SOCIAL IMPACT ASSESSMENT REPORT

FY 2020-21, 2021-22 & 2022-23

MARITIME RESEARCH CENTER

FOUNDATION FOR UNDERWATER DOMAIN AWARENESS

Acknowledgment

KANJ & Co. LLP, Company Secretaries, expresses its sincere gratitude to the Management of FOUNDATION FOR UNDERWATER DOMAIN AWARENESS (FUDA) for entrusting us with the task of conducting the Social Impact Assessment for the projects and collaborations undertaken by the Company in the field of maritime research and development initiatives and underwater domain awareness among many other such projects.

We are grateful to the Board of Directors, Promoters of FUDA and academicians, researchers, PhD Scholars, post graduate students working at FUDA for their continuous support, guidance and cooperation during the execution of the assignment. We also extend our sincere thanks to all the beneficiaries of FUDA for their full-fledged support and valuable contribution in this impact assessment study. Their keen interest and wholehearted support were instrumental in the successful completion of this assessment. It is well worthy to mention that the efforts being taken and the enthusiasm shown by all the personnel is admirable.

MARITIME RESEARCH CENTER
FOUNDATION FOR UNDERWATER DOMAIN AWARENESS

Table of Contents

1. Abbreviations

FUDA	Foundation for Underwater Domain Awareness
UDA	Underwater Domain Awareness
MRC	Maritime Research Center
SIA	Social Impact Assessment
NDT	NirDhwani Technology Private Limited
PhD	Doctor of Philosophy
IIT	Indian Institute of Technology
TERI	The Energy and Resources Institute, New Delhi
DIAT	Defense Institute of Advanced Technology, Pune

2. Methodology

The assessment was conducted through a combination of literature reviews, stakeholder consultations, site visits, webinars and expert interviews. Key focus areas included Community Engagement, Economic Impact, Environmental Impact, Health and Safety Protocols, Cultural Heritage and other socio-economic factors.

Relevant local communities, NGOs, Government Agencies were identified and engaged with for data collection purposes. Additionally, questionnaires were circulated and interviews were conducted of the scholars and researchers working at FUDA ("the Company") to gather inputs. On the basis of the inputs and data collected, contribution of the Company to the local and regional economies and ecological impact of research activities was analyzed.

The Social Impact Assessment (SIA) was conducted for Maritime Research Centre (MRC) FOUNDATION FOR UNDERWATER DOMAIN AWARENESS (FUDA) and the projects, collaborations and initiatives undertaken by the Company. The assessment considers the direct and indirect effects on local communities, stakeholders, and the broader society.

This Assessment Report primarily covers activities of the Company and impact created during the period of previous three financial years i.e. FY 2020-21, FY 2021-22 and FY 2022-23 and aims to comprehensively evaluate the potential social impacts of the various projects and associations of the Company. It further aims to assist the Company in making informed decisions to maximize positive outcomes and mitigate any adverse effects.

The primary goal of this Social Impact Assessment is to identify, evaluate, and manage the potential social impacts of the Maritime Research Centre.

3. Executive Summary

The oceans cover more than 70 per cent of the Earth's surface and share close relationships with rivers and freshwater reserves. The seas supply half the oxygen we breathe, and provide food and livelihoods for more than a billion people.

They are also home to over 260,000 species of wondrous creatures and scientists believe there are more than a million species in the seas. However, unscientific human exploitation is driving many creatures to extinction before we have had a chance to even learn about them.

Maritime Research Center (MRC) viz. a brand name of FOUNDATION FOR UNDERWATER DOMAIN AWARENESS (FUDA) is a private company, limited by guarantee, bearing CIN: U85300PN2019NPL182720, incorporated under Section 8 of the Companies Act, 2013, in the year 2019, with the primary objective of promoting and undertaking research in areas such as Underwater Domain Awareness, Anthropogenic Noise and its impact on Marine Eco-system, Acoustic Habitat Assessment, Ambient noise assessment for security formulations and sonar deployments, etc. The Company is also actively involved in creating a general awareness among people regarding Underwater Domain Awareness (UDA) through seminars, workshops, training programs, lectures, internships, field experiments, policy formulation, business development models, etc. Another major area of engagement of the Company is formulation of maritime strategies which will provide as an aide to the Indian Defense Sector.

Underwater Domain Awareness (UDA) is a concept that refers to the comprehensive understanding and monitoring of activities and events in the underwater environment. This domain encompasses oceans, seas, and other bodies of water, and UDA aims to enhance situational awareness and security in these areas. It involves the collection, analysis, and interpretation of information related to both favorable and potentially adverse activities beneath the water surface.

4. Core Members Of The FUDA & MRC Team

Board Members

Dr. (Cdr) Arnab Das

Dr. Arnab Das is the founder and Director of Maritime Research Center (MRC), Pune and he personally drives all the initiatives. Dr. Das completed his Masters and PhD from Indian Institute of Technology, Delhi while serving in the Indian Navy as a uniformed officer for two decades.

Praful Talera

Mr. Praful Talera has been associated with MRC since its time of inception in 2017. He is part of the board members and has been guiding the organization for all its strategic and innovation related decisions. He is also the Director of Dynamic Logistics Private Limited and is based in Pune, Maharashtra. He is a dedicated advocate for maritime advancement, brings two and a half years of invaluable expertise from Maritime research center. He illuminates India's historical oversight of its oceans, rooted in the enduring taboo of "kala pani."

Ashwinikumar Das

Mr. Ashwinikumar Das has been associated with the Maritime Research Center and Nirdhwani Technologues since the inception. It is under his guidance that the organization has garnered various accolades and achievements.

Indrani Bora Das

Ms. Indrani Das Bose has been a major contributor to MRC and NDT for its great success. Her contribution towards the team members and the organization has been remarkable.

Research Advisory Board

Dr. Satheesh Shenoi

Dr. Satheesh Shenoi's specialization is in Physical Oceanography. After working as a full-time researcher in the National Institute of Oceanography (NIO), Goa, India during 1982 to 2009, he joined Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, India in May 2009, a unique institution tasked with providing operational oceanographic services to researchers, government agencies, industry and the stake holders who depend on the sea for livelihood and economic activity. He is currently associated with the Union Ministry of Earth Sciences.

Prof. Radhika Seshan

Dr. Radhika Seshan retired as Professor and Head of the Department of History, Savitribai Phule Pune University, Pune, Maharashtra. She is now Visiting Faculty, Symbiosis School of Liberal Arts, Pune. Her area of specialization is Medieval Indian History, within which she has concentrated on economic history, especially maritime and urban history. She is the author of three books, Trade and Politics on the Coromandel Coast (Primus Books, 2012), Ideas and Institutions in Medieval India, 8th to 18th centuries (Orient BlackSwan, 2013), and The Constructions of the East in Western Travel Narratives, 1300-1800 (Routledge, 2020).

Dr. (Cmde) Somen Banerjee

Somen Banerjee is a naval officer and specializes in Anti-submarine warfare. He has been involved in Indian naval plans and procurement and is a commentator on maritime issues, especially with respect to security and governance in the Indian Ocean. He has had extensive exposure in the Indian Ocean region during his operational tenures and had the privilege of commanding frontline warships of the Indian Navy. He has completed his post-graduation from the Madras University and MPhil from Mumbai University and is currently pursuing his PhD from the Mumbai University on Indo Pacific.

Prof Varsha Kelkar Mane

She is the Head of the Department of Biotechnology, University of Mumbai. She has 16+ years of experience in Academia, Teaching, Research / Research Management, Student Mentoring. She represented University of Mumbai in international collaborations and associations. Coordinated GIAN (Global Initiative for Academic Networks), a Ministry of Human Resource Development, Govt of India initiative.

Dr. R Vijay Kumar

He is currently serving as an Associate Professor Department of Ocean Engineering, Indian Institute of Technology Madras, Chennai. He has previously served as a Commander in the Indian Navy.

Strategic Advisory Board

Lt Gen DB Shekatkar (Retd)

Lieutenant General D. B. Shekatkar PVSM, AVSM, VSM is a retired Indian army officer. He was commissioned on 30 June 1963 into the Maratha Light Infantry. He is currently the chancellor of Sikkim Central University. Shekatkar Committee was formed by centre under ministry of defense to suggest steps for enhancing combat capability of the armed forces. Some of the recommendations are closure of military farms and army postal establishments in peace locations, more recruitment of clerical staff and drivers in the army and to improve efficiency of the National cadet corps.

Amb Anup Mudgal

Ambassador Anup K. Mudgal, a distinguished member of the Indian Foreign Service (IFS), retired in May 2016 after a notable thirty-two-year diplomatic career. His extensive experience encompassed key roles at India's Ministry of External Affairs, as well as postings in various countries including Mexico, Peru, Belgium, Germany, Austria, and Mauritius, where he served as India's High Commissioner.

Dr. Ajay Kumar, IAS

Dr. Ajay Kumar is the former Defense Secretary of India and currently an advisor for electronics development projects. He is an Indian Administrative Service officer from the 1985 batch. Dr. Ajay Kumar is an alumnus of IIT Kanpur and the University of Minnesota.

Vice Admiral DSP Varma (Retd)

Vice Admiral DSP Varma is a former Director General of the Advanced Technology Vessel Programme (which produced India's first nuclear submarine) and a former Chief of Material of the Indian Navy. He is a Post Graduate in Radar and Communications from the Indian Institute of Technology, Delhi.

Vice Admiral AR Karve (Retd)

Abhay Raghunath Karve PVSM, AVSM is a retired Indian Navy Vice Admiral. He last served as the 27th Flag Officer Commanding-in-Chief Southern Naval Command. He retired on 30 July 2018 and was succeeded by Vice Admiral Anil Kumar Chawla.

Shri Mukesh Malhotra

Mr. Mukesh Malhotra is the Chairman of the Governing Board of the Indo-Swiss Centre of Excellence. He is also the Chairman of Weikfield Products Corporation LLP. He has been the founder trustee of Pune International Centre and the former president of the Mahratta Chamber of Commerce, Industries and Agriculture (MCCIA), Pune, Maharashtra.

Core Team

Dr. (Cdr) Arnab Das

Dr. Arnab Das is the founder and Director of Maritime Research Center (MRC), Pune and he personally drives all the initiatives. Dr. Das completed his Masters and PhD from Indian Institute of Technology, Delhi while serving in the Indian Navy as a uniformed officer for two decades.

Shridhar Prabhuraman

Shridhar Prabhuraman holds the esteemed position of Deputy Director at the Maritime Research Center, where, since 2018, he has been instrumental in propelling forward the domain of maritime research, with a particular focus on Underwater Noise. His significant contributions are evident in a notable collection of publications, underscoring his profound expertise and unwavering commitment to advancing maritime studies.

J Catherine

Catherine is the Head of Publications at the Maritime Research Center. Her research focuses on Blue Economy, Marine Spatial Planning, trans boundary water issues, conflict resolution, sustainable water management, and community resilience. She graduated from St. Stephens College in Delhi with a bachelor's degree in physics. She has also completed Ashoka University's Young India Fellowship in Liberal Arts. She has completed her Masters in Water Science and Policy from Shiv Nadar University.

Nishtha Vishwakarma

Nishtha is the Communications and Advocacy Lead at the Maritime Research Centre (MRC), Pune, and is also the Editor of the UDA Digest e-magazine. She is an experienced Communications professional with a demonstrated history of working in the public policy and advocacy domain. She completed her post-graduation in Public Relations and Corporate Communications at XIC, St. Xavier's College, Mumbai. Further, she has worked as a Media Researcher at Doordashan India, Government of India as part of her previous stint in her career.

Divya Nagarajan

Divya Nagarajan is the Administration Head of the Maritime Research Center and has been associated with the organization since August 2021. Se also handles Finances at MRC. Her contribution to the team has been immense wherein she has been ensuring that the operations of the team are handled well.

5. Historical Background Of FUDA And The Underwater Domain Awareness Journey

FUDA is a leader in maritime research, committed to advancing knowledge and technology in the maritime industry. The Maritime Research Center (MRC), Pune was started on 02nd February, 2017, as a Research and Policy Center to promote Underwater Domain Awareness (UDA). In March 2019, Foundation for Underwater Domain Awareness (FUDA) was incorporated as a Section 8 company, registered with the Registrar of Companies, Pune.

Vision

To drive the Underwater Water Domain Awareness (UDA) Framework across stakeholders and policy makers for facilitating a safe, secure and sustainable growth model for the tropical littoral waters of the Indo-pacific Region and beyond.

Approach

MRC is well positioned to fulfill the role as a nodal agency for policy and technology interventions as well as acoustic capacity & capability building requirements for all in the Indo-Pacific Strategic Space and beyond.

The objective of the Company with respect to creation of underwater domain awareness in the Indo-Pacific region is largely basedon five pillars, viz. Research, Academia, Skilling, Innovation and Policy. Among the other stakeholders, the Company aims at serving the following four major stakeholders, viz. Blue Economy, National Security Apparatus, Environment and Disaster Management Authority, Science and Technology, Acoustic capacity and capability as a backbone for all.

The UDA framework is a niche concept. The MRC has worked on varied dimensions to build a strong foundation that supports policy and technology interventions along with acoustic capacity and capability building. The Company has addressed the concept of UDA in a very structured manner by focusing on three core concepts of Outreach, Engage and Sustain.

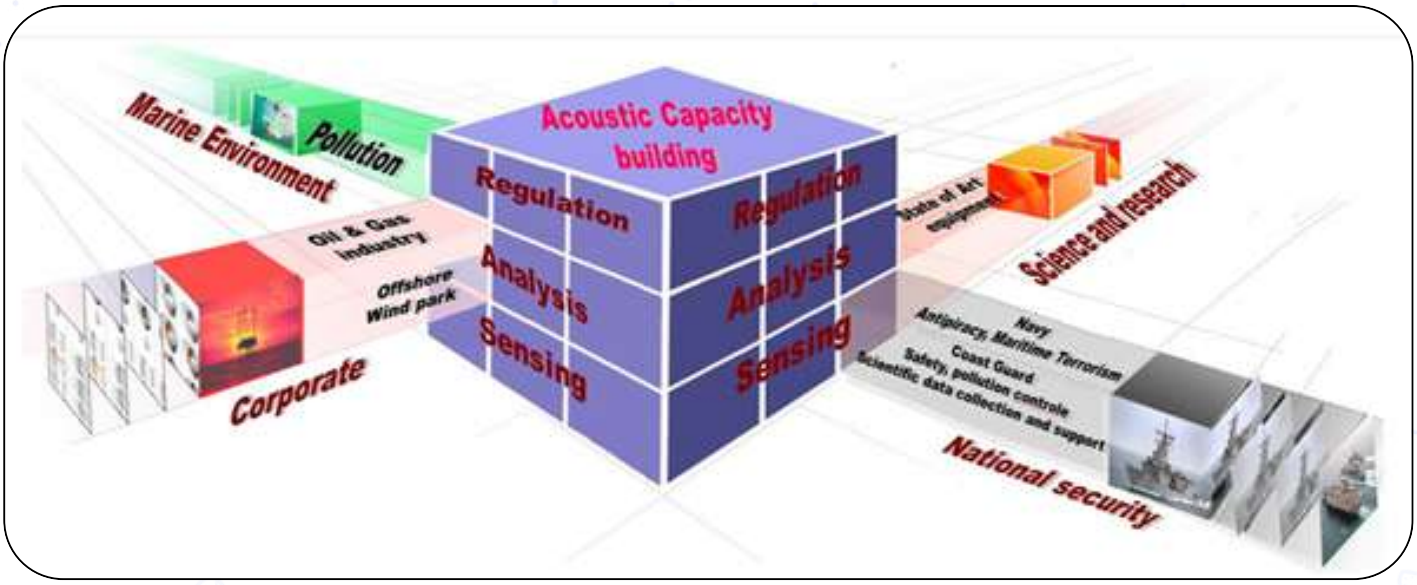
6. Underwater Domain Awareness Framework

As a think tank and a registered not-for-profit organization, the Maritime Research Center is dedicated towards promotion of Underwater Domain Awareness (UDA). Over the years, MRC has emerged as a platform of national and regional significance, fostering dialogue and cooperation amongst stakeholders from Maritime Security, Blue Economy, Marine Environment, Disaster Management and Research & Innovation.

The MRC has drafted a comprehensive framework towards Underwater Domain Awareness (UDA) which has been wholeheartedly embraced by key stakeholders for driving discourse and affirmative action.

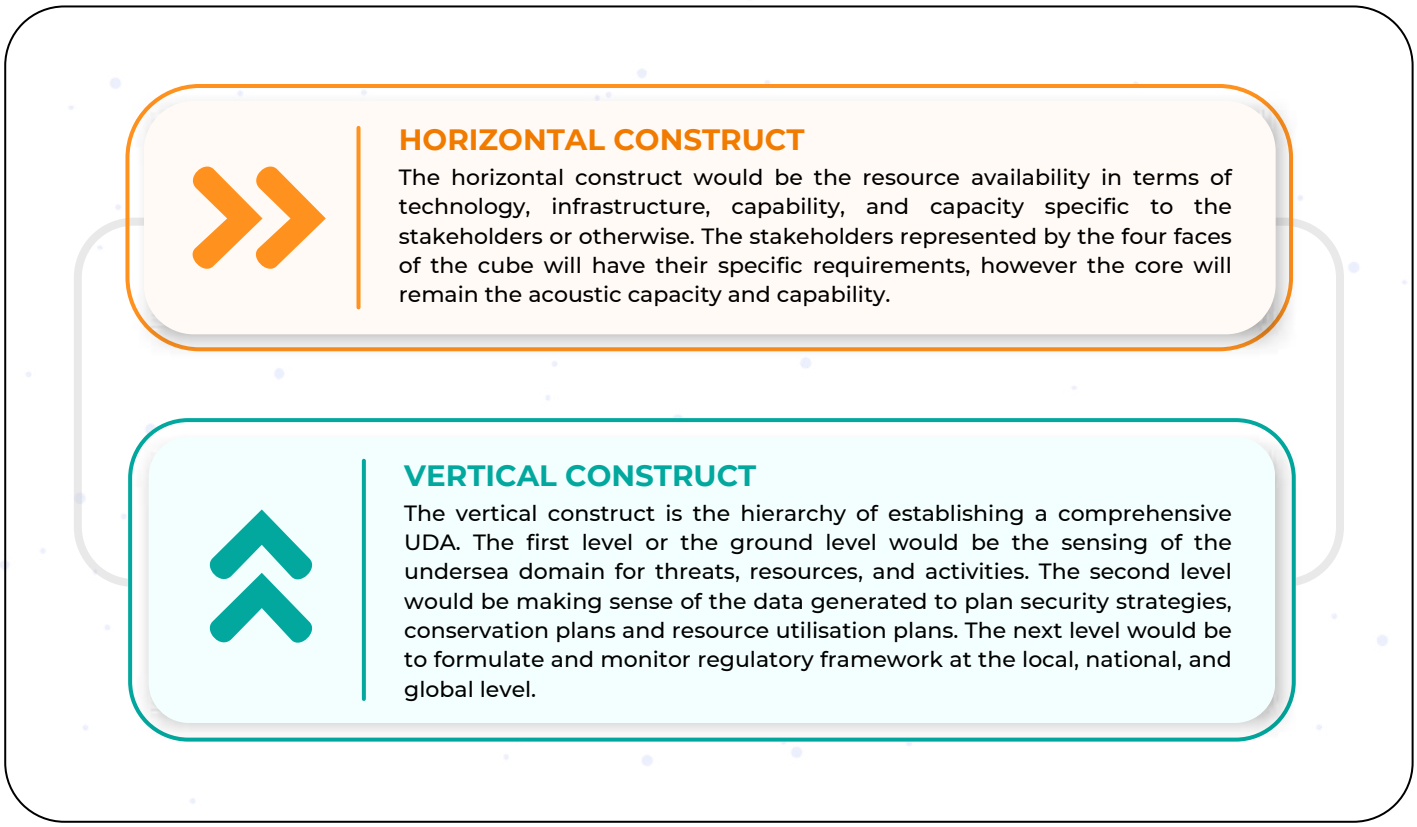
The concept of Underwater Domain Awareness (UDA) in a more specific sense will translates into knowing what is happening in the undersea realm of our maritime areas. This includes undersea awareness from the security perspective, means defending our Sea Lines of Communication (SLOC), coastal waters and varied maritime assets against the proliferation of submarines and mine capabilities intended to limit the access to the seas and littoral waters.

❖ Understanding Underwater Domain Awareness Framework



Comprehensive Perspective of Undersea Domain Awareness

- The UDA on a comprehensive scale needs to be understood in its horizontal and vertical construct. The horizontal and vertical constructs broadly explained hereunder:



- Comprehensive Perspective of Undersea Domain Awareness

The figure represents a comprehensive perspective of the UDA. The underlying requirement for all the stakeholders is to know the developments in the undersea domain, make sense out of these developments and then respond effectively and efficiently to them before they take shape of an event.
The figure gives a gives a comprehensive way forward for the stakeholders to engage and interact. The individual cubes represent specific aspects that need to be addressed. The User-Academia- Industry partnership can be seamlessly formulated based on the user requirement, academic inputs and the industry interface represented by the specific cube. It will enable more focused approach and well-defined interactive framework. Given the appropriate impetus, the UDA framework can address multiple challenges being faced by the nation today.

❖ Centre Of Excellence On Underwater Domain Awareness (UDA) Framework

This proposal includes the establishment of a "Centre of Excellence" comprising 5 sub-centers (or verticals), under the MRC, which would be characterized by a strong coherence but with independent activities. All five centers will draw inputs from each other but have their unique and well defines Key Result Areas (KRAs) and Key Performance Areas (KPAs). The following are the sub- centers under MRC:

Brief Description of the above-mentioned sub-centers

Strategy Centre

The Strategy Center keeps track of the R&D and industry requirements to build effective policy frameworks. It employs data driven policy formulation to address stakeholder requirements. The key result area (KRA) for the Strategy Center is to identify gaps in the domestic and regional policies and formulate effective ways forward to build effective maritime governance. The key performance areas (KPA) are reflected in seamless interactions among policy makers and local communities, and the key indicator of success is the policy intervention for enhanced economic growth for the local industry and long term sustainable maritime activities.

Research Center

The research efforts of the Company provide nuanced inputs for the strategy center for effective policy formulation with data driven real time ground understanding. This minimizes the dependence on the technology imports and also enhances strategic capabilities.

Incubation Center

The Incubation Center maps the research outcomes of the Research Center to application specific requirements of stakeholders. Start-ups and industries draw ideas from here and build business plans. The effective eco-system provided by this incubation center nurtures the talent pool and provides innovative directions to channelize efforts towards nation building.

Skilling Center

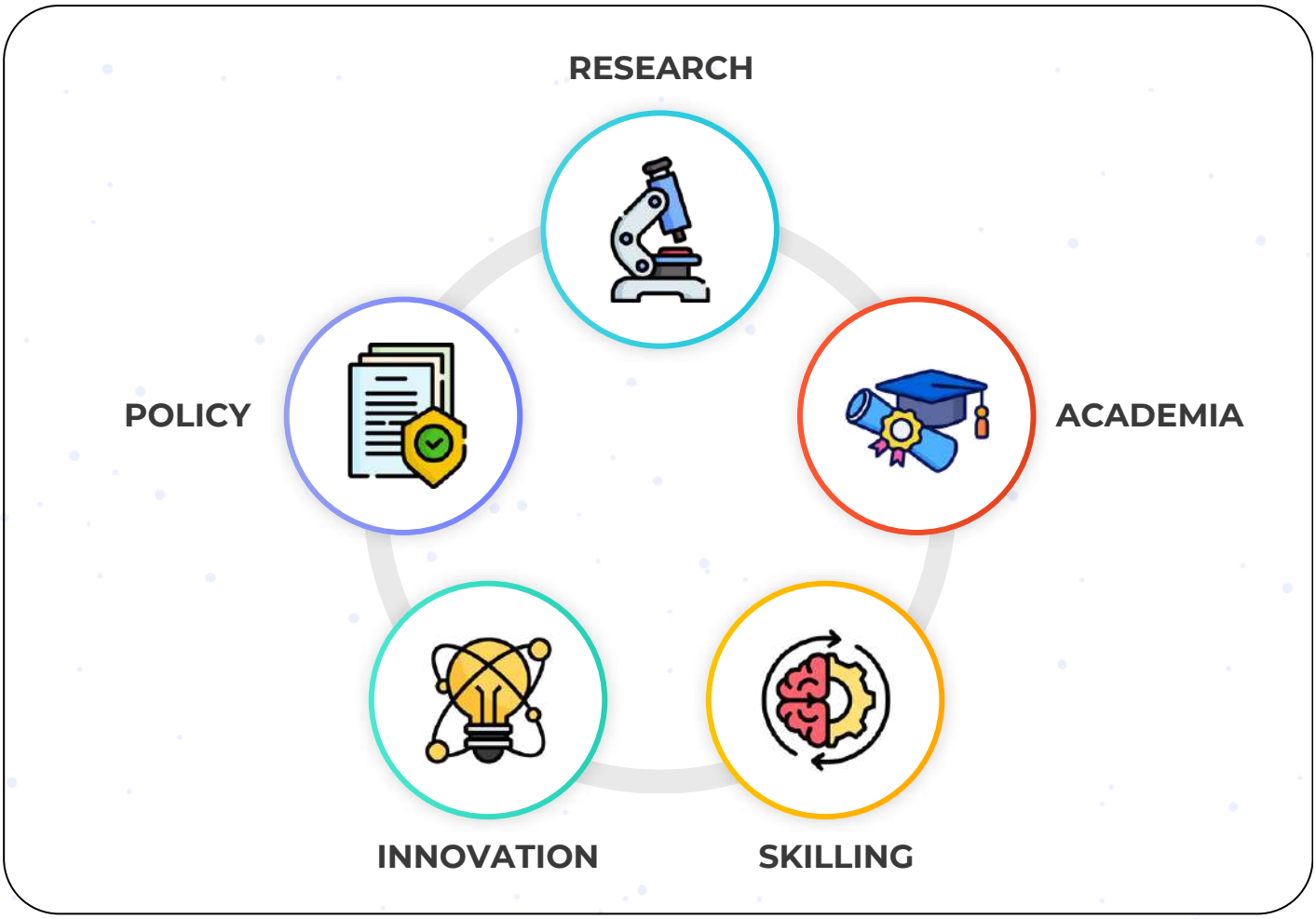
The Skilling Center ensures that professionals and practitioners from stakeholders, including partner countries, can translate the nuances of the UDA framework and apply them effectively in their operations and strategic planning. This not only makes practitioners more scientific and effective in their routine operations but also promotes building national infrastructure and enables seamless collaboration across stakeholders. This facility further adds diplomatic leverage in the pursuit of larger maritime objectives.

Academic Center

The Academic Center builds academic programs along with project-based learning to prepare the next generation of students and professionals to attain higher qualifications to appropriately take forward the UDA framework. These centers are the hotbed of innovations and ideas for effective progress and seamless interactions at all levels of decision making.

❖ Five Pillars of UDA framework

UDA framework is driven by the five main pillars which are described in detail as follows:



❖ Challenges Being Faced

- The Underwater Domain Awareness is a relatively new subject and requires serious thinking. Security includes use of advance scientific knowledge as well as deployment of highly sophisticated technical devices and instruments. United Nations Convention on the Law of the Sea (UNCLOS) needs to be revisited to accommodate UDA jurisdictions. The important thing to note here is that the Agenda of the Third United Nations Conference on the Law of the Sea that drafted the UNCLOS, did not include military uses of the sea.

- The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) has included Blue Economy in its agenda since 2016. BIMSTEC emphasizes the importance of co-operation in the region and includes Maritime security, safety, and regulatory enforcement. For BIMSTEC, both security concerns and management of resources are of immense importance. Addressing security issues that includes non-traditional challenges, requires unified regional vision, institutional and regulatory framework, governance instruments, scientific and technical collaboration, and monitoring mechanisms.

7. Limitations In The Preparation Of This Report

The impact assessment carried out in this report is based on a limited review held on the basis of research project outputs, consultation of stakeholders, assessing the academic impact of the organization with the help of webinars, programs conducted and conducting expert interviews through questionnaires. However, it was not feasible to arrange any field visits where the projects are held to practically gauge the impact of the research undertaken. The organization has been actively participating in the underwater domain awareness for a period of less than five years. The fact that the majority of projects are in the inception and pre-execution stages, minimizes the opportunity to actualize the social impact that will be created through them in the long run. Hence, it has been a limiting factor in the preparation of this report.

Further, in view of the COVID-19 pandemic, the internships and courses that were offered by the organization were remote. Hence, while conducting the interviews of some of the research interns and fellows, it was found that they did not possess practical or on-field exposure and had not personally interacted with the local communities for the research conducted by them. The impact assessed therefore focuses on their internship experiences and perception of the research outputs and work culture of the organization.

While the preparation of this report, it was also not possible to personally interview the farmer community and the shipping industry personnel so, the data received by the company pertaining to this has been relied upon. The impact assessment carried out for these beneficiaries has been obtained through questionnaires and data received from the Company.

8. Projects, Collaborations & Initiatives Of FUDA

8.1 Blue Economy

➤ About the Project

India's blue economy is considered a subset of the national economy comprising of the entire ocean resources system and human-made economic infrastructure in marine, maritime, and on shore coastal zones within the country's legal jurisdiction. With a coastline of nearly 7.5 thousand kilometers, India has a unique maritime position. Nine of its 29 states are coastal, and the nation's geography includes 1,382 islands.

There are nearly 199 ports, including 12 major ports that handle approximately 1,400 million tons of cargo each year. Moreover, India's Exclusive Economic Zone of over 2 million square kilometers has a bounty of living and non-living resources with significant recoverable resources such as crude oil and natural gas. Also, the coastal economy sustains over 4 million fisher folk and coastal communities. The draft blue economy policy document outlines the vision and strategy that can be adopted by the Government of India to utilize the plethora of oceanic resources available in the country. Therefore, India's draft blue economy policy is envisaged as a crucial framework for unlocking the country's potential for economic growth and welfare. (Source: Press Information Bureau,Government of India)

➤ Projects Covered Under Blue Economy Domain

MRC has covered the following projects under the Blue Economy Domain:

❖ Blue Bond Initiative For The Underwater Domain Awareness Framework

This research project highlights the need for alternate and innovative financing mechanisms to fund the transition toward a Blue Economy. It outlines the link between sustainability and blue bonds, suggesting the need for both private and public investments to accelerate progress toward the United Nations Sustainable Development Goals (SDGs). It details the significance of the UDA Framework in governing the sustainable utilization of undersea resources and presents applications for blue projects such as Inland Waterways, Sustainable Fisheries, and Shrimp farming. The research note discusses existing blue economy policies and the future opportunities available to India to harness its Blue Economy to its full potential.

Key Highlights of the Project

- The Indian Ocean plays a vital role in the economy through a significant contribution to livelihoods, cultural identities, fisheries, offshore oil and natural gas resources, tourism, and maritime industries. Indian Ocean nations can build skills and knowledge to underpin sustainable blue economic growth and sustainability.
- For India, Blue Economy assumes high priority. This has been expressed through the vision of Prime Minister Narendra Modi for 'Security and Growth for All in the Region (SAGAR).' It is a call for stakeholders to unearth the true development potential present in India's 7,500 km coastline in the form of a network for inland waterways with a cross-sectoral multiplier effect on employment and growth.
- The Blue Economy serves as a framework and policy for sustainable marine economic activities as well as new marine-based Today, at the core of the Blue Economy concept is the de-coupling of ocean economic development from environmental degradation.

Application of Blue Bonds

Sustainable Fisheries: A critical role can be played by the blue bond market towards the financing of sustainable development along the coastline and in oceans by mainstreaming emerging ocean industries such as sustainable fisheries, and driving investments toward a blue economy. It would ensure food security, growth, and jobs for the coastal communities.

Undersea mining: There is an urgent need for comprehensive ecosystem-based management practices for deep ocean environments subject to mineral extraction to ensure the sustainable use of resources. Blue bonds will help the country raise funds to implement mechanisms for the preservation and effective stewardship of the marine environment while facilitating seabed mineral resources usage.

Ports and Shipping: Oceans are a vital repository and supporter of biological diversity, a key contributor to the global economy through sea-borne trade. Given India's dependence on ports for transportation, the oceanic route needs to be developed and regulated to ensure smooth operation.

Inland Waterway Transport: Despite water transport presenting as a cheaper alternative, it only holds a 7% share in coastal shipping and 0.17% for Inland Water The revival plan of IWT requires public and private investment to fund the development of ports, and infrastructure for shipping and navigation as well as road and rail connectivity. Blue bonds could help raise the required capital for such projects and aid in the development of the country.

❖ Area, Production, And Yield Analysis For Shrimp And Seaweed Farming

The goal of the study is to conduct Area, Production, and Yield (APY) analysis, in a way never done before, and bring out the uniqueness of the study. The findings brought out the key stakeholders of the Underwater Domain Awareness (UDA) framework. Assisting these stakeholders, namely science and technology, the blue economy, the marine environment, and disaster management, subsequent progress in APY analysis and focusing on the shortcomings and potholes can help in determining a sustainable route for the growth of aquaculture in the Indian Ocean region (IOR).

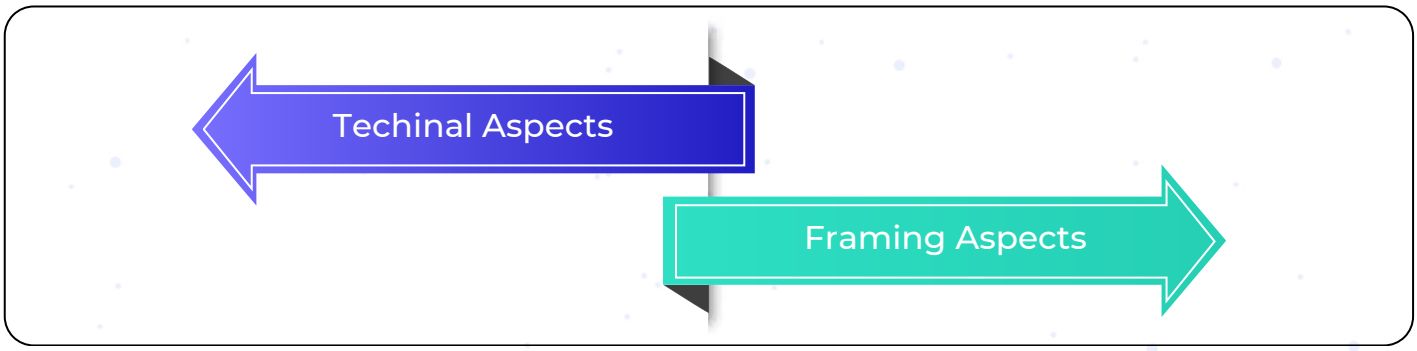
About the Project

The tropical waters are known for shrimp farming and provide lucrative commercial opportunities for the coastal and riverine communities involved in aquaculture. The aquaculture activities are extremely vulnerable to diseases and weather fluctuations. The communities are thus not able to draw the benefits of institutional financial assistance. These communities continue to rely in their traditional practices with no safe guards from the changing ecosystem parameters and climate change risk. The policy makers are also not able to intervene as these communities are small and their operations do not have scale.

Impact created:

The study accentuates the environmental impacts study of shrimp and seaweed aquaculture and shows up the vast disparities between the two. Shrimps farming clearly showed some negative impacts while the current research on seaweed and their cultivation has shown them to be highly sustainable.

Aspects of the Project



Technical Aspects

- For work to be more reliable large datasets are required and Data sets tabulating real-time environmental factors are to be made available for research.
- Efforts should be made to perform thorough on-site research to ensure the long-term viability of any aquaculture project.
- Farmers should be made more aware of technology to make the whole project a practical success.

Framing Aspects

Shrimps

- Growth virtually stops below 18 degrees C and is optimal around 30 degrees C, and Lower stocking density & Higher DO levels favor the growth of the shrimps
- The salinity of brackish waters is preferable for the shrimp's growth
- The optimal pH is slightly above neutral and lies in the range of 8.0 to 9.0 pH.

Seaweed

Advantages

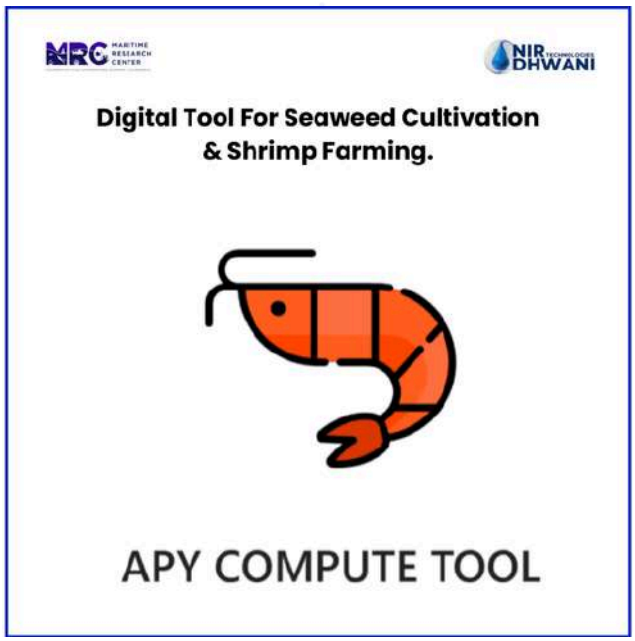
- The temperature of the IOR and water with higher salinity is suitable for higher growth.
- With higher turbidity, the attenuation of the light wave in the water also increases.

Disadvantages

- Lower solar irradiance inhibits photosynthesis, diminishes the growth rate.
- Very high exposure to light causes thallus tissue loss.
- Higher stocking density upsets the organism.

Seaweed cultivation, as a diversification activity in mariculture, has tremendous potential all along the Indian coast. Seaweeds are rich in vitamins and minerals and are consumed as food in various parts of the world and used for the production of phytochemicals, viz., agar, carrageenan, and alginate, which are widely employed as gelding, stabilizing, and thickening agents in several industries of food, confectionery, pharmaceutical, dairy, textile, paper, paint, etc.

❖ Apy Analysis Web Tool For Seaweed Cultivation And Shrimp Farming



Key Highlights of the Project

- The Government of India, realizing that the farmers have no facilities for the production and processing of seaweed, farming of which is done majorly in Tamil Nadu and Gujarat coasts and around some parts of Lakshadweep and Andaman and Nicobar Islands, proposed a multi-purpose seaweed park to be set up in Tamil Nadu to promote seaweed cultivation as a part of Budget 2021. (Source: Ministry of Fisheries, Animal Husbandry & Dairying)
- Seaweeds such as Gracilaria edulis, Hypnea musciformis, Kappaphycus alvarezii, Enteromorpha flexuosa, and Acanthophora spicifera can be successfully cultivated in longline ropes and nets by vegetative propagation method.
- This activity has the potential to provide income and employment to about 200,000 families.
- To promote aquaculture and the blue economy, GoI has passed various policies and helped set up various organizations to impart required education and training to the farmers such as NPMF, PMMSY, NETFISH, and training by MPEDA.

➤ Impact creation through the Centre of Excellence for Blue Economy

- MRC has collaborated with Excel Industries Limited to set up a 'Center of Excellence' (CoE) for the Blue Economy. This initiative comprises a variety of facets including research, innovation, and strategy, which have been intricately designed to help coastal and riverine communities become financially independent.
- The CoE is intended to serve as a hub for digital transformation in the underwater realm to improve governance.
- Excel Industries has offered CSR support for the Center of Excellence. Pidilite Industries and Mamta Group have collaborated under the Clima Crew brand to provide support for Seaweed Cultivation.

8.2 The Khadakwasla Lake Project

Research was undertaken at the Khadakwasla Lake in Pune on the topic of 'Statistical Characterization of an Underwater Channel in a Tropical Shallow Freshwater Lake System.' The research was undertaken by Director and Founder of FUDA Dr. Cdr. Arnab Das and his fellow researchers Dr. Jyoti A. Sadalage and Dr. Yashwant Joshi.

About the project

Underwater acoustics has made significant strides over the last century, which finds applications over a wide range from basic bathymetry study to high-end research extensions. The acoustic propagation in underwater is typically governed by physical properties of the underwater channel, such as temperature, pressure, and salinity. The seasonal fluctuations in the physical properties of the tropical region manifest as thermal stratification. The random thermal stratification has a significant impact on the Sound Speed Profile (SSP), thereby distorting the received echoes from the surface and the bottom. In this work, an attempt was made to analyze underwater channel characteristics of the tropical freshwater lake system at Khadakwasla, Pune.

Key highlights of the project

In October 2017, a workshop on Modeling and Simulation (M&S) along with field experimental validation was held at Khadakwasla Lake. This workshop was a comprehensive freshwater management exercise with an objective to illustrate all three facets of policy and technical intervention, as well as development of acoustic capacity and capability. Participants included PhD research scholars, postgraduate, undergraduate students and young professionals from various stakeholders and research organizations. A three-year investigation was conducted on the Khadakwasla Lake by PhD scholar which involved mapping the underwater parameters and model construction. Additionally, the work was validated through field experiments based on M&S outcomes. To do this, four different types of sonars (Side Scan Sonar, Single Beam Sonar, Sub-Bottom Profiler and CTD Probe) were deployed in the lake for data collection and demonstration to participants. The participants were given an opportunity to learn how to deploy sonars in actual conditions, understand the operating mechanisms of four different kinds of sonar along with performing data collection and its analysis through a research guided problem-solving approach.

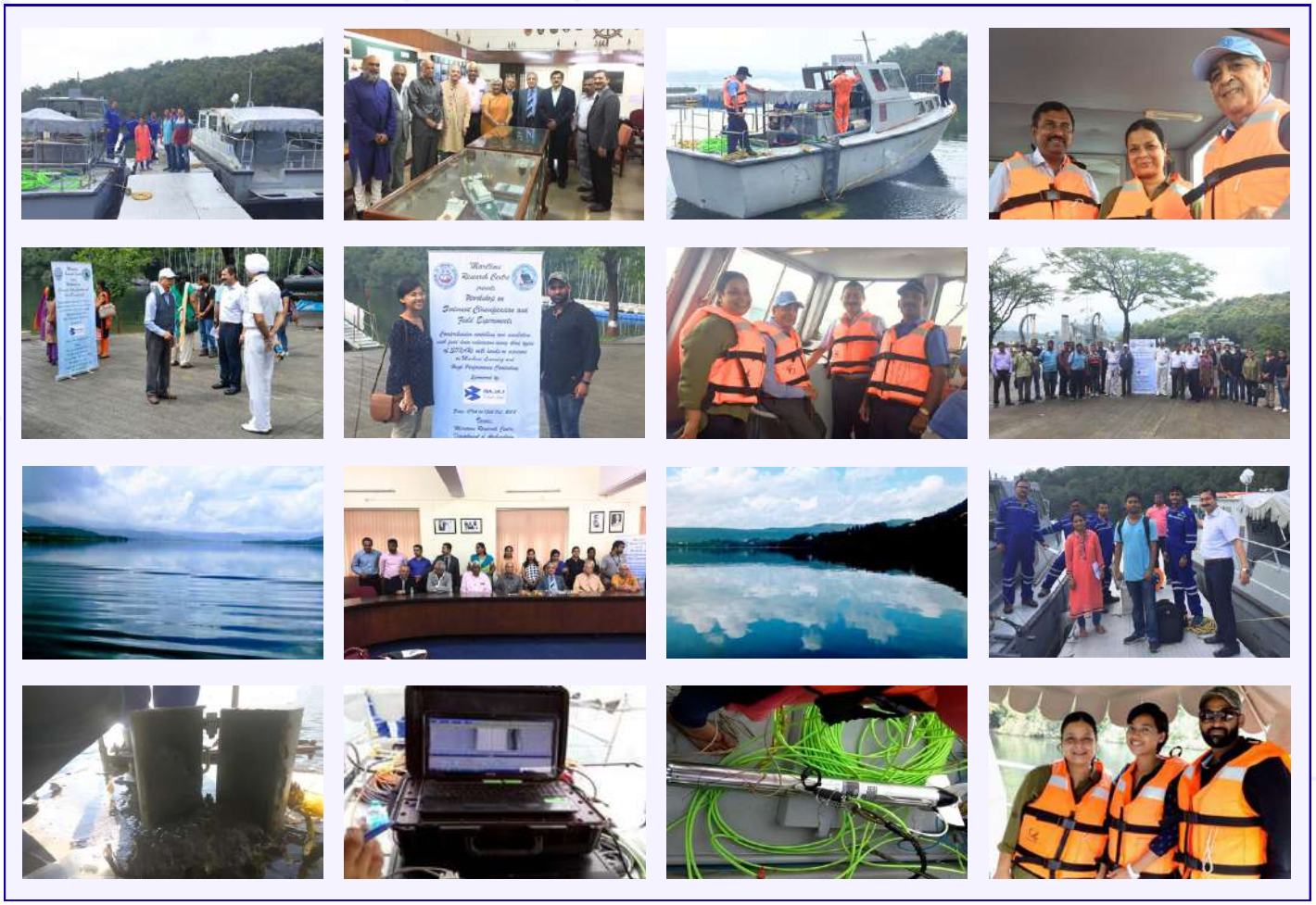
Bajaj Group fully funded workshop as a part of their CSR activities, while the Government of Maharashtra provided a research fund. The National Defense Academy graciously offered boats and personnel for operating five boats used during workshop. The Unique Group was generous enough to supply sonar's practically free of charge and their team was responsible for deployment. Finally, MRC and NDT organized and carried out all aspects of workshop.

➤ Impact assessment of this project

The workshop was attended by over 25 researchers from multiple academic and research institutes. It was a part of the field experimental validation for the research work of one of the PhD scholars at MRC along with three PG students and seven interns, over a period of two years before the workshop. The collected data has been used by over 2 PhD scholars, 10 PG students and innumerable interns at MRC.

This kind of field experimental research has never been undertaken by an academic institute in the country before thereby creating a new benchmark in academic research. The learnings of the field experiment have been extremely valuable for the MRC's research and policy effort in freshwater management in the tropical waters. Such unique inputs shall be substantial in bolstering future research to realize the Digital Transformation and enhance governance.

Snippets from the Workshop held on Sediment Classification and Field Experiment at Khadakwasla, Pune

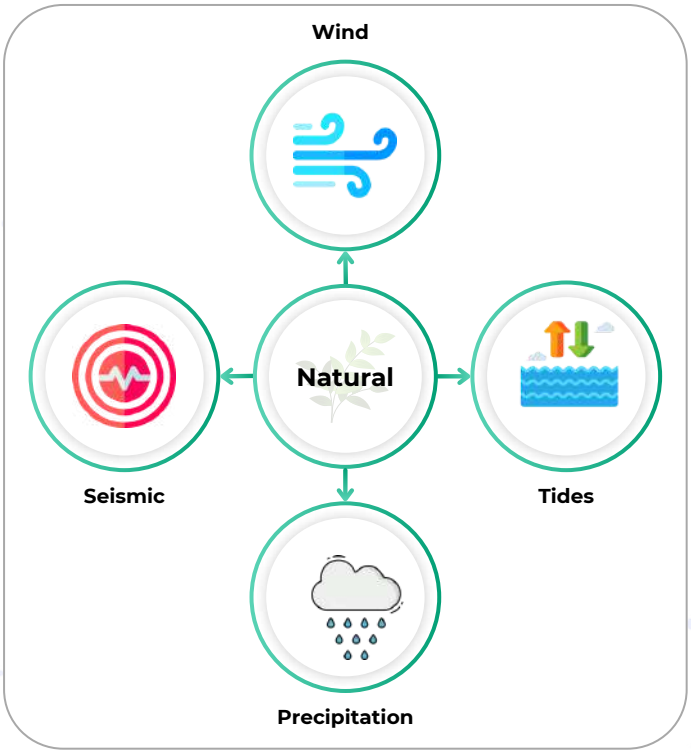


8.3 Underwater Noise Mapping

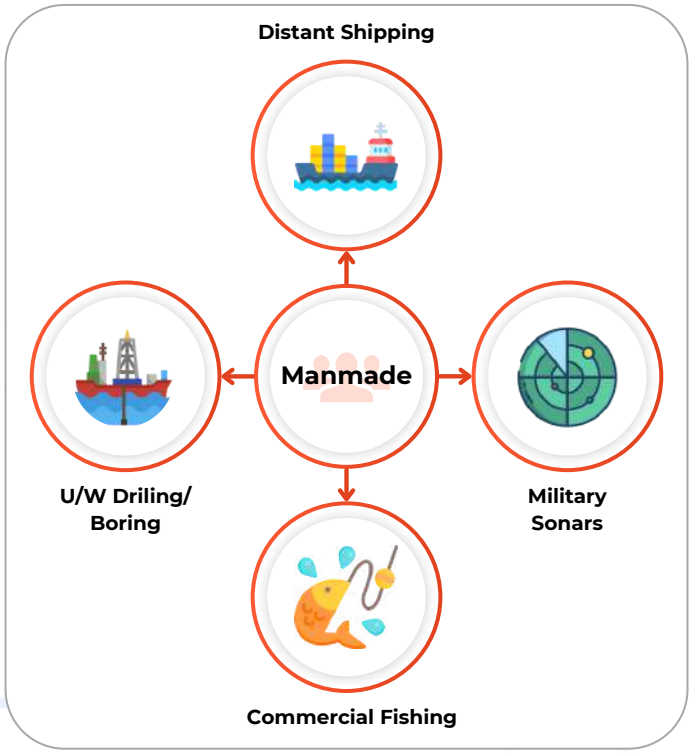
About the Research

The study was conducted by Capt. Soubhagya Roul, CRS Kumar and Dr. Cdr. Arnab Das. The primary objective of this study was to establish a spatial ambient noise pattern in the territorial waters of the Indian Ocean Region using the Automatic Identification System (AIS) data available with the Marine Traffic or the Director General of Light Houses and Lightships (DGLL).

During the course of this study, the four main categories of dominant sources of noise in a coastal environment viz. Shore noise, Industrial noise, Natural seabed noise and Shipping noise were studied.

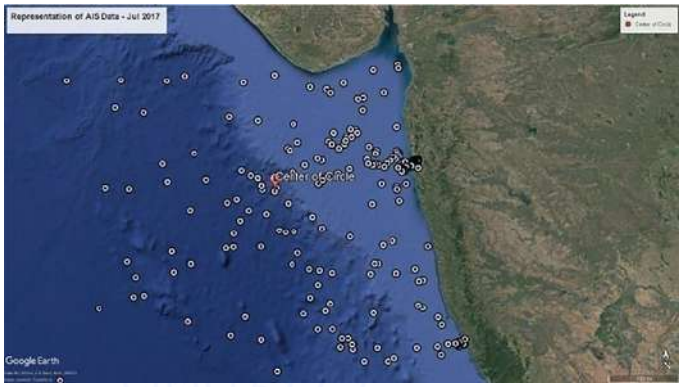


Sources of Natural Noise



Sources of Anthropogenic Noise

Key highlights



AIS map of the Arabian Sea near to the Mumbai Coast

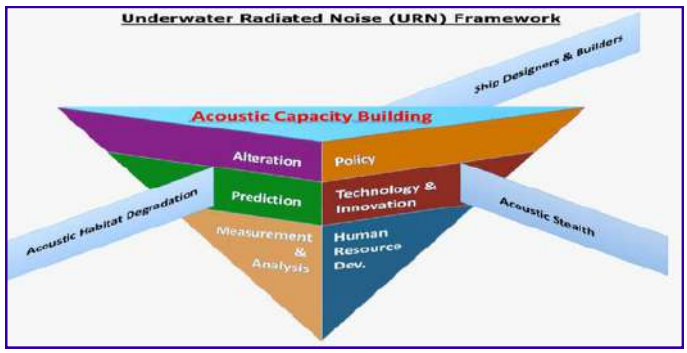
Ambient noise in ocean is a complex combination of numerous types of natural and anthropogenic noise. The noise is dominant in all frequencies from 1 Hz to over 100 KHz with the various noise sources contributing in specific frequency bands as per their acoustic attributes.

AIS, it is a ship identifier mandated to be transmitted by all ships when underway in the oceans. AIS receivers are located along the Indian coastlines and the DGLL with its connected chain of lighthouses collates this data for the stakeholders. The AIS packet provides various ship parameters i.e., IMO number, Length, Speed, Location, Name, Last/next port of call etc. where the ships systems are integrated with the AIS transmitter, other navigational data viz. Course, Speed, Depth below keel etc. are also available in the AIS data packet.

For the purpose of this research, AIS data for the Arabian Sea region near the Mumbai Coast was considered as the primary subject.

8.4 Acoustic Habitat Degradation Due To Shipping

About the Research



A research paper by fellow academicians and researchers at MRC on 'Assessment of acoustic habitat degradation due to shipping' was India's submission to the Marine Environment Protection Committee of the International Maritime Organization (IMO). As a part of the research, the hazards of noise due to shipping, manifesting as acoustic habitat resulting into degradation for the marine ecosystem were discussed at lengths.

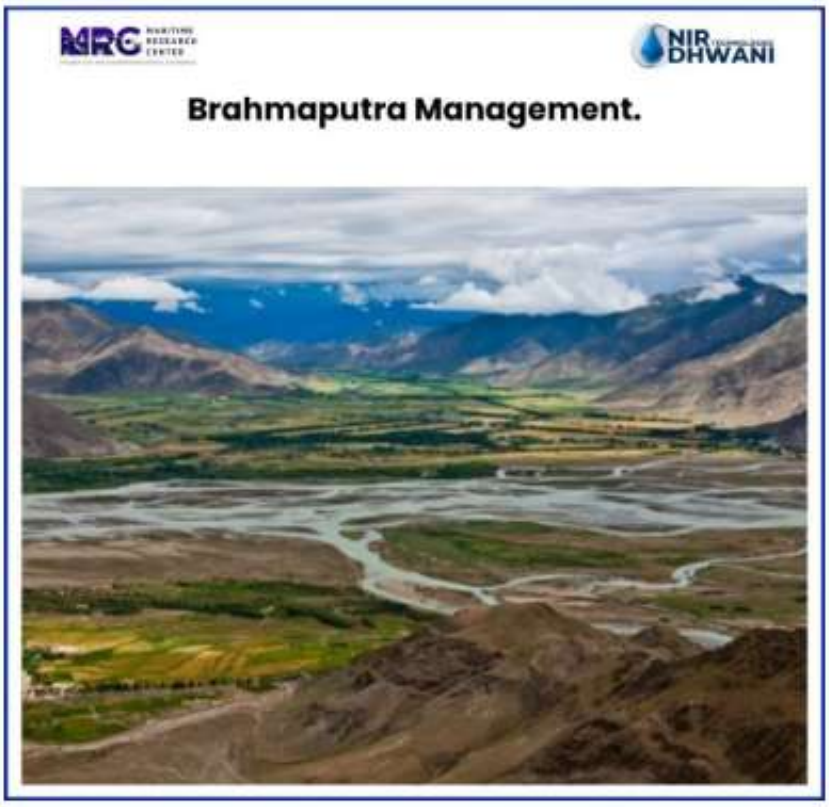
The Indian Ocean Region (IOR) has strategically become the most critical sea area in the 21st century. The strategic relevance comes from the following economic, political and military aspects. It is often stated that the shipping traffic has an adverse impact on the marine ecosystem due to the resulting acoustic habitat degradation. However, a precise assessment of the extent of damage is required, so that the necessary awareness is spread, and an informed decision-making process is expedited.

Key Highlights

- The Ministry of Earth Sciences (MoES), has approved a research project for the MRC for building spatio-temporal underwater noise map to shipping activities in June 2023. This is a very unique effort in ensuring digital transformation in monitoring acoustic habitat degradation. Low frequency ambient noise due to shipping is a major cause of acoustic habitat degradation for Big Whale species. Mass stranding of Big Whales is on the rise due to increasing shipping traffic. The unique tropical waters, acoustic propagation characteristics needs to be factored while generating the spatio-temporal maps.

- The URN management for acoustic stealth of warships has been a very well-developed domain for quite some time. The same noise control techniques for design as well operational aspects are also relevant for acoustic habitat degradation management. There is requirement for a policy, technology and innovation, and human resource development to effectively address URN management. The other aspect relates to the stages of URN management, from measurement and analysis, to prediction and deception (in naval terminology) or alteration (in case of acoustic habitat degradation). Since the local medium will play a major role in the propagation of the sound from the source to the receiver, a source- path-receiver study is equally relevant. Acoustic capacity and capability building will remain key for effective URN management and the larger UDA framework.

8.5 Brahmaputra Management

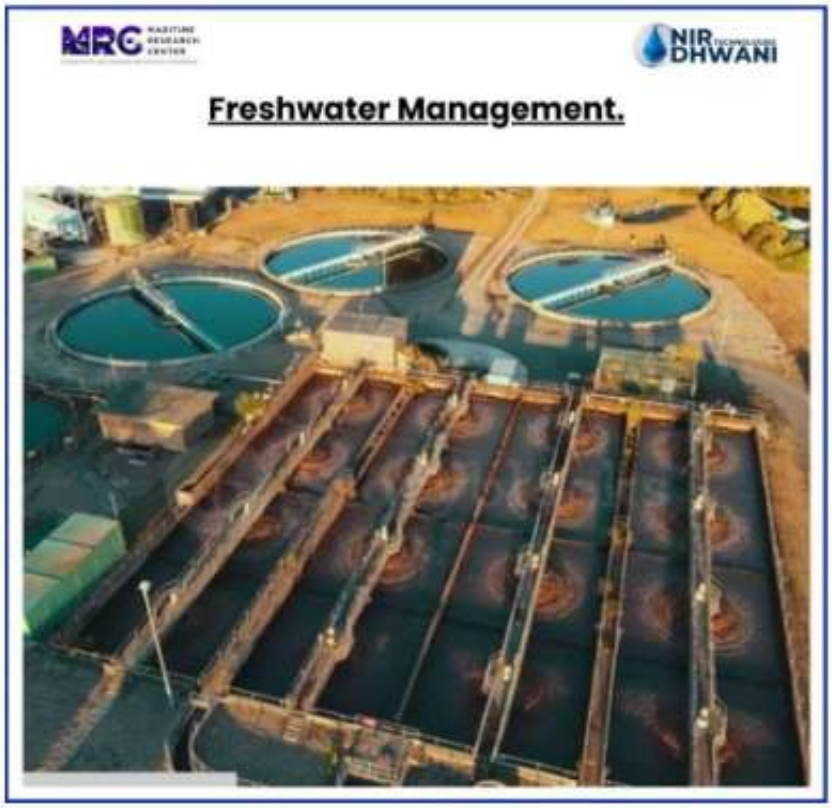


The project deals with identifying the specific gaps with respect to IWT, Freshwater Management and strategic security perspective. The gaps will include policy & technology intervention along with the acoustic capacity & capability building, driven by the UDA framework. The IWT has multiple dimension related to navigability (sediment management) both in India and Bangladesh. The freshwater management will include water resource and water quality, whereas the strategic security will include projects being undertaken in China that could impact water availability and combined with the climate change phenomenon, it could be a critical issue.

➤ Impact assessment of this project

The aspects of flood management, drought relief, ecosystem degradation and various other freshwater related challenges and opportunities will be addressed. A consolidated UDA framework proposes to address all the three aspects in an effective and efficient manner.

8.6 Freshwater Management

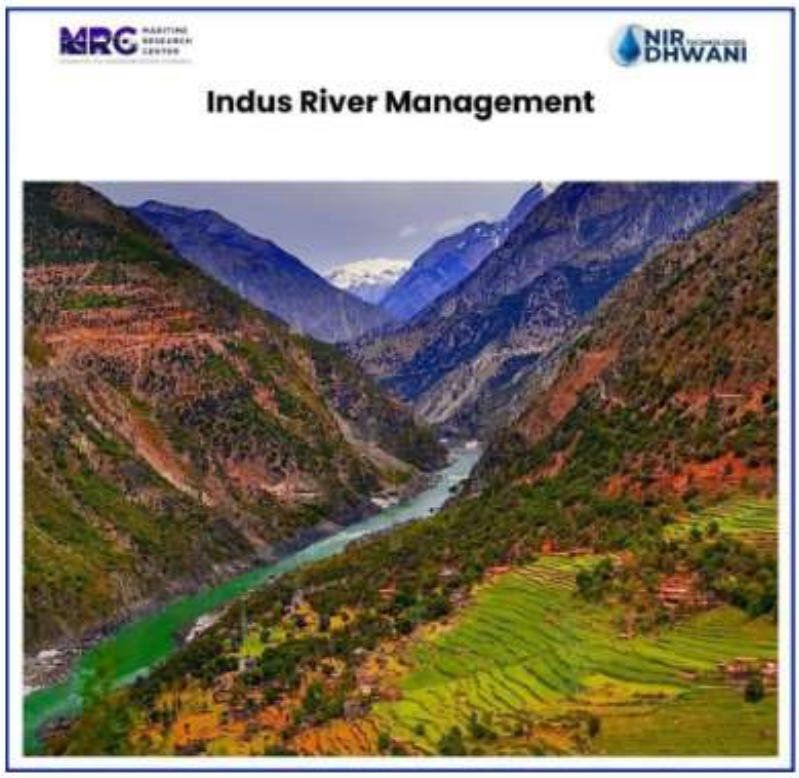


The project will identify the gaps across the varied applications and provide the UDA framework driven digital construct. The detailed interventions will be articulated with local site specific R&D inputs. The traditional knowledge will also be incorporated while formulating the solutions. Aspects of MSP and field validated M&S tools will be deployed to formalize the interventions. The criticality of freshwater needs no emphasis, and the urgency of intervention also needs no further elaboration.

➤ Impact assessment of this project

The incorporation of traditional knowledge while formulating solution is a significant step while providing digital and R&D inputs. As the freshwater systems play a critical role in the entire ecosystem management and the growing population is putting massive stress on these systems, the efforts of the company towards the improvement of the same proposes to create a positive impact towards fulfilling freshwater needs of the ecosystem.

8.7 Indus River Management



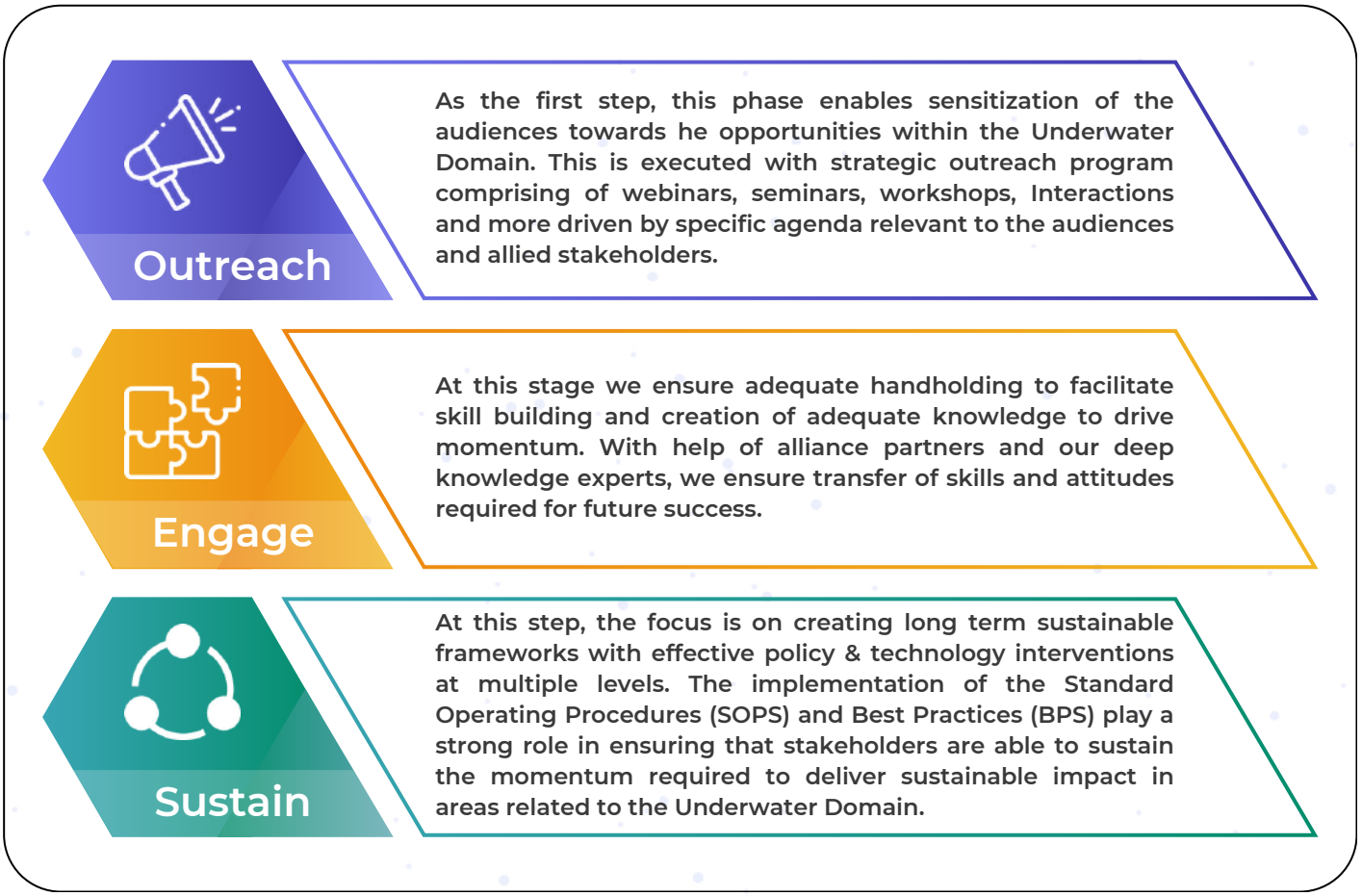
This project will undertake a detailed study of the Indus River and the Basin from a comprehensive stand point. The IWT will be reviewed for its adequacy to deal with the challenges and opportunities of the new global order. The UDA framework will be the guiding structure to manage the site specific gaps in technology, knowhow and the present understanding of the way forward. The work will account for the complex geopolitical and geostrategic ground realities and build the structure accordingly. The inclusive approach will be the main driving agenda and multiple policy makers, stakeholders, practitioners and the local communities will be accounted for, while formulating the way ahead. The traditional knowledge and practices will be evaluated for their relevance in the modern times. The state-of-the-art technology and knowhow will be deployed for scaling up the relevant traditional practices.

➤ Impact assessment of this project

The study of sediment transport pattern in the tropical waters to ensure effective sediment management is crucial as the sediment management in the tropical waters is not straight forward like in the temperate or polar regions. The innovations to customize the high-tech knowhow for managing the local site-specific challenges and opportunities will be the key agenda. The policy & technology interventions along with the acoustic capacity & capability building will be the final deliverables.

8.8 Skilling Ecosystem

MRC acts as a catalyst in skill development by providing necessary advice and technical assistance to enterprises, companies and organizations that provide skill training. It also develops appropriate models to enhance, support and coordinate initiatives.



Skilling Modules

The Underwater Domain Awareness (UDA) framework requires massive skilling to support nuanced career opportunities and effective capacity & capability building across diverse stakeholders. The entire UDA skilling modules have been divided into four categories:

(a) Corporate Training Programs
(b) Diploma Programs
(c) BVoc Programs
(d) Post Graduate Programs

The Diploma Programs are two-year duration programs that will cover the specific aspects of the UDA framework at the working level for varied stakeholders. These will enable the participants to acquire the required skills to be relevant to a specific aspect across stakeholders. The aspects that will get covered are:

- Technician who will operate, maintain and repair instrumentation for acoustic survey, bio-sample handling and data handling & robotics.
- Data logger and bio-sample collector to make sure the digital data and the bio-samples are collected properly to ensure minimal loss of their characteristics.
- Deployment specialist to make sure the equipment for data collection or biosample collection is undertaken properly.

Additionally, E-Learning Modules have been developed to provide a nuanced exposure to the students and young professionals on varied aspects of the UDA framework. The series are mentioned below:

(a) Basic & Advance Level Modules for the UDA Framework. This has been uploaded in the IGOT platform of the Government of India, to expose the government officials across the Union Government and the States.
(b) Blue Economy.
(c) Climate Change Risk Management.
(d) Sediment Management across Marine & Freshwater Systems.
(e) Digital Transformation for Coastal & Riverine Communities.
(f) Tyranny of Small Decisions.

❖ UDA Summer School

Benefits of the UDA Summer School

Project-based learning to **solve real-world challenges** and upskill the participants towards employability in maritime sector.

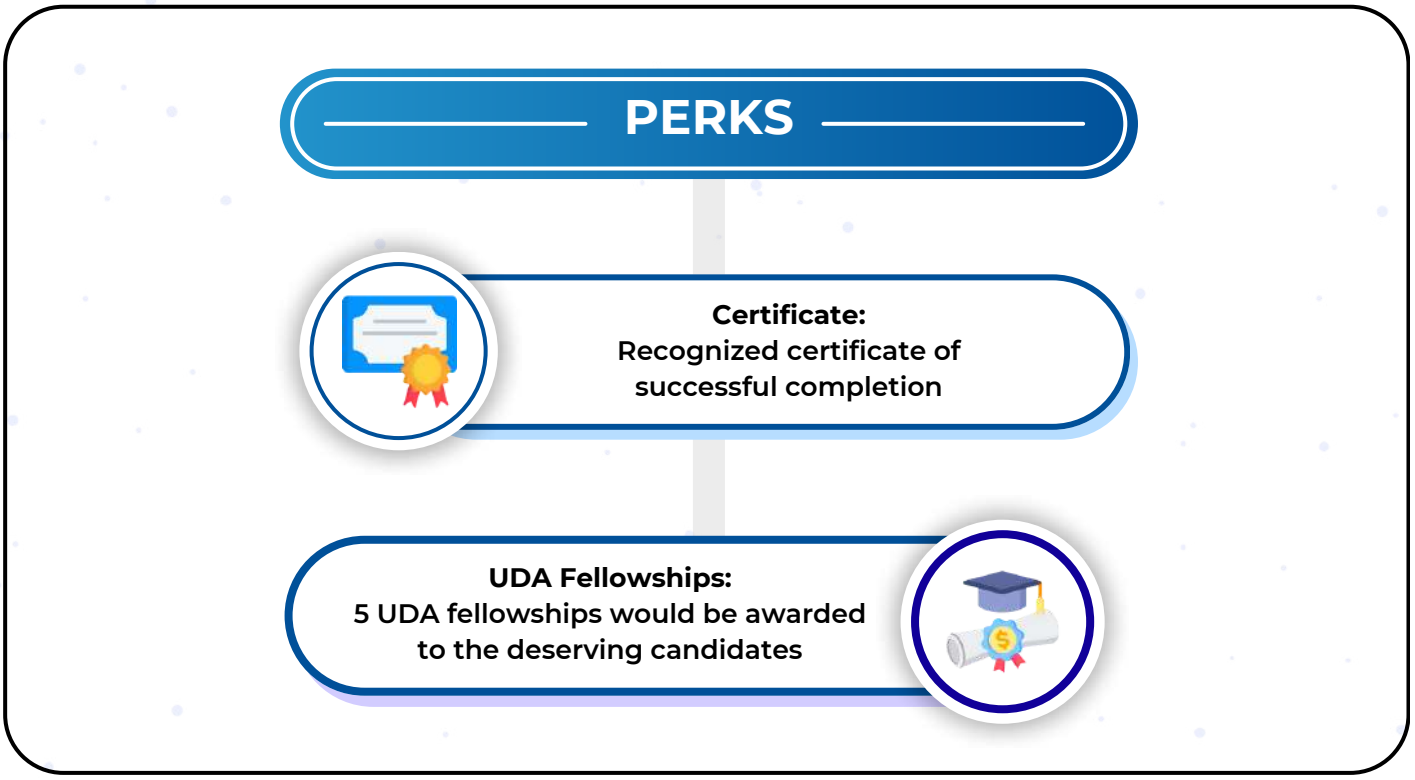
Promote **User-Academia-Industry partnership** to achieve global, national and regional aspirations of skilling and governance.

Digital transformation to enhance governance.

➤ Impact Assessment of the Skilling programs

The program aims to encourage participation from a variety of disciplines such as Science, Technology, Economics and Management and grab an opportunity to interact with subject-matter experts from national security, blue economic entities, environmental regulators and science and technology providers.

By offering a wide range of perspectives from different disciplines and industries, the summer school hopes to prepare participants to face real-world challenges, develop solutions through collaboration and innovative thinking which will enable them in achieving successful career paths in the field of underwater research.



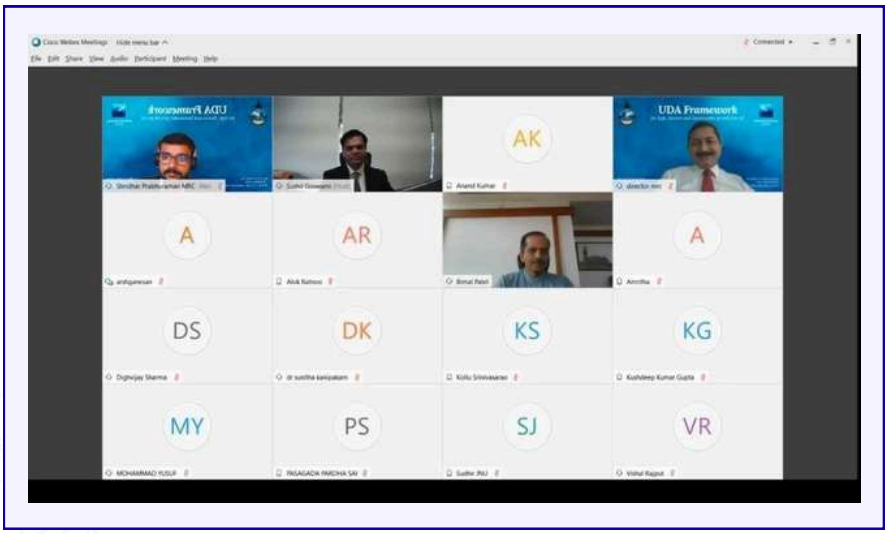
❖ Training Programs

1. Online: 6 Day Training Program at Bharat Electronics (Date: 07/11/2020)

Team MRC along with NDT delivered six day training program at Bharat Electronics Limited. The BEL Academy of Excellence (BAE) is a ultra-modern facility and it was indeed a pleasure to interact with the engineers and the senior technology managers at BEL. BEL is the largest manufacturer of Sonars in the country and now they are embarked on a mission to complement the Honourable Prime Minister's SAGAR vision. Significant modernisation is on the cards and MRC and NDT hope to contribute to their ambitious vision for the nation. BEL could be the most appropriate driver for our UDA mission.

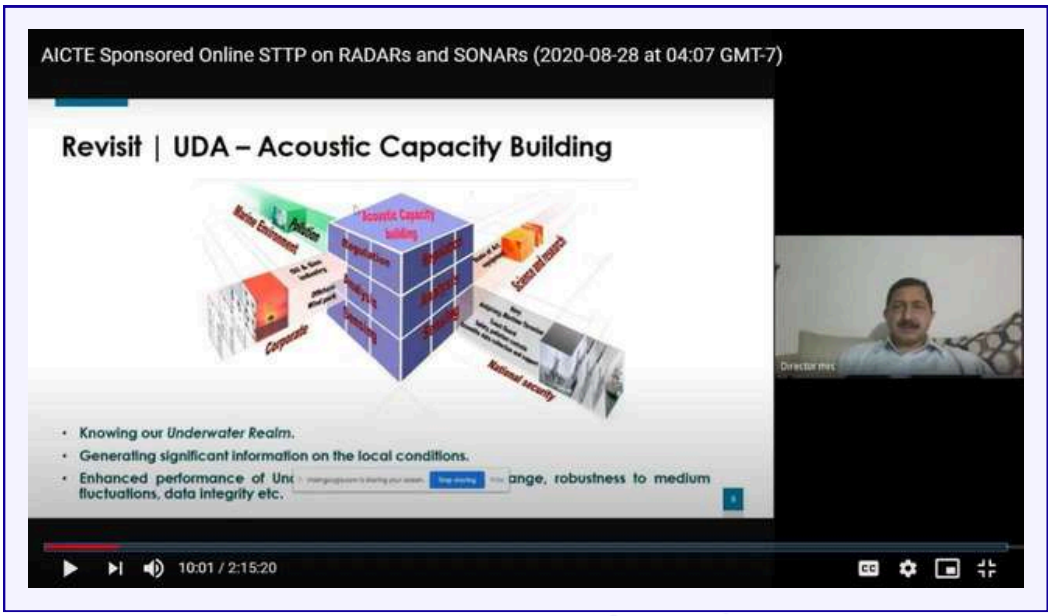
2. Online Certificate Course on UDA Framework for Effective Security & Growth for All in the Region (SAGAR). (Date: 05/09/2020)

Maritime Research Center, in association with Shakti University 's School of Maritime, Air & Space Studies, organized an Online Certificate Course on UDA Framework for Effective Security & Growth for All in the Region (SAGAR).



3. Short Term Training Program on RADARS & SONARS: in Academic, Industrial & Defense perspectives. (Date : 31/08/2020)

Maritime Research Center gave a Short-Term Training Program at PSG College of technology, Coimbatore on RADARS & SONARS: in Academic, Industrial & Defence perspectives. The topics covered included Underwater Domain Awareness (UDA) and use of Artificial Intelligence for UDA



4. Skill Development in Acoustic Survey for Varied Applications in the Indian Ocean Region IOR (Date: 28/03/2021)

Prof Anil D Sahasranudhe (Chairman, AICTE, New Delhi) and Dr Cdr Arnab Das (Founder & Director, Maritime Research Center, Pune), enlighten us on 'Skill Development in Acoustic Survey for Varied Applications in the Indian Ocean Region IOR', at a webinar organized by AICTE

8.9 Collaborations Of FUDA

Webinar on Underwater Domain Awareness (UDA) Framework and The Sagar Vision

The webinar was conducted on 07th November 2023 in association with FUDA and Society for Policy Studies. On the panel Dr. (CDR) Arnab Das was the Host, Shri Ajay Kumar, who is Former Defense secretary was the Lead speaker and CMDE Uday Bhaskar (retired General Secretary) and Vice Admiral A R Karve were moderator and discussant.

Key notes by dignitaries during the webinar

➤ Dr. Ajay Kumar Former Defense Secretary of India

Summary of key inputs from Dr. Ajay Kumar the former Defence Secretary of India:

1) He was involved in the formulation of varied policy initiatives of the Government of India and a coastal state of Kerala made his remarks as the lead speaker.
2) He emphasized on the importance of the UDA for realizing the SAGAR vision.
3) He made a very strong case for weaning out of our dependence on external power on strategic capabilities on the UDA. He stressed on the importance of innovation and mentioned the new initiative of the Government of India to encourage entrepreneurs from within the country to attempt problem solving for the Indian Navy.
4) The importance of building a talent pool for UDA was emphasized by him, not only meet our own domestic requirement but also to support the regional and global demand.
5) He concluded by saying that UDA is a humungous opportunity, and we all need to come together to build a nuanced mechanism to manage this new frontier.

➤ Vice Admiral A R Karve PVSM, AVSM (Retd)

Summary of key inputs from Vice Admiral A R Karve
an underwater specialist:
The global effort on UDA was highlighted by him, however he also warned that it requires massive resources and sustained efforts for a long term. He made a strong case for the UDA framework to be an agenda point for the multilateral forums like the Indian Ocean Rim Association (IORA), Indian Ocean Naval Symposium (IONS), International Tuna Convention (ITC), QUAD and more, so that we can leverage the international mechanisms to ensure peace and prosperity in the IOR. He stressed on adding the underwater component to the ongoing Maritime Domain Awareness (MDA) efforts in the Indo-Pacific strategic space, through the data fusion centres across multiplelocations, including the one in India at Gurugram.

➤ Cmde Anil Jai Singh Submarine Veteran

Cmde Anil Jai Singh highlighted the urgent need for India's readiness in Underwater Domain Awareness (UDA), urging the formulation of a comprehensive roadmap with clear timelines and milestones. He emphasized the importance of addressing identified gaps, both in military and non-military aspects. He also supported the proposed UDA framework by the MRC and NDT, stressing the need for a coordinated and accelerated capability development strategy.

➤ Shri Anis Pankhania
(Senior Representative of Capgemini Technology Service India Ltd)

The benefits of adopting new technologies and moving away from legacy infrastructure were highlighted. He commends the MRC team for their insightful presentations on World Maritime Day and recognizes the need for a clear vision and urgency in digital transformation.

➤ Rear Admiral Amit Vikram

Campus Director, D.Y.Patil Akurdi Campus

The significance of World Maritime Day was highlighted and the importance of Marpol (the International Convention for the Prevention of Pollution from Ships) in addressing marine pollution was emphasized. He also underscores the global significance of maritime trade, emphasizing that over 80% of global trade by volume and 70% by value is transported by sea. Rear Admiral Amit Vikram commends the MRC's initiative in maritime domain awareness and expresses support for their efforts, particularly in engaging students in their mission.

➤ Vice Admiral DSP Varma

PVSM, AVSM, VSM (Retd), Former DG of the Strategic Submarine Project and Chief of Material, Indian Navy

He highlighted the potential for combining acoustic and optic technologies and their application for local benefits, such as aiding fishermen. He stressed the necessity of overcoming challenges and leveraging global efforts to benefit local communities, expressing optimism about potential collaborations between Tokyo University and MRC.

➤ Captain Sudhir Subedar

Former President and CEO of the Indian Coastal Conference Shipping Association (ICCSA)

Captain Sudhir Subedar with the years of sailing and onshore experience, expressed gratitude for the insight shared regarding the MRC's future plans. Their struggle lay in advocating for Underwater Domain Awareness (UDA) and Maritime Domain Awareness (MDA) within India's merchant shipping fraternity, urging the MRC to popularize these concepts. He highlighted the challenge of garnering attention from authorities due to the limited presence and influence of India's merchant shipping sector. He highlighted the importance of making these concepts tangible and relevant to the shipping industry. His address concluded with an invitation for collaboration and assistance, expressing readiness to continue supporting the MRC's endeavors, and offering further assistance to Commander Das in advancing these crucial initiatives.

❖ Collaborations with International Organizations

- **Collaboration with the IMO**

The International Maritime Organization (IMO) accepted a paper from the Government of India for the Marine Environment Protection Committee (MEPC-76) in 2021. The paper highlighted an innovative tool developed by MRC/NDT on digital transformation to monitor underwater noise generated due to shipping. Further, the IMO has designated the Government of India as the lead nation in the Indian Ocean Region (IOR) for underwater noise management and has allocated two million USD for the project.

- **Collaboration with ISA**

The International Seabed Authority (ISA) is working with MRC/NDT to support capacity and capability building globally for deep ocean mining. MRC/NDT has a track record of promoting a sustainable blue economy and has developed multiple digital tools for institutionalized governance mechanisms that have gained significant recognition.

❖ Collaborations with Government Organizations

UNESCO India has also proposed the establishment of a Center of Excellence (CoE) to support capacity and capability building on marine and freshwater biosphere reserves. The CoE is intended to serve the requirements of Africa and South Asia. MRC has collaborated with UNESCO India in multiple events to spread awareness of the UDA framework as a sustainable growth model for tropical waters. The Ministry of Education & Skilling is processing the case and MRC has briefed the UNESCO HQ in Paris and India's permanent delegate for UNESCO in Paris on the same.

MRC presented a policy paper to the NITI Aayog, proposing a nationwide approach for augmenting acoustic capacity & capability building, thereby bolstering the UDA framework for the Government of India. The NITI Aayog tasked them to work on a study report to articulate the details of the proposal and provide a roadmap. The report was submitted and is now being circulated to numerous ministries for their remarks and further action.

- **Collaboration with the Indian Navy**

The Indian Navy discussed the UDA framework proposed by the MRC in their Commander's Conference in Apr 2018. The Indian navy has now embarked on an ambitious UDA implementation for its strategic and tactical deployments.

- **Collaboration with the NSCS**

The National Security Council Secretariat (NSCS) has accepted a policy paper on the larger underwater security roadmap based on the UDA framework. 3MRC is now recognized as a domain expert and consulted on strategic security matters.

- **Collaboration with MEA**

The Ministry of External Affairs (MEA) is in the process of submitting a proposal for hosting a two-day workshop for the nations in the Indian Ocean Region (IOR). The UDA framework has been gaining recognition as a diplomatic tool for achieving the SAGAR vision of the Prime Minister.

- **Collaboration with INCOSI under MoES**

The Indian National Center for Ocean Information Services (INCOIS), Ministry of Earth Sciences (MoES), has signed a Memorandum of Understanding with MRC to progress the Digital Ocean initiative of the Government of India. The entities recognize the data analytics abilities and support the UNESCO Center of Excellence at INCOIS.

- **Collaboration with Capacity Building Commission of India (CBC)**

As part of the Union Ministry of Commerce and Industry (Government of India), the Capacity Building Commission of India works closely with the Prime Minister's Office through initiatives such as Mission Karmayogi, which strives to equip government officials with the necessary skills and knowledge required for effective public service delivery under the country's economic and educational development plans. The organisation has successfully contributed an e-learning module that will soon be adopted as part of Mission Karmayogi's structured learning modules, thereby making a nationwide impact through competency-driven official training in the underwater domain. The Capacity Building Commission (CBC), under the oversight of the Prime Minister's Office (PMO), is working in collaboration with the MRC to design e-learning modules for policymakers and a structured outreach program to operationalize the UDA framework across the governance system.

❖ Other major collaboration at the policy-intervention level

To consolidate the User-Academia-Industry partnership and to build an institutionalized construct, a sector skill council on the underwater domain has been proposed and is being deliberated upon at the National Skill Development Council (NSDC). The Maratha Chamber of Commerce, Industry, and Agriculture (MCCIA), Pune forwarded the MRC's proposal to NSDC which is further being backed by the Federation of Indian Chambers of Commerce and Industry (FICCI).

9. Brief Activities Conducted During Previous Three Years

Sr. No.	Date	Brief activities and Report link
1	01st December 2023	Koregaon Bhima, Pune, Interaction and Presentation by Dr. Mehul Naresh Sangekar, JAMSTEC & TOKYO University The event involved the significance of effective Underwater Domain Awareness (UDA) as the most critical driver for the Security And Growth for All in the Region (SAGAR) vision https://mrc.foundationforuda.in/interaction-and-presentation-by-dr-mehul-naresh-sangekar-jamstec-tokyo-university/
2	07th November 2023	Underwater Domain Awareness (UDA) Framework and the SAGAR Vision: The initiative aims to revolutionize India's capabilities in Underwater Domain Awareness (UDA) across the expansive Indo-Pacific region, aligning with India's strategic imperatives for sustainable security and economic advancement. https://mrc.foundationforuda.in/webinar-on-underwater-domain-awareness-uda-framework-and-the-sagar-vision/
3	22nd November 2023	Koregaon Bhima, Pune, Interaction and Presentation by Dr. Chaitanya Patil University of Strathclyde. The event focused on the global communities having massive strategic deployment in the Indo-Pacific region.
4	28th September 2023	Webinar on World Maritime Day: The Webinar involved a discussion on the Government of India's plan to modernize the country's ports through a project called Sagarmala. https://mrc.foundationforuda.in/webinar-on-world-maritime-day/
5	22nd August 2023	Webinar for Review of UDA Research & Innovation Activities by MRC's Research Advisory Board (RAB). The UDA Framework was discussed in detail. https://mrc.foundationforuda.in/22-08-2023/

6	08th June 2023	Celebration of World Oceans Day 2023: The significance of the World Ocean Day was highlighted by explaining its relevance for local communities which are to be actively involved in the development process in order to achieve the Sustainable Development Goals in a true sense. https://mrc.foundationforuda.in/celebrating-world-oceans-day-2023-with-mrc/
7	6th March 2023 to 10th March 2023	College of Engineering Pune Institutionalizing Skilling Ecosystem through Policy Intervention: This was hosted to build on the entire spectrum of policy formulation. A clear emphasis on skilling for livelihood enhancement was also emphasized. Key decision makers presented to identify gaps for policy interventions. https://mrc.foundationforuda.in/institutionalized-skilling-ecosystem-of-the-sagar-vision-based-on-the-underwater-domain-awareness-uda-framework/
8	13th March to 17th March 2023	College of Engineering Pune, Institutionalizing Skilling Ecosystem through Technology intervention This was hosted, with a focus on exploring the role of science and technology as a catalyst for livelihood enhancement. https://mrc.foundationforuda.in/institutionalized-skilling-ecosystem-of-the-sagar-vision-based-on-the-underwater-domain-awareness-uda-framework/
9	20th March to 24th March 2023	Malvan Coast, Institutionalizing Skilling Ecosystem through Grassroots Community Engagement This initiative was hosted at the Konkan coast and involved collaboration with multiple partners from the government and private sectors to engage with the coastal communities. https://mrc.foundationforuda.in/institutionalized-skilling-ecosystem-of-the-sagar-vision-based-on-the-underwater-domain-awareness-uda-framework/
10	03rd Nov 2022	UNESCO Cluster Office, New Delhi, Conference commemorating the “1st International Day for Biosphere Reserves” https://mrc.foundationforuda.in/1st-international-day-for-biosphere-reserves/

11	14th Oct 2022	MCCIA, Pune, Skilling Centre to Support the Underwater Domain Awareness (UDA) Framework: The Centre of Excellence will build human resources for the future with abilities to solve problems of the new global order. Hands-on and state-of-the-art innovation will be the key focus of the new initiative https://mrc.foundationforuda.in/mou-signing-event-skilling-centre-to-support-the-underwater-domain-awareness-uda-framework/
12	29th Sept 2022	World Maritime Day Webinar on UDA Framework for Effective Blue Frontiers in the Indo-Pacific Strategic Space https://mrc.foundationforuda.in/world-maritime-day-webinar-on-uda-framework-for-effective-blue-frontiers-in-the-indo-pacific-strategic-space/
13	21st July 2022	Underwater Domain Awareness UDA Framework for Effective Blue Frontiers in the Indian Ocean Region: The socio-economic challenges in the region, should be a reason to prioritise Science & Technology (S&T, including the physical challenge of sub-optimal Sonar performance in the tropical waters.
14	30th June 2022 and 21st May 2022	Australia, United Kingdom and the United States (AUKUS): A New Perspective based on the UDA Framework: to be able to reach out and build policy priority for the UDA framework both at the national and regional level.
15	05th May 2022	COP26 and the Brahmaputra A New Perspective Based on the UDA Framework – 05: The seminar brought all the stakeholders together and deliberate on multiple aspects of the water resource management issue, focused on the UDA framework.
16	25th March 2022	Indo-Sri Lankan Relations and the BIMSTEC: The interactions will strengthen the Indo-Sri Lankan partnership and encourage joint acoustic capacity and capability building at the regional level.
17	05th March 2022, 05th January 2022 and 05th February 2022	COP26 and the Brahmaputra A New Perspective Based on the UDA Framework – 02 and 03 The seminar will bring all the stakeholders together and deliberate on multiple aspects of the water resource management issue, focused on the UDA framework.

18	30th Oct 2021	UDA Framework for Effective Internal & Coastal Security in the Indo-Pacific: The Indo-Pacific strategic space has gained substantial relevance in the last five years due to multiple reasons ranging from political, socio-economic, military and more. https://mrc.foundationforuda.in/uda-framework-for-effective-internal-coastal-security-in-the-indo-pacific-date-30-10-2021/
19	12th Oct 2021	Blue Economy, Underwater Domain Awareness (UDA) and Maritime Security Challenges for India: UDA can be a useful system both to monitor the subsurface threat as well as marine life, undersea environments, monitor, assess the geophysics, anthological activities, biological health environment of the Ocean. https://mrc.foundationforuda.in/blue-economy-underwater-domain-awareness-uda-and-maritime-security-challenges-for-india-date-12-10-2021/
20	31st July 2021	Underwater Domain awareness (UDA) Framework for Enhanced Maritime Governance The UDA in the tropical littoral waters of the Indo-Pacific Strategic Space has some very unique challenges and opportunities https://mrc.foundationforuda.in/underwater-domain-awareness-uda-framework-for-enhanced-maritime-governanc-date-31-07-2021/
21	26th June 2021	Anti Submarine Warfare and UWSAR | UDA Framework: The Maritime Research Centre (MRC), Pune in collaboration with the M/S NirDhwani Technology Pvt Ltd (NDT) hosted a webinar. https://mrc.foundationforuda.in/anti-submarine-warfare-and-uwsar-uda-framework-date-26-06-2021/
22	08th June 2021	This online workshop was conducted on the occasion of the World Ocean Day to encourage the Young India to focus on the UDA initiative for enhanced Ocean Consciousness and Effective Maritime Governance. https://mrc.foundationforuda.in/underwater-domain-awareness-uda-framework-and-the-opportunities-for-young-date-08-06-2021/

23	22nd May 2021	UDA Framework for Effective Blue Frontiers in IOR and Beyond: The Maritime Research Centre (MRC), Pune in collaboration with M/S NirDhwani Technology Pvt Ltd (NDT) hosted this webinar. https://mrc.foundationforuda.in/uda-framework-for-effective-blue-frontiers-in-ior-and-beyond-date-22-05-2021/
24	23rd April 2021	Maritime Security & Atmanirbhar Bharat- A New Perspective on UDA* Framework An attempt to identify the gaps and evolve synergy among the stakeholders and policy makers across the region. https://mrc.foundationforuda.in/maritime-security-atmanirbhar-bharat-a-new-perspective-on-uda-framework/
25	22nd Dec 2020	Acoustic Survey: A Critical Skill for Progressing Effective Blue Economy Growth in the Indian Ocean The Maritime Research Centre (MRC), Pune and M/S NirDhwani Technology Pvt Ltd in partnership with the Indo-Swiss Centre of Excellence (ISCE), organized this webinar. https://mrc.foundationforuda.in/acoustic-survey-a-critical-skill-for-progressing-effective-blue-economy-growth-in-the-indian-ocean/
26	01st Oct 2020	UNDERWATER ARCHAEOLOGY IN INDIA – THE LOST ENIGMA | BOOK LAUNCH: Marine archaeology, in itself has a very broad spectrum of aspects to be addressed to give a comprehensive treatment to the subject. https://mrc.foundationforuda.in/underwater-archaeology-in-india-the-lost-enigma-book-launch/
27	24th Sept 2020	Envisioning India as a Maritime Nation | World Maritime Day: The MRC, Pune in partnership with the Centre for Advanced Strategic Studies (CASS) proposes to hosted this webinar. https://mrc.foundationforuda.in/envisioning-india-as-a-maritime-nation-world-maritime-day/

28	5th Sept 2020	Online Certificate Course on UDA Framework for Effective Security & Growth for All in the Region (SAGAR) MRC, in association with Shakti University „s School of Maritime, Air & Space Studies, organized an Online Certificate Course on UDA Framework for Effective Security & Growth for All in the Region (SAGAR). https://mrc.foundationforuda.in/online-certificate-course-on-uda-framework-for-effective-security-growth-for-all-in-the-region-sagar/
29	19th Aug 2020	A discussion by global maritime experts on UDA Framework & Ocean Governance. https://mrc.foundationforuda.in/webinar-underwater-domain-awareness-uda-framework-ocean-governance/
30	31st August 2020	Short Term Training Program on RADARS & SONARS: in Academic, Industrial & Defence perspectives at PSG college oftechnology, Coimbatore on RADARS & SONARS: in Academic, Industrial & Defense perspectives. https://mrc.foundationforuda.in/short-term-training-program-on-radars-sonars-in-academic-industrial-defence-perspectives/
31	27th July 2020 till 29th July 2020	MRC along with NDT delivered six day training program at Bharat Electronics Limited. https://mrc.foundationforuda.in/online-6-day-training-program-at-bharat-electronics/
32	26th August 2020	Savitribai Phule, Pune, UDA Framework for Effective Realization of Sagar Vision | A High Level Dialogue for National Capacity Building. The Maritime Research Centre (MRC), Pune in association with the Centre for Advance Strategic Studies (CASS), Pune organized this webinar https://mrc.foundationforuda.in/uda-framework-for-effective-realization-of-sagar-vision-a-high-level-dialogue-for-national-capacity-building/

33	16th March 2019	Mumbai University, One Day Workshop on Underwater Domain Awareness at Mumbai University Vijnana Bharati and Mumbai University hosted a one day workshop on Underwater Domain Awareness. Academia, industry and think tanks well represented and the UDA framework well received https://mrc.foundationforuda.in/one-day-workshop-on-underwater-domain-awareness-at-mumbai-university/
34	25th Nov 2019	Presenting in Indo-French Maritime Seminar, Founder-Director Dr. Arnab Das addressed the French Industry delegation on Maritime and Naval sector. https://mrc.foundationforuda.in/presenting-in-indo-french-maritime-seminar/
35	30 July 2019 to 03/08/2019	5 Day Training Program at Bharat Electronics The BEL Academy of Excellence (BAE) is a ultra-modern facility and it was indeed a pleasure to interact with the engineers and the senior technology managers at BEL. https://mrc.foundationforuda.in/5-day-training-program-at-bharat-electronics/
36	21/05/2019 to 04/07/2019	BITS PS-1 Internship 11 Students belonging to various streams, joined us for their PS1 internship which laster between 21 May 2019 to 14 July 2019. Each handled independent research problems and successfully completed the milestones allotted to them. https://mrc.foundationforuda.in/bits-ps-1-internship/

10. Impact Assessment Survey

10.1 Data collection and Analysis Methodology

The impact assessment survey was conducted using various data collection and analysis methodologies which include conducting interviews of academicians, researchers, scholars, Board members, etc., attending webinars, site visits, interaction with the people working on projects etc. The assessment was conducted on a test basis and the findings of the impact assessment survey aim to assess the impact of the Company's research efforts on various stakeholders / beneficiaries within the maritime community. By engaging with stakeholders and soliciting feedback on the Company's research activities, analysis of how the Company's work contributes to addressing key challenges, creating awareness, promoting research, and driving innovation in the maritime sector was done.

Following relevant stakeholders / beneficiaries of the Company's activities are identified:

1. Researchers / students pursuing PhD under guidance of the Company
2. Farmers (some of the research projects of the Company have been implemented for shrimp farming where farmers are benefitted)
3. Shipping industry (the Company is engaged in modelling for research & guidance to shipping industry for environmental cause)
4. Government official (the Company is recommending changes in governmental policies for UDA sector)
5. Women researchers (the Company is actively trying to engage women researchers/ students to pursue career in the field of UDA)

The survey was designed to gather quantitative and qualitative data on stakeholders' perceptions of the Company's research outputs, dissemination efforts, and overall impact on the maritime industry and the society at large. Through a combination of closed-ended and open-ended questions, respondents were invited to share their perspectives on the relevance of the research, its practical applications, and areas for improvement.

❖ Interactions With Academicians And Researchers At FUDA

➤ Interaction with Mr. Shridhar Prabhuraman (Deputy Director for Maritime Research Centre)

Mr. Shridhar Prabhuraman is the Deputy Director for the Maritime Research Centre. He is involved in the operational and technical research. His profile mainly involves communication, overseeing the engineering department, development of products, mentoring research fellows, overall monitoring the project stages, advice and monitoring and mark the progress of the projects. His work deals in the analysis and identification of projects that can be converted into tools or ideas for the final engineering product.

Mr. Shridhar Prabhuraman has working experience of about 2 years, and he is associated with the company for over 6 years.

In the interaction, it was found that Mr. Shridhar Prabhuraman has been overlooking the projects from the time of inception of MRC, under the guidance of Arnab Sir. The following Research projects created a material impact:

Low frequency ambient noise mapping in the Indian Ocean region

Shipping is one of the most dominant source of noise. The estimation of shipping noise, ambient noise mapping, estimation of overall noise generated by the ships in the region by analyzing the depth, speed of movement, computing overall noise and analyzing the three dimensional aspect of calculating noise not just across the spatial area but also across the depth is crucial.

Estimation of transmission loss using neural network

When a signal is emitted from a particular source and goes to a particular receiver there are mathematical models that allow to compute transmission loss to that signal. The challenge faced today is the instantaneous calculation of transmission loss as the specific mathematical models need to be executed numerous times for a particular sender and receiver base. Neural networks predict the transmission loss in a particular sender and receiver base and by the usage of the model, the computational cost had come down exponentially.

Alignment of research projects conducted by the company with the overall organizational mission and societal needs

All the projects that are undertaken are carried out with the main object being the Underwater Domain Awareness (UDA).This means anything and everything that can be seen and understood and capturing of the data and thereby make decisions out of it. In the company, focus has been niche, every project, task is focused only on the underwater domain.

The mission of every single project carried out by the Company comes down finally to promote India as a maritime nation and gain boost for enhancement of the country's GDP.

Envisioning the role of academics in advancing the mission of UDA

All other fields say Artificial Intelligence, Information technology start with academics. A student's understanding of a particular domain is what drives them to innovate. The awareness imbibed at a young age will educate the students about specific domains and give them a broader perspective to explore these fields. There are not many projects that are a part of the Smart India Hackathons which revolve around underwater or maritime domain.

The projects that have been undertaken like the UDA Summer school where students are taken to Goa, Pune on field visits to show them the ports, acquire a brief understanding of the performance of India in this domain, the improvement needed and an outline of the challenges faced contributes greatly to this mission. Various topics are allotted to the students for them to undertake different projects. Various Internship opportunities are offered. Although the company has interns from IIT Bombay, IIT Delhi, BITS Pillani and other prestigious universities, students from all universities are treated equally.

Impact created through skilling programs on Workforce Development and capacity

The current set of knowledge that the students possess in the domains of AI, computer science, healthcare, can be applied in the underwater domain. For example, someone who has an understanding of healthcare sector can research and provide a remedy for the mental impact of noise on the divers in the underwater domain which is much neglected.

Students have a lot of knowledge but the effort of the organization has always been to root them into a cause innovatively and providing solutions that are future centric. People come according to their interest and capabilities in the policy or technology fields and the internships provided operate in the real world and are application based. Students are assisted with completing their Masters and carry on research projects in depth and thoroughly. The goal is igniting a fire in students for furthering their knowledge and not just for getting placed in reputed institutes.

There is a holistic skilling program put in place. Organizations like Bharat electronics, many naval candidates refer the same for improving their current products, processes and development, imparting knowledge which is not known by a lot of people.

About the Vessel Traffic Management System

Their recent work is Vessel Traffic Management System. All the vessels are to follow a set path between countries and not supposed to wander around. Mr. Shridhar and his team created an algorithm with the help of data science which takes the historical data of a particular vessel and it routes the expected route that a vessel should be at a particular position, so even if their transponder is off , it is possible to check if the ship has gone out of the path and conclusion can be drawn on what is the path it should have been followed instead, the location where it is heading at a particular moment which helps in figuring out if the vessel is involved in some illegal activity and prediction of any risk of collision , real time navigation and then suitable aids can be provided. He broached that the definition of UDA is a comprehensive one. Making people have their own definitions would no allow the focus which is required.

➤ Interaction with Ms. Nishtha Vishwakarma (Communication and Advocacy Lead)

The role of Ms. Nishtha Vishwakarma involves Social media management, UDA Digest, website, assisting in publication summaries and making the technical jargons, terms or complex concepts into a simple and easily understandable language for the target audience. The target audience, is not just the people belonging to the research domain, or experts of the field but also beyond these streams. Public relations is also a part of her profile in the company.

She has been associated with the company since February 2022. She wrote a position paper about 'Blue Economy' which she co-authored with Dr. Cdr. Arnab Das. The copies of this paper were shared with the Capacity Building Commission of India which is part of the Prime Minister's office. This was a indeed a successful endeavor. She is involved in simplification of a position paper and its publication currently.

About the practical aspect of trainings provided

In addition to conducting events and webinars, the company has actively been conducting numerous field visits. She shared a memory from the Khadkwasla lake experiment which was executed on the field. Field visits and exhibitions were conducted in the month of March. The involvement of multiple research fellows, interns in the projects undertaken and their active participation and involvement in the projects and visits is a clear sign of the impact being created. The knowledge and awareness created amongst the student community, interns and the commendable on-ground exposure that the company provides, is a remarkable feature that makes it stand out.

The increasing reach via students, freshers in the field has a trickle-down effect that is enormous. Not just the policy makers need to be reached out, but the students and interns are made wary of the real word issues and challenges. She strongly asserted that apart from the publications, research work carried out by the MRC, it has created a significant on ground impact as well.

Positive outcomes of the projects undertaken

The work of the Company has been highlighted at the top level government institutions. The company has been creating e-learning modules for various platforms. The awareness about the work done and successfully executed has been made at the very topmost level which is very crucial. Hence, the opportunity of being able to create awareness and thereby interact with the top level of the policy makers of the government is surely a positive impact. Also, the positive outcome of this opportunity is that the organization can convey their cause of UDA and vision through their work to the decision makers of the nation.

There are many organizations that are vocal about the land situation, but very few organizations speak about the underwater domain. The reach is expanding constantly and the company has reached out to many experts in the field as well as interns, students and currently, the build of the organization is strong and continuously collaborative. The company had partnered with UNESCO and was invited to the first Biosphere Reserves Day. The company was a partner organization for this conference. The collaboration continued and it was part of the second event as well that was held. Arnab sir and Ms. Catherine were a part of this conference. This is proof enough that MRC does not make affirmative collaborations for only one off instances, but continue to do it for long.

Assistance provided to interns while their association

Some of the researchers who had worked with the organization are currently studying at high end and reputed universities. A researcher completed her fellowship and when that researcher mentioned about her internship and association with the company at the time of her interviews, it was highly appreciated and gave her an edge over others.

Interns from IIT Delhi and other prestigious universities have continued their association with the company even after their internships. The best part about pursuing an internship is that there is nobody who is going to bind you to work and execute in a certain way which is restricting. One may be provided with a format and necessary guidance but there is certain amount of freedom provided which is necessary for any researcher. Researchers are given flexibility and any additional inputs suggestions are welcomed.

Growth of the organization throughout the years

The growth of the team from the time her association commenced to now is tremendous. There is an increasing number of applications that are received for the collaborations and internships. The communications team itself has expanded. There has also been a steady flow of articles which is a very important arm of the organization. There has been great progress of the organization in terms of engagement, webinars, interaction, achievements. Her personal achievement is being given the opportunity of editing the UDA Digest. "The confidence of being able to do this was instilled in me by Arnab sir. The journey from starting out and getting the confidence to start the editing process, to now reaching over a 100 articles, the journey has been remarkable. My work involves communication and she found a great space for herself in MRC that covers a 180 degree perspective and reaching out to wider audience which includes the technical as well as the non-technical background.

➤ Interaction with Ms. Catherine (Research and Publications Head at MRC)

Ms. Catherine joined the organization about two years back, and started her journey as an intern in the organization. She worked on the Indus and Brahmaputra water management project. The outcome of the project was the creation of a confidential documentation for the Government of India for their bilateral and diplomatic usage. The research was based on a critique on the Indus water treaty and various dimensions related to the relationship of India with China and Pakistan. She then started working on various aspects of blue economy wherein she worked with Amb. Anup Mudgal (Retd) on critical chapters for the Task force report like marine energy transition, marine spatial planning and marine biotechnology and continued developments there with a position paper on marine spatial planning. She is currently working on e-learning modules on blue economy and coordinating and managing the work of research fellows. Her qualifications are Bachelors degree in Physics, liberal arts program, Masters degree in water science and policy. She has been Associated with the company for around two years.

About her project and interaction with governmental agencies

She has worked on a project that involved the development of documentation for governmental agencies which became their aid for internal analysis of Indus and Brahmaputra water management, and writing a position paper on marine spatial planning.

She asserted that the modules and websites on underwater domain awareness are accessible by over three million government officials. All fellows are developing e-learning modules based on their project which will be uploaded on a separate website hosted by the company. The participation in the UDA Summer school every year is increasing and summer interns are also joining in large numbers for two month internships where the research fellows guide the interns on a sub topic of their research and the interns are to deliver research notes and receive guidance and feedback for the same. The organization is working towards disseminating knowledge through various channels and increasing engagement with policy stakeholders and government agencies giving rise to a lot of real world feedback.

The students who are summer interns have opportunity to present on the topics as per their interests and many academicians and experts provide elaborate feedback on the same.

Recent developments in the projects

There is a prospective project in which the company is trying to develop skilling modules for Assam government the organization is moving forward in a very organic way. A handbook on UDA skilling modules, including Post graduate programs, diploma programs and vocational studies related to UDA, is created which encapsulates everything which will be shared with students and policy makers.

Interaction With Research Fellows

➤ Interaction with Mr. Shlok Nemani (Research Intern at MRC)

Mr. Shlok Nemani is currently pursuing the final year of the Dual Degree Integrated Program for Electrical Engineering at the prestigious IIT Bombay. He has been Interning with the company on the topic of analysis of shrimp and sea weed farming. His work revolves around Aqua culture industry in the Indian ocean region.

About the mission of his project

The mission is trying to build a framework that is sustainable, economically rewarding as well as one which looks into the environmental degradation associated with the growth of aqua culture in India and the impact of shrimp farming and integration of sea weed into shrimp and making it more profitable and sustainable.

Recognition received of the project undertaken

His work profile involves a SWOT analysis of Indian ocean region and framework that can predict the growth rate of shrimp and sea weed in Indian ocean region based on the climate and weather in that region. This work was presented in the World Aqua Culture Conference in the 2023 edition. The intention of working on ground level to conduct experiments to collect data which will help to build an indigenous database which contains the complete growth profile of shrimp based on the different type of aqua culture for instance the cage culture or open pond culture and how growth rates of shrimp vary. He has been working on e-learning modules to disseminate the facts that have been collected.

Mr. Shlok has been associated with the company for about a year. The projects that he has been a part of involve building the framework that can predict the growth rate, weight of shrimp and sea weed in Indian ocean region based on the climate and weather in that region which was accurate and well received at the World Aqua Culture Conference. The predictive analysis, good achievement and models are available on public domain, via applications for benefit of farmers well.

Interaction with stakeholders during the project

His work involved many farmers in the aqua culture, in case of open pond aqua culture. These small farmers are a highly vulnerable part of the chain who suffer climate changes and other related challenges. For the purpose of bringing technological advancement and to enhance productivity, the team is working for a higher economic productivity which will lead to a better lifestyle for farmers. In this way the farmer community is the true stakeholder in this project.

About the Internship opportunities provided by the organization

The intern is given an opportunity to fully explore the existing literature, brainstorm upon all ideas and come up with the objectives on his own, proposal of new objectives, problems that can be solved are welcome. “When I joined as a fellow, I had been given a predetermined objective depending upon the stakeholders, the path became fixed and a whole lot of maturity and reasonability was instilled.”, he asserted.

He shared that his work started with analysis of productivity differences between the states, figuring reasons why some states are performing well, identification of gaps and proposal ofa tool which can help farmers by amalgamating technological advancement with the conventional practices by the farmers which will increase productivity. Integrating digital transformation which will act as a binding tool with domains of underwater, in his opinion is of great relevance.

He spoke about the feedback received on the models , which were proved to be reasonably accurate, but should also take into consideration the ground realities. The team was made aware of the acceptability of the models by the community. Suggestions involved putting sensors on ground, collecting data and then showcasing that the models are correct and highlight errors, if any.

Challenges faced during the research

Challenges like connectivity issues occurred while conducting research in Malvan. “These technological and demographic challenges, linguistic barriers are hard to overcome and one needs to be well aware of them” , he mentioned.

He praised the collaborative projects that are promoted at MRC. He asserted that the quality of research work and research notes has increased considerably and the research team is built in such a way that they thoroughly examine and provide crucial feedback. He highlights his personal growth by stating that in spite of being a fresher, MRC had still given him more than a year worth of experience. “The experience gained at MRC, projects, knowledge, learnings add value to my resume, provide an edge and widen my opportunities to build my career.”

➤ Interaction with Mr. Romit Kaware (Research Fellow at MRC)

Mr. Romit Kaware has been associated with the company for around a year. He had earlier worked on the topic of sediment classification and is currently working on Sediment management, which in his opinion is an integrating approach. He is also involved in the development of e-learning modules.

He has been developing a Sediment Classification Model, mathematical models, data analysis, models that can be used and are relevant to the Indian ocean characteristics. He has also been involved in sediment bearing pressure analysis. The company has data from the studies conducted at the Khadakwasla lake at Pune and he is actively working on incorporating that data into the models to improve predictability of the models.

➤ Interaction with Ms. Divya Rai (Research Fellow at MRC)

Ms. Divya Raj works in the domain of climate change and its impact on the underwater domain awareness. She explained the importance of adoption of underwater domain awareness framework in order to mitigate the impact of climate change within marine lives. She has formerly worked with MRC on a fellowship on topic of the need for underwater domain awareness in various bilateral, trilateral and multi-lateral constructs. Her current work mainly involves the study of aspects and impact of climate change on the underwater ecosystem of the oceans. She is associated with MRC for over 8 months.

About her research project

Ms. Divya has been involved in the creation of a concept room for The Indian Ocean Rim Association to include the underwater domain awareness framework for various divisions. She has also worked with High commission of Maldives, concept note for IORA division where inclusion of UDA framework was explained, and drafted an article on the need for UDA which was published and appreciated in and outside India. She mentioned that the responsibility of publication of maximum amount of research papers and articles is done by the organization “I have backed personal opportunities like fellowship in Hawaii in a think tank because of experience gained from MRC.”, she asserts.

About her research project

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Opinion on the overall Contribution of MRC

She spoke with pride about how the presentations given by fellows on various platforms, help people understand the nuances of the underwater ecosystem. The papers published help the student community as well as the policy makers in drafting policies according to the need of the underwater domain and hence implementation of the researches is of extreme importance and has been at the forefront. The research papers drafted by fellows can be integrated by finding a point of commonality in between them which can help in understanding concepts from all perspectives and can then be presented to the policy makers for drafting policies.

➤ Interaction with Ms. Aradhya Kapoor

Ms. Aradhya Kapoor has been associated with the MRC for a tenure of more than a year. She initially worked as a communication and advocacy fellow wherein her role was engaging with stakeholders, maximizing outreach, coordination for CSR outreach program, publishing UDA Digest articles. She is actively involved in the proposed SSE registration, ESG and its relevance in the underwater perspective and coordinating for writing various position papers. Now, she is focused on the e- learning module, literature surveying, directing the policy makers on ground water mismanagement, fresh water mismanagement and urban flooding.

About her research

The survey which was undertaken was based on the online databases, and some inputs from experts in the field. Her research is based on small decisions taken in day to day life which has an impact on the underwater domain as a whole. The small decisions which not only affect at the individual level but the significant decisions that are taken on a government level are studied. The broad goal is to inform the decision makers, relevant stakeholders at the Government level to think and assess the small decisions that they are taking for the community by providing them a structured approach across various underwater domains like ground water mismanagement, freshwater mismanagement, urban flooding, plastic pollution and providing them with the UDA framework as a tool for assisting them in taking the appropriate decisions. This serves as an aid in decision making and also serves the community by enhancing water management.

India is ranked globally as the 4th largest consumer of ground water because of rapid urbanization and industrialization. There are rapid changes in the consumption pattern. The government has introduced various policies to support farmers and make India a food sufficient nation by enhancing agriculture. The Green revolution took place in India for the purpose of pivoting India from a food deficiency state to food sufficient nation. There was a need of protecting the ground water because 2/3rd of ground water which is withdrawn globally by India is used for irrigation purposes. To support the excessive demand of the increasing population, there emerged the concept of ground water pumping. Statistically, around 600 Crore people in India are facing water scarcity because of ground water depletion. The government is focused at achieving the ‘food goal’ and the water scarcity issue goes rather unnoticed. Ground water contamination is leading to water scarcity. The reason for this is industrial discharges.

Some of the governmental regulatory frameworks in India are allowing the discharge by industries of their effluents into the rivers and oceans and which ultimately seeps into ground, contaminating ground water as well which is a challenge. One such challenge is urban flooding. Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas (like cities), caused by rainfall overwhelming the capacity of drainage systems.

Opinion on the operation and advantages of the UDA Summer school

The company does not only impart academic training but focuses at the on ground training and skill development of students. Effort is made for imbibing the industrial skills and learning about the real world. Interaction with industry experts and grooming creates a certain leverage. Research fellows get opportunities to participate in a research with the organization which provides them an edge to understand their interest and explore the same.

She concluded with asserting her experience and the growth of the organization, "the growth has been commendable, we have proudly collaborated with UNESCO. Various webinars, associations have opened avenues of growth and opportunities. The UDA Summer school, valued trainings, participation of interns has been increasing steadily. I have been working on e-learning modules for the participants which is a great opportunity as well".

➤ Interaction with Ms. Rishika (Research intern and Fellow)

Ms. Rishika has been associated with the company in the two month summer internship and has been part of the fellowship program as well. She is from a mechanical engineering background.

About her research experience

She started her research with sediment classification, current state of the art things which other countries are implementing for sediment classification and how we can implement the same in the Indian scenario. During her fellowship, she focused on three major case studies on Jawaharlal Nehru Port, Konkan coast, Brahmaputra River. The corporate internship experience at MRC, was her first professional internship. Through the course of her association with MRC, she developed an insight in doing market research, her best experiences were giving various presentations to industry leaders and government officials from the Water Ministry who were guest lecturers, speakers at different seminars and conferences. MRC gave her an opportunity to showcase her research in front of dignitaries which she feels has been a great learning experience.

She mentioned that the fellowship is more specific in the sense that more specific and ascertained projects are allotted. During her internship there is limited time so it is difficult to go deeper in the subject. Her work revolved around literature surveys but in her fellowship there was a chance to interact with people, raw data collection and there was scope for deeper research as opposed to conducting only literature surveys. The research undertaken during her internship acted as a base for her fellowship research and she built up on it.

During her fellowship she submitted reports, and presented in front of guest speakers and stakeholders. She remembered particularly a guest from Water Commission of India who was very positive about the showcased work ,and stated that it should be researched further. The case study was based on Jawaharlal Nehru Port, Konkan coast, Brahmaputra river. The supply chain management in Jawaharlal Nehru Port, the skill gap which currently exists in the workforce was identified. She also worked on articles which focused on up-skilling required in Sediment management. Though it was focused on the specific sector, she said that some of the conclusions could be applied in other sectors in the maritime domain as well.

Sediment management-an integrated approach

She has been researching in the field of sediment classification and management. Her research involved the integration of Artificial Intelligence in Sediment management. During her fellowship she was working on the geospatial analysis with the help of sediment data which was already collected. She worked with other fellows who were working on geospatial mapping and they exchanged research papers and articles. There was usage of Google classification maps to analyze which part of India has what type of sediments, satellite imaging etc. She also wrote an article on the importance of integration of satellite imaging, drafted proposals for the ministry, with the help of case studies and convinced investors, corporates, by explaining the importance of the sediment classification systems in use by the other countries, various gaps, loopholes in the current Indian systems and how they can affect in the long run.

Gender inclusivity in the organization

The work culture in the organization is quite equal. Opportunities are given purely on the basis of skill and what you bring to the table so one never feels like it is an issue. “The best thing I like is that even if there are many people in the organization and Arnab Sir has a lot on his schedule, he makes sure that he interacts with everyone on a one to one basis and gives feedback”, she asserts.

Skilling framework

She was involved in the development of the skilling framework. The framework included short term and long term initiatives. Short term one day conferences, one day student presentations, round table discussions, weekly lectures, quizzes etc. were included. Field trips, site visits were organized for better insight and to provide practical aspect to the academics. Take-home assignments for students who were not available physically to join the courses were also included.

Overcoming the challenges faced

The major challenge faced during the research was the unavailability of public data for Indian coastlines and riverbeds which could be analyzed. She completed her internship at the time of the pandemic so she could not physically be present for analysis and data collection. During her fellowship she focused on drafting of the proposals and when she referred to data from western countries, researches currently in process in other countries like China, she was unsure about the feasibility of acquiring the required equipments and requisite level of workforce in India and whether the proposed things will be adaptable for the Indian mindset.

She gave an example of the Brahmaputra coast, where there are local people who get affected, even though not directly involved in the projects, but are the stakeholders, whose lives get affected whenever a major project is being introduced, may it be their displacement from their homes, or livelihood getting affected. The team helped her to overcome these challenges and the research was an overall success.

About the growth of the organization

The organization brings together people from different backgrounds like engineering, bio-medical, information technology, software etc. This inclusion allows different points of view which helps in ideating. Earlier there were few people and four to five interns only but when she joined back as a fellow, she was surprised to see the growth in the number of associations, presentations, reach and the overall growth was drastic in a span of one year. She was proud of growth of the organization. Personally, the experience helped her in improving writing skills, team building capacity and pre-view of the professional setting.

In conclusion she asserted, "The guest lecturer was really impressed with the MRC's work and wanted to see the research going forward and showed excitement about our projects. I was surprised to see how much impact MRC has at national level."

➤ Interaction with Atharva Nagarkar (Intern)

Mr. Atharva has completed a six month internship with MRC. He possess a degree inMechanical engineering. Hisinternship role involved working on acoustics, vibrations and noise on marine vessels, study of different transfer paths by which noise and transmissions are transmitted such as air borne, structure borne etc. These paths were researched upon before and he was tasked with quantifying the noise and vibrations on marine vessels and study of how they are transmitted through different transfer paths and analyzing the impact on different areas of the vessel. Mr. Shridhar and Mr. Arnab were his mentors. The internship gave him a real life experience of handling the simulation software. It acted as an ally in gaining his current role and helped him stand out from other candidates because of his already acquired technical knowhow.

Motive and social impact behind his research

The motive of his research was the identification and assessment of unnecessary noise and vibrations which could go out of the transmission paths and affect other areas of the ships. This could also affect the human life, structures and overall ecosystem of the shipping sector. Tolerance levels or limits were found which were considered standard and safe for the noise and vibrations. If this noise was generated beyond the levels, then they are likely to cause hearing loss and issues to aquatic and marine life surrounding the ship environment, damage to structures which might result in other consequent losses. The identification of such tolerance limits was the overall goal behind the research. The underwater radiated noise (URN) directly affects the water bodies in our society. The fish, plant life, oxygen levels get affected due to the excessive noise and the project undertaken focused on the preservation of all these aspects of the marine life by identifying the tolerance levels. Also, the human impact, adverse issues caused were analyzed and mitigation of these issues was focused upon. There was a clear alignment of his project with the organizational vision.

Benefit of internships provided by MRC

This was the first internship that Atharva was a part of. It was his first exposure to the professional environment. He understood in depth, the process of execution of a project, sticking to a timeline which was a beneficial skill for him. A lot of technical exposure and guidance was provided with the help of accessibility to various resources provided by MRC and the networking opportunities also played a huge part in the enhancement of the internship experience. One can also learn team building skills and networking skills through the training programs.

His contribution to the UDA Digest

His contribution to the UDA Digest:
Mr. Atharva finds the initiative of UDA Digest to be very interesting. It is a collection of different articles on varied topics related to the blue economy. The experts from different domains know the technicalities of the topics well and their experiences in the field help in collecting information, and creating awareness in the domain of blue economy.

➤ Interaction with Akshita Mangal (Research Fellow at MRC)

Ms. Akshita joined the company as a Research Intern and is now working as a Research Fellow.

About her Research project

Her current project is based on the topic of ambient noise mapping wherein efforts have been made to fasten the noise calculation of a particular ship in the Indian Ocean region specifically. She has worked on transmission loss during her internship and is currently working on the source level. The interaction threw light upon the significance of developing a machine learning model which is fast, instead of going into cumbersome models which are time consuming.

She has worked on a report that concluded the validity of the model developed by the company by proving it to be in congruence of the recorded actual data. Ms. Akshita has completed her two month internship and joined as a Research Fellow since January 2024.

“MRC helped me in understanding the practical applications of our academic curriculum. The projects fascinate in the way they have created impact, foreseeing my own project to do the same in the near future. Even though work is specific to Indian Ocean region, it might have an application worldwide. We do speak about air, noise pollution and the environment but impact needs to be created in the marine lives and marine ecosystem as well. The company is helping my career and also assisting in creating a significant social impact”, she concluded when asked about the impact of the company on her personal growth.

➤ Interaction with Ayush Sawadh (Research engineer)

The work profile of Mr. Ayush involves the management of the back end structure of the company, operations, internship coordination and website management. He has been associated with the organization for a tenure of ten to eleven months. He has also contributed to the crosschecking of articles to be published in the UDA Digest and checking for plagiarism in the articles. He has also provided guidance in the UI Design of the APY Tool.

Highlights of the Research projects that have created impact

There are around 66 research projects in the repository currently and 500+ applications are in line from the graduates of various reputed institutions. The significant project currently is the APY (Area Production and Yield) tool which deploys sensors in the coastal regions where shrimp farming is carried out. It takes certain parameters like temperature, oxygen level, PH levels of water and gives a detailed predictive analysis of the effective yield and survival rate so that farmers can get a useful feedback on their farming methods. Mr. Shlok, from IIT Bombay who was an intern at MRC has been researching on this in detail and the tool is ready. The current work involves its implementation.

About the project involving Shrimp farming

India is the 2nd largest producer and exporter of shrimp, hence solving the issues faced by farmers while carrying it out is very crucial. The APY Tool acts as a great ally to the farmers for increasing effectiveness and efficiency while farming. The process involves identification of right areas and regions for shrimp farming and then deploying sensors which collect real time data. The farmers do not have to manually put labor into this analysis and the sensors serve as a good source of information. The sensors feed the collected data to the AI model and simulate the data which gives predictive results. The farmers can easily understand the feedback, flaws and correct them to improve the farming process as a whole.

Skilling ecosystem and government collaborations

There are continuous and conscious efforts by the organization for awareness of the youth and uniting all the young minds. Offline and online training programs, internships are offered to students from different domains. Their skills are developed beyond academics. The MRC is focused to set up training programs for students from the coastal areas so that they can carry on their family legacy of shrimp farming, enhance the effectiveness and help in digitalization of processes. E- Modules are put in place and students get a better understanding of different maritime related topics. The Underwater domain course has ten modules in aggregate and has been uploaded on government platform. MOU has been signed with the Capacity Building Commission for the same. Many government officials have enrolled in the same. Several dignitaries participate in the webinars and workshops that are conducted...

Interaction with local community

The team had visited the Malvan coastal region and interacted with several farmers. They are restricted to the specific farming methods and need help in digitization of processes. The tools created will assist in reducing man power with the help of sensors.

➤ Interaction with Jay Pinjarkar (Research engineer)

Mr. Jay is associated with the organization for a period of seven to eight months. He has been working on the MSP (Marine Spatial Planning) tool that will be beneficial to all the stakeholders who will be related to the maritime domain. His work involves website management, data analytics, MSP backend and frontend structure and tracking the outreach of the organization.

About the MSP tool

The MSP tool can be used in the mitigation of ship noise in a specific region and for decision making. The tool has two aspects: one is technical and another is policy. From the policy point of view, there are interns from liberal arts who are working on the aspects like sustainable blue economy, freshwater management etc.

About the UDA Digest

Mr. Jay explained that how the UDA Digest includes various commentaries, short which mention different global events and give a crisp idea to the reader about the global events taking place in underwater domain.

➤ Interaction with Mr. Shreya Waghmare (Research engineer)

Mr. Shreya has been working on the back end structure management. He has been associated with the organization for over eleven months. He has worked on the ambient noise mapping and APY Tool in the development phase.

Projects undertaken

The projects aim at increasing opportunities for the farmers and their younger generation. APY tool assists in shrimp and sea weed farming. Temperature, salinity, pH levels are analyzed and based on that data the approach to farming is suggested. After a term of 120 days, outcome of production of shrimp / sea weed can be predicted and effort is made to reduce manual errors.

Ambient noise mapping and digital transformation

The manmade noise and mammal frequency noise is calculated through sensors to get maximum data. The place, distance is important for analyzing the exact location of the sensors. Digital transformation in his opinion is the automation of processes made easy, less time consuming and efficient for obtaining a better, optimized output. He emphasized the importance of MSP tools and how MRC is leading for the development of this tool and is certainly contributing towards digital transformation.

Overcoming challenges faced while project execution

Linguistic challenges we faced as research was done completely in English and local farmers know only Marathi, Malvani, and Konkani languages. They do not know the technical jargons and technicalities of the research done so it is difficult to explain. They are not ware of any AI tools. Simple language was used to explain the benefits to them. Translation of the reports has been done in local languages for easy understanding by the farmers.

Outreach of MRC

Many YouTube videos, the UDA Digest, knowledge centers, articles, social media engagement, workshops, seminars and e-learning modules serve in the increase in outreach of the activities of the organization. Interested people, themselves, join the activities and workshops.

"The organization is contributing towards simplifying the technicalities and explaining concepts to a person with a non- technical background, I am a result of that. I had only basic information about the maritime domain but came to know in detail about the technical side and how it is important for the country. Personally I developed the ability to speak in front of people at higher positions, dignitaries, interact with guests from all over India and other countries as well. My confidence has been built and I got to learn the professional approach to work. The organizational structure, simplicity, consistency sincerity, inspiration from the team motivated me to work toward the goals of the organization. The MRC is truly keeping it simple and sincere", he concluded.

Interaction with local communities

Disclaimer: The following information about the interaction with local communities has been obtained via the Company and we, (Kanj and Co. LLP) have not been directly involved in these surveys.

➤ Interaction with Mr. Laxman (Farmer)

Mr. Laxman has been involved in shrimp/seaweed farming for a period of one year. He has been actively involved in research projects conducted by MRC.

The following outcomes can be classified as the desired future benefits of the APY Tool for farmers and stakeholders:

Adoption of research-based practices recommended by MRC

MRC has developed a tool to monitor the environmental parameters and farmers can monitor the statistics in real-time using any device (e.g. Mobile phone/laptop) via App/web App and get information about the farm productivity. "Earlier there were no proper tools to detect the environmental parameters or to predict disease or to suggest proper changes in feed, there used to be loss of yield due to disease outbreak. With the APY tool we are able to detect the quality of shrimps and easily identify the rotten one and they can be removed which saves the entre culture batch. The tool has been helpful in predicting the changes in climate and adjusting the feed and other parameters so as to get higher yield and higher production, making it more profitable.", he stated. There has been lesser outbreak of disease as with the tool it is easier to identify and predict at earlier stages.

Mr. Laxman mentioned that he has understood that Shrimp farming alone is not environmentally sustainable as over shrimp farming can cause damage to the waters and disrupt the marine eco system. The dual farming practices which include shrimp as well as seaweed farming co cultivation can be adopted. Both shrimps and seaweed are in two sides of the spectrum. Together they can bring sustainable ecosystem and healthier environmental conditions. The farming practices suggested are quite sustainable and environmental friendly.

Effect on income after participating in the research projects

The farmers have recently adopted the tool, but good change can be seen in the health of the shrimps, which is providing higher yield and healthier/ good quality shrimps thereby helping to get a stable income.

Benefit of the collaboration to the community

Communities have been actively involved as earlier they did not have proper tool for farming and detection at various stages. APY tool helps them to analyse in real-time the condition of their species. It helps them to regularly monitor their environmental condition and health parameter. The species grow only if adequate environmental parameters are available.

The research is based on the technological intervention trough the usage of sensors as endpoints, the data from the farm (Temperature, salinity, oxygen, nutrient content, and sunlight data) is constantly collected. A mathematical model will be hosted that is fed with the collected data and outputs informational statistics about the farm. The farmer can monitor those statistics in real-time using any device (e.g. Mobile phone/laptop) via App/webApp and get information about their farm productivity. Based on the information, the farmer is now able to make decisions to optimize the inputs and enhance productivity.

Feedback or suggestions regarding the research projects

The farmers would like to expand the farming to more marine species and they wish more such tools are available for farming of small fishes/carps and various other species. It will help farmers get a stable and assured source of income from aquaculture.

➤ Interaction with a shipping industry personnel

Influence from adoption of sustainable practices

The research has helped in understanding two major issues: one Underwater Radiated Noise (URN) management and the other effective Sediment Management and Sediment Classification.
URN helped in understanding the issue of ocean pollution, specifically the impact of increased ambient noise on marine life, caused by anthropogenic (human-induced) sources such as maritime shipping and seismic exploration by the oil/gas industry.

Secondly, India has 5,202 large dams and many more small dams and barrages, 111 inland waterways classified as ‘National Waterways’ (NWs) having 20,275 kms spread across 24 States and a coastline of total length 7516.6 km including mainland, Lakshadweep islands and Andaman. There is high flow of water bodies due to concentration of annual monsoon in one quarter of the year causing excessive siltation. Thus, sediment deposition threatens the sustainability from both onsite and off-site damages causing enormous costs to the national economy. Siltation occurs when supply of sediment locally exceeds sediment transport capacity of the water flow. Although sedimentation and soil erosion is a natural process, their rate significantly increases due to anthropogenic activities like poor agricultural practices, construction & expansion of harbour, deforestation etc.

During transport of sediment it gets separated into 3 components: suspended load, Bedload & saltation load. Constituent particles & sampling methods differ for each of them. The composition of suspended load varies with depth. Measurement of bedload is comparatively difficult due to their movement only during high discharge, turbulent flows such as in floods making it hard for field measurement & sediment monitoring. Recreational, economic, and military oceanic applications need qualities of the seabed close to the surface. For locating stable environments and ensuring the proper operation of structures, pipelines, and other installations on the surface of and buried within marine sediments, construction projects on ocean seafloors frequently require extensive knowledge of strength, deformability, and hydraulic, thermal, acoustic, and seismic properties.

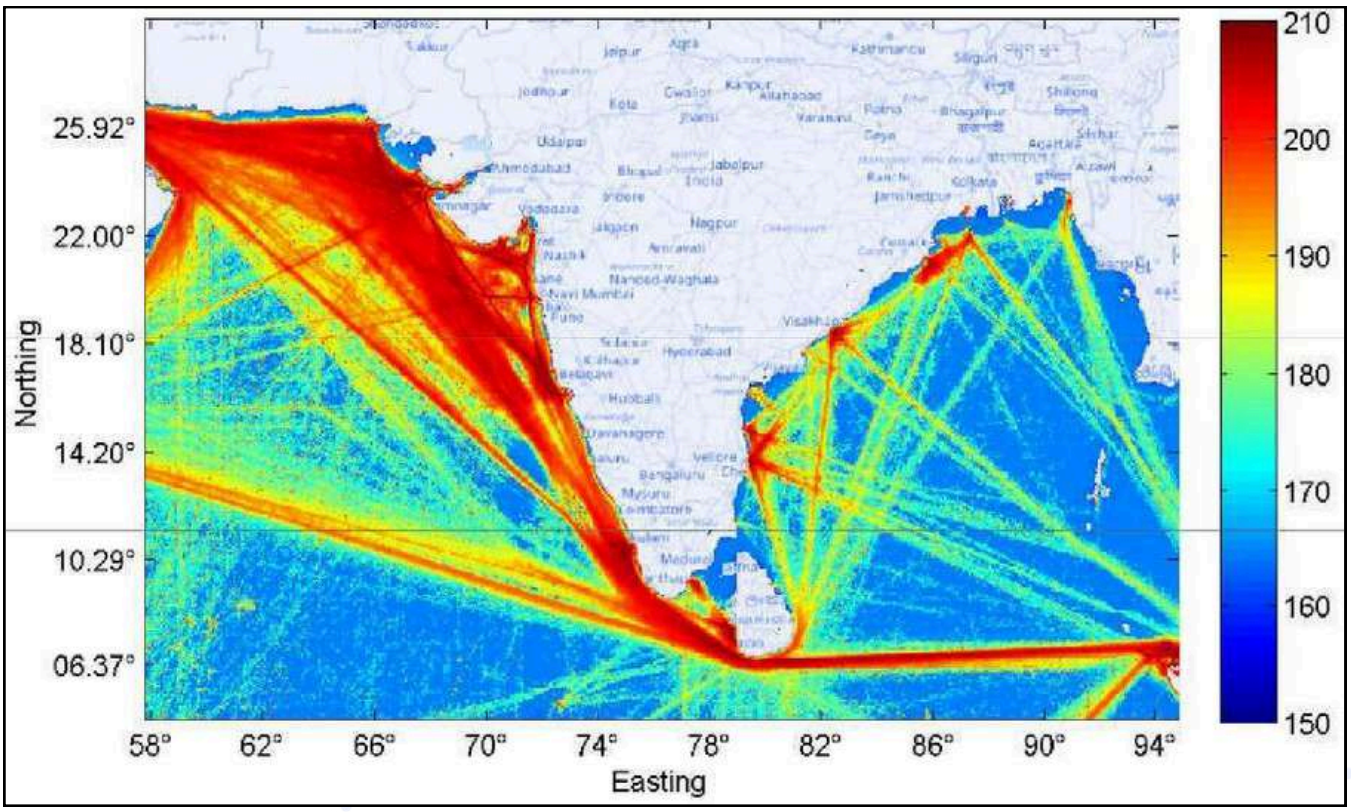
Reduction in the ecological footprint of shipping operations as a result of implementing recommended practices

For URN -The hazards of noise due to shipping, manifesting as acoustic habitat degradation for the marine ecosystem, is well known. There is substantial global attention to the issue and ongoing research efforts are aimed at facilitating sustainable growth for all. UDA attempts to put in perspective the issue of acoustic habitat degradation in the Indian Ocean Region (IOR) with identification of hotspots in terms of extent of degradation, and proposes new means for site-specific assessment of the degradation. It also brings into focus Underwater Domain Awareness (UDA), based on the data gathered from IOR.

For Sediment Management – The importance of developing a UDA Framework for Sedimentation Management is it suggests that Sedimentation Management is a large-scale multilevel problem and requires cooperation from different stakeholders to avoid fragmented approach and formation of policy. Further, it provides various methods for application of Sedimentation Management such as Water resource management, Port management, Inland Water Management and Ecosystem Management. It recommends employing an effective and integrated system of sediment management in every water based project in the country.

Contribution to efficiency improvements in shipping operations

It is often stated that the shipping traffic has an adverse impact on the marine ecosystem due to the resulting acoustic habitat degradation. However, a precise assessment of the extent of damage is required, so that the necessary awareness is spread, and an informed decision-making process is expedited. The urgency of the issue needs to be quantified. Preliminary work done to assess the level of low frequency ambient noise due to shipping traffic reveals substantial increase with a spatio-temporal pattern. The limitations in terms of the accuracy of the results are due to the restricted availability of Automatic Identification System (AIS) data and also lack of high-end computational infrastructure to undertake real-time simulation.



Spatio-temporal low frequency ambient noise due to shipping in the IOR

Sediment Management: Owing to the fast development of sonar devices and signal-processing technology, acoustic approaches for imaging seabed ecosystems have shown considerable promise. The Acoustic Seabed Classification System (ASCS) is a system for predicting acoustic impedance, sediment type, and various specified geotechnical parameters of the seafloor in near real-time. Classification of sediments using acoustic remote sensing techniques is advantageous due to their excellent coverage capabilities and low cost compared to the physical sampling of the bottom. For this, acoustic systems involving active sonars like Side Scan Sonars (SSSs), Single Beam Echo-Sounders (SBESs), Multi-Beam Echo-Sounders (MBESs), and Sub-Bottom Profilers (SBPs) are used. 12 Optical remote sensing is another alternative to map seabed sediments. Depending on the depth, environmental circumstances, area of interest, and available resources, these devices may be hull-mounted, towed, or hung. Autonomous Underwater Vehicles (AUVs) and Remotely Operated Vehicles (ROVs) have enabled seamless surveys in remote places.

Level of collaboration and cooperation between your company and MRC

The evolving maritime governance has often seen each stakeholder trying to individually deploy resources for scientific research and technological development at national and regional levels. The tropical littoral challenges of sub-optimal sonar performance are a major hurdle in ensuring effective UDA for ensuring safe, secure, sustainable growth for all in the region. Effective UDA will also allow us to navigate sustainable growth and ensure minimal acoustic habitat degradation.

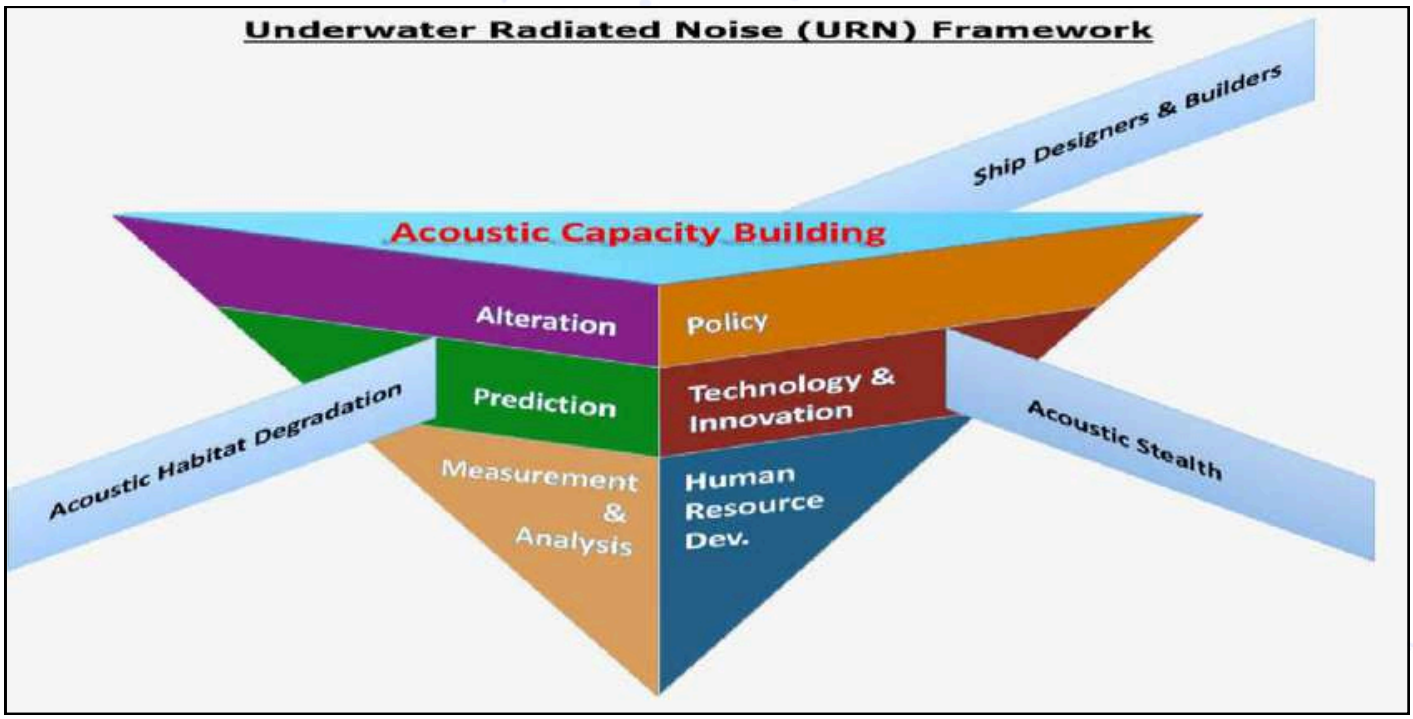
Value and effectiveness of the guidance provided

The UDA framework proposed in this information document suggests pooling of resources and synergizing of efforts across stakeholders to optimize the resource deployment for effective UDA. The four stakeholders – the national security apparatus, blue economic entities, environmental regulators and disaster management authorities, and science and technology providers - need to come together under this proposed UDA framework. They need to focus on acoustic capacity and capability building to be able to enhance sonar performance to facilitate efficient resource deployment across multiple applications. The framework also provides a new way ahead to address the socio-economic challenges in terms of career opportunities for the young generation in the region High research funding requirements for marine environmental issues in the region will be better served by the UDA framework proposed in the document.

Environmental initiatives that influenced the perception of their company in the communities where you operate

Underwater Radiated Noise (URN) management

The UDA framework for URN management is a critical way ahead for stakeholder integration for developing effective acoustic capacity and capabilities. Acoustic stealth is a very critical requirement for warships; the same techniques are relevant for managing acoustic habitat degradation and also for ship designers and manufacturers in the business of making better ships in all aspects.



The URN management for acoustic stealth of warships has been a very well developed domain for quite some time. The same noise control techniques for design as well operational aspects are also relevant for acoustic habitat degradation management. There is requirement for a policy, technology and innovation, and human resource development to effectively address URN management. The other aspect relates to the stages of URN management, from measurement and analysis, to prediction and deception (in naval terminology) or alteration (in case of acoustic habitat degradation). Since the local medium will play a major role in the propagation of the sound from the source to the receiver, a source- path-receiver study is equally relevant. Acoustic capacity and capability building will remain key for effective URN management and the larger UDA framework.

Sediment Management - According to the annual survey during the year 2020 based on the sedimentation rate across 264 reservoirs in India, 0.95% of gross reservoir storage is being lost to sediment deposit annually. Sediment tends to accumulate at all levels (Dead and live storage) within the reservoir but the pattern varies from site to site. The average annual percentage loss in dead storage is 2.39% while in live storage it is 0.67%. Loss of reservoir storage results in reducing flexibility in generation and make hydropower plant dependent on seasonal flows. Apart from storage sediment accumulation also block low level outlets and clog spill way tunnels leading to reduction in spill way capacity. Sediment can also damage turbines and other equipment through erosion. Generally sediments coarser than 0.20 mm size is harmful for turbine blades.

Feedback on the collaborative efforts in the context of environmental cause

Acoustic habitat degradation is a real issue and requires a focused approach from all levels. Precise assessment of the extent of degradation, and identification of the trends, global regulatory provisions and the possible way ahead needs to be undertaken.

Massive awareness initiatives through workshops/seminars across policy makers, practitioners, stakeholders, academia and others need to be undertaken on an aggressive scale.

Institutionalization of fellowships for acoustic capability and capacity building across multi-disciplinary, project based research and development initiatives with a significant field experimental component for real world problem solving.

Sediment Management

Each stakeholder is required to enrich the process by providing his share of ideas and solutions which increases the support for the proposed policy. Precise sediment classification can facilitate effective desiltation and can also help in preventing further siltation by providing deeper understanding of the siltation process.There is a need for development of a comprehensive database management system and application & site specific measurements.

10.2 Summary of Impact Created

The Foundation for Underwater Domain Awareness is committed to advancing knowledge and innovation in the maritime sector through cutting-edge research, collaboration with industry partners, and dissemination of research findings to relevant stakeholders. As part of its ongoing efforts to evaluate the effectiveness and impact of the research initiatives, a test-based impact assessment survey was conducted to gather insights from stakeholders / beneficiaries regarding the perceived relevance, utility, and influence of the Company's activities. The impact created by the Company on various stakeholders / beneficiaries is multifaceted and includes both direct and indirect, short-term as well as long-term effects.

Impact creation through Research

The research findings have led to the development of innovative technologies, processes, or practices that improve efficiency, safety, and sustainability within the maritime industry. Additionally, the industry partners have benefitted from collaborating with the Company by gaining access to specialized knowledge, facilities, and research capabilities. Research findings can provide evidence-based insights that inform policymaking and regulatory decisions related to maritime transportation, environmental protection, and maritime security.

The Company's activities have immensely contributed to the Country's economic development by supporting initiatives aimed at enhancing maritime infrastructure, promoting trade, and fostering innovation within the maritime industry.

The issues relating to India's maritime security have been discussed at lengths at national as well as international forums and meetings after the 26/11 terrorist attacks on Mumbai. The Company's research activities have contributed to India's maritime security issues such as piracy, smuggling, and maritime terrorism and is in the process of proposing various policy decisions to the Government agencies to develop strategies for safeguarding national interests and protection of maritime assets.

Impact creation through Academia

The Company believes that knowledge creation is the best way for creation of awareness on any issue. The advancement of knowledge in maritime-related fields through research and innovation leads to generation of new theories, methodologies, and empirical findings.

Academic institutions as well as other industry stakeholders have greatly benefitted from collaborations with the Company by offering students opportunities for hands-on research experience, internships, and access to cutting-edge research facilities. Along with students, the Company has provided numerous networking opportunities to researchers, academics, and scholars for fostering interdisciplinary collaborations and knowledge exchange.

Environmental and societal impact

The activities of the Company are aimed towards creation of sustainable maritime practices, pollution prevention, marine conservation, protection of marine ecosystems and the promotion of environmental sustainability. The Company has been successful so far in creating awareness among local coastal and riverine communities regarding the maritime issues primarily relating to shrimp and seaweed farming. It is known that shrimp and seaweed farming is a viable alternative for coastal communities, diversifying livelihoods and reducing pressure on fisheries and can provide employment opportunities and boost local economies, particularly in coastal communities where traditional livelihoods may be under threat, and therefore the Company has been continuously taking efforts for its promotion.

The Company aims towards creation of awareness about educating farmers and stakeholders about best management practices to improve shrimp health, prevent disease outbreaks, and increase productivity sustainably. The Company has repeatedly emphasized the importance of sustainable shrimp farming practices to minimize environmental impact and highlighted various methods to reduce waste and reliance on antibiotics.

Impact creation in the farmer community

The dual farming practices suggested which include shrimp as well as seaweed farming co cultivation cause a valuable impact in building a sustainable ecosystem and healthier environmental conditions. The farming practices suggested by the company are sustainable and environmental friendly. A positive change can be seen in the health of the shrimps, which is providing higher yield and healthier/ good quality shrimps thereby helping farmers in availing a stable income.

Impact creation in shipping industry

There has been great cost saving, sustainable shipping practices and effective UDA allows to navigate sustainable growth and ensure minimal acoustic habitat degradation.

The pilot project carried out by the Company can be replicated across the globe for assessment and quantification of acoustic habitat degradation. The scale of noise is in dB and provides the indicative instantaneous value for average shipping traffic data over four years from 2011 to 2014. Such an assessment can provide significant inputs for future policy formulation that will aid management of the shipping traffic in ecologically sensitive areas. The noise reduction methods and their effectiveness can also be assessed using algorithms. It is important to note that underwater noise is highly dependent on the local propagation conditions and other local sources of noise. The proposed work accounts for site-specific characteristics to provide a realistic assessment of the situation that will facilitate well informed decision making.

The URN management strategy proposed can be a model for the entire world, including socio-economically challenged nations, to optimize resource deployment and also achieve sustainable growth objectives. The framework provides a new way ahead to address the socio-economic challenges in terms of career opportunities for the young generation in the region and thereby is impacting by creating awareness.

Impact creation in Government sectors

The Company is actively involved in governmental collaborations and has partnered with numerous government organizations. Various government officials have been interacting with and participating as advisors, guest lecturers in the webinars and conferences conducted by the company and have appreciated the vision and mission of the Company as a whole.

Awareness strategies of the Company

Education and Training: Conduct workshops, training programs, and educational campaigns targeting farmers, communities, students, and policymakers to disseminate information about shrimp and seaweed farming practices, benefits, and challenges.

Demonstration Projects: Establish demonstration farms or pilot projects to showcase best practices in shrimp and seaweed farming and provide hands-on learning experiences for interested stakeholders.

Information Dissemination: Utilize various communication channels, including social media, websites, brochures, videos, and radio programs, to disseminate information and engage with diverse audiences.

Partnerships and Collaboration: Collaborate with government agencies, non-profit organizations, research institutions, industry associations, and community groups to leverage resources, expertise, and networks for effective awareness-raising efforts.

Policy Advocacy: Advocate for supportive policies and regulations that promote sustainable shrimp and seaweed farming practices, including incentives for adoption, environmental safeguards, and market access initiatives.

Overall, the impact created by FUDA on various stakeholders / beneficiaries is significant and spanning across economic, social, environmental, and educational dimensions. By collaborating with stakeholders and addressing their needs and priorities, the Company has maximized its positive impact on the maritime community and contributed significantly to sustainable development in the maritime sector.

11. Corporate Social Responsibility

CSR Proposal	Objectives	Impact Projection	Impact Assessment
Acoustic Capacity and Capability Building for Community Empowerment The Acoustic Capacity and Capability Building for Community Empowerment initiative focuses on leveraging indigenous efforts to enhance acoustic expertise within the Underwater Domain Awareness (UDA) framework. This proposal outlines strategies, budget allocations, and impact assessment plans to foster talent development and promote industry innovation in the underwater domain. Its strategic approach emphasizes skill development, industry innovation, and community-driven research to advance the underwater domain's acoustic capabilities.	***Elevating Acoustic Expertise:*** This project focuses on nurturing talent through specialized training and research projects, aiming to advance expertise across various underwater disciplines, particularly emphasizing acoustic signals. ***Industry-Academia Collaborations:*** Facilitating collaborative research projects between industries and academia to drive innovation addressing specific industry needs and fostering knowledge exchange. ***Skill Development and Innovation Initiatives:*** Tailoring relevant programmes to develop specialized skills crucial for industry requirements, fostering innovation aligned with the UDA framework.	Enhanced acoustic expertise is poised to revolutionize the underwater domain, catalyzing transformative changes across communities and industries. Envisioned outcomes include the following: ***Community Impact:*** The initiative anticipates a shift in coastal community dynamics. By harnessing advanced acoustic knowledge, these communities can better understand marine life patterns. This understanding enables the adoption of sustainable fishing practices, preserving fragile marine ecosystems and ensuring the long-term viability of fisheries. ***Industrial Advancements:*** Acoustic innovations hold the promise of revolutionizing various sectors reliant	***Talent Pool Development:*** The assessment framework involves a thorough evaluation of talent progression across diverse disciplines. This comprehensive review aims to measure not only the acquisition of technical expertise but also the application of acquired skills within the underwater acoustic domain. Quantitative and qualitative assessments are conducted periodically to gauge the depth and breadth of talent development. ***Industry Collaboration Outcomes:*** FUDA proposes to employ robust metrics to monitor and analyze the impact of industry-academia collaborations. These metrics will be designed to measure the degree of

Long-term Engagement: A continuous engagement framework encompassing regular workshops, mentorship programs, and knowledge-sharing platforms. This ensures that communities remain empowered, informed, and actively involved in the evolving landscape of underwater acoustics.

Acoustic Talent Development: - Specialised training and research projects (budget allocated as per specific needs). Talent development across diverse fields with a keen focus on harnessing acoustic signals.

Industry Collaborations and Research Initiatives: Collaborative research projects with industries and academia. Encouraging innovation within industries through specialised skills.

on underwater acoustics. From marine research to shipping and defense, the enhancement of acoustic technologies could help elevate efficiency, minimize environmental impact, and substantially improve safety measures, thereby ushering in an era of unprecedented advancements.

innovation resulting from collaborative projects, as well as the effectiveness of partnerships established between academia and various industries. The aim is to track key indicators that signify progress, innovation-driven outcomes, and the sustainable nature of these partnerships.

Skill Development and Innovation Success Metrics: Assessment methodologies will employ a rigorous evaluation framework to determine the efficacy of skill development programmes and the tangible outcomes of each initiative. FUDA proposes to conduct a detailed analysis to measure efficacy in imparting specialized skills relevant to the underwater acoustic landscape. These evaluations will help quantify the innovative solutions generated through the application of these acquired skills,

	Skill Development and Innovation Programmes: - Customised skilling programmes emphasising critical skill development aligned with industry requisites. - Encouraging innovation aligned with the UDA framework (budget allocation based on programme requisites).		ensuring a clear understanding of the project's impact on fostering innovation.
Policy Intervention for Good Governance The Policy Intervention for Good Governance initiative aims to integrate Marine Spatial Planning (MSP) and the Underwater Domain Awareness (UDA) framework, focusing on sustainable resource management and empowering marginalised communities. Addressing the limited understanding of our underwater world, this initiative leverages MSP and UDA, crucial for sustainable marine	***Technology Integration:*** Integrate innovative technological solutions to enhance community engagement, skill development, and sustainable resource management within the Marine Spatial Planning (MSP) and Underwater Domain Awareness (UDA) frameworks. ***Community Engagement and Workshops:*** Conduct quarterly workshops engaging stakeholders at local, state, and global levels to foster a deeper	Implement a robust framework to measure the impact of the fellowship programme on participants' skill enhancement and their contribution to policy interventions aligned with MSP and UDA frameworks. ***Needs Assessment and Partnership Identification:*** Assess the specific skill gaps within communities and identify suitable partners among local institutes, governments, and Industry bodies.	The effectiveness of the Company's workshops will be assessed through an integrated approach involving consistent monitoring of attendance rates, policy adoption rates post-workshop sessions, and regular stakeholder feedback mechanisms. Additionally, in order to gauge long-term community engagement, the Company will implement a Community Policy Engagement Index alongside longitudinal surveys, ensuring sustained community

and freshwater resource management. The key focus is empowering less privileged youth and coastal communities through skill-building and policy engagement, ensuring inclusive growth and effective governance.

This proposal outlines strategic actions, budget allocations, and impact assessment strategies for effective implementation.

understanding of MSP and UDA's significance. This aims to educate and encourage policy adoption for sustainable resource management.

UDA Fellowship Programme: Establish a comprehensive UDA fellowship programme targeting underprivileged youth and professionals, equipping them with opportunities to engage in skill development and policy-making processes.

Collaborations and Skill Development: Partner with local institutes, governments, and industry bodies to foster skill development initiatives and encourage policy interventions aligned with MSP and UDA frameworks.

Collaborative Program Design: Co-create skill development initiatives with partners, aligning them with MSP and UDA frameworks. This will be designed to cater to the identified needs and leverage partners' expertise.

Monitoring and Evaluation: Establish monitoring mechanisms to track the progress of Skill development programmes.

involvement and measuring the perceived impact resulting from policy interventions over time.

Sustainable Livelihoods for Fisherfolk and Riverine Communities
The initiative is dedicated to addressing challenges faced by coastal fisher folk due to climate change and economic vulnerabilities. Tailored programs focusing on skill development and sustainable fishing practices aim to empower these communities. This proposal outlines strategic partnerships, technology integrations, and targeted interventions to promote sustainable models that seek to empower fisher folk and foster ecological conservation. By leveraging the tremendous potential of the Underwater Domain Awareness (UDA) framework, our approach emphasises tailored programmes, technology integrations, and targeted collaborations to uplift these communities.

Enhanced Skills and Livelihood Improvement: Develop tailored skill development programmes for coastal fisher folk to enhance fishing techniques, navigation methods, and resource management practices. The objective is to optimise catch, reduce wastage, and ensure sustainable harvesting, thereby bolstering income stability and resilience against environmental changes.

Diversification of Livelihood Opportunities: Empower communities with requisite skills in alternative income-generating activities such as aquaculture, eco-tourism, and related trades.

Spill over Effects on Community and Ecosystem: Promote sustainable practices among fisher folk to preserve marine

The long-term impact of this initiative is envisaged as a sustainable and thriving ecosystem for coastal fisher folk and riverine communities. By imparting essential skills and promoting sustainable practices, the initiative aims to create resilient communities capable of navigating climate change challenges. Through strategic collaborations and technology integrations, it seeks to establish sustainable models that not only ensure the livelihoods of these communities but also contribute to preserving marine ecosystems. The envisioned long-term impact is a harmonious coexistence between human activities and nature, fostering sustainable livelihoods and ecological conservation for generations to come.

By employing a combination of quantitative data and qualitative feedback, our impact assessment strategy aims to comprehensively measure the direct effects on beneficiaries, the ecological impact, and the efficacy of collaborative partnerships, ensuring a holistic evaluation of the initiative's success.

Skill Development Outcomes: Evaluate skill enhancement and socio-economic impact on communities. Quantitative assessments can include tracking improved resource management practices among participating communities. Qualitative assessments encompass gauging their feedback, assessing the adoption of sustainable practices, and observing changes in their

habitats, benefiting not only the fishing industry, but also other sectors reliant on healthy marine ecosystems.

Governance and Regulatory Framework: Establish a robust regulatory framework and governance structure based on UDA inputs. This framework will aim to ensure effective resource management, aligning policies with sustainable practices and community needs.

Partnerships for Skill Development: Form strategic partnerships integrating academia, industry, and governmental bodies to design relevant skill development programmes aligned with emerging technological requirements. This collaboration fosters innovation, empowering coastal and riverine communities by ensuring a skilled

livelihoods. Surveys and interviews will serve as valuable tools to collect this data, providing insights into the tangible impact of skill development.

Ecosystem Conservation Metrics: Assessing the success of conservation initiatives involves monitoring various ecological indicators. This includes tracking the health of marine habitats, changes in biodiversity, and the presence of key indicator species. Quantifying the reduction in harmful practices and the adoption of sustainable fishing methods among participating fisher folk becomes crucial. Additionally, evaluating community participation in coastal clean-ups or conservation efforts will help provide qualitative data on the ecological impact of our initiatives.

workforce for sustainable growth.

Collaborative Partnership Outcomes: Evaluating the outcomes of collaborative partnerships entails assessing the effectiveness of technology integrations and the impact on community development. Metrics include tracking the adoption of 4 technological tools by fisher folk, observing changes in fishing practices after technology integration, and assessing the scalability of these interventions. Qualitatively, feedback from stakeholders on the usefulness and adaptability of the integrated technology will be essential in gauging its impact.

Technology Intervention for Sustainable Community Development

The Technology Intervention for Sustainable Community Development initiative seeks to implement the Underwater Domain Awareness (UDA) framework to drive forward technological advancements specifically tailored for tropical waters. This proposal outlines strategic actions, budget allocations, and impact assessment strategies to foster operational efficiency and community development.

Technology Development and Workshops: Conduct workshops and field experiments, emphasizing Modelling & Simulation (M&S) to address challenges in tropical waters.

Skill Development and Operational Efficiency: Enhance technology access and skill development through internships and collaborations, fostering sustainable community development.

Policy Interventions and Innovation: Drive policy interventions that align with technological advancements and innovation for community-specific needs.

To measure the effectiveness of these efforts, a robust assessment framework has been crafted. Additionally, defining success stories and conducting evaluations will highlight the project's qualitative impact, capturing the nuanced transformations and advancements within the community.

Effectiveness of Technology Workshops: Measure technology adoption rates, feedback, and operational enhancements.

Skill Development Outcomes: Evaluate skill enhancement, employment rates, and community impact.

Policy Intervention Success Metrics: Quantify policy adoptions and their direct impact on community development.

CSR Support

Global sustainability initiatives have integrated marine sustainability and players connected with marine ecosystem are focused on various aspects of underwater protection and preservation. For such evolved enterprises, MRC is the partner ensuring that their CSR contributions deliver impact at scale.

As a Section 8 company, it has an enviable track record since 2019 with approvals of Section 80G, 12A and CSR1 from competent authorities. The Company is progressing the Underwater Domain Awareness (UDA) framework for safe, secure and sustainable growth for all in the tropical waters of the Indo-Pacific and beyond. The UDA framework is relevant both to the marine and freshwater systems. MRC activities have gained significant recognition among key stakeholders connected with Maritime Security, Blue Economy, Marine Environment & Disaster Management and Research & Innovation to cohesively synergize action.

Sectors that could be served by the UDA framework are as follows

Freshwater Management

India is currently grappling with a shortage of water resources. Freshwater management ensures the right amount and quality of water is available at all times. Issues like flooding, drought, erosion, chemical and biological contamination require a nuanced approach. Constant monitoring of water sources and being able to predict any climate change effects or disasters will help us manage our freshwater systems effectively.

Acoustic Habitat Degradation

Human exploitation of oceans and freshwater has severely harmed their health, impacting industries and human well-being. Activities like transportation and industry have led to increased underwater noise, harming species reliant on acoustic signals. India's freshwater dolphins face critical conservation challenges due to acoustic habitat degradation. Additionally, high noise levels from ships pose risks to marine life and human divers.

Digital Transformation for Communities

Coastal and riverine communities face heightened vulnerability due to climate change, urbanization, and industrialization, disrupting traditional livelihoods. Digital Ocean, employing UDA framework, seeks to mitigate these challenges by filling knowledge gaps, predicting weather extremes, and promoting profitable recycling practices. Collaboration with financial institutions can bolster community livelihoods, bridging the gap between profitability and environmental sustainability. This initiative aims to enhance overall wellbeing and stability in these vulnerable communities.

Climate Change Assessment

Climate change poses a critical global challenge, with profound implications for current and future generations. UDA framework acts as an effective assessment tools the are vital for understanding and managing these risks, especially concerning oceans and freshwater bodies.

Utilizing this framework enables a comprehensive understanding of climate change impacts, facilitating the development of robust mitigation and adaptation strategies. The future of our planet hinges on our ability to effectively address climate change through informed assessment and responsive action.

Enhance opportunities for the Young India

Promoting maritime awareness among India's youth demands a targeted strategy, emphasizing skill development and resource allocation. Indigenous initiatives tailored to tropical waters are crucial, mirroring the significance of maritime and terrestrial sectors. Harnessing maritime opportunities is pivotal for national advancement, maximizing demographic potential through effective on-ground frameworks like UDA. Integration of infrastructure, expertise, and policy focus is essential for realizing the full maritime potential of India.

Deep Ocean Mission

India has joined the elite club of nations with capabilities to explore and utilize underwater resources in international waters, initiating the Deep Ocean Mission with substantial funding. This mission aims to promote sustainable blue economies, enhance livelihoods, and safeguard ocean ecosystem health while strategically leveraging critical undersea resources to fulfil long-term national objectives. Leveraging the UDA framework, hence, MRC can play a pivotal role in enabling the mission, fostering capacity building, and empowering stakeholders involved.

Enhanced Supply Chain Management

The Government of India, has announced significant focus on logistic and supply chain management across the country However, the congested road transport system has been a major bottleneck, leading to high costs. To improve the efficiency and effectiveness of the Inland Water Transport and Port infrastructure in tropical waters, underwater domain awareness (UDA) support is required. One unique challenge faced in these waters is siltation, which demands site-specific efforts for effective sediment management Sediment management and Underwater Radiated Noise (URN) management are two critical aspects that merit significant attention at multiple levels to make it sustainable.

SAGAR Vision

The SAGAR vision of the Honorable Prime Minister is a remarkable declaration by the Government of India at the apex level. The SAGAR vision, declared by the Honorable Prime Minister, is a significant initiative by the Government of India at the highest level, recognizing both security concerns and the vast economic opportunities at the regional level. To complement this vision, the Government of India has announced a large number of mega projects. This initiative will drive the UDA framework at a regional level. The SAGAR vision can be bolstered with effective implementation of our UDA framework, which would very well align with the Indo-Pacific strategic construct. India’s leadership in the Indo-Pacific region can be established with true demonstration of the acoustic capacity and capability building driven by the UDA framework. Moreover, India has the potential to export skilling and knowledge across the tropical waters of the Indo-Pacific region, thereby cementing its position as a regional power.

12. Awards And Recognition

The Company has been recognized for its innovation on the digital tools for monitoring underwater noise caused due to shipping. NDT were shortlisted for the Narwhal Challenge at Brest France and were the only entry from Asia. The Narwhal Challenge caters specifically to startups and businesses aiming to tap into the extensive maritime ecosystem.

In 2021, another innovation for effective submarine deployment in the tropical waters of the Indian Ocean Region (IOR), was shortlisted for a Global Defense Technology Challenge. These recognitions are a reflection of the relevance of the UDA framework for applications across varied sectors ranging from sustainability, strategic security, blue economy, climate change and more. The digital transformation in the underwater domain will be the main hero in the future.

The Director General (DG) Shipping forwarded a paper draft by MRC for monitoring low frequency underwater noise due to shipping to the International Maritime Organization (IMO) for the Marine Environment Protection Committee (MEPC-76) meeting in 2021. Based on the paper presented at the MEPC-76 by MRC rep, India has been nominated as the lead nation for managing underwater noise in the IOR.

Research Milestones

- The pioneering research efforts continue to yield crucial insights for effective underwater system deployment.
- Approvals were received on projects by the Ministry of Earth Sciences focused on spatio-temporal underwater noise mapping for habitat preservation.
- Recognition granted as a scientific and Industrial Research Organization (SIRO) from the Government of India in September 2023, opening doors for research grants and import duty exemptions.
- Validation studies at Khadakwasla lake revealed critical insights into tropical water sediment management.
- Facilitation of pioneering research by scholars spanning across underwater noise mapping, sonar performance, underwater modelling, and AIS data analytics, significantly impacting freshwater and marine ecosystem management.


GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
Welcome to the launch of ACAP
Ministry of
Earth Sciences

Partnership Highlights

The Indo-Swiss Centre of Excellence

ISCE has partnered with MRC and NDT to establish a Centre of Excellence for Skilling to drive the UDA Framework

The Indo-Swiss Centre of Excellence, a not-for-profit entity, has partnered with both MRC and NDT to establish a Centre of Excellence for Skilling in support of the UDA framework. This underwater studies Center of Excellence works to accelerate UDA initiatives across research, academia, skilling, innovation, and policy concerns. The signing of this MoU marked a comprehensive new capacity building initiative aimed at adapting participants to evolving workplace dynamics, providing vital skills for new job opportunities and continuous professional upgrades.

An Extensive European Tour

Dr. (Cdr) Arnab Das held an important meeting with Director General Maritime Affairs and Fisheries (DG MARE) offcials at the EU

Dr Das visited the UNESCO Headquarters in Paris, France to hold meetings with their representatives

In December 2022, the founder of the company embarked on an extensive diplomatic and strategic engagement initiative across multiple European countries. The trip aimed to engage with UNESCO and the European Union (EU) in terms of leveraging the UDA framework's potential in managing security and growth in the Indo-Pacific strategic space and beyond.

In an effort to explore collaborative opportunities at the UNESCO Headquarters in Paris as well as the EU Headquarters in Brussels, Dr. Arnab Das visited and engaged with a number of stakeholders and dignitaries including HE Santosh Jha (India's Ambassador to Belgium and the EU), HE Vishal Sharma (India's Permanent Representative at UNESCO), HE Amb. Raj Kumar Srivastava (India's Ambassador to Croatia), Dr. Ralf Heckner (India's Ambassador to Switzerland), HE Didier Vanderhasselt (India's Ambassador to Belgium), Charlina Vitcheva (Director-General, MARE, EU), and more. As a result, MRC was widely acknowledged as the nodal agency for the UDA framework in the region, with governments such as Sri Lanka, Bangladesh, Mauritius, and beyond recognising our organization's UDA capacity-building potential and reinforcing our role in advancing the UDA framework on a global scale.

UNESCO Headquarters Visit

Glimpses from Dr. Das' visit to Europe in December 2022, where he held Strategic Meetings with Key International Representatives and Officials

Dr. Das' visit to the UNESCO Headquarters in Paris aimed to strengthen collaborations and discussions initiated by MRC with UNESCO India. These interactions sought to enhance the ongoing collaborations and align them with UNESCO's proposal to establish a Category II Center of Excellence focused on the UDA framework. The visit to the UNESCO Headquarters was a strategic step forward in fostering inter-organizational partnerships within UNESCO's established framework, specifically the Intergovernmental Oceanographic Commission (IOC). These engagements underscored commitment to driving innovation and capacity-building in alignment with UNESCO's overarching objectives, particularly in terms of fostering sustainable practices and bolstering the UDA framework's significance. These collaborations reflect the commitment to fostering cross-disciplinary partnerships, driving innovation, policy formulation, and skilling initiatives essential for comprehensive UDA development as the company looks to a future bright with possibility.

Events and Interactions

Team MRC, under the guidance of Dr (Cdr) Arnab Das participated at the SACA.M Event '23 hosted by the UNESCO

The participation of the company at various conferences and speaking engagements across India signifies the commitment to knowledge-sharing and fostering collaborations for UDA development. Additionally, the partnership with the Indo-Swiss Centre of Excellence (ISCE) has facilitated several events and interactions with influential speakers throughout this past year

Policymaking Partnerships

Participation of the organization at various conferences and speaking engagements across India signifies commitment to knowledge-sharing and fostering collaborations for UDA development. Additionally, the partnership with the Indo-Swiss Centre of Excellence (ISCE) has facilitated several events and interactions with influential speakers throughout this past year.

Distinguished Academics and Domain Expert Interactions

Throughout the year, the company successfully conducted a series of educational and outreach events at dedicated centers for underwater studies with the Indo-Swiss Centre of Excellence, leveraging state-of the- art infrastructure to facilitate hands-on learning and field experimental exposure. Key presenters at some of our events this year included Dr. Chaitanya Patil of the University of Strathclyde (Scotland, UK), and Dr. Mehul N. Sangekar, who is affiliated with the University of Tokyo and the Japan Agency for Marine-Earth and Science Technology, as well as keynote addresses from influential speakers including Dr. Ajay Kumar (former Defense Secretary to the Government of India) and His Excellency Jawed Ashraf (the Indian Ambassador to France), among several others.

Comprehensive Skilling Workshops

Empowering Communities, Sensitizing Stakeholders

In March 2023, a series of transformative workshops was conducted focused on sensitizing policymakers, stakeholders, practitioners, academics, researchers, and the youth toward institutionalizing a robust skilling ecosystem. These workshops aligned with the country's SAGAR vision.

Various Domain Experts and Industry Leaders Visited MRC's Dedicated Center for Underwater Studies

1. Policy Intervention

The Company collaborated with experts and stakeholders from various fields such as policy makers, regional experts, traditional knowledge custodians, capacity building specialists, and institutional framework architects.

2. Technology Intervention

The Company partnered with technology innovators, sustainable development experts, governance specialists, infrastructure developers, and SDG advocates to bring diverse expertise into each workshop session.

3. Grassroots Community Engagement

The company coordinated efforts with local government bodies, private sector entities involved in coastal activities (such as aquaculture, pisciculture, diving, shipbuilding, etc.), community leaders, and representatives from coastal communities.

4. Practical Implementation

The Company engaged with educational institutions, technology providers, acoustic specialists, and industry experts for both classroom interactions and field visits. Collaborations included universities, technology firms, acoustic research groups, and industry associations.

Interactions across Research and Academia

Technical Partners and Panel Chair at the UNESCO 'Ridge to Reef' Event

The company was honored to have served as technical partners at the UNESCO 'Ridge 2 Reef' event at the 10th South and Central Asian Biosphere Reserve Network Meeting (SACAM) in Chennai, India. The event aimed to bring together domain experts and key stakeholders across the globe, united under broadly scoped subjects addressing biosphere reserves and conservation goals. In addition to the collaboration as technical partners, the founder, Dr. Arnab Das, also presented and chaired a session on the topic of 'Blue Carbon Ecosystems, Oceans and Underwater Issues', contributing to crucial dialogue on conservation efforts and scientific research on blue carbon ecosystems.

The 4th India International Seaweed Expo & Summit 2023: Participation and Keynote Speech

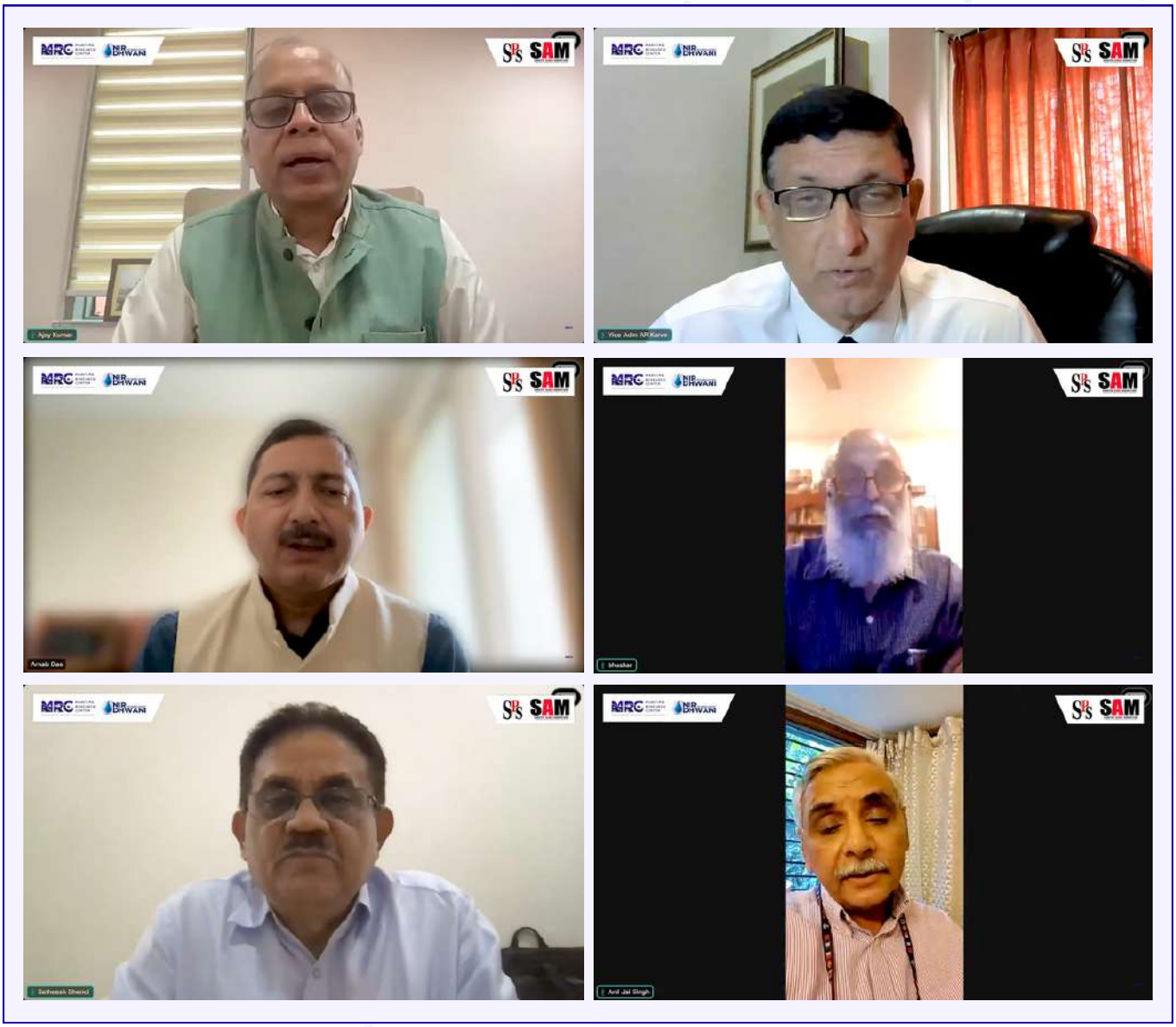
At the summit organized by the Indian Chamber of Commerce, the organization highlighted the vital role of UDA in digital transformation, emphasizing its importance in the evolving global order. During his keynote address, our founder, Dr. Arnab Das presented a strategic approach focusing on 'Digital Transformation driven by Underwater Domain Awareness Framework', emphasizing the critical role of UDA in revolutionizing and modernizing approaches to understanding and utilizing underwater domains.

The University of Strathclyde, Scotland UK

The company was honored to host Dr. Chaitanya Patil, a distinguished academic and lecturer with theDepartment of Naval Architecture, Ocean and Marine Engineering at the University of Strathclyde, and facilitate his delivery of a comprehensive presentation on the subject of Underwater Domain Awareness. Dr. Patil emphasized the UDA framework's geopolitical implications, exploring the intricate balance between policy, technology, and the necessity for integrated strategies that align environmental conservation, socio-economic growth, and technological innovation. Additionally, the event marked the signing of an MoU between the Maritime Research Center and the University of Strathclyde as the organization works to collaboratively enhance their research, education, policy and practice objectives pertaining to Underwater Domain Awareness.

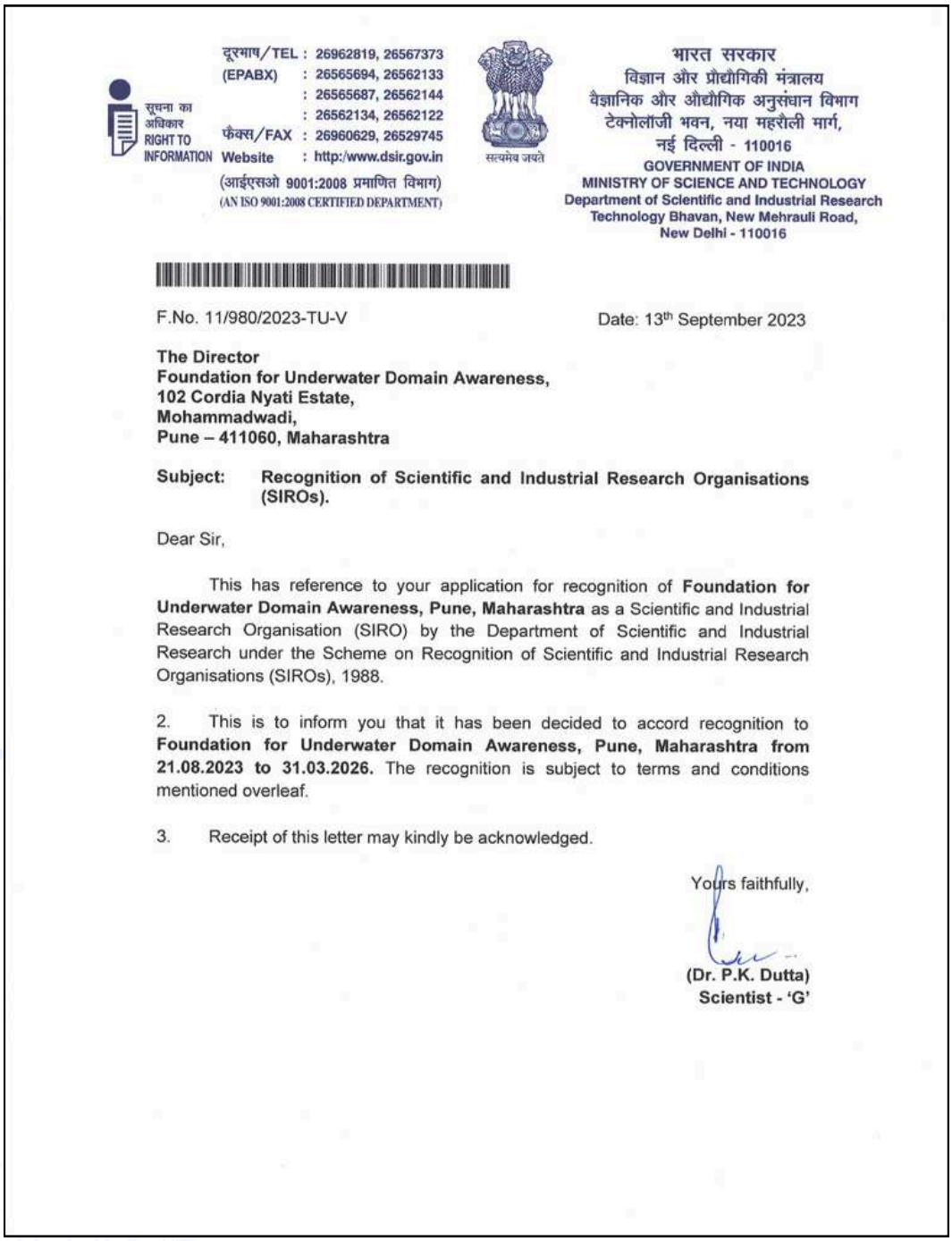
Key Discussions on Sustainable Growth in the Indo-Pacific

As part of the regular webinar series, this year, the company collaborated with the South Asia Monitor, the Society for Policy Studies and the Indo-Swiss Centre of Excellence to host a discussion on the importance of Underwater Domain Awareness within India's SAGAR vision in the Indo-Pacific region. Leading experts including India's former Defense Secretary Dr. Ajay Kumar, Cmde Uday Bhaskar, and Vice Admiral AR Karve gathered to emphasise strategic policies, innovative technologies, and the need to considerably enhance capacities in marine and freshwater ecosystems through the UDA framework.



SIRO approval, Department of Scientific and Industrial Research

In a significant milestone, the organization has obtained approval under the Scientific and Industrial Research Organizations (SIRO) recognition scheme, standing as yet another testament to the commitment to pioneering research and innovation with integrity. SIRO recognition reaffirms our dedication to advancing knowledge and impact across various scientific, strategic, and practical domains. Additionally, being recognized by the Department of Scientific and Industrial Research (DSIR) not only validates our research-oriented goals, but also grants us access to essential benefits such as customs and excise duty exemptions, enabling us to further enhance our research infrastructure and facilitate more efficient operations in the coming years.



सूचना का अधिकार RIGHT TO INFORMATION

दूरभाष/TEL : 26962819, 26567373
(EPABX) : 26565694, 26562133
: 26565687, 26562144
: 26562134, 26562122
फैक्स/FAX : 26960629, 26529745
Website : http:/www.dsir.gov.in
(आईएसओ 9001:2008 प्रमाणित विभाग)
(AN ISO 9001:2008 CERTIFIED DEPARTMENT)

सत्यमेव जयते

भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
वैज्ञानिक और औद्योगिक अनुसंधान विभाग
टेक्नोलॉजी भवन, नया महरौली मार्ग,
नई दिल्ली - 110016
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
Department of Scientific and Industrial Research
Technology Bhavan, New Mehrauli Road,
New Delhi - 110016

F.No. 11/980/2023-TU-V

Date: 13th September 2023

The Director
Foundation for Underwater Domain Awareness,
102 Cordia Nyati Estate,
Mohammadwadi,
Pune – 411060, Maharashtra

Subject: **Recognition of Scientific and Industrial Research Organisations (SIROs).**

Dear Sir,

This has reference to your application for recognition of **Foundation for Underwater Domain Awareness, Pune, Maharashtra** as a Scientific and Industrial Research Organisation (SIRO) by the Department of Scientific and Industrial Research under the Scheme on Recognition of Scientific and Industrial Research Organisations (SIROs), 1988.

2. This is to inform you that it has been decided to accord recognition to **Foundation for Underwater Domain Awareness, Pune, Maharashtra from 21.08.2023 to 31.03.2026.** The recognition is subject to terms and conditions mentioned overleaf.

3. Receipt of this letter may kindly be acknowledged.

Yours faithfully,

(Dr. P.K. Dutta)
Scientist - 'G'

A sneak peak into MRC's Malvan excursion…

"Diving deep" into the blue sea …

Visit at the Devbag Beach Centre and Scuba Diving Centre…





Visit at the Indian Institute of Scuba Diving and Aquatic Sports (IISDA)…






Snippets from the workshop conducted at the Indian Institute of Scuba Diving and Aquatic Sports (IISDA) which is India's first integrated Scuba diving school located next to the Tarkarli Beach…

Articles And Features

स्वित्झर्लंडचे राजदूत हेकनर : कौशल्य प्रशिक्षण केंद्राला भेट

उद्योजकतेसाठी महाराष्ट्रात पोषक वातावरण

कोरेगाव भीमा : स्विट्झर्लंडचे राजदूत डी. राफ्ल हेकनर यांनी इंडो स्विस मेरिट ॲक्रॉस एक्सलन्स येथे मेरिटाइम रिसर्च सेंटरद्वारे स्थापन करण्यात आलेल्या कौशल्य प्रशिक्षण केंद्राला भेट दिली. या वेळी डी. अर्णब दास (मे.) यांनी त्यांना केंद्राबाबत माहिती दिली. मुकेश माहीजा, डी. हेकनर आणि मार्टिन मायर या प्रसंगी उपस्थित होते.

सागरी सुरक्षेचा 'सेतू'

संयुक्त राष्ट्रसंघाच्यावतीने 'जागतिक सागरी दिवस' दरवर्षी २९ सप्टेंबरला साजरा करण्यात येतो. त्यानिमित्त सागरी क्षेत्राबाबत जागरूकतेकरिता मार्गदर्शक तत्त्वांचा उहापोह.

कमांडर डॉ. अरनब दास

जा

जैवविविधतेवर गंभीर परिणाम

Maritime skills centre in Koregaon Bhima

TIMES NEWS NETWORK

Pune: With an eye on the growing importance of the underwater domain in the current global scenario, the city-based Maritime Research Centre (MRC) and Indo-Swiss Centre of Excellence have joined hands to set up a skilling centre.

A Memorandum of Understanding between the two institutes was signed on October 14 to create human resources for the future with regard to the Underwater Domain Awareness framework. Claimed to be India's first Maritime Skilling Centre, the institute is located in Koregaon Bhima.

Speaking about the project, MRC founder-director Dr (Cdr) Arnab Das, said that fieldwork will also be a key element of the centre's curriculum to help build human resources with abilities to solve problems of the new global order.

He said: "Hands-on and state-of-the-art innovation will be the key focus of the new initiative. The centre will not only skill new entrants with requirements of new job opportunities, but also provide continuous upgrades to already deployed professionals."

सागरी क्षेत्राच्या विकास व संरक्षणासाठी धोरणात्मक निर्णय महत्त्वाचे : सुरेश प्रभू

पुणे : भारताला तब्बल ७,६०० किमीचा समुद्रकिनारा लाभला आहे, मात्र धोरणात्मक व मुख्य निर्णयांमध्ये सागराला आपल्याकडे तितकेसे महत्त्व दिले जात नाही. मात्र आर्थिक विकास व संरक्षणासाठी सागरी क्षेत्र महत्वाचे असून सागरी परिसंस्था समजावून घेण्यासाठी एन्व्हार्नमेंट इम्पॅक्ट असेसमेंट स्टडी (पर्यावरण प्रभाव मूल्यांकन अभ्यास) सोबत सागरी जैवविविधता व त्याचे जतन करणारे धोरणात्मक निर्णय घेणे महत्त्वाचे असल्याचे मत माजी केंद्रीय मंत्री आणि सध्या जी २० व जी ७ शिखर परिषदेचे भारताचे शेर्पा सुरेश प्रभू यांनी व्यक्त केले.

अंडरवॉटर डोमेन अवेअरनेस (यूडीए) या विषयात काम करणाऱ्या पुण्यातील मेरिटाईम रिसर्च सेंटर (एमआरसी) व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने आयोजित कार्यक्रमात ते बोलत होते.

सामना

सागरी क्षेत्राच्या विकासासाठी धोरणात्मक निर्णय महत्त्वाचे – सुरेश प्रभू

पुणे, दि. २३ (प्रतिनिधी) - हिंदुस्थानला तब्बल ७,६०० किमीचा समुद्रकिनारा लाभला आहे; मात्र धोरणात्मक व मुख्य निर्णयांमध्ये सागराला आपल्याकडे तितकेसे महत्त्व दिले जात नाही. आर्थिक विकास व संरक्षणासाठी सागरी क्षेत्र महत्त्वाचे असून, सागरी परिसंस्था समजावून घेण्यासाठी एन्व्हार्नमेंट इम्पॅक्ट असेसमेंट स्टडी (पर्यावरण प्रभाव मूल्यांकन अभ्यास) सोबत सागरी जैवविविधता व त्याचे जतन करणारे धोरणात्मक निर्णय घेणे महत्त्वाचे असल्याचे मत माजी केंद्रीय मंत्री सुरेश प्रभू यांनी व्यक्त केले.

अंडरवॉटर डोमेन अवेअरनेस मेरिटाईम रिसर्च सेंटर व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने आयोजित कार्यक्रमात ते बोलत होते. इंडियन फाउंडेशनचे संचालक कॅप्टन (निवृत्त) अशोक बन्सल, माजी नौदल प्रमुख ॲडमिरल आर. के. धवन, प्राज इंडस्ट्रीजचे संस्थापक अध्यक्ष डॉ. प्रमोद चौधरी, संदीप उन्नीथन, मेरिटाईम रिसर्च सेंटरचे संचालक डॉ. (कमांडर) अर्णब दास, सल्लागार प्रफुल तलेरा आदी सहभागी झाले होते.

प्रभू म्हणाले, 'जागतिक व्यापाराच्या दृष्टीने हिंद महासागर आणि दक्षिण चीनच्या जवळील समुद्र हे दोन सागरी मार्ग महत्त्वाचे आहेत, जर त्याचे व्यवस्थापन योग्य पद्धतीने झाले नाही, तर सुरक्षिततेबरोबरच राजकीय समस्या निर्माण होऊ शकतात.

डॉ. कमांडर अर्णब दास यांनी एमआरसीच्या स्थापनेमागील उद्देश सांगत संस्था राबवित असलेल्या उपक्रमांची माहिती दिली, तर प्रफुल तलेरा यांनी कार्यक्रमाचा समारोप केला.

सागरी जैवविविधतेच्या जतनासाठी धोरणात्मक निर्णय महत्त्वाचे : सुरेश प्रभू

प्रभात वृत्तसेवा

पुणे, दि. २३ - आर्थिक विकास व संरक्षणासाठी सागरी क्षेत्र महत्त्वाचे असून, सागरी परिसंस्था समजावून घेण्यासाठी एन्व्हार्नमेंट इम्पॅक्ट असेसमेंट स्टडी (पर्यावरण प्रभाव मूल्यांकन अभ्यास)सोबत सागरी जैवविविधतेचे जतन करणारे धोरणात्मक निर्णय महत्त्वाचे आहे, असे मत माजी केंद्रीय मंत्री सुरेश प्रभू यांनी व्यक्त केले.

अंडरवॉटर डोमेन अवेअरनेस (यूडीए) या विषयात काम करणाऱ्या पुण्यातील मेरिटाइम रीसर्च सेंटर (एमआरसी) व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने आयोजित 'यूडीए फ्रेमवर्क फॉर ब्लू इकॉनॉमी इन इंडियन ओशन रिजन अँड बियॉन्ड' या विषयावरील वेबिनारमध्ये ते बोलत होते. वेबिनारमध्ये इंडियन फाउंडेशनचे संचालक कॅप्टन (निवृत्त) अशोक बन्सल, माजी नौदल प्रमुख ॲडमिरल आर. के. धवन, प्राज इंडस्ट्रीजचे संस्थापक अध्यक्ष डॉ. प्रमोद चौधरी, मेरिटाइम रीसर्च सेंटरचे संचालक डॉ. (कमांडर) अर्णब दास, सह्यागार प्रफुल तलेरा आदी सहभागी झाले होते.

सागरी प्रदूषण व हवामान बदलाचा सागरी क्षेत्रावर मोठा परिणाम होत आहे. सागरात प्लॅस्टिकचे प्रदूषण झाले असून देशाने स्वच्छ सागर मोहीम हाती घेत ते कमी करण्यासाठी एकत्रित प्रयत्न करायला हवेत. यामध्ये नौदल, तटरक्षक दल मोठे योगदान देऊ शकते, असे ॲडमिरल धवन यांनी नमूद केले. भविष्यात मेरिटाइम वायो फ्युएल ही विकासाच्या दृष्टीने काळाची गरज आहे. मात्र, प्लॅस्टिक प्रदूषणामुळे सागरी जैवसृष्टीचे होत असलेले नुकसान कमी करण्याकडेदेखील प्राधान्याने लक्ष दिले पाहिजे, असे डॉ. प्रमोद चौधरी म्हणाले.

प्रभात Mon, 24 May 2021 https://epaper.eprabhat.net/c/60661731

पुढारी

सागरी क्षेत्राच्या संरक्षणासाठी धोरणात्मक निर्णय महत्त्वाचे

पुणे : भारताला तब्बल ७,६०० किमीचा समुद्रकिनारा लाभला आहे, मात्र धोरणात्मक व मुख्य निर्णयांमध्ये सागराला आपल्याकडे तितकेसे महत्त्व दिले जात नाही. मात्र, आर्थिक विकास व संरक्षणासाठी सागरी क्षेत्र महत्त्वाचे असून परिसंस्था समजावून घेण्यासाठी पर्यावरण प्रभाव मूल्यांकन अभ्यासासोबत सागरी जैवविविधता व त्याचे जतन करणारे धोरणात्मक निर्णय घेणे महत्त्वाचे असल्याचे मत माजी केंद्रीय मंत्री आणि शिखर परिषदेचे भारताचे शेर्पा सुरेश प्रभू यांनी व्यक्त केले.

अंडरवॉटर डोमेन अवेअरनेस (यूडीए) या विषयात काम करणाऱ्या पुण्यातील मेरिटाईम रिसर्च सेंटर (एमआरसी) व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने आयोजित कार्यक्रमात ते बोलत होते. इंडियन फाउंडेशनचे संचालक कॅप्टन (निवृत्त) अशोक बन्सल, माजी नौदल प्रमुख ॲडमिरल आर. के. धवन, प्राज इंडस्ट्रीजचे संस्थापक अध्यक्ष डॉ. प्रमोद चौधरी, इंडिया टुडे मासिकाचे कार्यकारी संपादक संदीप उन्नीथन, मेरिटाईम रिसर्च सेंटरचे संचालक डॉ. (कमांडर) अर्णब दास, सल्लागार प्रफुल तलेरा आदी सहभागी झाले होते.

Pune Edition May 24, 2021 Page No. 5

'सागरी क्षेत्राच्या विकासासाठी धोरणात्मक निर्णय महत्त्वाचे'

पुणे : प्रतिनिधी

खोर आत्मक व मुख्य निर्णयांमध्ये सागराला आपल्याकडे तितकेसे महत्त्व दिले जात नाही. मात्र, आर्थिक विकास व संरक्षणासाठी सागरी क्षेत्र महत्त्वाचे असून, सागरी परिसंस्था समजावून घेण्यासाठी पर्यावरण प्रभाव मूल्यांकन अभ्यासासोबत सागरी जैवविविधता व त्याचे जतन करणारे धोरणात्मक निर्णय घेणे महत्त्वाचे असल्याचे मत, माजी केंद्रीय मंत्री आणि शिखर परिषदेचे भारताचे शेर्पा सुरेश प्रभू यांनी व्यक्त केले.

मेरिटाईम रिसर्च सेंटर व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने पुण्यात फ्रेमवर्क फॉर ब्लू इकॉनॉमी इन इंडियन ओशन रिजन अँड बियॉन्ड या विषयावरील वेबिनारचे आयोजन करण्यात आले होते. त्या वेळी ते बोलत होते. त्यावेळी [illegible] सहभागी झाले होते.

धोरणात्मक निर्णय संरक्षणासाठी महत्त्वाचा

माजी केंद्रीय मंत्री सुरेश प्रभू यांचे मत

म. टा. प्रतिनिधी, पुणे

सागरी क्षेत्राच्या विकास आणि संरक्षणासाठी देशाने धोरणात्मक निर्णय घेणे महत्त्वाचे असल्याचे मत माजी केंद्रीय मंत्री सुरेश प्रभू यांनी व्यक्त केले.

पुण्यातील मेरिटाइम रिसर्च सेंटर (एमआरसी) व नीरध्वनी टेक्नॉलॉजी यांच्या वतीने आयोजित 'यूडीए फ्रेमवर्क फॉर ब्लू इकॉनॉमी इन इंडियन ओशन रिजन अँड बियॉन्ड' या विषयावरील वेबिनारमध्ये ते बोलत होते. 'यूडीए फ्रेमवर्क फॉर ब्लू इकॉनॉमी इन इंडियन ओशन रिजन अँड बियॉन्ड' आज वेबिनारचा विषय होता. त्यामध्ये प्रभू यांच्यासह इंडियन फाउंडेशनचे संचालक कॅप्टन (निवृत्त) अशोक बन्सल, माजी नौदल प्रमुख ॲडमिरल आर. के. धवन, प्राज इंडस्ट्रीजचे संस्थापक अध्यक्ष डॉ. प्रमोद चौधरी, सेंटरचे संचालक (कमांडर) डॉ. अर्णब दास, सल्लागार प्रफुल तलेरा आदी सहभागी झाले होते.

> "इंडो-पॅसिफिक महासागरात हायड्रोकार्बन, नैसर्गिक वायू व जलसाठ्याची उपलब्धता मोठ्या प्रमाणात आहे. आर्थिक महत्त्वासह मानूल चीनच्या उदय महासागराच्या भौगोलिक परिस्थितीसाठी आव्हान आहे. अमेरिका, जपान, भारत, ऑस्ट्रेलिया या देशांनी एकत्र येण्याची गरज निर्माण झाली आहे.
> – डोनल (निवृत्त) अशोक बन्सल

'जागतिक व्यापाराच्या दृष्टीने हिंद महासागर आणि दक्षिण चीनच्या समुद्र हे दोन सागरी मार्ग महत्त्वाचे आहेत, त्यांचे व्यवस्थापन योग्य पद्धतीने झाले नाही, तर सुरक्षिततेबरोबर राजकीय समस्या निर्माण होऊ शकतात. त्यासाठी भारताने सागरासंबंधित आव्हानांचा सामना करण्यासाठी तयारी करावी,' असेही प्रभू यांनी नमूद केले.

MRC: Media Board

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Conclusion

The primary objective of the impact assessment study was to review the impact created by the Maritime research Centre (MRC) through Foundation of Underwater Domain Awareness with respect to their environmental, social, cultural, academic contribution and it has been concluded through a detailed analysis of their research projects, academic endeavors, socially reformative efforts that the contribution in all these respects has been remarkable.

The Company is an epitome of effective, efficient, innovative and collaborative organization in all senses and is taking constant effort to excel in their area of expertise.

For and on behalf of
KANJ & Co. LLP, Company Secretaries

Rucha Kale
Partner

Disclaimer

This Social Impact Assessment (SIA) report is provided for informational purposes only and is not intended to constitute professional advice. The information contained in this report is based on the data made available by the Company at the time of the assessment, and its accuracy, completeness, and reliability are subject to the limitations of available information and research methodologies.

The findings and conclusions presented in this report are not exhaustive and may not fully capture all possible social impacts associated with the proposed [project/activity].

The report includes assumptions that influenced the results and recommendations. These assumptions are grounded in the best available information at the time of the assessment. Additionally, there may be uncertainties associated with predicting social impacts, and unforeseen factors may affect the actual outcomes.

Stakeholder engagement played a crucial role in shaping the findings of this report. However, not all perspectives may be fully represented, and stakeholders' opinions and preferences may evolve over time, potentially affecting the accuracy of the report's conclusions.

The inclusion of any specific social impact mitigation measures or recommendations in this report does not imply an endorsement or guarantee of their effectiveness. The feasibility and success of such measures may depend on a variety of factors, and the report does not absolve the reader from complying with applicable laws, regulations, or obtaining necessary approvals for the proposed project.

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This report is presented solely for informational purposes, and it is important to note that it does not offer any guarantee of the performance of the company or impact created or to be created or performance of the projects under consideration.

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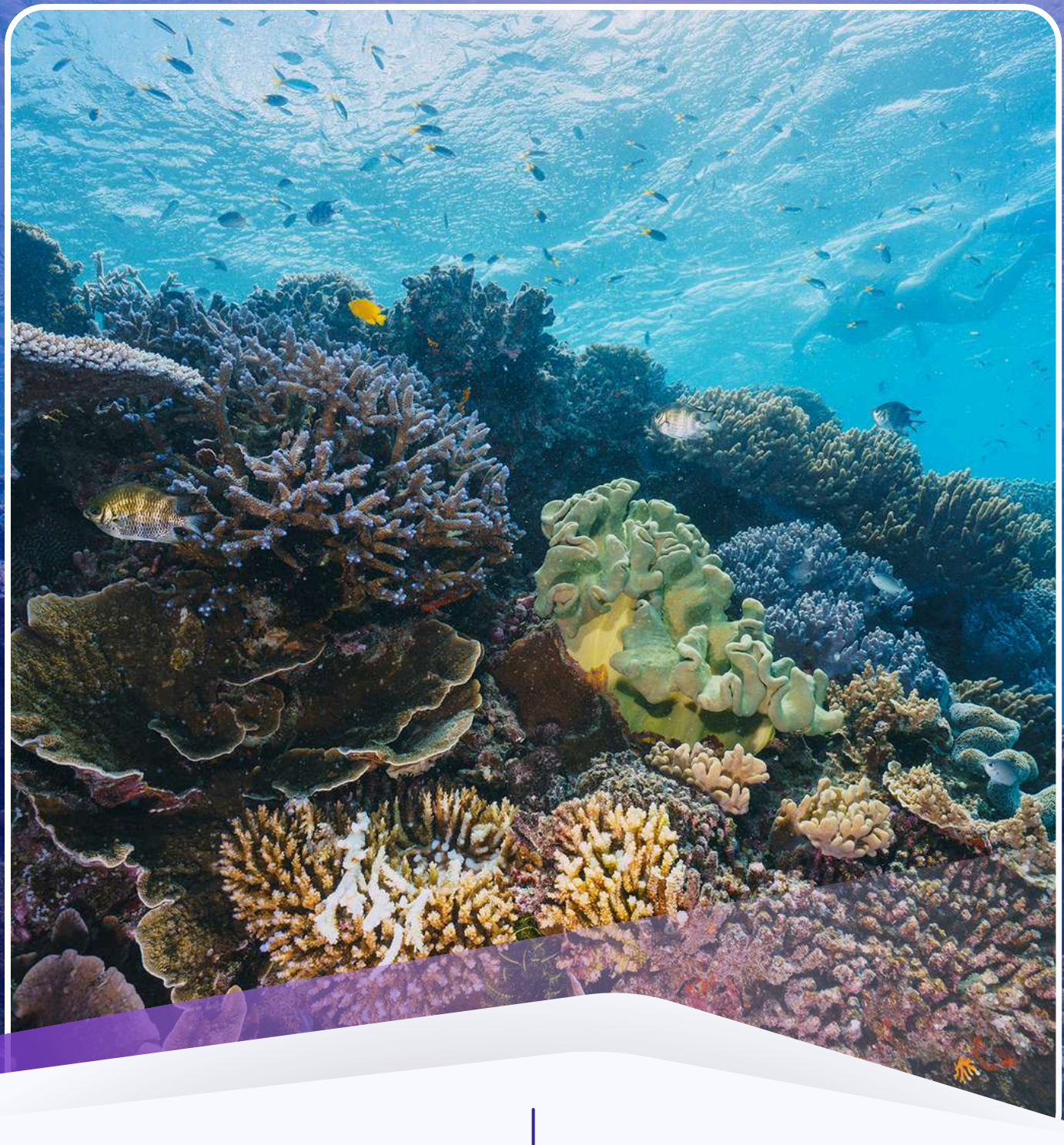

Let’s collaborate !!

DR. (CDR) ARNAB DAS

Founder and Director, MRC

+91-96650-33463

mrc.foundationforuda.in

director.mrc@foundationforuda.in

Address -

Maritime Research Center, CEUDS, Indo Swiss Centre of Excellence Behind Maruti Suzuki Showroom Pune-Nagar Highway, Koregaon Bhima Pune – 412216