, manifested as MSP for the de-facto governance tool to all marine and freshwater systems. The accelerated migration to MSP will be in everybody's interest. The coastal and riverine communities will greatly benefit from this migration. This module will present the MSP for its basic framework & implementation, the challenges & opportunities of implementation in the tropical waters and finally the way ahead.

The Potential Participants
The potential participants for the E-learning modules will include:

(a)   The Fisheries Department.
(b)   The Water Resource Departments.
(c)   The Public Sector Undertakings (PSUs).
(d)   The Administrative Training Institutes under the Government of India.
(e)   Maritime Boards in all the nine Coastal States.
(f)   Environmental Regulators and Disaster Management Authorities.
(g)   Energy Regulators
(h)   Central Pollution Board
(i)   Auditors and Science & Technology Departments
(j)   Ministry of Environment, Forest and Climate Change
(k)   Central Water Commission
(i)   Ministry of Jal Shakti
(m)   Surface Transport Departments & Regulators

The participants will be provided with a significant amount of reading material, along with the presentation in the form of a video. The MRC runs a digital platform, named the UDA Digest and has four forms of content. A series of commentaries (800 words – quick insight), issue briefs (1500 words – easy read), papers (3500 words – rigorous analysis

with references) and short reports (10,000 words – detailed analysis and comprehensive presentation), presenting easy to read content for quick appreciation of the UDA framework and its varied aspects. These are all peer reviewed by the specific subject matter expert from the Research Advisory Board (RAB) and the in-house research team.