ADAPTATION FUND

# PROGRAMME ON INNOVATION: SMALL GRANT PROJECT PROPOSAL

## PART I: PROJECT INFORMATION

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|---|---|
| Country: | Dominican Republic |
| Title of Project: | Strengthening of a Replicable Micro Ecosystem for Accelerated Development of Technologies for Climate Change Adaptation of the Dominican Republic - Phase I - Disruptive Modular Dynamic Floating Breakwater Technology |
| National Implementing Entity: | Instituto Dominicano de Desarrollo Integral (IDDI) |
| Executing Entity/ies: | IDDI |
| Amount of Financing Requested: | US$248,734 |

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**Project Background and Context:**

Agenda 21 of the Earth Summit held in Rio De Janeiro, Brazil, June 1992 recognized SIDS as a group of countries with special environment and development challenges. At present, there are fifty-eight SIDS designated by the United Nations (UN), out of which 38 are UN members while 20 are non-UN members or associate members of regional commissions. These SIDS are spread over three regions – the Caribbean, the Pacific, and AIMS (Atlantic, Indian Ocean, Mediterranean, and the South China Sea). SIDS share a common vulnerability to climate change-induced sea level rise (SLR), changes in sea surface temperature, precipitation, and extreme events. This vulnerability mostly stems from their low elevation and densely populated coastal areas. Climate change manifests itself in many ways such as changes in sea levels, storm surges, and sea surface temperatures. Dominican Republic is a SIDS.

Many SIDS are dependent on single economic sectors such as tourism, especially sandy beach tourism, that provide the main source of employment and economic growth. In the Caribbean region, tourism created one in four new jobs and contributed to 20% of the total visitor exports in 2019. While the economic damages of a storm in a rural area might not be comparable to the impact on a developed coast, the resilience of rural communities is usually much lower. Impacts due to extreme events are particularly challenging for SIDS given their high exposure and vulnerability to tropical cyclones, as revealed during Hurricane Dorian in 2019 and Hurricanes Maria and Irma in 2017. Devastating hurricanes in the Caribbean in 2017 revealed the non-economic loss and damage associated with prolonged climate-induced displacement of entire populations of islands due to the complete destruction of their communities. Projected increases in sea level will therefore encroach into this intensely developed area, and act to exacerbate erosion and flooding conditions. For the Caribbean region, the Fifth IPCC report predicts from 0.5 to 0.6 meters of sea level rise for the year 2100. It is therefore critical that island nations in the region consider how, when and which sections of their coastlines will need to be protected from this increasing risk.

When considering coastal zone management and developing coastal protection for the Caribbean context, there are many factors that must be taken into account, including:

• The use of beach nourishment - Sand nourishment is often a preferred “soft engineering” approach to coastal enhancement. However, sand supply can be limited or expensive. In addition, as a stand-alone activity, beach nourishment requires ongoing maintenance, and governments and developers are often hesitant to commit to activities with such recurring costs.

• Logistics of construction material - The extreme waves from hurricanes often dictate the need for either large rock armor or concrete armor units for coastal defense. Large boulders sometimes cannot be transported on the small roadways, and concrete can be an expensive material for the usually limited construction budgets. Access from the sea is in many cases not practical due to the unprotected coastal zones on the Atlantic side of these islands.

• The applicability of retreat - Relocation and the enforcement of sound setback regulations is a means of reducing coastal vulnerability. However, relocation has the potential to introduce undesired social impacts. Local residents can be dislocated from their livelihoods (e.g. fishing). Development pressures and political interests may also result in problems in enforcing setback regulations.

The Caribbean region is therefore faced with the challenge of developing appropriate strategies to deal with coastal erosion in a unique environment, giving consideration to climate change impacts. In Dominican Republic, under normal swell conditions, the net littoral drift is established from East to West, which marks clear patterns of accumulation and erosion on the beaches. The prevalence of coastal drift in an east-west direction and the existence of sources of sand supply that are upstream of the drifting area (be they rivers, submarine banks, dune chains, etc.) make the beaches behave in a stable manner for most of the year.

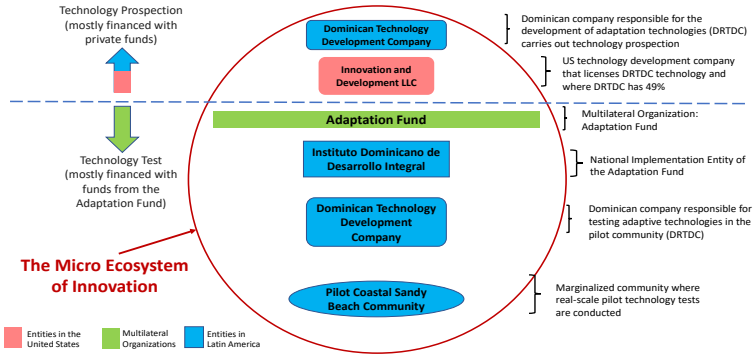
However, there are atypical phenomena that cause waves to reach the shores in the opposite direction than usual. Among these phenomena, the cold fronts stand out, which can reverse the direction of coastal drift. When the waves come from places that do not have sufficient sand reserves to supply the beaches, or the entrance of sand is limited by natural obstacles, a setback of the coastline occurs. If the phenomenon continues for several days or even weeks, erosion problems intensify and losses as significant as those that occur during the passage of hurricanes can occur. Generally, with the reestablishment of normal conditions, the supply of sand to the beaches also recovers and the situation returns to normal. However, many of the cliffs formed by the waves remain as evidence of the retreat of the coastline. The results of these erosive processes related to the inversion of the littoral drift due to changes in wave direction can be seen on the beaches of Cabarete or Las Terrenas.

In a disruptive way, these technologies can be developed through a process of co-creation between Dominican private companies and small and medium-sized companies in the United States, including those with Dominican partners residing or citizens of the US.

The overall objective of the project is the acceleration of the development of climate change adaptation and mitigation technologies in marine-coastal areas, especially island countries (large and SIDS), through the strengthening of an international micro ecosystem of accelerated technological co-creation that it is already in formation and that was explain in some detail in the innovation grant to develop a desalination technology that was approved for IDDI in September 23d, 2020 (Decision B.35.a-35.b/72). This ecosystem has already identified a set of specific technologies that, when developed, will have a significant impact on the communities to be used and in both an accelerated productive adaptation, and mitigation of greenhouse gases once commercialized globally (Figure 1 presents the micro ecosystem for the development of the floating breakwater objective of this proposal).

**Figure 1**

**Micro Ecosystem for Accelerated Development of a Disruptive Modular Dynamic Floating Breakwater Technology in the Dominican Republic - Phase I**




## Project Objectives:

The purpose of the innovation project is to develop and test in a small pilot community a disruptive technology that will attenuate wave energy before reaching sandy beaches therefore lowering the erosion potential of extreme climate events (storms, high seas and/or hurricanes). This technology is a modular dynamic floating breakwater. This general objective will be achieved through three specific objectives:

a) Development of a modular dynamic floating breakwater technology including the Prototype for Testing at a Wave Tank Facility and continue the strengthening of an international innovation micro ecosystem (already established) for the accelerated development of climate change adaptation technologies.
b) The design, establishment and implementation of a process to test the technology in a marginalized coastal community, including the selection and awareness of pilot communities, and the training of these communities for the management and operation of adaptation technologies; and
c) The design and establishment of a knowledge management process to capture and disseminate the lessons learned.

## Projected Calendar:

| Milestones | Expected Dates |
|---|---|
| Beginning of Project implementation | July 2021 |
| Project closure | October 2022 |
| Terminal evaluation | February 2023 |

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## Project Components and Financing:

| Project Components | Expected Conc |
|---|---|
| COMPONENT 1 - Development of the Technology including the Prototype for Testing at a Wave Tank Facility | **Activity 1.1:** Develop the basic and de preliminary prototypes of two embodime tested in a wave generating tank or prototypes concluded and prototypes buil |
| | **Activity 1.2:** Preliminary Proof of concep prototypes in wave tank or pool in c operational philosophies and develop stakeholders. **Outputs:** a) Final Prototype |
| | **Activity 1.3:** Develop the basic and de selected prototype to be tested in wave t testing of an anchorage system. **Outputs:** |
| | **Activity 1.4:** Carry out all necessary testi or pool including the design and testing c and removal operational procedures an efficiencie. **Outputs:** a) Selected prototyp |
| | |
| COMPONENT 2 - Selection of the beach community in Dominican Republic where the pilot testing will take place | **Activity 2.1:** Selection of the coastal adaptation technology. **Outputs:** a) (Minimum Viable Product) selected |
| | **Activity 2.2:** Consultation and aware community where new pilot adaptation te Community selected for testing the minim consulted and sensitized; b) Community se |
| | **Activity 2.3:** Selection of the site (beach) new pilot adaptation technology will be t Consultation with stakeholder of the site t |
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| COMPONENT 3 - Pilot test of prioritized adaptation technology in the selected community in Dominican Republic | **Activity 3.1:** Preliminary Environmental floating dynamic breakwater technology Environmental assessment report obtainec |
| | **Activity 3.2:** Based on the research re adapt the technology to best practices hardware to the basic breakwater concep with design modifications included to l **Outputs:** a) Larger prototype built |
| | **Activity 3.3:** Performing all the necess selected community, including the ope placement. **Outputs:** a) Larger prototype community |
| | **Activity 3.4:** Development of a prelimin Manual developed |
| | **Activity 3.5** Development of final re **Outputs:** a) Final reports developed |
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| COMPONENT 4 - Knowledge management to capture and disseminate lessons learned | **Activity 4.1:** Workshop to disseminate less of the Adaptation Fund in the Caribbea National Implementation Entities and Fo 15 Caribbean island countries sensitized adaptation project; b) Partnerships estat Possible request for funds for Phase II Adaptation Fund and / or request for Full S |
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| Project Components | Expected Concrete Outputs | Expected Outcomes | Amount (US$) |
|---|---|---|---|
| COMPONENT 1 Development of the Technology including the Prototype for Testing at a Wave Tank Facility | **Activity 1.1:** Develop the basic and detailed engineering blueprint of the preliminary prototypes of two embodiments of the floating breakwater to be tested in a wave generating tank or pool. **Outputs:** a) Design of the prototypes concluded and prototypes built | Accelerated development of appropriate size adaptation technologies (floating breakwater). . Incorporation of the private sector from the beginning in both the design of technologies: Proof of concept of the technology carried out | TO BE FINANCED BY THE COMPANY |
| | **Activity 1.2:** Preliminary Proof of concept of both breakwater embodiment prototypes in wave tank or pool in order to test basic hypothesis and operational philosophies and develop film for discussions with major stakeholders. **Outputs:** a) Final Prototype selected; film of testing made. | | TO BE FINANCED BY THE COMPANY |
| | **Activity 1.3:** Develop the basic and detailed engineering blueprint of the selected prototype to be tested in wave tank or pool including the design and testing of an anchorage system. **Outputs:** a) Selected prototype built | | TO BE FINANCED BY THE COMPANY |
| | **Activity 1.4:** Carry out all necessary testing of second prototype in wave tank or pool including the design and testing of an anchorage system, deployment and removal operational procedures and measure wave energy reduction efficiencie. **Outputs:** a) Selected prototype tested at wave facility | | TO BE FINANCED BY THE COMPANY |
| | | **TOTAL COMPONENT 1** | **0** |
| COMPONENT 2 Selection of the beach community in Dominican Republic where the pilot testing will take place | **Activity 2.1:** Selection of the coastal community to test the new pilot adaptation technology. **Outputs:** a) Community to test the prototitpe (Minimum Viable Product) selected | Coastal community with sandy beach selected, sesibilized and trained | 35.410 |
| | **Activity 2.2:** Consultation and awareness and training of the coastal community where new pilot adaptation technology will be tested. **Outputs:** a) Community selected for testing the minimum viable product of the technology consulted and sensitized; b) Community selected trained | | 20.800 |
| | **Activity 2.3:** Selection of the site (beach) in the coastal community where the new pilot adaptation technology will be tested. **Outputs:** a) Site selected; b) Consultation with stakeholder of the site to carry out the test established. | | 13.350 |
| | **Activity 2.4:** Definition of a Mechanism to Transfer a % of the Royalties received by the Dominican Republic Private Company for the Sales of the Technology to a Non-Profit entity to be identified in the selected Coastal Community. **Outputs:** a) A disruptive mechanism to transfer a % of royalties to the selected coastal community established. | | 6.800 |
| | | **TOTAL COMPONENT 2** | **76.360** |
| COMPONENT 3 Pilot test of prioritized adaptation technology in the selected community in Dominican Republic | **Activity 3.1:** Preliminary Environmental Assessment Evaluation to test the floating dynamic breakwater technology in the pilot community. **Outputs:** Environmental assessment report obtained | Disrupted modular floating breakwater tested in a real environment | 31.800 |
| | **Activity 3.2:** Based on the research results, make design modifications to adapt the technology to best practices, including additional features and hardware to the basic breakwater concept. Rebuild a robust larger prototype with design modifications included to be tested in the pilot community. **Outputs:** a) Larger prototype built | | 80.500 |
| | **Activity 3.3:** Performing all the necessary tests of the prototype in the selected community, including the operational procedures of technology placement. **Outputs:** a) Larger prototype tested at the pilot beach in the pilot community | | 19.700 |
| | **Activity 3.4:** Development of a preliminary operating manual. **Outputs:** a) Manual developed | | 6.200 |
| | **Activity 3.5** Development of final research and development reports. **Outputs:** a) Final reports developed | | 6.200 |
| | | **TOTAL COMPONENT 3** | **144.400** |
| COMPONENT 4 Knowledge management to capture and disseminate lessons learned | **Activity 4.1:** Workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands. **Outputs:** a) At least 15 National Implementation Entities and Focal Points of the Adaptation Fund in 15 Caribbean island countries sensitized and trained on the results of the adaptation project; b) Partnerships established for Phase II of the project; c) Possible request for funds for Phase II of the project developed for the Adaptation Fund and / or request for Full Size Regional Project for the GEF. | Strategy to replicate the project in other Caribbean islands initiated. Different entities of adaptation to climate change are incorporated into replica projects in their countries. Possibility to request multilateral funds together several countries | 5.100 |
| | | **TOTAL COMPONENT 4** | **5.100** |
| | | **Total Project Costs without Execution Fees** | **225.860** |
| | | **Executing cost fee by IDDI (1,5%)** | **3.388** |
| | | **Total cost of the Project** | **229.248** |
| | | **Implementation fee (8,5%)** | **19.486** |
| | | **Amount of financing requested** | **248.734** |

## PART II: PROJECT JUSTIFICATION

**A.** Describe the project components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience.

**A disruptive innovative approach for small community coastal management protection during extreme weather events**

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There are basically to general approaches to control erosion in coastal communities:

a) Through the construction of hard structures; and
b) Through the design and implementation of "soft" tools and methodologies.

But when trying to protect sandy beaches, the hard structure approach has serious disadvantages: 1) it is expensive (US$ 5,000 to 20,000/lineal meter); 2) a permanent structure is put in place to manage a few extreme events a year, the rest of the time the structure in place creates a series of environmental problem; 3) if the sandy beach is oriented to tourism (local or international), it loses attractiveness with hard structures. Also, for these sandy beaches, especially in the Caribbean, a soft approach like beach nourishment is expensive and usually there is no extra sand available to carry it out, and the placing of mangroves will make the beaches also unattractive to tourism.

The approach proposed in our project (the placement of a disruptive modular dynamic floating breakwater) is unique because the technology is used only when extreme event happens (high seas, storms and hurricanes), acting similarly to a hard structure but removed just after the extreme event is gone. The placement of the technology takes hours to a couple of days and the removal just hours. It is design to be managed and operated by local community people.

To develop the technology in an accelerated way, the newly formed micro innovation ecosystem not only considers an efficient technical process or methodology for its development, but also the process of structured leverage of financial resources to be able to carry out said technological development in an accelerated manner and joint between companies in the Dominican Republic and small and medium enterprises in the United States.

To demonstrate that it is possible to accelerate the joint development or co-creation of technologies for adaptation to climate change in an appropriate scale and in a volume that has an impact, a four-component project / program is outlined:

**COMPONENT 1 - Development of the Technology including the Prototype for Testing at a Wave Tank Facility (TO BE FINANCED BY THE PRIVATE SECTOR OF THE MICRO ECOSYSTEM AND NOT BY THE ADAPTATION FUND)**

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This component will develop and test, at a laboratory level, an appropriate technology for adaptation to climate change of coastal communities (reduction of erosion of sandy beach coastal communities through a disruptive modular dynamic floating breakwater for coastal protection). Since the prospection and conceptualization of the technology has been carried out between Dominican Republic and US private entities, the result of the component also will strengthen an existing international micro-ecosystem of accelerated technological co-creation to test an innovative mechanism for financing the early stages of technological development. This micro ecosystem includes the linking of creative private companies in the Dominican Republic

and small and medium enterprises in the United States, with public organizations specializing in the financing of early stages of technological development, and bilateral and multilateral partners for the financing of proof of concepts and minimum viable products. Also, it includes the definition of a strategy to replicate the accelerated innovation co-creation model at a global level.

For the execution of this component, the following activities will be carried out (NOT TO BE FINANCED BY THE ADAPTATION FUND):

**Activity 1.1:** Develop the basic and detailed engineering blueprint of the preliminary prototypes of two embodiments of the floating breakwater to be tested in a wave generating tank or pool. Build the prototypes

**Activity 1.2:** Preliminary Proof of concept of both breakwater embodiment prototypes in a wave tank or pool facility in order to test basic hypothesis and operational philosophies and develop film for discussions with major stakeholders. Select the most efficient embodiment of the two prototypes

**Activity 1.3:** Develop the basic and detailed engineering blueprint of the robust prototype to be tested in wave tank or pool including the design and testing of an anchorage system. Build the prototype

**Activity 1.4:** Carry out all necessary testing of second prototype in wave tank or pool including the design and testing of an anchorage system, deployment and removal operational procedures and measure wave energy reduction efficiencies

**COMPONENT 2 - Selection of the beach community in Dominican Republic where the pilot testing of the technology will take place**

Once the proof of concept of the disruptive modular floating breakwater has been established under controlled conditions, the Component 2 will be carried out to identify an appropriate coastal rural community where their livelihood depends on sandy beaches that might be heavily impacted during high seas, storms or hurricanes. Ideally, for the testing of the first prototype for real environment, the pilot beach should be relatively small in length and housing or other relevant infrastructure should be close to the breaking of the waves. Also, if local and national people use these beaches for pleasure it is also of interest.

**Activity 2.1:** Selection of the coastal community to test the new pilot adaptation technology

**Activity 2.2:** Consultation and awareness and training of the coastal community where new pilot adaptation technology will be tested

**Activity 2.3:** Selection of the site in the coastal community where the new pilot adaptation technology will be tested

**Activity 2.4:** Definition of a Mechanism to Transfer a % of the Royalties received by the Dominican Republic Private Company for the Sales of the Technology to a Non-Profit entity to be identified in the selected Coastal Community

**COMPONENT 3 - Pilot test of prioritized adaptation technology in the selected community in Dominican Republic**

Once the specific beach in a specific coastal community has been identified, a preliminary environmental assessment will be carried out. Since the prototype is small and removable and would not be installed for more that a few days (one or two weeks), it is expected to have minimum impact on the environment. Additionally, the floating breakwater technology is oriented only to be used during storms and high seas or hurricanes where there is a high probability that the sandy beach will be eroded, and this type of technology is oriented to lower the wave energy. Also, during this component, the technology at small scale will be tested to evaluate its efficiency in reducing erosion in the pilot beach.

**Activity 3.1:** Preliminary Environmental Assessment Evaluation to test the floating dynamic breakwater technology in the pilot community

**Activity 3.2:** Based on the research results, make design modifications to adapt the technology to best practices, including additional features and hardware to the basic breakwater concept. Rebuild a robust larger prototype with design modifications included to be tested in the pilot community

**Activity 3.3:** Performing all the necessary tests of the prototype in the selected community, including the operational procedures of technology placement

**Activity 3.4:** Development of a preliminary operating manual

**Activity 3.5:** Development of final research and development reports

**COMPONENT 4 - Knowledge management to capture and disseminate lessons learned**

**Activity 4.1:** Workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands

**B.** Describe how the project provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project will avoid or mitigate negative impacts, in line with the Environmental and Social Policy of the Adaptation Fund.

Communities served with adaptive technology, starting with the pilot coastal community to be selected, will lower their problems associated will losing sand in sandy beaches due to erosion during high seas, storms and hurricanes. A different with fixed breakwater, especially those that have a part above water, is the proposed technology does not pretend to eliminate all energy in the waves but to lowered to a large percentage. Also, the proposed technology will only be used (put in place) previous to high seas events or storms or hurricanes to lower the impacts of such events in the sandy beaches.

The project does not contemplate negative environmental and / or social impacts. On the contrary, it is oriented to minimize environmental and social impacts of the destructive forces of

high energy waves during extreme weather events. Also, it is the intention of the project promoters to train local coastal communities with sandy beaches so that they are the ones who manage and operate the floating breakwaters, creating local jobs.

For the private sector, the technology will generate revenue through international licenses (royalties) and exports. Similarly to the desalination proposal approved last year, a percentage of the royalties received by the Dominican Republic company will go to a non-profit entity to be identified and selected in the coastal community selected in Component 2 of this proposal. A specific activity to define a royalty transfer mechanism was added to Component 2 of this revised proposal (Activity 2.4). Consideration will be given to assure that this non-profit to be identified to transfer royalties, has women and girls as beneficiaries. Additionally, in maintenance activities, women and girls can be considered for training in repairing geotextile components of the floating breakwater.

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**C.** Describe how the project encourages or accelerates development of innovative adaptation practices, tools or technologies and/or describe how the project helps generate evidence base of effective, efficient adaptation practices, products or technologies, as a basis for potential scaling up

The development of an appropriate modular floating breakwater technology will result in the strengthening of the international micro ecosystem of innovation for the accelerated development of climate change adaptation technologies. This micro ecosystem is considered unique, not only because it focuses on adaptation to climate change but because for the first time it approaches the development of appropriate technologies to through a co-creation process, where the prioritization of what technologies to develop and their conceptualization is mainly carried out by companies in developing countries (Dominican Republic in this case) and the leverage of resources is combined with private sector resources from States United and multilateral resources from multilateral funds such as the Adaptation Fund. All the technologies to be developed by the micro ecosystem will be modular and of appropriate size for island countries, especially SIDS. They will be designed for easy transport, assembly and operation by local communities.

**D.** Please confirm whether the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and is in line with the Environmental and Social Policy of the Adaptation Fund.

The Program is aligned with the National Development Strategy, which states that the DR "fairly and effectively manages the risks and protection of the environment and natural resources and promotes adequate adaptation to climate change" as one of its four pillars. Likewise, the Program is consistent with both the National Environment Policy and the National Climate Change Policy. This commitment is supported by several documents, including the National Policy on Climate Change, the Climate Compatible Development Plan (CCDP), and the National Adaptation Plan of Action (NAPA-DR). The participation of Santiago de los Caballeros, the second largest city in the Dominican Republic, in the 100 Resilient Cities network, signals the government's commitment to become more resilient to physical, social and economic challenges, as well as disaster exposure. In addition, the Program includes the main PNACC-RD recommendations:

- The vulnerability of poor communities and vulnerable groups will be a priority for the country, due to threats of climate change in human settlements and infrastructure.
- Institutional and community capacities will be strengthened to provide adequate responses to climate change problems and increase resilience.

- It is essential to promote partnerships that include the private sector and civil society to address climate change in areas with limited or low income; and
- Addressing climate change and its impacts needs to mobilize additional financial resources and capital to manage risks and promote technologies and innovation.

One of the key aspects of the proposed project is the development of community management approaches and the management of innovative pilot projects related to coastal protection, especially of sandy beaches during storms, high seas and hurricanes, which do not have significant environmental impacts normally associated with the development of large infrastructure. Infrastructure investment is expected to be made as part of government and community programs to improve coastal protection and resilience. The project is in line with the Environmental and Social Policy of the Adaptation Fund.

**E.** If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned

As the technologies to be generated by the proposed ecosystem, including the first on disruptive modular floating breakwater, and its modularity and dimensions are oriented to island countries, it is considered to have a two-day workshop with about 15 NIEs and Focal Points of the Adaptation Fund from of Caribbean islands. In this workshop, not only will the results of an accelerated development of appropriate technologies be presented, but alliances and partners will be established for the design and implementation of Phase II of the project, which would involve scaling in three to four Caribbean islands. The workshop will also present a draft request for funds for Phase II to either the Adaptation Fund or other possible clean tech funds available.

**F.** Provide an overview of the environmental and social impacts and risks identified as being relevant to the project. Describe how the project will engage, empower and/or benefit the most vulnerable communities and social groups, including gender considerations, in line with the Environmental and Social Policy of the Adaptation Fund.

| **Checklist of environmental and social principles** | **No further assessment required for compliance** | **Potential impacts and risks – further assessment and management required for compliance** |
|---|---|---|
| *Compliance with the Law* | The program complies with the relevant national laws, regulations and policies; and complies with the country's relevant legal framework for environmental protection and local rural development. | **Low:** Low potential risks related to compliance with the law are expected during the implementation of the Environmental and Social Impact Assessment (EIAS). |
| *Access and equity* | The intervention logic of the project is to provide benefits in the most vulnerable communities, with fair and equitable access to activities, equipment, resources and training throughout the planning and execution phases.<br>All individuals or groups that request participation will have the same opportunity to benefit from the adaptation activities proposed by the project. The eligibility criteria of the program are clear and transparent and defined together with the relevant stakeholders. The interventions of the project plan to remove barriers such as: difficulty of access to job opportunities; | **Very low:** project interventions guarantee access and equity to sensitive groups, especially women (heads of household or single mothers) and young people. |

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| *Marginalized and vulnerable groups* | The program focuses on marginalized and vulnerable groups (poorest rural communities) and aims to help them improve their living conditions and quality of life, which are already compromised by poor local development, poverty, lack of access to opportunities, deficit infrastructure and Climate change. The project will include all members of the community and will be careful not to exclude (by action or omission) Dominicans of Haitian descent and Haitian immigrants (especially those with questionable immigration status) and their families. The program does not have a negative impact on these groups. | **Low:** the project has observed the appropriate environmental and social safeguards. These include: Community detection; environmental and social impact assessment, including needs and conflicts; Open, free and informed consultations with key stakeholder groups. It is considered to prepare a contingency plan if applicable. |
| *Human rights* | The Program respects the fundamental rights of people in the areas subject to intervention: it does not affect their freedom, nor does it discriminate the participation or benefits for people regardless of their condition, age, sex, political or religious affiliation, etc. In addition, the Program does not integrate any activity contrary to the laws or traditions of the people. Participation in the program will be voluntary and free for all people. | **Very Low**: all program activities and interventions have been developed and designed within the framework of international and national human rights. Through participatory approaches, people and communities will be consulted to avoid any impact on human rights. |

**G.** Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Small Island Developing States (SIDS) are vulnerable to a range of shocks and stresses, and are particularly affected by climate change. SIDS are often geographically remote, spatially dispersed, and low-lying. They are often highly exposed to global disruption, with undiversified economies, small domestic markets, and dependence on only one or two rapidly growing urban centers. From densely populated urban centers of the Philippines and Taiwan, to atolls and archipelagos of the Caribbean, Asian-Pacific and Indian Ocean, over 600 million people living on islands are at risk. On the one hand, natural hazards such as cyclones, floods and storm-surges, exacerbated by climate change, in addition to geo-hazards specific to some islands represent major threats for the people, assets and economies of SIDS. Coastal erosion is a common problem affecting about 75% of the world's shorelines, producing not only beach loss but also a deterioration of scenic quality, that is becoming a problem that hinders economic growth of many SIDS. Tools and technologies to handle extreme weather events that generate high energy eroding waves, specifically during the duration of these events, is a priority that would not only lower the cost of adaptation, but also minimize environmental and social impacts in comparison with the available technologies that exist currently.

The Project aims to test a new and disruptive modular dynamic floating breakwater technology in a low-income community in the Dominican Republic, where a minimum viable product prototype will be tested. To do this, it is requesting US $ 249,786 from the Adaptation Fund. However, if the test is successful, and a profitable business model is proven, an escalation to thousands of modular floating breakwaters is expected over the next five years, lowering the energy of waves eroding sandy beaches but with a much lower initial investment compared with fixed structural alternatives. Fixed breakwaters are quite expensive (US$ 5,000 to 20,000/lineal meter) for the protection of marginalized coastal communities. The investment of the Adaptation Fund is contributing to create a global market for modular floating breakwaters oriented to be placed in a distributed manner and with lower capital costs and only to be deployed just previous to extreme weather events in coastal communities. Once the event has passed, the floating technology is either submerged or removed.

## PART III: IMPLEMENTATION ARRANGEMENTS

**A.** Describe the arrangements for project / programme implementation.

The project will be executed by the Dominican Institute of Integral Development (IDDI) with the help of a micro ecosystem of international innovation with the following members or partners (see Figure 1): A technological development company in the Dominican Republic; a small technology development company in Florida, United States (Innovation and Development LLC) responsible for the international patent protection of the technology, a wave generating facility to test the technology, all of them coordinated by the IDDI that serves as the implementing and executing entity. The Dominican company will own 49% of the small business in the United States. The US company will request funds in the future from both federal and venture capital in the US.

**B.** Describe the measures for financial and project / programme risk management.

The project has lowered its financial risk by diversifying its sources of financing which consider multilateral, bilateral, federal/public resources as well as private financing for the financing of the first four stages of the technology development process (from problem identification, solution idealization, international protection of industrial property, and proof of concept and minimum viable product). The financing of all activities related to proof of concept will be financed only by the private partners of the international micro ecosystem. Activities related to the minimum viable product and community selection, training and environmental assessment considered in the project will come from Adaptation Fund resources and will not depend on the obtention of private financing. The future Phase II of the project will finance the scaling up of the technology through the US private partner (through the Small Business Innovation Research Program of the National Science Foundation (SBIR NSF) or through venture capital to the scaling up of the technology. Some scaling up of the technology will be pursue by the international micro ecosystem through bilateral and multilateral entities in Phase II.

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**C.** Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

**M&E Arrangements:** The results of Monitoring and Evaluation (M&E) will be to provide project updates, risk assessments and any Program change required. In summary, M&E will provide answers, in a systematic way, on the progress and success of the Program and its partners in achieving the desired outcomes and outputs. This includes community's progress on climate adaptation. Given the nature of the Program, PMU will contract the services of a M&E officer to be responsible for data collection, compilation, and project monitoring and reporting, as well as operational support and additional assistance in the design and implementation throughout the Program, adjusting projects outcomes and activities according to a changing context. It is important to remain flexible to and learn from inevitable unforeseen in the operational landscape using an adaptive management approach. Reporting will take place on a quarterly basis in accordance with AF standards. The monitoring and reporting plan involve an iterative approach to collecting data and improving the Program design and its proposed interventions. The Program will start following and inception workshop with key stakeholders, IDDI, PMU and M&E officer assigning and clarifying the Program purpose, roles and responsibilities, and addressing any outstanding barriers. There are specific budget lines dedicated for M&E to ensure that the necessary resources are allocated to execute the M&E framework. The Program comprehensive M&E framework will meet the Adaptation Fund's policy and drawing on the IDDI safeguards formalized under the Accreditation process.

**M&E Budget:** The costs associated to implement the M&E system are detailed below.

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**Table 1: Costs Associated with Implementing M&E**

| Type of M&E Activity | Budget (USD) (Excluding PMU time) | Timeframe |
|---|---|---|
| Initiation Workshop and report | US 1.000 | Within the first 2 months. |
| Means of verification of Program expected results. | | Start, mid and end of Program (during evaluation cycle). |
| Periodic status/progress reports | US$ 500 | Quarterly |
| Mid-term Evaluation | US 1.000 | At the mid-point of Program implementation. |
| Final evaluation | US 1.000 | At least 3 months before the end of Program. |
| Program terminal report | US 1.000 | At least 3 months before the end of Program. |
| Audit | | |
| Visits to field sites | | Program lifespan. |
| **ESTIMATED TOTAL (USD)** | US$ 4.500 | |

**D.** Include a simple results framework for the project proposal, including milestones, targets and indicators.

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| Project Components | Milestones |
|---|---|
| COMPONENT 1 Development of the Technology including the Prototype for Testing at a Wave Tank Facility | **Activity 1.1:** Develop the basic and detailed enginee the preliminary prototypes of two embodiments breakwater to be tested in a wave generating **Outputs:** a) Design of the prototypes concluded and |
| | **Activity 1.2:** Preliminary Proof of concept of b embodiment prototypes in wave tank or pool in or hypothesis and operational philosophies and d discussions with major stakeholders. **Outputs:** a) selected; film of testing made. |
| | **Activity 1.3:** Develop the basic and detailed enginee the selected prototype to be tested in wave tank the design and testing of an anchorage system. **Outp** prototype built |
| | **Activity 1.4:** Carry out all necessary testing of sec wave tank or pool including the design and testing system, deployment and removal operational measure wave energy reduction efficiencie. **Outp** prototype tested at wave facility |
| COMPONENT 2 Selection of the beach community in Dominican Republic where the pilot testing will take place | **Activity 2.1:** Selection of the coastal community to t adaptation technology. **Outputs:** a) Commur prototitpe (Minimum Viable Product) selected |
| | **Activity 2.2:** Consultation and awareness and traini community where new pilot adaptation technolog **Outputs:** a) Community selected for testing the product of the technology consulted and sensitizec selected trained |
| | **Activity 2.3:** Selection of the site (beach) in the co where the new pilot adaptation technology will be t a) Site selected; b) Consultation with stakeholder of out the test established. |
| COMPONENT 3 Pilot test of prioritized adaptation technology in the selected community in Dominican Republic | **Activity 3.1:** Preliminary Environmental Assessment t the floating dynamic breakwater technology in the **Outputs:** Environmental assessment report obtained |
| | **Activity 3.2:** Based on the research resul modifications to adapt the technology to best pra additional features and hardware to the basic brea Rebuild a robust larger prototype with design modif to be tested in the pilot community. **Outputs:** a) t built |
| | **Activity 3.3:** Performing all the necessary tests of the selected community, including the operationa technology placement. **Outputs:** a) Larger prototy pilot beach in the pilot community |
| | **Activity 3.4:** Development of a preliminary op **Outputs:** a) Manual developed |
| | **Activity 3.5** Development of final research and devel **Outputs:** a) Final reports developed |
| COMPONENT 4 Knowledge management to capture and disseminate lessons learned | **Activity 4.1:** Workshop to disseminate lessons lear focal points of the Adaptation Fund in the Ca **Outputs:** a) At least 15 National Implementation E Points of the Adaptation Fund in 15 Caribbean sensitized and trained on the results of the adapt Partnerships established for Phase II of the pro request for funds for Phase II of the project de Adaptation Fund and / or request for Full Size Reg the GEF. |

| Project Components | Milestones | Targets | Indicators |
|---|---|---|---|
| **COMPONENT 1 - Development of the Technology including the Prototype for Testing at a Wave Tank Facility (TO BE FINANCED ONLY BY THE PRIVATE COMPANIES OF THE INTERNATIONAL MICRO ECOSYSTEM, NOT AF)** | **Activity 1.1:** Develop the basic and detailed engineering blueprint of the preliminary prototypes of two embodiments of the floating breakwater to be tested in a wave generating tank or pool. **Outputs:** a) Design of the prototypes concluded and prototypes built | Design and construction of two preliminary floating breakwater prototypes to be tested in a "laboratory" environment (a wave generating facitily) | a) Two prototypes built |
| | **Activity 1.2:** Preliminary Proof of concept of both breakwater embodiment prototypes in wave tank or pool in order to test basic hypothesis and operational philosophies and develop film for discussions with major stakeholders. **Outputs:** a) Final Prototype selected; film of testing made. | | b) Two prototypes tested in a controlled facility and most effective prototype chosen |
| | **Activity 1.3:** Develop the basic and detailed engineering blueprint of the selected prototype to be tested in wave tank or pool including the design and testing of an anchorage system. **Outputs:** a) Selected prototype built | | c) Most effective prototype built with an appropriate anchorage system |
| | **Activity 1.4:** Carry out all necessary testing of second prototype in wave tank or pool including the design and testing of an anchorage system, deployment and removal operational procedures and measure wave energy reduction efficiencie. **Outputs:** a) Selected prototype tested at wave facility | | d) Most effective prototype tested and research report generated |
| **COMPONENT 2 - Selection of the beach community in Dominican Republic where the pilot testing will take place** | **Activity 2.1:** Selection of the coastal community to test the new pilot adaptation technology. **Outputs:** a) Community to test the prototitpe (Minimum Viable Product) selected | Coastal community with sandy beach selected, sesibilized and trained | a) Community to test the prototitpe (Minimum Viable Product) selected |
| | **Activity 2.2:** Consultation and awareness and training of the coastal community where new pilot adaptation technology will be tested. **Outputs:** a) Community selected for testing the minimum viable product of the technology consulted and sensitized; b) Community selected trained | | b) Community selected trained |
| | **Activity 2.3:** Selection of the site (beach) in the coastal community where the new pilot adaptation technology will be tested. **Outputs:** a) Site selected; b) Consultation with stakeholder of the site to carry out the test established. | | a) Site selected; b) Consultation with stakeholder of the site to carry out the test established. |
| | **Activity 2.4:** Definition of a Mechanism to Transfer a % of the Royalties received by the Dominican Republic Private Company for the Sales of the Technology to a Non-Profit entity to be identified in the selected Coastal Community. **Outputs:** a) A disruptive mechanism to transfer a % of royalties to the selected coastal community established. | | a) A disruptive mechanism to transfer a % of royalties to the selected coastal community established. |
| **COMPONENT 3 - Pilot test of prioritized adaptation technology in the selected community in Dominican Republic** | **Activity 3.1:** Preliminary Environmental Assessment Evaluation to test the floating dynamic breakwater technology in the pilot community. **Outputs:** Environmental assessment report obtained | Disrupted modular floating breakwater tested in a real environment | Environmental assessment report obtained |
| | **Activity 3.2:** Based on the research results, make design modifications to adapt the technology to best practices, including additional features and hardware to the basic breakwater concept. Rebuild a robust larger prototype with design modifications included to be tested in the pilot community. **Outputs:** a) Larger prototype built | | b) Most effective prototype built for a real environment test at pilot beach |
| | **Activity 3.3:** Performing all the necessary tests of the prototype in the selected community, including the operational procedures of technology placement. **Outputs:** a) Larger prototype tested at the pilot beach in the pilot community | | c) Most effective prototype tested in a real environment |
| | **Activity 3.4:** Development of a preliminary operating manual. **Outputs:** a) Manual developed | | d) Operating manual report |
| | **Activity 3.5** Development of final research and development reports. **Outputs:** a) Final reports developed | | e) Final report with real environment testing result |
| **COMPONENT 4 - Knowledge management to capture and disseminate lessons learned** | **Activity 4.1:** Workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands. **Outputs:** a) At least 15 National Implementation Entities and Focal Points of the Adaptation Fund in 15 Caribbean island countries sensitized and trained on the results of the adaptation project; b) Partnerships established for Phase II of the project; c) Possible request for funds for Phase II of the project developed for the Adaptation Fund and / or request for Full Size Regional Project for the GEF. | Strategy to replicate the project in other Caribbean islands initiated. Different entities of adaptation to climate change are incorporated into replica projects in their countries. Possibility to request multilateral funds together several countries | a) Workshop attended by at least 15 National Implementation Entities and Focal Points of the Adaptation Fund in 15 Caribbean island countries; b) Partnerships established for Phase II of the project; c) request for funds for Phase II of the project developed for the Adaptation Fund and / or request for Full Size Regional Project for the GEF. |

**E.** Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

The project is expected to contribute to the following "Expected Results of Strategic Focus 2: Innovation" of the Adaptation Fund:

- ER1: successful innovations implemented. Innovative adaptation practices, tools and technologies that have proven successful in a country extended to new countries / regions.
- ER3: new innovations encouraged and accelerated. Development of innovative adaptation practices, tools and technologies encouraged and accelerated.
- ER4 - Base of evidence generated. Evidence of effective and efficient adaptation practices, products and technologies generated as a basis for the implementation of entities and other funds to assess the expansion

**F.** Include a budget, including a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

| Activity | 1 | 2 |
|---|---|---|
| **COMPONENT 1 - Development of the Technolo** | | |
| Activity 1.1: Develop the basic and detailed engineering blueprint of the preliminary prototypes of two embodiments of the floating breakwater to be tested in a wave generating tank or pool. Build the prototypes | | |
| Activity 1.2: Preliminary Proof of concept of both breakwater embodiment prototypes in wave tank or pool in order to test basic hypothesis and operational philosophies and develop film for discussions with major stakeholders. Select the most efficient embodiment of the two prototypes | | |
| Activity 1.3: Develop the basic and detailed engineering blueprint of the robust prototype to be tested in wave tank or pool including the design and testing of an anchorage system. Build the prototype | | |
| Activity 1.4: Carry out all necessary testing of second prototype in wave tank or pool including the design and testing of an anchorage system, deployment and removal operational procedures and measure wave energy reduction efficiencies | | |
| **COMPONENT 2 - Selection of the beach commun** | | |
| Activity 2.1: Selection of the coastal community to test the new pilot adaptation technology | | |
| Activity 2.2: Consultation and awareness and training of the coastal community where new pilot adaptation technology will be tested | | |
| Activity 2.3: Selection of the site in the coastal community where the new pilot adaptation technology will be tested | | |
| **COMPONENT 3 - Pilot test of prioritized adaptatio** | | |
| Activity 3.1: Preliminary Environmental Assessment Evaluation to test the floating dynamic breakwater technology in the pilot community | | |
| Activity 3.2: Based on the research results, make design modifications to adapt the technology to best practices, including additional features and hardware to the basic breakwater concept. Rebuild a robust larger prototype with design modifications included to be tested in the pilot community | | |
| Activity 3.3: Performing all the necessary tests of the prototype in the selected community, including the operational procedures of technology placement | | |
| Activity 3.4: Development of a preliminary operating manual | | |
| Activity 3.5: Development of final research and development reports | | |
| **COMPONENT 4 - Knowledge manag** | | |
| Activity 4.1: Workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands | | |

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| Activity | MONTHS 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Total Costs to be Financed by AF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COMPONENT 1 - Development of the Technology including the Prototype for Testing at a Wave Tank Facility** | | | | | | | | | | | | | | | | | | | |
| Activity 1.1: Develop the basic and detailed engineering blueprint of the preliminary prototypes of two embodiments of the floating breakwater to be tested in a wave generating tank or pool. Build the prototypes | | | | | | | | | | | | | | | | | | | TO BE FINANCED BY THE COMPANY |
| Activity 1.2: Preliminary Proof of concept of both breakwater embodiment prototypes in wave tank or pool in order to test basic hypothesis and operational philosophies and develop film for discussions with major stakeholders. Select the most efficient embodiment of the two prototypes | | | | | | | | | | | | | | | | | | | TO BE FINANCED BY THE COMPANY |
| Activity 1.3: Develop the basic and detailed engineering blueprint of the robust prototype to be tested in wave tank or pool including the design and testing of an anchorage system. Build the prototype | | | | | | | | | | | | | | | | | | | TO BE FINANCED BY THE COMPANY |
| Activity 1.4: Carry out all necessary testing of second prototype in wave tank or pool including the design and testing of an anchorage system, deployment and removal operational procedures and measure wave energy reduction efficiencies | | | | | | | | | | | | | | | | | | | TO BE FINANCED BY THE COMPANY |
| **COMPONENT 2 - Selection of the beach community in Dominican Republic where the pilot testing will take place** | | | | | | | | | | | | | | | | | | | |
| Activity 2.1: Selection of the coastal community to test the new pilot adaptation technology | | | | | | | | | | | | | | | | | | | 35.410 |
| Activity 2.2: Consultation and awareness and training of the coastal community where new pilot adaptation technology will be tested | | | | | | | | | | | | | | | | | | | 20.800 |
| Activity 2.3: Selection of the site in the coastal community where the new pilot adaptation technology will be tested | | | | | | | | | | | | | | | | | | | 13.350 |
| Activity 2.4: Definition of a Mechanism to Transfer a % of the Royalties received by the Dominican Republic Private Company for the Sales of the Technology to a Non-Profit entity to be identified in the selected Coastal Community | | | | | | | | | | | | | | | | | | | 6.800 |
| **COMPONENT 3 - Pilot test of prioritized adaptation technology in the selected community in Dominican Republic** | | | | | | | | | | | | | | | | | | | |
| Activity 3.1: Preliminary Environmental Assessment Evaluation to test the floating dynamic breakwater technology in the pilot community | | | | | | | | | | | | | | | | | | | 31.800 |
| Activity 3.2: Based on the research results, make design modifications to adapt the technology to best practices, including additional features and hardware to the basic breakwater concept. Rebuild a robust larger prototype with design modifications included to be tested in the pilot community | | | | | | | | | | | | | | | | | | | 80.500 |
| Activity 3.3: Performing all the necessary tests of the prototype in the selected community, including the operational procedures of technology placement | | | | | | | | | | | | | | | | | | | 19.700 |
| Activity 3.4: Development of a preliminary operating manual | | | | | | | | | | | | | | | | | | | 6.200 |
| Activity 3.5: Development of final research and development reports | | | | | | | | | | | | | | | | | | | 6.200 |
| **COMPONENT 4 - Knowledge management to capture and disseminate lessons learned** | | | | | | | | | | | | | | | | | | | |
| Activity 4.1: Workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands | | | | | | | | | | | | | | | | | | | 5.100 |
| **Total Project Costs without Execution Fees** | | | | | | | | | | | | | | | | | | | **225.860** |
| **IDDI Cost of Execution (1,5%)** | | | | | | | | | | | | | | | | | | | **3.388** |
| **Total Costs of Project** | | | | | | | | | | | | | | | | | | | **229.248** |
| **IDDI Cost of Implementation (8,5%)** | | | | | | | | | | | | | | | | | | | **19.486** |
| ***TOTAL*** | | | | | | | | | | | | | | | | | | | ***248.734*** |

**G.** Include a disbursement schedule with time-bound milestones

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| | Upon signature of Agreement | Dis |
|---|---|---|
| Schedule date | jun-21 | |
| Program funds | 70,350 | |
| Implementing Entity Fee | 9,382 | |
| **Total** | **79,732** | |

| | Upon signature of Agreement | 1st Disbursement | 2nd Disbursement | 3rd Disbursement | Total (US$) |
|---|---|---|---|---|---|
| Schedule date | jun-21 | | oct-21 | may-22 | |
| Program funds | 77,505 | | 146,566 | 5,177 | 229,248 |
| Implementing Entity Fee | 6,588 | | 12,458 | 440 | 19,486 |
| **Total** | **84,093** | | **159,024** | **5,617** | **248,734** |

Milestones of the project:

a) Presentation of the statutes and documents of the company in the United States where the Dominican company of technological development has 49%;
b) Filing of the two provisional applications for patents in the United States (the USPTO);
c) Presentation of the results of the floating dynamic breakwater prototype laboratory test at a wave tank or facility;
d) Presentation of the selection report, sensitization of the pilot community where the minimum viable product and the specific placement and operation site will be tested;
e) Presentation of the results of the floating dynamic breakwater prototype test in the selected community;
f) Presentation of the Preliminary Operation Manual of the floating dynamic breakwater prototype; and
g) Presentation of final reports and report the workshop to disseminate lessons learned for NIEs and focal points of the Adaptation Fund in the Caribbean Islands.

## PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. **Record of endorsement on behalf of the government**

| | |
|---|---|
| *(Enter Name, Position, Ministry)*<br>*Orlando Jorge Mera, National Designated Authority,*<br>*Minister, Ministry of*<br>*Environment, Dom. Rep.* | Date*: (January 18, 2021)* |

*B.* **Implementing Entity certification**

| | |
|---|---|
| I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (National Development Strategy, National Communications to UNFCCC, National Policy on Climate Change, and Dominican Republic's National Action Plan for Climate Change Adaptation) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme. | |
| *David Luther, Executive Director, Dominican Institute of Integral Development -IDDI*<br>Implementing Entity Coordinator | |
| Date: *(January, 12, 2021)* | Tel. and email: +18095341077/ dluther@iddi.org |
| Project Contact Person: David Luther (Executive Director) | |
| Tel. And Email: +18095341077/ dluther@iddi.org | |

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