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CENTER

FOUNDATION FOR UNDERWATER DOMAIN AWARENESS



Webinar Report- The Brahmaputra: UDA- Enabled River Governance for Regional Sustainability, Security and Cooperation



Held on: 28th January 2025

Introduction

The Maritime Research Centre (MRC), India, convened a high-level webinar titled “*UDA-Enabled River Governance for Regional Sustainability, Security and Cooperation in the Brahmaputra Region*” with the objective of examining innovative governance approaches for one of South Asia’s most complex and strategically significant river systems. The webinar brought together senior diplomats, leading academics, policy analysts, and domain experts with extensive experience in transboundary water governance, environmental security, climate resilience, and regional cooperation.

The discussions focused on the applicability of the Underwater Domain Awareness (UDA) framework to river systems, particularly the Brahmaputra basin. While UDA has traditionally been associated with maritime and naval contexts, the webinar explored its relevance for riverine governance by emphasising that many of the most consequential processes shaping risk, instability, and ecological change occur beneath the water surface and remain poorly integrated into governance mechanisms.

Participants examined how sediment dynamics, riverbed morphology, underwater ecological habitats, and acoustic environments fundamentally influence flooding, erosion, infrastructure stability, biodiversity, and livelihoods. The webinar also addressed the strategic and diplomatic implications of subsurface invisibility, particularly in transboundary contexts where uncertainty and limited data-sharing often exacerbate mistrust. Overall, the dialogue sought to assess whether UDA-enabled governance could support more anticipatory, evidence-based, and cooperative approaches to managing the Brahmaputra river system.

Background

The Brahmaputra is one of Asia’s most dynamic transboundary river systems, flowing across China (Tibet), India, and Bangladesh, and supporting millions of people through its ecological, economic, and cultural functions. It sustains hundreds of millions of people through agriculture, fisheries, inland navigation, energy generation, and ecological services. Despite extensive scientific research on the basin, governance frameworks across the region continue to rely predominantly on surface-level indicators such as flood stages, discharge measurements, and visible infrastructure damage.

However, the Brahmaputra is a sediment-dominated, morphologically dynamic river characterised by rapid channel migration, intense erosion, frequent deposition, and high sediment loads. In such a system, many of the processes that ultimately lead to disasters, infrastructure failure, and ecological degradation develop gradually below the waterline. These subsurface processes are rarely monitored in real time and often escape institutional attention until visible damage has already occurred.

Contemporary pressures have further amplified this governance challenge. Accelerated infrastructure development, including hydropower projects and navigation corridors, has increased exposure to morphological instability. Climate change has introduced greater hydrological variability and unpredictability. Transboundary data asymmetries persist, particularly with respect to sediment regimes and riverbed response. Together, these factors have rendered reactive and event-driven governance approaches increasingly inadequate.

Within this context, the webinar examined whether adapting the UDA framework to river governance could help align policy interventions with the actual behaviour of the Brahmaputra, thereby enhancing resilience, reducing risk, and supporting regional cooperation.

Participation

The participation segment of the webinar featured a well-structured line-up of distinguished speakers from diverse professional backgrounds. The session opened with an inaugural address by Dr. (Cdr) Arnab Das, maritime analyst and strategic affairs expert, setting the context for the discussions. This was followed by a keynote presentation by Ms. Tejaswini Kaktikar, policy analyst and research fellow, who provided key insights into the central theme of the webinar. The programme was further enriched by expert interventions from Amb. Tariq A. Karim, former High Commissioner of Bangladesh to India; Dr. Anamika Barua, environmental economist and faculty member at IIT Guwahati; Dr. Emadul Islam, Senior Research Fellow at the Sasakawa Peace Foundation; and Dr. Asit K. Biswas, renowned water resources expert and Distinguished Visiting Professor. The webinar concluded with closing remarks by Amb. Jaideep Mazumdar, former Ambassador of India, effectively summarizing the deliberations and key takeaways.

Presentation by Dr. (Cdr) Arnab Das, Founder and Director, Maritime Research Centre, India

Dr Arnab Das delivered the opening presentation, introducing the conceptual foundations of Underwater Domain Awareness and its relevance to riverine environments. He emphasised that the underwater domain encompasses scientific, ecological, technological, economic, and governance dimensions that are often overlooked in conventional development and security planning.

Dr Das highlighted the unique challenges of tropical river systems, noting that governance models developed in temperate regions frequently fail to account for intense sedimentation, rapid biofouling, and high biodiversity sensitivity. He identified three critical underwater concerns in the Brahmaputra basin. The first was sediment management, given the river's extraordinary sediment transport and deposition patterns, which directly affect navigation, erosion, and flood management. The second concerned underwater radiated noise, particularly its impact on freshwater species such as river dolphins that depend on acoustic perception for survival. The third issue related to biofouling, which poses serious risks to riverine infrastructure in tropical waters.

He presented the UDA Framework developed by MRC, which integrates strategic security, blue economy considerations, sustainability, climate change, and digital transformation. Dr Das stressed that effective governance requires collaboration across multiple stakeholders and sectors, including security agencies, environmental institutions, technologists, researchers, and local communities. He underscored the importance of digital tools such as sensing, analytics, and visualisation in improving situational awareness and enabling informed policy decisions.

He concluded by reaffirming MRC's strategic perspective centred on People, Economy, and Nature, and by emphasising that inclusive capacity-building and community participation are essential for sustainable river governance in the Brahmaputra basin.

You can watch the full presentation [here](#).

Keynote Address by Ms Tejaswini Kaktikar, Research Fellow, Maritime Research Centre, India

Ms Tejaswini Kaktikar delivered the keynote address, presenting a comprehensive analytical framework for applying Underwater Domain Awareness to the Brahmaputra river system. She clarified that her objective was not to introduce new terminology, but to address a persistent structural imbalance in river governance. She argued that while governance systems focus primarily on surface indicators, the most influential processes shaping risk and instability occur below the water surface.

She explained that governance frameworks prioritise variables such as flood levels, discharge peaks, and visible infrastructure damage because they are institutionally legible and politically salient. However, failures such as embankment collapse, severe erosion, navigation disruption, and fisheries decline are often driven by subsurface processes, including sediment routing, scour, and riverbed adjustment. These processes evolve incrementally over time and remain largely invisible until damage becomes irreversible.

Ms Kaktikar identified four factors that have intensified this governance mismatch. These included accelerated infrastructure development, persistent transboundary data asymmetries, increasing climate variability, and highly mobile sediment regimes that are poorly monitored in real time. She described how governance systems, designed around episodic events, tend to detect failure only after subsurface change has already occurred, thereby reinforcing reactive policy cycles. Applying the UDA framework to river systems, she proposed the systematic integration of subsurface variables such as

bathymetry, sediment flux, and underwater ecological indicators into existing monitoring and decision-making processes. She highlighted practical benefits, including early detection of scour at infrastructure foundations, improved flood forecasting, more informed infrastructure planning, and better fisheries and habitat management.

Beyond technical advantages, Ms Kaktikar emphasised the strategic significance of UDA as a mechanism for trust-building in transboundary contexts. She described UDA as enabling hydro-verification rather than hydro-hegemony, allowing states to operate from a shared evidentiary baseline even in the absence of political consensus. She concluded by stating that making the underwater domain visible is a necessary condition for resilience, cooperation, and long-term stability in the Brahmaputra basin.

You can watch the full presentation [here](#).

Intervention by Amb. Tariq Karim (Retd), Director, Centre for Bay of Bengal Studies, Bangladesh

Ambassador Tariq Karim provided a diplomatic and political perspective on transboundary river governance, drawing on decades of experience in water negotiations. He underscored the fundamentally reactive nature of governmental decision-making and noted the persistent difficulty of institutionalising anticipatory approaches to environmental and ecological challenges.

He highlighted Bangladesh's profound dependence on the Brahmaputra, noting that changes in river behaviour directly affect livelihoods, domestic politics, and national stability. Reflecting on his role in negotiating the Ganges Water Treaty, he expressed concern over the absence of adaptive, living agreements capable of responding to changing hydrological and political conditions.

Ambassador Karim shared lessons from China's approach to river management, emphasising that rivers cannot be effectively governed through fragmented or segmented interventions. He argued that focusing on underwater and less politicised aspects of river systems, such as sediment dynamics and ecological degradation, could provide a constructive entry point for renewed technical cooperation.

He concluded by advocating sustained Track II dialogue, expert-led engagement, and perseverance in regional cooperation efforts, even when political conditions are unfavourable.

You can watch the full presentation [here](#).

Intervention by Dr Anamika Barua, Indian Institute of Technology Guwahati, India

Dr Anamika Barua framed the Brahmaputra as a transboundary socio-ecological system. She emphasised that governance challenges stem not only from data limitations but from how data, power, risk, and responsibility are negotiated across borders. She agreed that UDA presents an important opportunity, but cautioned that data alone does not guarantee cooperation.

She noted that without appropriate governance frameworks, advanced monitoring systems risk reinforcing existing asymmetries, particularly between upstream and downstream actors. Dr Barua stressed the importance of linking UDA-enabled governance to issues of justice, non-economic loss and damage, and community vulnerability. She advocated

basin-wide, multi-scalar governance arrangements that integrate technology with trust-building, capacity development, and inclusive participation, particularly for downstream and vulnerable communities.

You can watch the full presentation [here](#).

Intervention by Dr. Emadul Islam (Nayan), Ocean Policy Research Institute, Sasakawa Peace Foundation, Japan.

Dr Emadul Islam offered insights grounded in lived experience within the Brahmaputra basin. He highlighted the gap between policy discourse and community realities, noting that river-related vulnerabilities often remain marginal in formal education and policymaking.

He emphasised the importance of anticipatory governance, people-to-people engagement, and Track II diplomacy, particularly in a global context where water issues receive diminishing political attention. He also drew attention to emerging environmental challenges such as plastic pollution and declining fish stocks, underscoring the need for stronger environmental education and community-level stewardship.

You can watch the full presentation [here](#).

Intervention by Dr Asit K.Biswas, Distinguished Visiting Professor, University of Glasgow

Dr Asit K.Biswas provided a macro-level critique of water governance in South Asia, arguing that poor management rather than physical scarcity lies at the heart of regional water challenges. He emphasised that water must be framed as a driver of economic development, employment generation, and improved quality of life to command sustained political attention.

He criticised outdated institutional arrangements, short political planning horizons, and the uncritical adoption of Western water management models. Drawing comparisons with China's long-term planning and indigenous governance solutions, he called for a fundamental rethinking of water management suited to monsoon-dominated systems. Dr Biswas cautioned that without institutional continuity, technological integration, and strong political commitment, both national and transboundary water challenges in the Brahmaputra basin will remain unresolved.

You can watch the full presentation [here](#).

Concluding Remarks by Amb. Jaideep Mazumdar (Retd), Former Secretary (East), Ministry of External Affairs, India

In his concluding remarks, Ambassador Jaideep Mazumdar synthesised the discussions and emphasised that Brahmaputra governance challenges are simultaneously technical, political, and strategic. He underscored the importance of expert-led dialogue, evidence-based policymaking, and sustained engagement across diplomatic, academic, and community domains.

He noted that UDA-enabled river governance should be viewed not as a standalone solution, but as part of a broader effort to align governance systems with river dynamics, regional interdependence, and long-term sustainability.

You can watch the full presentation [here](#)

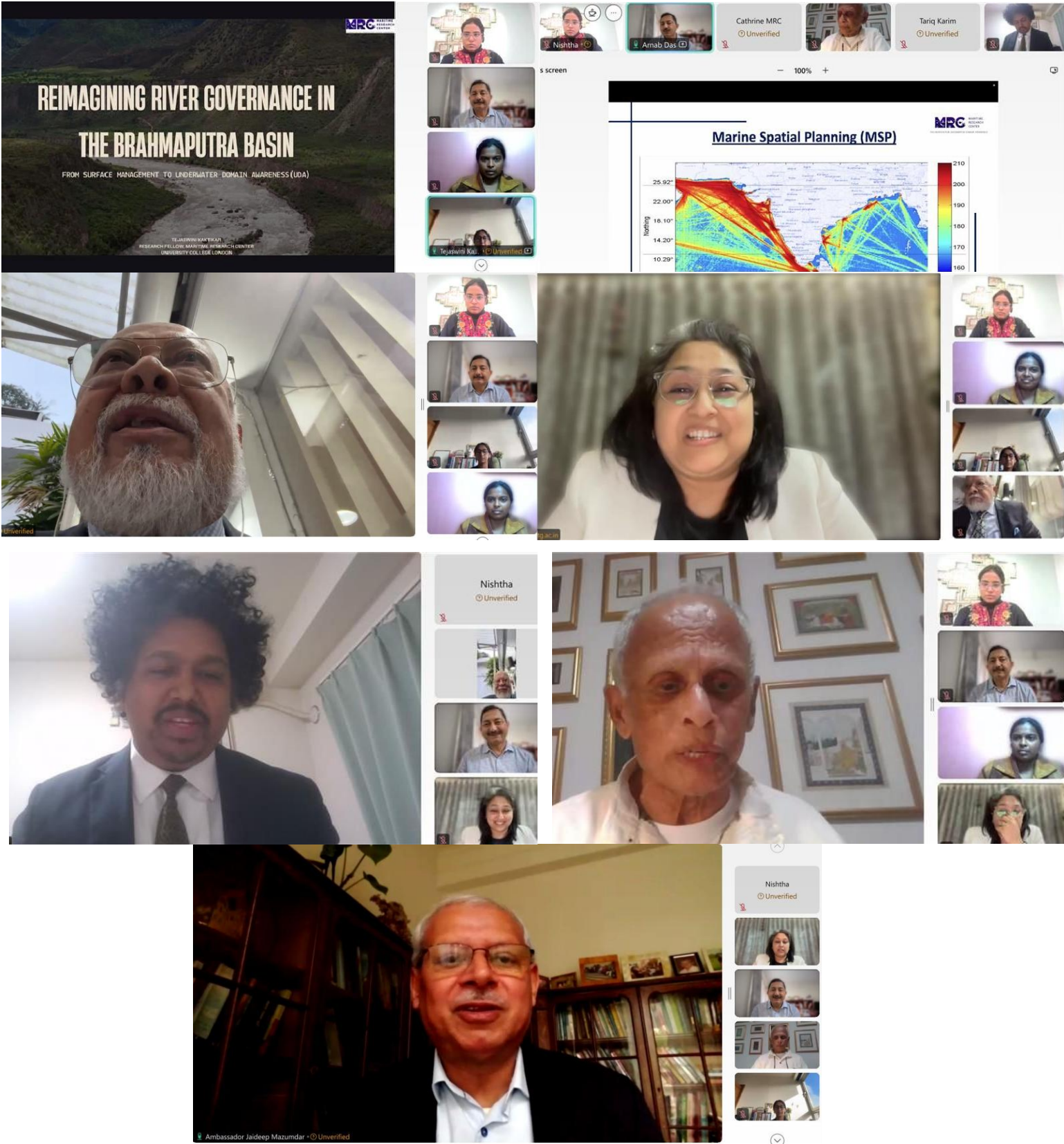
Conclusion

The webinar demonstrated that the future of Brahmaputra governance depends on addressing the persistent disconnect between surface-oriented decision-making and subsurface-driven realities. Underwater Domain Awareness emerged as a valuable framework for enhancing anticipatory governance, improving risk management, and supporting transboundary cooperation.

Participants emphasised that while technological tools and data integration are essential, meaningful progress ultimately requires governance reform, institutional continuity, political will, and a commitment to equity and cooperation. In a basin as dynamic and strategically sensitive as the Brahmaputra, making the underwater domain visible is not merely a technical exercise but a strategic necessity for resilience, regional stability, and sustainable development.

You can watch the full webinar [here](#).

Image Gallery



Enclosure 1

Underwater Domain Awareness (UDA) Framework

Dr (Cdr) Arnab Das

The concept of Underwater Domain Awareness (UDA), in a more specific sense, will translate to our eagerness to know what is happening in the underwater realm of our maritime areas and the freshwater systems. This keenness for underwater 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 access to the seas and littoral waters. The freshwater systems, particularly the transboundary Rivers, are not defended by the Navy & the Coast Guard, but these waters are equally vulnerable and more complex to manage. However, military requirements may not be the only motivation for generating underwater domain awareness. The earth's underwater geophysical activities have a lot of relevance to the well-being of humankind, and monitoring them could provide vital clues to minimize the impact of devastating natural calamities. The commercial activities in the underwater realm need precise inputs on the availability of resources to effectively and efficiently explore and exploit them for economic gains. Underwater resources include fisheries, aquaculture, seaweeds, pharma ingredients, minerals, and others with significant market value. The regulators, on the other hand, need to know the pattern of exploitation to manage a sustainable plan. The connectivity through the water bodies has been recognized as the most effective and efficient mode of transportation, however, ensuring navigability in these water bodies requires a massive amount of UDA. With so many commercial and military activities, there is a significant impact on the environment. Any conservation initiative needs to precisely estimate the habitat degradation and species vulnerability caused by these activities and assess the ecosystem status and climate change risk. The scientific and research community needs to engage and continuously update our knowledge and access of the multiple aspects of the underwater domain. The global community is looking at the Indo-Pacific strategic space for their geopolitical and geostrategic engagements. The Indo-Pacific region, by definition, is the tropical waters of the Indian and Pacific Oceans. The tropical waters present unique challenges and opportunities regarding rich biodiversity and resource availability. However, the sub-optimal sonar performance is the biggest issue, limiting the UDA in these regions. The sonars that were designed for the temperate & polar waters of the Greenland, Iceland, United Kingdom (GIUK) gap during the Cold War era suffered 60% degradation when deployed in tropical waters. The developing nations in tropical waters need to customize these technologies to suit their conditions. The Western nations that are pushing this hardware do not have the manpower to deploy it. In contrast, the tropical nations, have the manpower but lack the appreciation of the technology and the know-how. The proposed UDA Framework, presented in the figure below, can optimize resource deployment and provide nuanced policy and technology intervention, along with acoustic capacity & capability building to manage the tropical challenges and opportunities. There is significant fragmentation among all four stakeholders, namely Strategic Security, Blue Economy, Sustainability & Climate Change Risk Management, and Science & Technology (Digital Transformation), and the UDA framework provides a comprehensive way forward for the stakeholders to engage and interact.

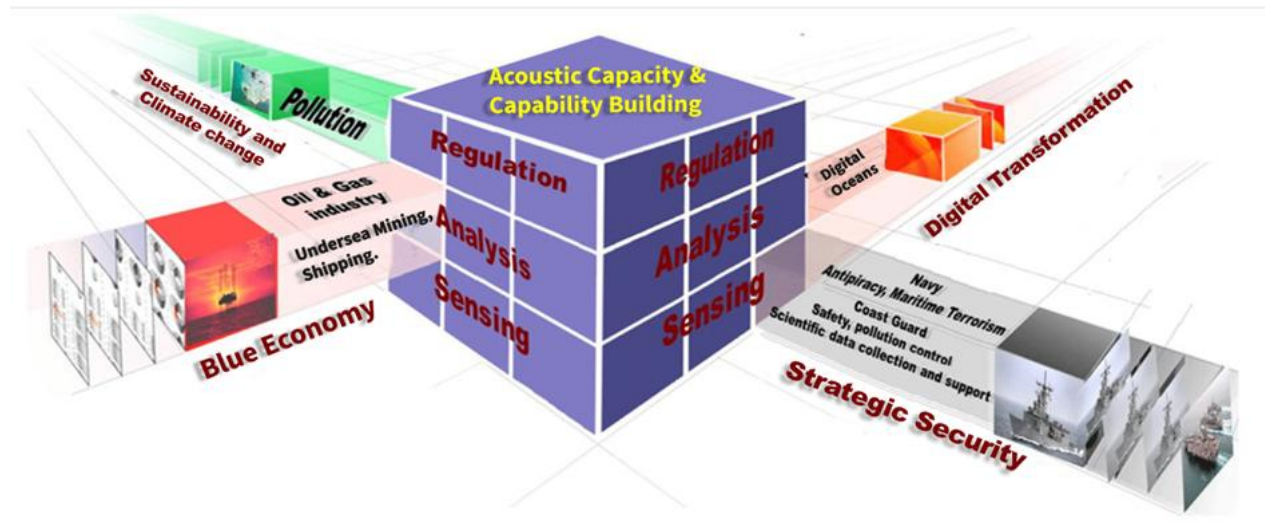


Figure. Comprehensive Perspective of the UDA Framework

On a comprehensive scale, the UDA Framework needs to be understood in terms of its horizontal and vertical construct. The horizontal construct would be the resource availability in terms of technology, infrastructure, capability, and capacity specific to the stakeholders or otherwise. The stakeholders represented by the four faces of the cube will have their specific requirements, however, the core will remain the acoustic capacity and capability. The vertical construct is the hierarchy of establishing a comprehensive UDA. The first level, or the ground level, would be the sensing of the underwater domain for threats, resources, and activities. The second level would be making sense of the data generated to plan security, conservation, and resource utilization strategies. The next level would be to formulate and monitor regulatory framework at the local, national, and global levels. 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 a more focused approach and a well-defined interactive framework. Given the appropriate impetus, the UDA Framework can address multiple challenges being faced by the global community today. Meaningful engagement of the young and aspirational population is probably the most critical aspect that deserves attention. Multi-disciplinary and multi-functional entities can interact and contribute to synergize their efforts towards a larger goal seamlessly.

The UDA Framework is a structured, comprehensive, and inclusive framework to drive the underwater domain effectively and efficiently. The structured approach will minimize the fragmentation among the stakeholders, regional players, national authorities, and local bodies. The multiple entities will have divergent interests and priorities, thus, converging them into one single and focused governance mechanism will be a challenge. The governance mechanism must be comprehensive and recognize all dimensions of the stakeholder requirement. The

dimensions include varied layers that are instrumental in building a strong governance mechanism. The first layer would be five pillars: research, skilling, academia, innovation, and policy. The second layer is its translation into policy & technology intervention, along with acoustic capacity & capability building. The inclusive aspects include varied socio-economic, socio-political, and socio-cultural native groups in the larger governance framework. The varied socio-economic strata of the society, particularly the coastal & riverine communities, get excluded in the conventional development models. The students need to prepare for real-world challenges and get very late before they get exposed to the nuances of real-world issues. The political spectrum is always driven by the social structure, based on left or right leanings. The governance mechanism has to address the concerns and aspirations of both sides. The cultural divide translates to the traditional practices and beliefs that drive their livelihoods and social structure. The governance mechanism has to address these divides and integrate everyone into one national, regional, or global framework.

The global community is also professing the triad of people, economy, and nature for enhanced governance mechanisms. The people component includes the livelihood, well-being of the native communities, social dynamics, and more. The economic component is the growth and prosperity associated with the activities. The nature component addresses sustainability and climate change risk management. This is also measured in terms of the Environmental, Social, and Governance (ESG) formulation. The UDA Framework is consciously addressing all these varied measures of global good parameters.

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