

## **TERMS OF REFERENCE**

### **Consultancy for Economic Valuation of current and potential maritime activities**

**Country:** Regional

**Project Number:** RG-T3342

**TC Public Link:** <https://www.iadb.org/en/project/rg-t3342>

**TC Title:** *Unleashing New Avenues for Growth by Tackling Opportunities in the Blue Economy*

#### **1. Background and Justification**

- 1.1. The economies of the Caribbean are small, open economies that depend mainly on tourism or on the exploitation of natural resources and that show persistent sluggish growth rates over time. Although the economies of Caribbean small states<sup>1</sup> grew on average by 0.7% in 2017, productivity has declined over the years. When comparing the performance of the Caribbean private sector to that of the Rest of Small Economies (ROSE), the Caribbean's productivity<sup>2</sup> does not allow for high levels of economic growth. In addition, economic growth has either concentrated in commodity exports (mainly oil, gas and gold) or in services industry, mainly tourism.
- 1.2. The Caribbean is one of the most vulnerable regions in the world to natural disasters, mostly cyclones and hurricanes. It is estimated that economic damages due to this event could be as high as 5.7% of GDP annually for the 1950-2014 period.<sup>3</sup> Moreover, the 2017 hurricane season further highlighted the region's vulnerability to natural disasters and external shocks and the need to increase resilience, economic diversifications and new avenues for growth. For example, it is estimated that in the Bahamas, the impact of hurricanes between 2015 and 2017 was of US 672 Million.
- 1.3. The oceans contribute between US \$1.5 trillion and US \$3 trillion each year to the global economic activities, generates around 31 million jobs and its contribution is expected to increase in the medium to longer term.<sup>4</sup> The "Blue Economy"<sup>5</sup> is an evolving concept that takes a step further than the Ocean Economy in its recognition of the need to not only maximize the economic potential presented by the ocean spaces but to also preserve the health, attributes, and environmental sustainability of the ocean's natural assets (OECD 2011). The concept of the Blue Economy includes the simultaneous promotion of economic growth, environmental sustainability, social inclusion and strengthening of oceans ecosystems. For small islands states, although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors, including marine aquaculture, seabed mining, maritime safety and surveillance, marine biotechnology and bioprospecting,

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<sup>1</sup> For the purpose of this document, Caribbean small states are defined as IDB Caribbean country member states: Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

<sup>2</sup> Ruprah, Melgarejo, and Sierra (2014). ROSE refers to countries with less than 3 million population outside the Caribbean.

<sup>3</sup> IMF. 2016. Gone with the Wind: Estimating Hurricane and Climate Change Costs in the Caribbean.

<sup>4</sup> ECLAC. 2018. Caribbean Outlook.

<sup>5</sup> First used during the 2012 United Nations Conference on Sustainable Development.

marine security offshore wind energy, ocean renewable energy and deep-sea oil and gas production.

- 1.4. The exploitation of the ocean space requires an environmentally sustainable approach, as the need to conserve the fragile resources, even for the current economic maritime activities, is a crucial point for this sector. The region's ocean space is vulnerable to the tragedy of the commons (overuse), acidification (affecting coral reefs and marine biodiversity), pollution and climate change. Nevertheless, it is expected that scientific and technological advances can potentially transform the way environmental challenges are addressed and will generate new economic, disruptive activities related to the ocean. Innovation in advanced materials, subsea engineering and technology, remote sensing technologies, big data analytics, biotechnology and nanotechnology will affect every current blue economy activity.<sup>6</sup> Many countries in the region, and outside the region, have been pioneering deep sea exploration searching for new minerals, animal and plants. This type of research is very incipient in the Caribbean, further contributing to asymmetries of information due to lack of knowledge of the ocean potential.
- 1.5. The Caribbean's Oceans Economy, which consists of traditional sectors such as shipping, tourism, oil and gas, fisheries and aquaculture, was estimated to contribute around 18% of GDP in 2012.<sup>7</sup> For Caribbean small island developing states (SIDS), although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors, including marine aquaculture, seabed mining<sup>8</sup>, marine biotechnology<sup>9</sup>, ocean renewable energy including offshore wind and solar energy<sup>10</sup>, deep-sea oil and gas production, deep sea mining, maritime safety and surveillance and high-tech marine services<sup>11</sup>.
- 1.6. The compounded sea zone (exclusive economic zones - EEZs)<sup>12</sup> of Barbados, Bahamas, Jamaica and Trinidad and Tobago (estimated to be 1.439 Million square Km) represents a significant amount of development space in comparison to the countries limited land area (379,110 square kilometers) coupled the existence of a unique biodiversity in terms of marine fauna and flora. In this regard, the marine space can be considered as an input in the production function of the countries, an input that can be more important and relevant than the scarce land space. Yet, marine space is an underexploited growth opportunity, many times because of lack of knowledge due to limited deep-sea

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<sup>6</sup> OECD.2016. The Ocean Economy in 2030.

<sup>7</sup> World Bank. 2016. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean.

<sup>8</sup> Some deep-sea deposits contain ores with up to 10 times the proportion of metal compared to deposits found on land. (Blue Economy Fund)

<sup>9</sup> For instance, the demand for pharmaceuticals from marine species is anticipated to grow to \$8.6 billion by 2016. (Blue Economy Fund) The native Caribbean shallow-water sponge, for instance, was used to develop anti-viral and anti-cancer drugs, including the HIV drug AZT, anti-viral drugs to treat herpes, and an anti-leukemia drug (the first marine-drug approved for cancer treatment). For more information, see <https://ocean.si.edu/ocean-life/invertebrates/sea-sponge-hiv-medicine>

<sup>10</sup> Marine-based renewable sources hold the potential to meet the region's energy needs. On a global basis and over the last few years, wind power has reached 487 GW of capacity (GWEC 2017) with increasing installations of offshore wind power.

<sup>11</sup> UNCTAD. The Oceans Economy. Opportunities and Challenges for Small Islands Developing States. Caribbean Development Bank. 2017. Financing the Blue Economy: A Caribbean Development Opportunity.

<sup>12</sup> The EEZ is the sea area over which a country has exclusive rights regarding the exploration and use of marine resources extending from the country's coast. See World Bank Data.

exploration. There exists a lack of knowledge on the real value and benefits of blue assets (information asymmetry). Aside from asymmetries of information, other market failures have been identified. There is great uncertainty ex ante about the success of pioneering developments with this factor that has led to inertia as countries wait for others to pioneer a path. Furthermore, the region requires guidance on the key elements and complementary factors that need to be put in place for profitable blue economy activities to emerge and for network economies to arise.

- 1.7. Some countries in the Caribbean have started policy actions relate to Blue Economy, such as developing integrated marine policies, for example the OECS adopted the Eastern Caribbean Regional Ocean Policy and the Bahamas and Belize are developing integrated marine policy networks, the Bahamas developed an ocean economy road map and Barbados established a Ministry of Blue Economy in 2018. However, the potential of the Blue Economy as an economic driver for the region has not being recognized and integrated into comprehensive policies in the region<sup>13</sup>.
- 1.8. Thus, the Caribbean needs to take advantage of current technological trends in the ocean economy and create knowledge and technical capacity for expanding current economic activities and creating new ones in coordination with all relevant stakeholders<sup>14</sup>, while promoting sustainable exploitation of the marine resources and enhancing the livelihood of the communities. The latter includes the need to have a detailed mapping of the marine territory and the its real economic value for the Caribbean ocean state.

## **2. Objectives**

- 2.1. The objective of this consultancy is to provide consultancy services to develop an economic valuation methodology for collecting data, to map the current and potential economic activities in the Caribbean, and to visualize that data for easy accessibility and use amongst to key stakeholders.

## **3. Scope of Services**

- 3.1. This is an estimated six (6) month consultancy. The consulting firm shall design and implement an economic valuation tool, along with a report of the economic valuation of economic activities in the Caribbean. The methodology for the economic evaluation tool should be publicly available and replicable.
- 3.2. Complementing the economic evaluation, the consulting firm is expected to populate a database of blue economic activities. The data collected will then be visualized in order to allow for the data to be easily accessible by policymakers in Caribbean region.

## **4. Key Activities**

The Consulting Firm will carry out the activities described hereunder and any other activities necessary to accomplish the stated objectives of the consultancy assignment. The main tasks/activities are described below:

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<sup>13</sup> Caribbean Development Bank. 2018. Financing the Blue Economy: A Caribbean Development Opportunity

<sup>14</sup> The export basket composition of the six Caribbean economies that are the focus of this study suggests room for improvement in the sustainable use of their ocean space as engine of growth and employment generation.

#### **4.1. Inception Meeting, Desk Review, and Progress Reporting.**

4.1.1. Attend a project kick-off meeting with the IDB to discuss project objectives, approach, expected outputs and outcome, and any other issues related to the execution of the consultancy.

4.1.2. Provide bi-monthly (twice a month) status updates on the progress of implementation to the IDB. Hold virtual meetings as necessary to discuss issues.

#### **4.2. Economic Valuation of Economic activities related to the Blue Economy.**

4.2.1. Carry out research and identify on-going initiatives related to conducting economic valuation in the Caribbean, including methodologies and existing databases.

4.2.2. Identify the main economic activities related to current and potential blue economic activities.

4.2.3. Develop a valuation methodology.

4.2.4. Conduct an evaluation of the Marine space as a factor of the productive function of the countries, including the externalities derived from the environmental vulnerability and scarcity of the resources and the different competing and non-competing uses;

#### **4.3. Populate a Data Base for Blue Economic Activities in the Caribbean**

4.3.1. Carry out research and identify on going initiatives related to database collection related to Blue Economy in the Caribbean, including methodologies and existing databases.

4.3.2. Identify current research trends in the blue economy topic both in the region and outside the region and identify a research agenda for the Caribbean, focusing on key technological trends in the industry relevant and with potential application for the Caribbean

4.3.3. Identify data gaps and develop a data collection scheme, including identifying current initiatives for spatial mapping<sup>15</sup>, and propose methodologies for homologation and data sharing;

4.3.4. Develop a database and the data's visualization

### **5. Expected Outcome and Deliverables**

5.1. The Consulting Firm will be required to submit/deliver the following based on the decisions taken after consultation with the IDB Team. The following shall be delivered:

5.1.1. **Work Program:** The work plan (project management plan) should include a synopsis and understanding of the consultancy, proposed activities, strategy and approach to the consultancy, timelines and milestones, responsibilities, expected travel (if needed), and expected outputs. It is expected the work plan will be updated as necessary.

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<sup>15</sup> For example, the Mapping Ocean Wealth Initiative is currently taking place in Barbados.

- 5.1.2. **Economic Valuation Methodology:** Submit the proposed economic valuation methodology, including the methodology for data collection strategy, to the IDB for commenting.
- 5.1.3. **Economic Valuation Report** on the Caribbean two months after contract signature. Economic Valuation of Blue Economy in the Caribbean including the economic value of current and potential activity, the methodology utilized, analysis of other methodologies that are currently used, and internalization of environmental and social costs. A perspective of sustainability and recovery must be incorporated as well.
- 5.1.4. **Database and Visualization** five months after contract signature. The data visualization must be interactive, easy to maintain and update. It should also be compatible or integrate other on-going initiatives in the region.

## **6. Project Schedule and Milestones**

- 6.1.1. Work Program, Strategy and Timeline two weeks after contract signature
- 6.1.2. Economic Valuation Methodology one month after contract signature
- 6.1.3. Economic Valuation Report on the Caribbean two months after contract signature
- 6.1.4. Database and Data Visualization five months after contract signature

## **7. Reporting Requirements**

- 7.1. Every report must be submitted to the Bank in an electronic file. The report should include cover, main document, and all annexes. Zip files will not be accepted as final reports, due to Records Management Section regulations.
- 7.2. The database shall be submitted in excel or STATA.

## **8. Acceptance Criteria**

- 8.1. *The reports submitted by the consultant firm shall be accepted by the IDB Team and must comply with the reporting on the progress and outcomes of the activities of the consultancy.*

## **9. Supervision and Reporting**

- 9.1. *The consultant shall report to the Competitiveness, Technology and Innovation Division (Claudia Stevenson -[claudiast@iadb.org](mailto:claudiast@iadb.org)), Caribbean Department (Juan Pedro Schmid – [jpschmid.org](mailto:jpschmid.org)) and the Climate Change and Sustainability Division (Gerard Alleng – [gerarda@iadb.org](mailto:gerarda@iadb.org))*

## **10. Schedule of Payments**

- 10.1. Payment terms will be based on the deliverables as described below.
- 10.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

<b>Payment Schedule</b>	
<b><i>Deliverable</i></b>	<b>%</b>
1. <i>Work Program</i>	20%
2. <i>Submission and IDB acceptance of Report 1</i>	40%
3. <i>Submission and IDB acceptance of Report 2</i>	40%
<b>TOTAL</b>	100%

## **Qualifications and experience of Firm**

### **4.2 Qualifications of Team:**

- This consultancy requires the services of an international consulting firm with extensive experience in the successful development and deployment of economic growth strategies, particularly working within the Blue Economy for at least 5 years.
- It is essential that the consulting firm demonstrate a proven track record in economic valuation and experience in developing databases and visualization tools, including previous work experience in developing strategies and action plans for the ocean and/or blue economy.

#### **Qualification of Team Members:**

- The Lead Consultant should possess an advanced degree in Economics, Engineering or related field, as well as at approximately three projects focused on the economic valuation of the Blue Economy.
- Other consultants or Junior Consultants should possess at least a Bachelor Degree in Computer Science or a related field with at least one project focused on the Blue Economy.

### **5.2 Skills and Experience in:**

- Experience in design and implementation of visualization databases
- Expertise in conducting valuation of economic activities
- In depth knowledge of the Blue Economy
- Experience working in the Caribbean and Latin America is an asset.
- Familiarity with technological capabilities in Latin America and the Caribbean. Proven project work at international, national and local levels.
- Experience with processing large amounts of information and synthesizing it in an understandable fashion to decision-makers and wider user audiences.

### **6.2 Core Competencies**

- Highly developed communication skills, including the preparation of high quality reports and the delivery of training;
- Ability to work under pressure to meet tight deadlines without compromising the quality of outputs;
- Ability to maintain confidentiality and use discretion when dealing with sensitive

intellectual property issues;

- Cultural awareness and sensitivity to country specific issues;
- Fluency in oral and written English.



## **TERMS OF REFERENCE**

### **Geospatial Information Systems to Foster the Restoration and Reforestation of Mangroves in the Caribbean**

Regional  
RG-T3342

<https://www.iadb.org/en/project/RG-T3342>

*Unleashing New Avenues for Growth by Tackling Opportunities in the Blue Economy*

#### **11. Background and Justification**

**11.1.** The economies of the Caribbean are small, open economies that depend mainly on tourism or on the exploitation of natural resources and that show persistent sluggish growth rates over time. Although the economies of Caribbean small states<sup>16</sup> grew on average by 0.7% in 2017, productivity has declined over the years. When comparing the performance of the Caribbean private sector to that of the Rest of Small Economies (ROSE), the Caribbean's productivity<sup>17</sup> does not allow for high levels of economic growth. In addition, economic growth has either concentrated in commodity exports (mainly oil, gas and gold) or in services industry, mainly tourism.

**11.2.** The Caribbean is one of the most vulnerable regions in the world to natural disasters, mostly cyclones and hurricanes. It is estimated that economic damages due to this event could be as high as 5.7% of GDP annually for the 1950-2014 period. <sup>18</sup> Moreover, the 2017 hurricane season further highlighted the region's vulnerability to natural disasters and external shocks and the need to increase resilience, economic diversifications and new avenues for growth. For example, it is estimated that in the Bahamas, the impact of hurricanes between 2015 and 2017 was of US 672 Million.

**11.3.** The oceans contribute between US \$1.5 trillion and US \$3 trillion each year to the global economic activities, generates around 31 million jobs and its contribution is expected to increase in the medium to longer term.<sup>19</sup> The "Blue Economy"<sup>20</sup> is an evolving concept that takes a step further than the Ocean Economy in its recognition of the need to not only maximize the economic potential presented by the ocean spaces but to also preserve the health, attributes, and environmental sustainability of the ocean's natural assets (OECD 2011). The concept of the Blue Economy includes the simultaneous promotion of economic growth, environmental sustainability, social inclusion and strengthening of oceans ecosystems. For small islands states, although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors,

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<sup>16</sup> For the purpose of this document, Caribbean small states are defined as IDB Caribbean country member states: Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

<sup>17</sup> Ruprah, Melgarejo, and Sierra (2014). ROSE refers to countries with less than 3 million population outside the Caribbean.

<sup>18</sup> IMF. 2016. *Gone with the Wind: Estimating Hurricane and Climate Change Costs in the Caribbean*.

<sup>19</sup> ECLAC. 2018. *Caribbean Outlook*.

<sup>20</sup> First used during the 2012 United Nations Conference on Sustainable Development.



including marine aquaculture, seabed mining, maritime safety and surveillance, marine biotechnology and bioprospecting, marine security offshore wind energy, ocean renewable energy and deep-sea oil and gas production.

- 11.4.** The exploitation of the ocean space requires an environmentally sustainable approach, as the need to conserve the fragile resources, even for the current economic maritime activities, is a crucial point for this sector. The region's ocean space is vulnerable to the tragedy of the commons (overuse), acidification (affecting coral reefs and marine biodiversity), pollution and climate change. Nevertheless, it is expected that scientific and technological advances can potentially transform the way environmental challenges are addressed and will generate new economic, disruptive activities related to the ocean. Innovation in advanced materials, subsea engineering and technology, remote sensing technologies, big data analytics, biotechnology and nanotechnology will affect every current blue economy activity.<sup>21</sup> Many countries in the region, and outside the region, have been pioneering deep sea exploration searching for new minerals, animal and plants. This type of research is very incipient in the Caribbean, further contributing to asymmetries of information due to lack of knowledge of the ocean potential.
- 11.5.** The Caribbean's Oceans Economy, which consists of traditional sectors such as shipping, tourism, oil and gas, fisheries and aquaculture, was estimated to contribute around 18% of GDP in 2012.<sup>22</sup> For Caribbean small island developing states (SIDS), although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors, including marine aquaculture, seabed mining<sup>23</sup>, marine biotechnology<sup>24</sup>, ocean renewable energy including offshore wind and solar energy<sup>25</sup>, deep-sea oil and gas production, deep sea mining, maritime safety and surveillance and high-tech marine services<sup>26</sup>.
- 11.6.** Mangrove forests are vital for the health of coastal environments, the preservation of biodiversity and the maintenance of coastal ecosystem services. Healthy mangrove forests form a natural coastal defense against storm surge, floods, storms and other natural disasters, thereby supporting resiliency naturally. Furthermore, mangroves support traditional livelihoods and bring important benefits to coastal communities.
- 11.7.** Mangroves also support the sustainability of our planet by sequestering significant amounts of Carbon, far more per hectare than tropical rainforest and other ecosystems. Unfortunately, more than half of mangrove forests globally have been destroyed over the

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<sup>21</sup> OECD. 2016. The Ocean Economy in 2030.

<sup>22</sup> World Bank. 2016. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean.

<sup>23</sup> Some deep-sea deposits contain ores with up to 10 times the proportion of metal compared to deposits found on land. (Blue Economy Fund)

<sup>24</sup> For instance, the demand for pharmaceuticals from marine species is anticipated to grow to \$8.6 billion by 2016. (Blue Economy Fund) The native Caribbean shallow-water sponge, for instance, was used to develop anti-viral and anti-cancer drugs, including the HIV drug AZT, anti-viral drugs to treat herpes, and an anti-leukemia drug (the first marine-drug approved for cancer treatment). For more information, see <https://ocean.si.edu/ocean-life/invertebrates/sea-sponge-hiv-medicine>

<sup>25</sup> Marine-based renewable sources hold the potential to meet the region's energy needs. On a global basis and over the last few years, wind power has reached 487 GW of capacity (GWEC 2017) with increasing installations of offshore wind power.

<sup>26</sup> UNCTAD. The Oceans Economy. Opportunities and Challenges for Small Islands Developing States. Caribbean Development Bank. 2017. Financing the Blue Economy: A Caribbean Development Opportunity.

past century, mainly by human development as their ecosystem functions and services were not adequately valued.<sup>27</sup>

- 11.8.** An estimated 18.5 billion US dollars are lost globally each year because of land conversions in coastal ecosystems.<sup>28</sup> This economic loss is driven by the value of carbon held in the soils and living tissue of seagrasses, salt marshes, and mangrove forests. The land degradation and conversion of these blue carbon ecosystems contributes approximately 10% to the carbon emissions from deforestation worldwide, even though they only represent 2-6% of forests, globally.<sup>29</sup> For the small island territories in the Caribbean, being disconnected from neighboring communities can leave them vulnerable with limited resources. For these Big Ocean States (BOSS) to be resilient in the face of rising seas and extreme weather events, a sustainable infrastructure that utilizes the natural benefits and protective function of mangrove forests is needed. Blue Carbon monitoring and reporting are key investments to help avoid exacerbating ecosystem degradation and economic losses in addition to reducing powerful storm surge during hurricanes.
- 11.9.** Blue carbon ecosystems store and sequester most of their carbon stocks in peat soils if they can maintain a balance between sediment accretion and sea-level rise. Sea-level rise and saltwater intrusion pose high-risks of change to mangrove forests and coastal marshes, which can result in extraordinary changes to inundation and salinity that impact both above and below ground carbon cycling. Plant productivity, community structure, soil stability, microbial activity, and root dynamics are affected by these environmental changes creating a cascade of events that can collectively impact regional energy and carbon cycling, freshwater availability, and future vulnerability. As the salinity and hydrologic regimes change, so does the ecosystem and carbon stocks. In particular, with the acceleration of sea level rise and changes in water flow, coastal Caribbean ecosystems are expected to be more susceptible to vegetation shifts and peat soil instability. The changes to the vegetation combined with the instability of peat soils could result in irreversible ecosystem transformations, increasing uncertainties in carbon stocks, and loss of livelihoods.
- 11.10.** Under the chronic pressures from rising seas, saltwater intrusion, agricultural development, and urban expansion, storm events can push the resilience of coastal wetlands beyond their environmental thresholds leading to irreversible changes to inundation and salinity. For growing coastal communities in hurricane prone regions, dense mangrove forests can help to drastically reduce both the damaging surface winds and storm surge level, limiting infrastructure damage and loss of lives. Therefore, spatially explicit information on mangrove extent and structural changes over time are needed to develop predictive modeling tools to understanding the fate of blue carbon ecosystems and the vulnerability to sea level rise.
- 11.11.** Global climate change and sea level rise will affect large tracts of mangrove forests and lowland coastal tropical forests. Countries of the Caribbean depend on numerous ecosystem services that wetland and lowland tropical forests provide including tourism, sustenance, and carbon sequestration.

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<sup>27</sup> Alfredo Quatro, "Ecological mangrove restoration: re-establishing a more biodiverse and resilient coastal ecosystem with community participation.", Sharing Lessons On Mangrove Restoration. Mangrove Action Project, 2012

<sup>28</sup> Linwood Pendleton et. al. Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems. PLoS One. 2012

<sup>29</sup> Ibid

- 11.12.** Supporting the recovery of an ecosystem that has been degraded, damaged, or destroyed can be costly. A recent Metastudy on the topic, which performed a synthesis of 235 studies with 954 observations from restoration or rehabilitation projects of coral reefs, seagrass, mangroves, saltmarshes, and oyster reefs worldwide, showed that the median cost of restoration per hectare is US\$80,000 (2010) and the average costs for restoration of one hectare of marine coastal habitat was around and US\$1,600,000 (2010). The study also identified that coral reefs and seagrass were among the most expensive ecosystems to restore, while mangrove restoration projects were typically the largest and the least expensive per hectare.<sup>30</sup> The information provided by remote sensing and GIS tools would allow Caribbean countries to be more strategic in targeting mangrove restoration projects.
- 11.13.** Recent developments in remote sensing and ecosystem modelling have greatly advance carbon monitoring and measurements in mangrove and tropical forests and provide valuable information to identify and select priority areas of intervention.
- 11.14.** The University of Maryland, using data from the United States National Aeronautics and Space Administration (NASA), have generated baseline maps of mangrove forest height and biomass of several regions including Africa and the Caribbean, in addition to other forest functional maps. Each approach provides its own unique benefits in measuring aspects of forest structure and growth. Combining these data products and models will advance existing estimates and reduce uncertainties in current biomass and predicted changes with respect to climate change and sea level rise.

## **12. Objectives**

- 12.1.** The objective of the consultancy is to develop Caribbean-wide maps of mangrove structure, function, and change using cutting-edge remote sensing datasets and algorithms.
- 12.2.** The consultants will analyze the data produced by the map to develop vulnerability models that can be explored using an interactive web-based tool suite to support coastal and climate resilience on Caribbean islands.

## **13. Main activities**

- 13.1.** The consultants will hold an initial meeting with the Bank to discuss the scope, detailed work plan, and methodology for the consultancy as soon as the contract is signed.
- 13.2.** The consultants will analyze data novel remote sensing data to produce Caribbean-wide estimates of mangrove forest area, the rate of mangrove change, the vertical structure of mangrove forests, and mangrove carbon using newly developed remote sensing approaches in technologies. These maps and estimates will be targeted specifically to address Sustainable Development Goals (SDG) and Nationally Determined Contributions (NDC).
- 13.3.** Consultants will develop vulnerability models to provide spatially explicit information of that identifies areas that are expected to be most affected by sea level rise and coastal development.

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<sup>30</sup> Elisa Bayraktarov et. al., The cost and feasibility of marine coastal restoration. Ecological Applications, 2016

- 13.4. The consultants will develop interactive web-based tools and visualization for all mapped data products
- 13.5. Consultants will develop a Brief report, including details of the methodology used. The report would also specify what the methodology does not cover and where more specific data would be needed (for example, for analysis at the very local level).

#### **14. Outputs:**

- 14.1. Mangrove forest extent maps for all Caribbean island nations.
- 14.2. Mangrove forest change maps by year from 1995 through 2018.
- 14.3. Vulnerability models showing hot spots of potential change in mangrove forests as a result of population and sea level rise.
- 14.4. Brief Report (3-10pp) including data, methodology and summary of the results;
- 14.5. Interactive online tools presenting detailed results for easy viewing of results (Mangrove extent, change, structure, and vulnerability); statistical data as well as GIS;
- 14.6. IDB will have access to the data developed under the consultancy for further internal analysis.

#### **15. Scope of Services**

This is an estimated four (4) month consultancy. The consulting firm will develop applicable remote sensing and Geospatial Information Systems tools to monitor and measure changes in the coastal transition zones where there can be a large exchange of carbon as terrestrial forests transition to marine ecosystems.

#### **16. Reporting Requirements**

- 16.1. Every report must be submitted to the Bank in an electronic file. The report should include cover, main document, and all annexes. Zip files will not be accepted as final reports, due to Records Management Section regulations.

#### **17. Acceptance Criteria**

- 17.1. *The reports submitted by the consultant firm shall be accepted by the IDB Team and must comply with the reporting on the progress and outcomes of the activities of the consultancy.*

#### **18. Supervision and Reporting**

- 18.1. *The consultant shall report to Jose Jorge Saavedra – ([josejs@iadb.org](mailto:josejs@iadb.org)) from the Caribbean Country Department, Gerard Alleng ([gerarda@iadb.org](mailto:gerarda@iadb.org)) from the Climate Change and Sustainability Division and Claudia Stevenson –[claudiast@iadb.org](mailto:claudiast@iadb.org) from the Competitiveness, Technology and Innovation Division*

## 19. Schedule of Payments

19.1. Payment terms will be based on the deliverables as described below.

- *30% at delivery and acceptance of work plan*
- *30% at delivery and acceptance of the Caribbean Mangrove Zone and Structure Map*
- *40% at delivery and acceptance of the Caribbean Mangrove Change and Vulnerability Map Web Portal and final report*

## **TERMS OF REFERENCE**

### **Consultancy for Prospective Studies on Global Industrial and Technological Trends in the Blue Economy and Policies to Promote Growth in the Caribbean**

**Country:** Regional

**Project Number:** RG-T3342

**TC Public Link:** <https://www.iadb.org/en/project/RG-T3342>

**TC Title:** *Unleashing New Avenues for Growth by Tackling Opportunities in the Blue Economy*

#### **1. Background and Justification**

- 1.1. The economies of the Caribbean are small, open economies that depend mainly on tourism or on the exploitation of natural resources and that show persistent sluggish growth rates over time. Although the economies of Caribbean small states<sup>31</sup> grew on average by 0.7% in 2017, productivity has declined over the years. When comparing the performance of the Caribbean private sector to that of the Rest of Small Economies (ROSE), the Caribbean's productivity<sup>32</sup> does not allow for high levels of economic growth. In addition, economic growth has either concentrated in commodity exports (mainly oil, gas and gold) or in services industry, mainly tourism.
- 1.2. The Caribbean is one of the most vulnerable regions in the world to natural disasters, mostly cyclones and hurricanes. It is estimated that economic damages due to this event could be as high as 5.7% of GDP annually for the 1950-2014 period.<sup>33</sup> Moreover, the 2017 hurricane season further highlighted the region's vulnerability to natural disasters and external shocks and the need to increase resilience, economic diversifications and new avenues for growth. For example, it is estimated that in the Bahamas, the impact of hurricanes between 2015 and 2017 was of US 672 Million.
- 1.3. The oceans contribute between US \$1.5 trillion and US \$3 trillion each year to the global economic activities, generates around 31 million jobs and its contribution is expected to increase in the medium to longer term.<sup>34</sup> The "Blue Economy"<sup>35</sup> is an evolving concept that takes a step further than the Ocean Economy in its recognition of the need to not only maximize the economic potential presented by the ocean spaces but to also preserve the health, attributes, and environmental sustainability of the ocean's natural assets (OECD 2011). The concept of the Blue Economy includes the simultaneous promotion of economic growth, environmental sustainability, social inclusion and strengthening of oceans ecosystems. For small islands states, although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors, including marine

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<sup>31</sup> For the purpose of this document, Caribbean small states are defined as IDB Caribbean country member states: Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

<sup>32</sup> Ruprah, Melgarejo, and Sierra (2014). ROSE refers to countries with less than 3 million population outside the Caribbean.

<sup>33</sup> IMF. 2016. *Gone with the Wind: Estimating Hurricane and Climate Change Costs in the Caribbean*.

<sup>34</sup> ECLAC. 2018. *Caribbean Outlook*.

<sup>35</sup> First used during the 2012 United Nations Conference on Sustainable Development.



aquaculture, seabed mining, maritime safety and surveillance, marine biotechnology and bioprospecting, marine security offshore wind energy, ocean renewable energy and deep-sea oil and gas production.

- 1.4. The exploitation of the ocean space requires an environmentally sustainable approach, as the need to conserve the fragile resources, even for the current economic maritime activities, is a crucial point for this sector. The region's ocean space is vulnerable to the tragedy of the commons (overuse), acidification (affecting coral reefs and marine biodiversity), pollution and climate change. Nevertheless, it is expected that scientific and technological advances can potentially transform the way environmental challenges are addressed and will generate new economic, disruptive activities related to the ocean. Innovation in advanced materials, subsea engineering and technology, remote sensing technologies, big data analytics, biotechnology and nanotechnology will affect every current blue economy activity.<sup>36</sup> Many countries in the region, and outside the region, have been pioneering deep sea exploration searching for new minerals, animal and plants. This type of research is very incipient in the Caribbean, further contributing to asymmetries of information due to lack of knowledge of the ocean potential.
- 1.5. The Caribbean's Oceans Economy, which consists of traditional sectors such as shipping, tourism, oil and gas, fisheries and aquaculture, was estimated to contribute around 18% of GDP in 2012.<sup>37</sup> For Caribbean small island developing states (SIDS), although traditional industries and sectors - fisheries, maritime transport and coastal tourism - represent a large portion of economic activity, pursuing the blue economy also enables diversification into many other new and emerging ocean-based activities and sectors, including marine aquaculture, seabed mining<sup>38</sup>, marine biotechnology<sup>39</sup>, ocean renewable energy including offshore wind and solar energy<sup>40</sup>, deep-sea oil and gas production, deep sea mining, maritime safety and surveillance and high-tech marine services<sup>41</sup>.
- 1.6. The compounded sea zone (exclusive economic zones - EEZs)<sup>42</sup> of Barbados, Bahamas, Jamaica and Trinidad and Tobago (estimated to be 1.439 Million square Km) represents a significant amount of development space in comparison to the countries limited land area (379,110 square kilometers) coupled the existence of a unique biodiversity in terms of marine fauna and flora. In this regard, the marine space can be considered as an input in the production function of the countries, an input that can be more important and relevant than the scarce land space. Yet, marine space is an underexploited growth

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<sup>36</sup> OECD.2016. The Ocean Economy in 2030.

<sup>37</sup> World Bank. 2016. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean.

<sup>38</sup> Some deep-sea deposits contain ores with up to 10 times the proportion of metal compared to deposits found on land. (Blue Economy Fund)

<sup>39</sup> For instance, the demand for pharmaceuticals from marine species is anticipated to grow to \$8.6 billion by 2016. (Blue Economy Fund) The native Caribbean shallow-water sponge, for instance, was used to develop anti-viral and anti-cancer drugs, including the HIV drug AZT, anti-viral drugs to treat herpes, and an anti-leukemia drug (the first marine-drug approved for cancer treatment). For more information, see <https://ocean.si.edu/ocean-life/invertebrates/sea-sponge-hiv-medicine>

<sup>40</sup> Marine-based renewable sources hold the potential to meet the region's energy needs. On a global basis and over the last few years, wind power has reached 487 GW of capacity (GWEC 2017) with increasing installations of offshore wind power.

<sup>41</sup> UNCTAD. The Oceans Economy. Opportunities and Challenges for Small Islands Developing States.

Caribbean Development Bank. 2017. Financing the Blue Economy: A Caribbean Development Opportunity.

<sup>42</sup> The EEZ is the sea area over which a country has exclusive rights regarding the exploration and use of marine resources extending from the country's coast. See World Bank Data.



opportunity, many times because of lack of knowledge due to limited deep-sea exploration. There exists a lack of knowledge on the real value and benefits of blue assets (information asymmetry). Aside from asymmetries of information, other market failures have been identified. There is great uncertainty ex ante about the success of pioneering developments with this factor that has led to inertia as countries wait for others to pioneer a path. Furthermore, the region requires guidance on the key elements and complementary factors that need to be put in place for profitable blue economy activities to emerge and for network economies to arise.

- 1.7. Some countries in the Caribbean have started policy actions relate to Blue Economy, such as developing integrated marine policies, for example the OECS adopted the Eastern Caribbean Regional Ocean Policy and the Bahamas and Belize are developing integrated marine policy networks, the Bahamas developed an ocean economy road map and Barbados established a Ministry of Blue Economy in 2018. However, the potential of the Blue Economy as an economic driver for the region has not being recognized and integrated into comprehensive policies in the region<sup>43</sup>.
- 1.8. Thus, the Caribbean needs to take advantage of current technological trends in the ocean economy and create knowledge and technical capacity for expanding current economic activities and creating new ones in coordination with all relevant stakeholders<sup>44</sup>, while promoting sustainable exploitation of the marine resources and enhancing the livelihood of the communities. The latter includes the need to have a detailed mapping of the marine territory and the its real economic value for the Caribbean ocean state.

## **2. Objectives**

- 3.2 The objective of this consultancy is to identify global industrial and technological trends that can be applied in the Caribbean and propose a set of policy actions per country to promote them.

## **3. Scope of Services**

- 3.1 This is an estimated eight (8) month consultancy. The consulting firm shall carry out a prospective study of the main industrial and technological trends related to the Blue Economy. This study will be developed into monograph publication by the IDB.
- 3.2 Utilizing inputs from this analysis, the firm will then identify the trends with the most potential for the Caribbean and develop a country by country policy action plan for realizing these trends. The countries for which policy action plans and agendas must be developed include: The Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

## **4. Key Activities**

The Consulting Firm will carry out the activities described hereunder and any other activities necessary to accomplish the stated objectives of the consultancy assignment. The main tasks/activities are described below:

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<sup>43</sup> Caribbean Development Bank. 2018. Financing the Blue Economy: A Caribbean Development Opportunity

<sup>44</sup> The export basket composition of the six Caribbean economies that are the focus of this study suggests room for improvement in the sustainable use of their ocean space as engine of growth and employment generation.

#### **4.1 Inception Meeting, Desk Review, and Progress Reporting.**

- 4.1.1 Attend a project kick-off meeting with the IDB to discuss project objectives, approach, expected outputs and outcome, and any other issues related to the execution of the consultancy.
- 4.1.2 Provide bi-monthly (twice a month) status updates on the progress of implementation to the IDB. Hold virtual meetings as necessary to discuss issues.

#### **4.2 Prospective Study on Global Industrial and Technological Trends.**

- 4.2.1 Identify main global trends that comprise the Blue Economy Industry
- 4.2.2 Identify the main technological, industrial and scientific advances that could disrupt the Blue Economy and generate new lines of activities
- 4.2.3 Identify the sustainability risks and actions to be taken to make these activities sustainable
- 4.2.4 Determine its applicability for the Caribbean, identifying bottlenecks that limit its sustainable growth, including research capability
- 4.2.5 Identify country specific sectors with the greatest economic potential as well as the actions to be taken to make it viable.
- 4.2.6 Identify main stakeholders to be involved as leader for the growth of the Blue Economy at the regional and country level.

#### **4.3 Develop a set of country specific policy actions for sustainable Blue Economic Development**

- 4.3.1 On a country by country basis, identify the areas with the most potential for development including an analysis so as to identify the growth potential and main gaps and bottlenecks that hinder sustainable exploitation of the Blue Economy, such as research capacity, technological adoption capacity, institutions and human capital.
- 4.3.2 Identify the regulatory, safeguard and environmental framework required for sustainable Blue Economic Development
- 4.3.3 Through consultation with stakeholders, identify and propose a country specific policy agenda for developing the Blue Economy.

#### **4.4 Dissemination of results**

- 4.4.1 Dissemination of results at a time and place to be designated by the IDB Team.

### **5. Expected Outcome and Deliverables**

**5.2** The Consulting Firm will be required to submit/deliver the following based on the decisions taken after consultation with the IDB Team. The following shall be delivered:

- 5.5.1. Work Program:** The work plan (project management plan) should include a synopsis and understanding of the consultancy, proposed activities, strategy and approach to the consultancy, timelines and milestones, responsibilities, expected travel (if needed), and expected outputs. It is expected the work plan will be updated as necessary.

- 5.5.2. **Report 1:** Prospective study and industrial trends three months after contract signature
- 5.5.3. **Report 2:** Country Specific Policy Action Plans
- 5.5.4. Dissemination of results six months after contract signature.

## **6. Project Schedule and Milestones**

### **5.2** The consultant shall abide to the following schedule and milestones

- 6.5.1. Work Program, Strategy and Timeline two weeks after contract signature
- 6.5.2. Prospective Study (report 1) on the Caribbean three months after contract signature
- 6.5.3. Country Specific Action Plans (report 2) six months after contract signature
- 6.5.4. Dissemination of results approximately eight months after contract signature

## **7. Reporting Requirements**

- ### **5.2** Every report must be submitted to the Bank in an electronic file. The report should include cover, main document, and all annexes. Zip files will not be accepted as final reports, due to Records Management Section regulations.

## **8. Acceptance Criteria**

- ### **5.2** *The reports submitted by the consultant firm shall be accepted by the IDB Team and must comply with the reporting on the progress and outcomes of the activities of the consultancy.*

## **9. Supervision and Reporting**

- ### **5.2** *The consultant shall report to the Competitiveness, Technology and Innovation Division (Claudia Stevenson -[claudiast@iadb.org](mailto:claudiast@iadb.org)), Caribbean Department (Juan Pedro Schmid – [jpschmid.org](mailto:jpschmid.org)) and the Climate Change and Sustainability Division (Gerard Alleng – [gerarda@iadb.org](mailto:gerarda@iadb.org))*

## **10. Schedule of Payments**

- ### **5.2** Payment terms will be based on the deliverables as described below.
- ### **6.2** The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

<b>Payment Schedule</b>	
<b><i>Deliverable</i></b>	<b>%</b>
1. <i>Work Plan</i>	20%
2. <i>Submission and IDB Acceptance of Report 1</i>	40%
3. <i>Submission and IDB Acceptance of Report 2</i>	40%
<b>TOTAL</b>	100%

## **Qualifications and experience of Firm**

### **7.2 Qualification of Team:**

- This consultancy requires the services of an international consulting firm with extensive experience in the successful identification and analysis of industrial and technological trends, particularly working within the Blue Economy for at least 3 years.
- It is essential that the consulting firm demonstrate a proven track record in conducting prospective or foresighting studies, including previous work experience in developing policy action plans for the ocean and/or blue economy.

#### **Qualifications of Team Members:**

- The Lead Consultant should possess an advanced degree in Economics, Engineering or related field, as well as experience in at least three projects which required the economic valuation of the Blue Economy.
- Other consultants or Junior Consultants should possess at least a Bachelor Degree in Computer Science or a related field and at least one project focused on the Blue Economy.

### **8.2 Skills and Experience in:**

- Experience in design and implementation of foresighting exercises
- In depth knowledge of the Blue Economy
- Experience working in the Caribbean and Latin America is an asset.
- Familiarity with technological capabilities in Latin America and the Caribbean. Proven project work at international, national and local levels.
- Experience with processing large amounts of information and synthesizing it in an understandable fashion to decision-makers and wider user audiences.

### **9.2 Core Competencies**

- Highly developed communication skills, including the preparation of high quality reports and the delivery of training;
- Ability to work under pressure to meet tight deadlines without compromising the quality of outputs;
- Ability to maintain confidentiality and use discretion when dealing with sensitive intellectual property issues;
- Cultural awareness and sensitivity to country specific issues;
- Fluency in oral and written English.