MARITIME RESEARCH CENTER
FOUNDATION FOR UNDERWATER DOMAIN AWARENESS

NIR TECHNOLOGIES DHWANI

Short Report on

"Safeguarding the Indian Ocean: Navigating Multilateral Partnerships for Underwater Security and Environmental Resilience."

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Executive Summary

- The recent geopolitical shift to the Indo-Pacific region has far-reaching implications for global politics and economies. Navigating this complex landscape requires countries in the region to balance economic opportunities and security concerns amidst intricate geopolitical dynamics. Oceans, covering over 70% of the Earth's surface, play a pivotal role in the global ecosystem, particularly in the context of climate change. According to the World Economic Forum, the oceans contribute approximately $70 trillion to the global GDP, with their ecosystem services valued at $38 trillion annually. Furthermore, oceans facilitate 90% of global trade by volume and 40% by value, providing crucial support to billions of people residing near coastal areas who rely on the ocean for sustenance and livelihoods. Beyond their economic significance, oceans harbor rich biodiversity, including over 50% of species, some of which are classified as vulnerable, endangered, or critically endangered. Additionally, oceans serve as the largest carbon sink, absorbing a quarter of the world's annual carbon dioxide emissions and mitigating climate change.

- The Indian Ocean holds strategic importance for four primary reasons. Serving as a major sea route connecting West Asia, Africa, and Southeast/East Asia, it handles half of the world's sea-borne trade. With 16.8% of global oil reserves and 27.9% of natural reserves, the Indian Ocean spans three continents and is home to 35% of the world's population, making it central to the geostrategic aspirations of both regional and extra-regional powers.

- Recognizing the underwater domain's importance is critical for ensuring maritime system stability, technological advancements, and economic cooperation. The proposed Underwater Domain Awareness (UDA) framework by the Maritime Research Centre (MRC) aims to address policy and technology needs while enhancing acoustic capacity and capability. As global attention shifts to the maritime domain, particularly the Indian Ocean region, the Bay of Bengal emerges as a strategically significant area. UDA in the Bay of Bengal is essential for protecting marine resources from potential threats and risks. With the global future dependent on healthy oceans, there is a growing recognition of the need to explore the underwater ecosystem independently of surface marine activity.

Despite being a critical component of the Earth's environment, the underwater ecosystem remains one of the least understood and underexplored areas. There is an increasing need for a better understanding of this ecosystem due to its significant ecological, economic, and scientific importance.

- Biodiversity: The underwater ecosystem is incredibly diverse, housing a wide range of species from microscopic plankton to massive whales. Researchers estimate that there may be millions of undiscovered species in the world's oceans. Understanding this biodiversity is essential for conserving and managing marine resources effectively.

- Climate Regulation: Oceans play a crucial role in regulating the Earth's climate. They absorb and store vast amounts of carbon dioxide, helping to mitigate climate change. Additionally, the temperature and circulation patterns of the oceans influence weather patterns and can impact global climate systems.

- Food Security: Over 3 billion people rely on seafood as their primary source of protein. A better understanding of the underwater ecosystem is essential for sustainable fisheries management to ensure food security for current and future generations.

- Pharmaceutical Potential: Marine organisms have provided numerous compounds that have led to the development of pharmaceuticals. Studying the underwater ecosystem could reveal new sources of potentially life-saving drugs.

- Economic Value: The ocean economy is worth trillions of dollars annually, including industries such as shipping, tourism, and offshore energy production. A comprehensive understanding of the underwater ecosystem is crucial for sustaining these economic activities.

- Conservation: Human activities, including overfishing, pollution, and habitat destruction, pose significant threats to marine ecosystems. Improved knowledge can inform conservation efforts and help protect vulnerable species and habitats.

- Scientific Discovery: The underwater ecosystem holds countless mysteries and has the potential to advance our understanding of life on Earth. Discoveries in this realm can lead to groundbreaking scientific advancements.

This notwithstanding, the underwater ecosystem is a critical but poorly understood part of our planet. As we face increasing environmental challenges and seek sustainable solutions, a comprehensive understanding of the underwater ecosystem is essential. Therefore, investments in research, technology, and conservation efforts are necessary to unlock the secrets of the deep sea and ensure the long-term health of our oceans and efforts to gain a better understanding of the underwater ecosystem include:

- Marine Research: Scientists use advanced technologies such as remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) to explore the depths of the ocean and study its inhabitants.
- Oceanographic Surveys: Research vessels equipped with sophisticated instruments collect data on temperature, salinity, currents, and marine life to create detailed oceanographic maps.
- Conservation Initiatives: Marine protected areas (MPAs) and international agreements like the Paris Agreement and the United Nations Convention on the Law of the Sea (UNCLOS) aim to protect and preserve marine ecosystems.

India's pursuit of enhanced Underwater Domain Awareness (UDA) has led to the development of both multilateral and bilateral relations with various nations. Multilaterally, India actively engages in regional forums and organizations such as the Indian Ocean Naval Symposium (IONS) and the Indian Ocean Rim Association (IORA) to collaborate on UDA initiatives. These partnerships

facilitate information sharing, joint exercises, and technology transfer, strengthening India's maritime security.

Bilaterally, India has bolstered UDA capabilities through strategic partnerships. For instance, its collaboration with the United States under the Maritime Security Dialogue has enabled intelligence sharing, joint patrols, and capacity building, enhancing UDA in the Indian Ocean Region (IOR).

Similarly, India's relations with Japan have resulted in the acquisition of advanced technology, including underwater surveillance equipment. Meanwhile, cooperation with France includes joint maritime exercises and the sharing of naval infrastructure, further augmenting UDA capabilities.

Additionally, India's engagement with Southeast Asian nations, such as Vietnam and Indonesia, has strengthened UDA efforts in the South China Sea, a region of growing geopolitical importance. This bilateral relations underscore India’s commitment to safeguarding its maritime interests and maintaining stability in the IOR, while also promoting regional security through UDA collaboration. Overall, these multilateral and bilateral efforts reflect India's proactive stance in enhancing its UDA capabilities and fostering maritime security in the region.

Introduction

India is located at the heart of the Indo-Pacific, envisioning an open, free, and inclusive Indo-Pacific with respect for territorial integrity and sovereignty. And to steer its vision, India, through various regional engagements, is pushing for economic development and shaping the security narratives in the wider Indo-Pacific. In recent years, China has relatively increased its presence in the region through various infrastructure projects coupled with a growing military presence by way of the People's Liberation Army Navy (PLAN), which has alarmed the regional powers. China has been deploying vessel and submarine patrols, particularly in the Indian Ocean, near the Andaman and Nicobar Islands, which is of utmost significance to India. Chinese increased forays in the region have instigated strategic competition with regional as well as extra-regional powers.

Understanding the criticality of the situation, India shifted its focus towards the Indian Ocean and envisaged taking on the role of security guarantor for the region. As a result, Prime Minister Modi's articulated the SAGAR vision, which stands for Security And Growth for All in the Region, at the annual Shangri-La Dialogue in 2018. In his speech, he highlighted three objectives: 'safe', 'secure', and 'sustainable growth' in the region, against the background of the emergence of the Indo-Pacific as a new theatre. These objectives can be achieved through:

(a) Maintaining stability and strengthening regional cooperation in the region

(b) Safeguarding maritime security

(c) Promoting Sustainable Growth

(d) Ensuring environmental protection through the conservation of coastal and marine ecosystems

Underwater Domain Awareness (UDA) is very well aligned with the SAGAR vision of the PM. It encompasses the ideas of a smart digital India with high-end technology integration to overcome the specific challenges of the IOR. The effective UDA framework, being a new initiative, will require efforts in all dimensions, namely – policy support, infrastructure creation, and human resource development. Pooling of resources and synergy of efforts is the only way forward, and to achieve that strategic vision, stakeholders such as the national security apparatus, economic

entities, environmental regulators, disaster management authorities, and science and technology providers have to come together.

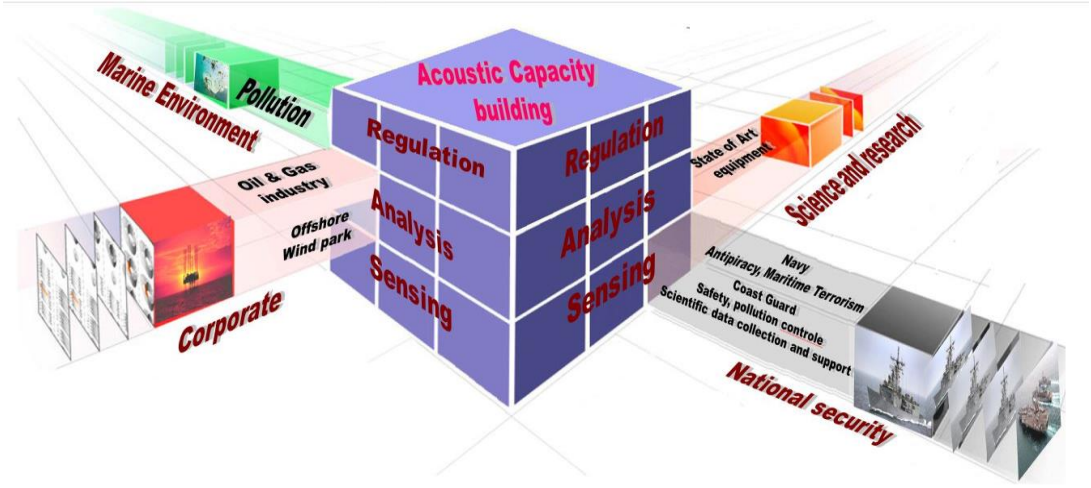

Fig 1: Comprehensive Underwater Domain Awareness Framework (Dr (Cdr) Arnab Das, Director MRC

The term UDA was first coined by Lt Cdr David Finch in his paper entitled "Comprehensive Underwater Domain Awareness: A Conceptual Model", published in the Canadian Naval Review[1]. He defined UDA as an aspect of Maritime Domain Awareness (MDA), focusing on events in the underwater environment. However, Lt Cdr Finch makes no reference to the MDA. MDA and UDA might be related, but they are two distant concepts. MDA refers to the ability to monitor, track, and understand the activities in the maritime domain 'in', 'under' and 'over', the sea, whereas UDA, on the other hand, specifically refers to the ability to monitor, track, and understand the activities below the surface of the ocean. UDA includes not only security operations such as submarine operations and underwater exploration but, also, the monitoring of the physical and environmental characteristics of the underwater environment. With the growing recognition of the Indo-Pacific as a single strategic space, India recognises the centrality of the location. Therefore, familiarisation with the underwater environment for effective Underwater Domain Awareness (UDA) is a prerequisite.

[1] Underwater domain awareness - Wikipedia. "Underwater Domain Awareness - Wikipedia," December 4, 2019. Accessed from https://en.wikipedia.org/wiki/Underwater_domain_awareness#:~:text=and%20capability%20building-,History,published%20in%20Canadian%20Naval%20Review.

In enhancing maritime security by detecting and tracking potential threats such as submarines, unmanned underwater vehicles, and divers, UDA is expected to play a prominent role. UDA technologies can help identify potential security risks and enable a more proactive response to potential Chinese threats. This is important for several reasons, including maritime security. India has been taking steps to develop a comprehensive Underwater Domain Awareness (UDA) strategy to enhance its maritime security and protect its interests in the Indian Ocean region (IOR). The development of a UDA strategy is part of India's broader effort to strengthen its naval capabilities and expand its presence in the IOR[2]. However, for any security framework to work, there is a need for information or awareness about the ongoing activities in that domain.

In recent years, ocean exploration has intensified, resulting in the discovery of untapped resources such as new medicines, genomes, food and energy resources, and even aspects of our own cultural heritage. The ecosystem in particular is under pressure due to over-exploitation, destructive fishing practises, habitat destruction, and pollution from land, as well as, from the sea, which has severely damaged the habitat. To make the situation worse, destructive practices such as bottom trawling, unsustainable exploitation of the hydrocarbons, and rapid expansion of plastic and oil discharge from the ships have further depleted marine wealth[3]. Often geographically remote and low lying, vulnerable to environmental challenges, and small in both size and population, Small Island Developing States (SIDS) span the globe. Many SIDS are simultaneously facing the risk of severe natural disasters like cyclones and hurricanes, as also, face a myriad of environmental problems, primarily as a direct result of increasing demand for already scarce resources, as for the most part, island inhabitants are dependent on fishing and subsistence farming. However, coastal SIDs marine systems are threatened by overfishing and destruction of reefs, resulting from the use of dynamite and cyanide poisoning. Moreover, the increasing negative impacts of global environmental problems such as climate change are putting additional pressure on SIDS. Mainly low-lying areas are vulnerable to sea-level rise and people are faced with the urgent need to

[2] Josep, Anil Jose UDA Digest - An e-Magazine for Underwater Domain Awareness. "Underwater Domain Awareness (UDA): A Road Less Travelled and Fathomed - UDA Digest," December 1, 2022. https://digest.foundationforuda.in/underwater-domain-awareness-uda-a-road-less-travelled-and-fathomed/.

[3] FAO. Bay of Bengal nations meet to work towards livelihood security to 400 million people. "Bay of Bengal Nations Meet to Work towards Livelihood Security to 400 Million People," n.d. Accessed From. https://www.fao.org/asiapacific/news/detail-events/en/c/47378/.

establish realistic measures to protect them against damage caused by the disasters aggravated by rising sea-levels.

The question arises: how do we understand underwater activities and to what extent are anthropogenic activities impacting the region? And, more critically, why mapping the Indo-Pacific becomes an important tool[4].

Small island developing states (SIDS) are generally dominated by highly diversified forest and coral ecosystems, which are especially vulnerable to natural and human activities. Encouragingly ocean issues seem to be rising up the international development agenda, as reflected in a rapidly expanding list of international commitments to the conservation and sustainable use of marine resources. but a recent survey of world leaders revealed that SDG 14 on life underwater is considered the lowest priority among the SDGs. SIDS are on the frontlines of climate change, and they will be the first to get impacted by the climate change and most severely, yet they contribute less than 1% of global carbon emissions. They are vulnerable to hurricanes and cyclones, which are becoming more frequent and extreme, causing economic and environmental devastation, not to mention loss of life. Their dependence on food and energy imports, and tourism revenue, increase their vulnerability to external shocks, such as the COVID-19 pandemic.

[4] Ibid

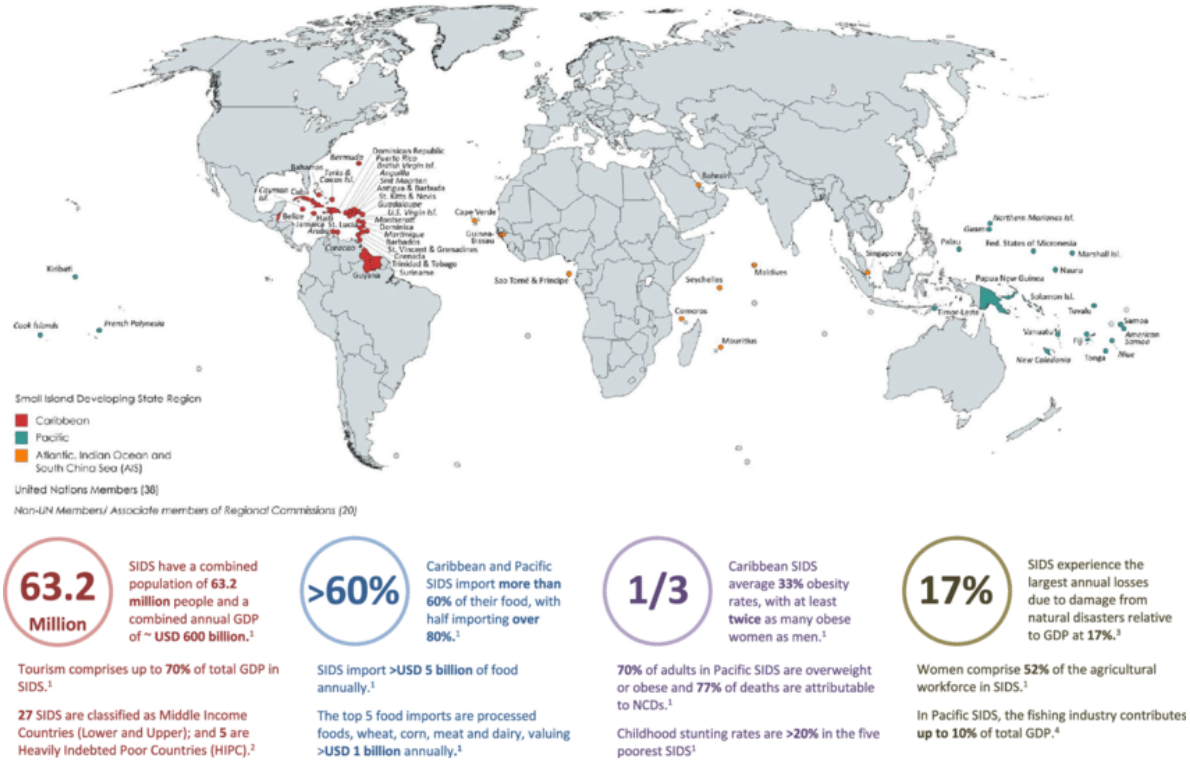

Fig 2: World map showing the 58 Small Island Developing States (SIDS)[5]

The ocean and its resources provide SIDS with an opportunity to tap into the "blue economy," a concept that ensures better stewardship of ocean resources by linking sustainable use and economic growth (Cheney, 2021). SIDs with limited options to withstand the current health and consequent socio-economic crisis. Maldives, like other SIDs, faces significant economic challenges stemming from COVID-19, followed by the war between Russia and Ukraine. A sharp fall in tourism revenues and remittances for both countries is likely to result in a significant economic contraction in the future; and, further, intensify their vulnerability to external shock. As a result, a comprehensive UDA framework will help identify areas at risk and, thereafter, actions can be taken to protect communities. The blue economy encompasses all economic activities related to oceans, seas and coastlines, including aquaculture, fisheries, coastal tourism, wind and ocean energy, and desalination. [6] A small economic base, a high degree of openness, and extreme dependence on the fiscal performance of developed countries in the global north have left the

[5] World map showing the 58 Small Island Developing States (SIDS) https://www.researchgate.net/figure/World-map-showing-the-58-Small-Island-Developing-States-SIDS-with-key-facts-and_fig1_342804854

[6] Flower, J., Ramdeen, R., Estep, A., Thomas, L. R., Francis, S., Goldberg, G., Johnson, A. E., McClintock, W., Mendes, S. R., Mengerink, K., Rogers, L., Zischka, U., & Lester, S. E. (2020). Marine spatial planning on the Caribbean island

The unrealized aptness of the UDA to monitor marine ecosystems, including fish populations and coral reefs, can help in sustainable exploration and regulate the use of marine resources. The response to natural disasters and climate change risks, hence, UDA capabilities, have indeed, become critical in ensuring sustainable development. An effective UDA framework can encourage a Safe, Secure, and Sustainable Growth model to manage the challenges and opportunities in the tropical littoral waters of the IOR, whilst also ensuring that it is well aligned to the 'Security And Growth for All in the Region' (SAGAR) vision proposed by the Indian Prime Minister. It will require efforts on all three fronts, viz. Policy, Technology & Innovation, and Human Resource Development. The effective UDA framework will focus on pooling resources and synergising of efforts across stakeholders so that a long-term, coherent, and structural initiative can be implemented on the ground.

The UDA framework will ensure the mapping of these best practices and traditional knowledge of modern digital tools and know-how. A comprehensive and inclusive approach based on sustainability and community interest will be central to the program. Underwater Domain Awareness (UDA) is a critical component within multilateral constructs, serving as a linchpin for a myriad of compelling reasons. First and foremost, it is indispensable for safeguarding maritime security, which is a shared global concern. Within the framework of multilateral organizations like regional security forums and international agreements, UDA technologies come to the forefront. They play a pivotal role in detecting and tracking potential threats lurking beneath the ocean's surface. This includes the identification of submarines, the monitoring of illegal fishing activities, the deterrence of piracy, and the interception of smuggling operations. By fostering collaboration among member nations, UDA bolsters the collective maritime security efforts, ensuring the safety and stability of international waters.

Oceans are a vital source of economic activities, ranging from shipping to fishing and offshore energy production, and the importance of UDA extends to the realm of resource management. However, without effective UDA, the sustainability of these resources is jeopardized. Multilateral constructs can facilitate information sharing and collaborative approaches to resource

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of Montserrat: Lessons for data-limited small islands. *Conservation Science and Practice*, *2*(4), e158. https://doi.org/10.1111/csp2.158

management. This ensures that overexploitation is prevented, marine ecosystems are protected, and the economic benefits of these resources are sustained for the long term.

Moreover, UDA is pivotal in the context of environmental protection. Oceans are increasingly facing threats such as pollution, habitat destruction, and the adverse impacts of climate change. Within multilateral agreements that incorporate UDA components, nations can actively monitor and enforce environmental regulations. This collective effort contributes significantly to the preservation of fragile marine ecosystems and the mitigation of ecological damage.

Furthermore, UDA plays a humanitarian role. UDA technologies facilitate search and rescue operations during maritime emergencies, which can range from shipwrecks to natural disasters. Multilateral organizations have the capacity to establish protocols for joint search and rescue missions, ensuring that responses to incidents at sea are timely and well-coordinated, ultimately saving lives. Additionally, UDA contributes to scientific advancements. Multilateral constructs promote scientific cooperation, and UDA is instrumental in expanding our understanding of the oceans. Collaborative research efforts can lead to groundbreaking discoveries in marine science, benefiting scientific knowledge, innovation, and technological development.

In regions with contested maritime boundaries, UDA also serves as a means of conflict prevention. By providing transparency and reducing misunderstandings, UDA can play a pivotal role in preventing conflicts. Multilateral agreements, such as the United Nations Convention on the Law of the Sea (UNCLOS), emphasize the importance of peaceful dispute resolution through the use of UDA data. Moreover, UDA is integral to counterterrorism efforts, especially in preventing the illicit trafficking of weapons or explosives through underwater routes. Multilateral organizations enhance their capacity to detect and deter such activities through collaborative UDA initiatives.

Additionally, UDA is closely linked to climate change mitigation. Oceans are critical in mitigating climate change by absorbing carbon dioxide. Multilateral UDA efforts contribute to monitoring ocean health and understanding its impact on climate systems, aligning with global climate change mitigation goals. Lastly, UDA can contribute to geopolitical stability. In regions with geopolitical sensitivities, such as the South China Sea or the Arctic, UDA technologies can mitigate potential tensions by providing transparency and fostering confidence-building measures among nations. Multilateral cooperation in UDA efforts can reduce the risk of conflicts and promote peaceful resolutions.

Underwater Domain Awareness (UDA) technologies are instrumental in fortifying maritime security and safety. They are particularly vital within multilateral constructs, where nations collaborate to address shared challenges. These technologies encompass a suite of tools and systems designed to monitor and comprehend activities within the underwater domain, encompassing oceans, seas, and various water bodies. Their applicability within multilateral contexts is underscored by their significant importance for nurturing collaboration.

For instance, sonar systems, which enable the detection of submarines, underwater objects, and marine life, have a profound impact. The Indian Ocean Naval Symposium (IONS), a multilateral forum, promotes the exchange of sonar data among member nations, enhancing underwater situational awareness. Underwater sensors, including hydrophones and underwater cameras, are critical data-gathering instruments. The European Union's Copernicus Marine Service, an international initiative, uses such sensors to collect data for comprehensive oceanographic assessments, emphasizing the value of multilateral cooperation.

Satellite-based monitoring, another facet of UDA, contributes to vessel tracking and environmental monitoring. The Global Maritime Awareness Initiative, which involves numerous nations, shares satellite data for maritime surveillance and disaster response. Unmanned Underwater Vehicles (UUVs) and Autonomous Underwater Vehicles (AUVs) are widely deployed for seabed mapping, mine clearance, and environmental monitoring. NATO, a multilateral organization, conducts joint exercises employing UUVs, exemplifying the collaborative use of these technologies.

Submarine detection and tracking technologies have implications for naval and maritime security. The Quad, comprising the United States, India, Japan, and Australia, collaborates on anti-submarine warfare capabilities, highlighting the relevance of multilateral cooperation in this area. Furthermore, underwater communication systems, which facilitate secure coordination, are integral to multilateral efforts. The Arctic Council, consisting of eight nations, works on standardizing underwater communication protocols to enhance cooperation in the Arctic region. Integrating UDA into broader Maritime Domain Awareness (MDA) systems is pivotal. The European Union's Common Information Sharing Environment (CISE) integrates UDA data, strengthening maritime security within the EU.

UDA technologies also have environmental applications. The Barcelona Convention, involving Mediterranean countries, leverages UDA data to monitor marine pollution and protect marine

ecosystems. Finally, these technologies are indispensable in search and rescue operations. The Arctic Coast Guard Forum, which unites Arctic nations, collaborates on search and rescue missions, demonstrating the humanitarian potential of UDA technologies. The UDA technologies are crucial for bolstering maritime security and addressing various challenges. Their applicability within multilateral constructs underscores the importance of international cooperation in harnessing the benefits of these technologies. The data-sharing and collaborative initiatives mentioned highlight the significant role that multilateral organizations play in advancing UDA capabilities on a global scale.

In conclusion, the need for Underwater Domain Awareness in multilateral constructs is multifaceted and far-reaching. It enhances maritime security, safeguards valuable resources, protects the environment, enables rapid response to emergencies, fosters scientific discovery, and promotes international cooperation. By recognizing the importance of UDA in these contexts, multilateral organizations can collectively address the complex challenges and opportunities presented by the underwater domain in an increasingly interconnected world.

Objectives:

The long-term goal of the research is to provide a comprehensive review of literature on the he objective of research on the topic "*Multilateral and Bilateral Relations for India and Underwater Domain Awareness"* and *"Climate Risks to the Underwater Ecosystem of Small Island Developing States (SIDs) in the Indian Ocean Region (IOR): Push for Multilateral Collaborations"* is to analyze and correlate the following key aspects:

- Assessment of UDA Capabilities: Evaluate India's current Underwater Domain Awareness capabilities, including technological infrastructure, naval assets, and surveillance systems. Assess the strengths and weaknesses of India's UDA infrastructure to identify areas for improvement.
- Impact of Bilateral Relationships: Investigate the impact of India's bilateral relationships with countries like the United States, Japan, France, and others on its UDA efforts. Analyze the extent of technology transfer, information sharing, and joint exercises in enhancing India's UDA capabilities.
- Multilateral Engagements: Examine India's participation in multilateral forums and organizations, such as the Indian Ocean Naval Symposium (IONS) and the Indian Ocean Rim Association (IORA), to promote UDA. Evaluate the effectiveness of these multilateral constructs in fostering cooperation and information sharing among member nations.
- Regional Security Dynamics: Analyze how India's UDA initiatives and collaborations contribute to regional security dynamics in the Indian Ocean Region (IOR) and beyond. Assess the implications of India's UDA efforts on regional stability and maritime security.
- South China Sea Engagement: Explore India's involvement in UDA activities in the South China Sea and its bilateral relationships with Southeast Asian nations like Vietnam and Indonesia. Assess the role of India's UDA capabilities in addressing regional challenges and promoting stability in the South China Sea.
- Policy Recommendations: Provide policy recommendations for India's UDA strategies, including suggestions for strengthening bilateral partnerships, leveraging multilateral forums, and enhancing technological capabilities. Offer insights into how India can better contribute to regional maritime security through UDA initiatives.

- Geopolitical Implications: Analyze the geopolitical implications of India's UDA efforts, including its impact on regional power dynamics and its role in shaping maritime governance and rules-based order in the Indian Ocean Region.
- Future Trends: Predict future trends in India's UDA development and its evolving role in bilateral and multilateral relations. Consider emerging technologies and geopolitical shifts that may influence India's UDA strategies.

The research aims is also to provide a comprehensive understanding of how India's multilateral and bilateral engagements contribute to its Underwater Domain Awareness capabilities and their broader implications for regional security, cooperation, and governance in maritime domains. Climate Risks to the Underwater Ecosystem of Small Island Developing States (SIDs) in the Indian Ocean Region (IOR): Push for Multilateral Collaborations" of the underwater threats faced by SIDS, the importance of UDA in addressing these challenges, and practical recommendations to enhance the capacity of SIDS to protect their marine environments, economies, and societies.

- Identify and Assess Underwater Threats: Investigate and catalog the various underwater threats that SIDS face, such as rising sea levels, ocean acidification, coral reef degradation, illegal fishing, marine pollution, and potential security concerns, and assess their impacts on the economies, environments, and societies of SIDS.
- Understand Vulnerabilities: Analyze the vulnerabilities of SIDS to these underwater threats, considering factors like limited resources, small land areas, and dependence on marine resources, and examine how these vulnerabilities exacerbate the challenges posed by underwater threats.
- Evaluate the Role of UDA: Evaluate the significance of Underwater Domain Awareness as a strategic tool for enhancing the ability of SIDS to monitor, mitigate, and respond to underwater threats effectively. Assess the potential benefits of UDA in improving the security, sustainability, and resilience of SIDS.
- Highlight Policy and Governance Aspects: Investigate the policy, legal, and governance frameworks needed to support the establishment and operation of UDA systems in SIDS. Address issues related to international cooperation, data sharing, and capacity building.

- Recommendations for Action: Develop practical recommendations and strategies for SIDS, regional organizations, and the international community to address underwater threats effectively through UDA. Emphasize the importance of capacity building, knowledge sharing, and financial support.
- Raise Awareness: Contribute to raising awareness among policymakers, stakeholders, and the general public about the significance of UDA in safeguarding the maritime interests and sustainable development of SIDS.
- Contribute to Sustainable Development Goals: Align the research objectives with the United Nations Sustainable Development Goals (SDGs), particularly Goal 14 (Life Below Water), by emphasizing how UDA can support the conservation and sustainable use of oceans, seas, and marine resources in SIDS.
- Promote Resilience and Adaptation: Investigate how UDA can be integrated into broader strategies for climate resilience, adaptation, and disaster risk reduction in SIDS, considering the increasing frequency and severity of climate-related events.

Literature Review:

The primary research method for this study is literature review and thorough understanding of countries geography. Identify interrelation between the geography and the international relations is the very first step toward understanding the application of the geography in the decision-making of a country (in this case UDA in various Multilateral and bilateral constructs) at the international level. This study will first investigate “Underwater Threats to Small Island Developing States (SIDS) and Underwater Domain Awareness (UDA)" with summaries and references to relevant scholarly articles and publications. Based on this understanding, a policy recommendation will follow which India could use to increase cooperation and mutual understanding in the region.

References

India's Multilateral Engagement in the Indian Ocean Region: India actively participates in regional multilateral forums like the Indian Ocean Naval Symposium (IONS) and the Indian Ocean Rim Association (IORA) to enhance its underwater domain awareness capabilities.

Source: Batra, S. (2018). Indian Ocean Rim Association: A Review. Maritime Affairs: Journal of the National Maritime Foundation of India.

India-U.S. Collaboration on UDA: India's bilateral relationship with the United States has led to advancements in UDA through collaboration on intelligence sharing, joint patrols, and technology transfer.

Source: Mohan, C. R. (2019). India-US Relations: Navigating the Agenda for the 2020s. ORF Special Report.

India-Japan Partnership in UDA: India and Japan have cooperated on UDA, including technology transfer and joint exercises, as part of their strategic partnership.

Source: Shrikumar, A. (2019). India-Japan Relations: Progress and Potential. Global Policy.

France-India Collaboration on UDA: The India-France strategic partnership extends to the underwater domain, including joint maritime exercises and sharing of naval infrastructure for enhanced UDA.

Source: Ranjan, R., & Chari, P. R. (2019). France and India: A New Equilibrium? ORF Occasional Paper.

India's Engagement in the South China Sea: India's bilateral relationships with Southeast Asian nations like Vietnam and Indonesia have strengthened UDA efforts in the South China Sea, where it has been actively involved in regional security initiatives.

Source: Khandekar, G., & Kesavan, K. (2019). India's South China Sea Dilemma: Emerging Trends and Future Options. Observer Research Foundation Issue Brief.

Indian Navy's UDA Capabilities: Often focus on the Indian Navy's efforts to enhance UDA capabilities, emphasizing the importance of bilateral and multilateral cooperation.

Source: Singh, M., & Mishra, A. (2020). Modernization of the Indian Navy: Challenges and Prospects. Strategic Analysis

India's Role in Regional Security: India's role in maintaining regional security and stability through UDA initiatives and bilateral/multilateral collaborations.

Source: Singh, G. (2020). India in the Indian Ocean Region: Geostrategic Imperatives and Challenges. International Studies.

Underwater Threats to Small Island Developing States (SIDS) and Underwater Domain Awareness (UDA): Small Island Developing States face unique underwater threats, including sea-level rise, coral reef degradation, and ocean acidification, which can affect their economies and ecosystems.

Source: Nurse, L. A., McLean, R. F., Agard, J., Briguglio, L. P., Duvat-Magnan, V., Pelesikoti, N., ... & Tompkins, E. (2014). Small islands. In Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1613-1654). Cambridge University Press.

Challenges of UDA in SIDS: Implementing effective UDA in SIDS is challenging due to limited resources, technical capabilities, and vast maritime territories. It requires international cooperation and support.

Source: Moors-Murphy, H. B., & Lück, M. (2016). Marine domain awareness for small island developing states: A conceptual framework. Marine Policy.

Regional Initiatives in the Caribbean: The Caribbean region, comprising many SIDS, has initiated regional efforts to improve UDA and address underwater threats, including marine pollution and illegal fishing.

Source: McConney, P., Mahon, R., & Oxenford, H. (2018). Caribbean marine ecosystems and their fisheries: Status and opportunities for sustainable development. Marine Policy.

Technological Solutions: The application of technology, such as remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs), to enhance UDA in SIDS.

Source: Bidhendi, M., & Bidhendi, S. (2019). Robotic technologies for marine debris collection: A review. Marine Pollution Bulletin, 145, 696-711.

UN Initiatives: The United Nations has recognized the vulnerabilities of SIDS and the need for UDA to address underwater threats. They have called for international cooperation and support.

Source: United Nations. (2014). Third International Conference on Small Island Developing States, A/CONF.223/3.

Integrated Coastal Zone Management: the importance of Integrated Coastal Zone Management (ICZM) as a holistic approach to address underwater threats and improve UDA in SIDS.

Source: Wong, P. P., Ibiyemi, A., & Losada, I. J. (2014). Coastal systems and low-lying areas. In Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 361-409). Cambridge University Press.

Research Methodology:

The primary research method for this study is literature review and thorough understanding of countries geography. Identify interrelation between the geography and the international relations is the very first step toward understanding the application of the geography in the decision-making of a country (in this case UDA in various Multilateral and bilateral constructs) at the international level. The research methodologies for the topics "Multilateral and Bilateral Relations for India and Underwater Domain Awareness" and "Climate Risks to the Underwater Ecosystem of Small Island Developing States (SIDs) in the Indian Ocean Region (IOR): Push for Multilateral Collaborations" would involve a combination of qualitative and quantitative research methods. Based on research findings, formulate policy recommendations for India, SIDs, and the international community. These recommendations should highlight the need for multilateral collaborations and propose actionable steps to address the identified challenges.

Data Collection:

For the topic on India's relations and underwater domain awareness:

Qualitative Data: Conduct interviews or surveys with experts, policymakers, and stakeholders involved in India's maritime security and bilateral/multilateral relations. This would help gather qualitative insights into the significance of UDA in India's foreign policy.

Quantitative Data: Collect relevant statistical data on India's maritime activities, defense expenditures, and participation in multilateral forums like IONS or IORA. Analyze this data to identify trends and patterns.

For the topic on climate risks to SIDs:

Qualitative Data: Conduct interviews or focus group discussions with representatives from SIDs in the Indian Ocean region, climate scientists, and policymakers. Gather qualitative information on the specific climate risks and challenges faced by SIDs.

Quantitative Data: Collect climate-related data such as sea-level rise rates, temperature trends, and historical climate events in the Indian Ocean region. Analyze this data to assess the severity of climate risks.

Case Studies:

Select case studies of SIDs in the Indian Ocean region to provide in-depth analysis. These case studies should highlight the challenges they face, their efforts to address climate risks, and their engagement in multilateral collaborations.

Surveys and Questionnaires:

Design surveys or questionnaires to gather opinions and perceptions from relevant stakeholders. These could include government officials, NGOs, and researchers. Use surveys to understand the perception of the importance of multilateral collaborations in addressing climate risks in the underwater ecosystem.

Comparative Analysis:

Conduct a comparative analysis of India's bilateral and multilateral engagements in the underwater domain awareness sector. Compare the benefits, challenges, and outcomes of bilateral agreements versus participation in multilateral forums.

Policy Analysis:

Analyze the policies and strategies implemented by India and SIDs in response to underwater threats and climate risks. Evaluate the effectiveness of these policies and their alignment with international agreements and conventions.

Data Visualization:

Use data visualization techniques like graphs, charts, and maps to present quantitative findings and trends effectively. Visual aids can enhance the understanding of complex data.

By employing these research methodologies, an informed policy recommendations can be generated to address the issues related to multilateral relations, underwater domain awareness, and climate risks in the Indian Ocean region. This study will be conducted between September 2023 and June 2024.

Research Question:

These research questions reflect the interplay between India's engagement in UDA, its bilateral and multilateral relations, and the pressing need for collaborative efforts to mitigate climate risks for underwater ecosystems in the Indian Ocean, particularly in SIDs. Exploring these questions can shed light on innovative approaches to address complex challenges at the intersection of maritime security and environmental sustainability.

- How can India's multilateral engagements in Underwater Domain Awareness (UDA) contribute to building resilience in Small Island Developing States (SIDs) against climate risks in the Indian Ocean region, considering both maritime security and environmental sustainability?
- What role do bilateral agreements between India and other maritime nations play in fostering international cooperation to address climate-related threats to underwater ecosystems in the Indian Ocean, and how can this collaboration be integrated into multilateral frameworks?
- How can the expertise and technological capabilities developed through India's bilateral relations in UDA be leveraged within multilateral collaborations to enhance the monitoring and mitigation of climate-induced risks for SIDs in the Indian Ocean?
- What lessons can be drawn from India's experience in navigating the complexities of bilateral and multilateral relations for UDA to inform strategies for SIDs seeking to address climate vulnerabilities in their underwater ecosystems while fostering international partnerships?
- How can the outcomes and best practices emerging from India's participation in multilateral forums such as the Indian Ocean Naval Symposium (IONS) and the Indian Ocean Rim Association (IORA) be applied to strengthen the resilience of SIDs' underwater ecosystems in the Indian Ocean region, especially in the context of climate change?

Conclusion

Multilateral and Bilateral Relations for India and Underwater Domain Awareness" and "Climate Risks to the Underwater Ecosystem of Small Island Developing States (SIDs) in the Indian Ocean Region (IOR): Push for Multilateral Collaborations" share a common thread in their interconnectedness within the broader context of maritime security, environmental sustainability, and international cooperation. These topics collectively underscore the imperative of multilateral collaborations in addressing the complex challenges faced by nations in the Indian Ocean region.

India, as a maritime nation, has been actively engaging in both bilateral and multilateral relations to bolster its underwater domain awareness (UDA). Bilaterally, it collaborates with key partners like the United States, Japan, and France to enhance its maritime security capabilities and technological prowess in UDA. These bilateral agreements facilitate the transfer of technology, intelligence sharing, and joint exercises, strengthening India's capacity to detect, deter, and respond to underwater threats.

Simultaneously, India's participation in multilateral constructs such as the Indian Ocean Naval Symposium (IONS) and the Indian Ocean Rim Association (IORA) reflects its commitment to fostering a collective approach to UDA. Through these forums, India collaborates with regional and international partners to promote information sharing, capacity building, and the development of standardized protocols for addressing maritime challenges. Multilateral relations provide a platform for India to advocate for common interests, share best practices, and engage in diplomatic efforts to ensure a stable and secure Indian Ocean region.

Small Island Developing States (SIDs) in the Indian Ocean region face an array of climate risks that threaten their underwater ecosystems and overall sustainability. Rising sea levels, ocean acidification, coral reef degradation, and extreme weather events pose significant challenges to the livelihoods and environments of these nations. SIDs, given their limited resources and vulnerabilities, are increasingly recognizing the need for multilateral collaborations to address these climate-related threats effectively.

The correlation between these topics becomes evident in the necessity for multilateral collaborations to bolster the resilience of SIDs in the face of climate risks while simultaneously addressing maritime security concerns. Multilateral forums like IONS and IORA provide

platforms for SIDs, including India, to engage in dialogue, share knowledge, and coordinate efforts to mitigate the impacts of climate change on their underwater ecosystems. Effective UDA is critical not only for addressing maritime security threats but also for monitoring the environmental changes caused by climate risks. By enhancing UDA capabilities, SIDs and their partners can better understand and respond to changes in ocean conditions, thereby improving disaster preparedness, early warning systems, and sustainable resource management.

In conclusion, these topics emphasize the interconnectedness of India's multilateral engagements in UDA and the pressing need for multilateral collaborations to address climate risks faced by SIDs in the Indian Ocean region. Multilateral forums serve as arenas for nations to build partnerships, share expertise, and develop collective strategies to safeguard the underwater ecosystems while ensuring maritime security.

It is clear: multilateral collaborations are pivotal for navigating the intricate challenges presented by the underwater domain and climate change. By actively participating in such collaborations, nations, including India, can work together to secure the oceans, preserve marine environments, and build resilience in the face of climate adversity, ultimately promoting sustainable development and security in the Indian Ocean region.

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