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DOMINICAN REPUBLIC

INNOVATIVE HEALTH SERVICE DELIVERY SYSTEM IN RURAL DOMINICAN REPUBLIC

(DR-M1049)

DONORS MEMORANDUM

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PROJECT SUMMARY
INNOVATIVE HEALTH SERVICE DELIVERY SYSTEM IN RURAL DOMINICAN REPUBLIC
(DR-M1049)

Poor and low-income residents in isolated rural areas access the public health system through the rural Units of Primary Attention (UNAP). Due to transport problems, it is often difficult for these populations to receive testing and diagnostic laboratory services. First Level Centers (FLC), as part of the UNAP, collect samples from patients one day per week which means that the remaining 6 days of the week the patients need to go straight to the hospital themselves for treatment and testing, entailing costly travel over longer distances. In addition, it is often the nurse themselves that have to leave the clinics to transport the samples from remote areas to the hospitals, resulting in an efficient use of their own time which is better spent providing nursing services.

The main problem this project will address is that health care needs for testing and diagnostics among rural populations are not attended to in a timely manner due to an inefficient health goods and service transportation system. This problem is especially serious in rural areas with difficult access and long distances between the UNAPs and province laboratories. In these places, the current health transport system impedes expedient and accurate testing; therefore it negatively affects the health conditions of a given local community. This undermines the provision of basic health services in rural communities.

This project will try to prove the concept of using Unmanned Aerial Vehicles (UAVs), or drones, for the transportation of lab samples and healthcare goods, to be operated in a network of eight UNAPS and two laboratories/hospitals in the province of San Juan de la Maguana.

The direct beneficiaries of this project are approximately 23,000 poor and low income people (approximately 10% of the people that are currently served by UNAPs). This includes people currently receiving some kind of healthcare related goods and services, like pregnant women receiving maternal and reproductive health products (22% are in the teen pregnancy category), 400 newborns and toddlers receiving immunization services and treatment against diarrhea, fever and respiratory diseases, in addition to AIDS, dengue, malaria and tuberculosis patients in need of regular diagnostics and treatment.

The project will improve rural primary health services through a cost-effective model that improves access and coverage and therefore local communities' living conditions. In addition it will create jobs and capacity in the transportation industry, providing a new technology and unique set of technical skills and capabilities. The pilot system will need an estimated 16 full-time positions to guarantee operations, maintenance and other supporting service. Other benefits are reduced transport costs in the local health system and a more reliable frequency of service.

The executing agency for the Project is Emprende, a business incubator for the development of technology-based businesses in the Dominican Republic with previous experience from MIF financed Projects. The executing period will be two years and the total budget is \$1.1 million of which U\$536,480 will be financed by the MIF.

ANNEXES

ANNEX I	Logical Framework
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ACRONYMS AND ABBREVIATIONS

AOP	Annual Operating Plan
DNA	Diagnostic of Executing Agency Needs
IADB	Inter-American Development Bank
MIF	Multilateral Investment Fund
OR	Operating Regulations
PCU	Project Coordination Unit
QED	Quality for Effectiveness in Development
TOR	Terms of Reference
UNAP	Units of Primary Attention
CPN	First Level Centers
SNS	National Health Services Office

PROJECT INFORMATION

INNOVATIVE SOLUTION FOR DELIVERING MEDICAL SUPPLIES AND LAB TESTS IN REMOTE
AREAS IN RURAL DOMINICAN REPUBLIC

(DR-M1049)

Country and Geographic Location:	Dominican Republic, province of San Juan de la Maguana		
Executing Agency:	Emprende		
Access Area:	Basic services and Green growth		
Agenda:	Basic services for the poor		
Coordination with Bank Operations:	DR-L1067, "Strengthening of the Health Sector Results Management"		
Direct Beneficiaries:	23,168 low income people in San Juan de la Maguana province 20 people with a new set of skills		
Indirect Beneficiaries:	The overall population of approximately 200,000 people living in the province served by the UNAPs.		
Financing:	Technical Cooperation:	US\$ 539,980	47%
	Investment:	-	-
	Loan:	-	-
	TOTAL MIF FUNDING:	US\$ 539,980	47%
	Counterpart:	US\$ 613,035	53%
	Co-financing (if available):	-	-
	TOTAL PROJECT BUDGET:	US\$ 1,153,015	100%
Execution and Disbursement Period:	24 months of execution and disbursements.		
Special Contractual Conditions:	Conditions prior to first disbursement will be: (i) contract signed with the selected and approved project coordinator; and (ii) first annual work plan approved by the MIF; (iii) operational regulations.		
Environmental and Social Impact Review:	This operation was screened and classified as required by the IDB's safeguard policy (OP-703). Given the limited impacts and risks, the proposed category for the project is C.		
Unit with Disbursement Responsibility:	MIF/CDR		

1. BACKGROUND AND JUSTIFICATION

A. Diagnosis of the Problem to be addressed by the Project

- 1.1 Despite recent reforms and advances in the Dominican health care system¹, poor and low-income people in rural Dominican Republic (DR) have suboptimal access to health care. The first point of contact with the Public Health System is through the rural Units of Primary Attention (UNAP), which have problems such as interrupted diagnostics schedules, lack of personnel, equipment and medicines. The UNAP is the place where lab samples are collected, immunization campaigns conducted and essential medicine, family planning and reproductive health products are distributed. Patients with HIV and tuberculosis usually receive their follow-up treatments in the UNAP, which also provides maternal and natal care, oral health services and is the first health provider in disaster situations.
- 1.2 UNAPs are usually staffed with one doctor, one nurse, one supervisor and a couple of health promoters. This minimum staffing means that crucial personnel have to leave their position for long periods of time to deliver and retrieve laboratory samples at the regional hospitals. When staff is engaged in these activities, the UNAP is closed or cannot operate effectively due the temporary lack of medical personnel². Low-income people living in rural communities do not have resources to pay for a round trip to the nearest hospital, and there is usually just one ambulance in the region.
- 1.3 An average UNAP collects about 15 lab samples on one designated day per week. Normally, the staff uses public transport or a motorcycle to transport the samples to and from the regional hospital. The transportation cost varies depending on the area, road conditions, and distance. For example, the cost of roundtrip transport from the UNAP in Los Frios to the regional hospital is DOP\$400 (US\$10). This is a relatively high cost, considering that the service is only provided once a week, and considering that, in many UNAPs, due to scarce funds, every so often a patient living on less than US\$1 per day has to pay him- or herself for the transportation of their lab samples.
- 1.4 The current transportation system relies on a fleet of motorcycles and public transport for delivering the samples and healthcare goods which are subject to constant budget constraints. This causes delays and in some cases a lack of pickup and retrieval of lab samples. A delay sending lab samples increases the time lag between testing and delivering the results, which can cause misdiagnosis, incorrect treatment and increased risks for the patients.
- 1.5 According to a study³ conducted on the First Level Health Centers (CPN) in the communities of Los Frios, Montacitos and La Guama in the province of San Juan de la

¹ Progress reports DR- L1053 : Support for the consolidation of the social protection system and the implementation of the law 123-15 establishing the National Health Services

² Dr. Alberto Martínez, in charge of the UNAP in Los Patos, Barahona.

³ Field visits and interviews with provincial health directors Samana , Dr. Rosa Dominga Maleno , and Dr. Demetrio Vicente , former Director . In San Juan de la Maguana , interviews Dr. Luis Jimenez , Regional Assistance Manager, Dra. Isabel Santiago , Enc . Monitoring and Evaluation , Dr. Junior Goiter San Juan Area Manager , Milagros Dinis, Diagnostic Coordinator

Maguana, the CPNs faced the following limitations: (i) difficult vehicular access given rugged terrain and long distances; (ii) low frequency in transporting health supplies (samples, lab results, immunizations, medicines) to and from provincial laboratories/hospitals; and (iii) the costs⁴ associated with service delivery and out-of-pocket expenditures incurred by the patient to overcome distances between primary and complimentary care services.

- 1.6 This problem especially affects maternal and child health care, where delivering samples to laboratories is critical for timely and accurate diagnosis and treatment. For example, pregnant women in rural areas that have to travel to other laboratories or hospitals often times choose not to travel and therefore miss critical vaccinations⁵ and/or prenatal care procedures, placing them and their child at risk. As another example, CPNs normally take lab samples once a week, which requires patients with urgent needs to travel to other hospitals or laboratories should they need tests on the day of the week their local CPN does not offer this service. Finally, should supplies and medications for emergency care be depleted, the possibility of restocking these supplies are directly affected by the difficult vehicular access to the CPN, resulting in increased opportunity costs for the health care system to maintain the appropriate coverage.
- 1.7 The resulting long lead times and the need of dedicated health workers to personally transport the samples, impacting the entire health care system's performance because of higher transactional and transportation costs. UNAPs normally collect samples from patients one day per week which means that the remaining 6 days of the week the patients need to personally go straight to the hospital for treatment and testing. Consequently, low income people oftentimes have to cover the health care costs themselves by having to go straight into hospitals resulting in congested hospitals. There is an average of six UNAPs per hospital, and according to the Ministry of Health, 80% of the populations' health issues could be resolved at the UNAP level.
- 1.8 Given the above described situation in rural DR, the main problem this project will address is that health problems among the low income populations are not treated in a timely manner. The main causes of this problem are inefficient and costly lab sample transportation, and the allocation and replenishment of specific and urgently needed medicines and medical supplies⁶. This inhibited response capacity at the local level in rural areas, which negatively affects the health conditions of the low income populations, opens the door to explore new solutions to improve the primary care services in rural Dominican Republic.

⁴ The cost of transport varies depending on the proximity of the CPN, hospitals and laboratories. For UNAP in El Rincón to Hospital Dr. Leopoldo Pou, the daily expenditure is RD\$ 400 (US \$ 10) for a total of RD \$ 800 (US \$ 20) per week ; while the lowest rate for a closer UNAP is estimated at RD\$180 (US \$ 4.5) per day , and RD \$ 360 (US \$ 9) per week .

⁵ Blood tests, Urine test, AIDS tests, Syphilis, etc.

⁶ The health care system in rural DR is comprise with a network of UNAPs that serve a first entry door to the health systems and province hospitals aimed to provide complementary services for people who cannot be serve in the first entry level.. One province hospital may serve between 4-6 UNPAs

B. Proposed solution

- 1.9 To address the aforementioned main problem, a proposal for using Unmanned Aerial Vehicles (UAV), or drones, for health care goods and services' transportation has been presented to the National Health Service Office (SNS). This innovative transportation concept will demonstrate that CPNs can improve their service capacity via the use of drones to transport health care material between CPNs, laboratories and hospitals. The proposed solution has been presented as a proof of concept using UAV to create a small transportation network in San Juan de la Maguana province⁷.
- 1.10 In addition, the Project will create an advisory committee consisting of the UAV manufacturer, a local NGO and the SNS to set up and run a UAV network to connect eight UNAPs and two hospitals to serve as a pilot and explore the feasibility of the concept with the purpose to expand it to other provinces with similar conditions.
- 1.11 UAVs are quickly making their way into development, particularly in disaster management and agriculture. Lately, global health organizations have started experimenting with UAVs in Africa and Asia. The experiments have shown that UAVs can be a safe and efficient alternative to current methods for transporting biological samples to laboratories in developing countries⁸.
- 1.12 The SNS has formally expressed the need to address this problem by testing the use of UAVs in rural and remote communities in the poor southwest region. The executing agency is Emprende, a business incubator of technology-based businesses in the Dominican Republic who together with the manufacturer of the UAVs (Matternet, who will provide the UAVs as counterpart to the Project) will provide the technical expertise and set up the UAV network. The Advisory Committee will structure a project concept that aims to: (i) reduce the transportation costs; (ii) provide a fast and reliable transportation method; (iii) increase the number of patients receiving tests results, and crucial medicines; (iv) achieve a better cost benefit ratio relative to the current land transportation system; and Dominican Republic is considered an ideal country for testing this concept for three reasons: i) an expressed interest from the Ministry of Health; ii) a real problem of health transport that can be addressed with the concept; and iii) a beneficial regulatory environment for using UAVs in the health sector. The project will collaborate with national aviation authorities to draft comprehensive regulation facilitating the gradual integration and use of civil UAVs in the country.
- 1.13 It should be noted that this concept is complimentary and does not substitute traditional transportation methods; thus it is expected that this model will be most effective in geographic areas with difficult access.

⁷ SJM is rank among the top 10 poorest provinces according to the National Population Census 2010, National Statistics Office.

⁸ Evaluation of the Utility of Automated Unmanned Aerial Vehicles in the Transportation of Laboratory Samples in Malawi (CDC) 2013

C. Project Beneficiaries

- 1.14 The model will be piloted in one of the poorest, least developed and most rural provinces in the country, San Juan de la Maguana, with a total population of around 200,000 inhabitants currently served by 66 UNAPs and 5 hospitals.
- 1.15 The direct beneficiaries are approximately 23,168 poor and low income people (approximately 12% of the people that are currently served by UNAPs). This includes people currently receiving some kind of healthcare services, like pregnant mothers getting maternal and reproductive health care (22% are in the teen pregnancy category), 400 newborns and toddlers receiving immunization services and treatment against diarrhea, fever and respiratory diseases, and AIDS and tuberculosis patients needing frequent diagnostics and treatment. Around 30% of the households in the province live in extreme poverty and 60% under the national poverty line⁹.
- 1.16 The Project is expected to especially benefit women, since the needs for efficient laboratory services is particularly important during and after pregnancy, and since mothers often have the responsibility for the health of newborns and young children in poor households.
- 1.17 Specifically, the Project will: (i) test a new transportation concept to provide more efficient and reliable health services to remote rural populations; (ii) evaluate if there is a decrease in transportation costs and lead times for local health stations through the use of reliable and fast transportation network; and; (iv) benefit local MSMEs by developing expertise around UAV technology, providing training on the system's operations, repair, maintenance, and support services, potentially creating job opportunities in high tech fields like aerial robotics.

C. Contribution to MIF Mandate, Access Framework and IDB Strategy

- 1.18 The Project contributes to MIF's agenda on basic services for the poor by increasing poor people's access to health services and using technology to improve local health facilities' service delivery system.
- 1.19 The Project is aligned with the MIF's objectives for private sector development and poverty reduction by improving poor people's quality of life by enhancing the health services in rural areas. The project will also create local job opportunities and knowledge, by training local operators and requiring that operation, repair, maintenance and supporting services be provided by local technicians. It is also aligned with IDB-DR Country Strategy 2013-2016 for the health sector, since its objective is aligned with the IDB strategic objective to improve the quality of health care services, as well as its management and financial sustainability¹⁰.
- 1.20 The Project is considered highly innovative, as a first in the region, by proving the concept of drone technology transport health goods and services using UAVs. By testing

⁹ Ministry of Health

¹⁰ IDB-DR Country Strategy 2013-2016, Priority Sectors - Health, page 11.

and documenting the effectiveness of the model in health services delivery it will prove the concept, a necessary first step to replicate and scale the experience in other similar areas in the DR as well as in the region.

- 1.21 The Project team has collaborated closely with health experts from the Bank in the design of the project and it is well aligned with the sector priorities and the current IDB Country strategy.

2 PROJECT DESCRIPTION

A. Objectives

- 2.1 The final impact objective of the project is to improve local primary health services in rural Dominican Republic through a cost-effective model that increases access and program coverage. The result objective is to increase the response capacity of UNAPs through a more efficient collection and transportation system of diagnostics and healthcare goods using UAVs in San Juan de la Maguana.

B. Description of Model/Solution/Intervention

- 2.2 By providing a reliable, regular and affordable transportation and logistics system of diagnostic samples, results and critical medical supplies between local UNAPs and regional hospitals, more samples can be retrieved per day by avoiding poor infrastructure and inefficient transportation solutions. Faster diagnostics can be delivered in less time, cold chain requirements could be reduced if delivered to hospitals in time, stock allocation and distribution can be improved, and transport costs reduced. In general, the National Health Service will have a better healthcare delivery system which will improve health indicators of low-income population living in rural areas.
- 2.3 The project will test a safe network for health-care transportation as a fully autonomous solution (no pilot necessary). It includes electric Unmanned Aerial Vehicles (UAVs); landing stations placed on the ground at UNAPs and hospitals with a special visual pattern that UAVs can identify for precision landing with better than GPS accuracy; and cloud software and mobile application that runs the UAVs routing and approves flight routes before take-off. This reduces the cost which enables replication and upscaling if compared with manned/piloted solutions.
- 2.4 The system has a reliability of 2,000 hours per year in an unsupervised system. This is important because reliability determines public safety, insurance costs, and regulatory approvals. The components of this UAV system provide different layers of safety and security. First, the UAV only flies to and from an identified, cleared and approved location that is pre-registered via the mobile application. This gives Aviation Authorities the ability to predict where the UAV traffic is, and the assurance that it will not conflict with any other air traffic. The cloud software oversees the whole network, providing real time information on what is being carried, to and from where, the identity of the sender and receiver, and the places from where the UAVs took off and landed. Every UAV is linked to a registered user through the mobile app, thus the system manager can

always know who is misusing the system, and can revoke the software license. If the UAV doesn't receive a command from the software, it won't fly or execute any command. In addition, the UAVs have been designed using guarded propellers, so they are not exposed and thus reducing any harm to people around them. They have an enclosed safe container, thus protecting the payload they're carrying. Also, they contain two fail-safe mechanisms (i.e. parachutes) that would deploy in case of malfunction by the vehicle, reducing the speed of the vehicle in case of potential impact with the ground. On the software side, the system uses a "See & Avoid" technology for fixed obstacle avoidance, and integrates airspace, weather and population data to avoid flying into airspace that is not secure or where the vehicle might experience bad weather or high winds, or fly above areas where there's significant population. Finally, the vehicle has a fully encrypted communications network and a unique system ID. On top of the robust technology and safe architecture of the system, the UAVs have an insurance policy covering up to \$1M liability for damages against third party property or people.

- 2.5 Sending samples for laboratory testing is well-suited for UAV transport since a lab sample only weighs around 3 grams. A multi-rotor UAV can transport several dozen specimens up to 25 kilometers and deliver them within a three meter radius of a designated target¹¹. Unlike health supplies and commodities that can be stockpiled, samples need to be sent frequently and without delay. UAVs offer the advantage that they can be electrically powered and can fly a direct path, saving time.

C. Project Components

Component I: Create and implement UAV network. (MIF: US\$159,970; Counterpart: US\$362,450)

- 2.6 The objective of this component is to establish proof of concept of the UAV network by identifying costs and benefits, risks, affordability for the public sector, value for money in comparison with the traditional approach to diagnostic testing and health care material transport. It will pilot two transportation networks that connect eight CPNs and two hospitals.
- 2.7 The activities are the following: (i) Develop a specification plan for UAV network setup to assess local conditions; (ii) Develop the operation concept for UAV pilot including the design of the optimal network connecting locations within range capabilities; (iii) Acquire aviation flights permits after having demonstrated the system's capabilities and safety; (iv) perform multiple community awareness campaign to gain trust and cooperation of local communities (v) Pilot launch and trials for six month period, including tests on location to understand real operations, performance, reliability and robustness of the technology and local awareness campaign, and; (vi) Research and

¹¹ Evaluation of the Utility of Automated Unmanned Aerial Vehicles in the Transportation of Laboratory Samples in Malawi (CDC) 2013

development for innovative ways of blood sample transportation and cloud software to monitor the network.

- 2.8 The outputs are: (i) A network of eight UNAPs and two hospitals/laboratories connected; (ii) 10 hours of flight time between UNAPs-Hospitals, and; (iii) flight permits obtained from the Dominican Aviation Agency.

Component II: Capacity building and know how transfer. (MIF: US\$25,160; Counterpart: US\$51,405)

- 2.9 The objective of this component to train end users (medical personnel, SNS personnel and youth from the technological community centers) in the technology that will operate the UAV network at local hospitals and UNAPs.
- 2.10 The activities to be financed are: (i) Development of training and operations manuals; (ii) Development of protocols for safety and management of the cargo, (iii) Hands on training for local maintenance technicians as well as SNS personnel to become the network operators. The training will provide knowledge on how to create new routes; how to operate and supervise the overall network; how to trouble shoot the mobile app; how to replace UAV components (propellers, motors, electronics); how to resolve emergency situations in real-time; maintenance routines; and in overall, provide any ancillary service needed for the operation of such UAV network in the area.
- 2.11 The expected outputs are: (i) 12 technicians at Drone Innovation center trained to operate a network of UAVs; (ii) six local technicians trained to maintain UAV network; (iii) 23 public health workers operating new transport model; (iv) a protocol by SNS to safely handle the cargo including lab tests and vaccines.

Component III: Creation of Innovation center for UAV. (MIF: US\$42,500; Counterpart: US\$155,580)

- 2.12 The activities of this component will establish a non-profit institution in partnership with four local universities and key private sector partners, which will establish an investigative laboratory for drone support and services. This innovation center will learn from the pilot experience and will attend to the future needs of local public and private commercial businesses derived from this technology. Due the nature of this center, its legal structure will be that of an NGO where the universities and key private partners can benefit from knowledge sharing, recognition and reference. This component also includes study tours to Matternet laboratory in California for local technicians.
- 2.13 The activities to be financed are the following: (i) creation of the legal structure of the center; (ii) Obtain laboratory equipment for the UAV center; (iii) space rental for flight testing and office utilities for the center; and (iv) hiring a UAV center manager.
- 2.14 The expected outputs are: (i) a Drone Innovation Center established with business plan; (ii) an agreement between universities and key private partners to collaborate in creating the Drone Innovation Center; (iii) 2 study tours organized.

Component IV: Knowledge Management and Communications Strategy. (MIF US\$81,150; Counterpart US\$0)

- 2.15 The objective of this component is to gather and systematize the experience of the pilot testing an innovative transportation method for improving health services in rural and remote areas services with the purpose of replication and possible scale up. The audiences of the knowledge activities and products include the regional governments in the rest of the country as well as other countries' governments for possible replication and regional and international health organizations and potential private sector investors interested in replicating the suggested model. The activities will seek to find information regarding how effective and efficient the business model is to improve health services for low income populations in rural areas and if using UAVs is an effective concept for healthcare provision and if so how can the model be replicated and scaled up. This component will finance: (i) studies that determine the feasibility of the pilot program, (ii) the efforts to increase the likelihood for scaling up the model especially through a PPP model involving the government to pay for services, and (iii) the coordination of events to disseminate the findings and project results.
- 2.16 The expected outputs are: (i) an audiovisual to showcase the project; (ii) a case study to show and analyze challenges, cost effectiveness, lessons learned and potential impact of using innovative technologies for the provision of basic services; (iii) a methodology for scale up and replication; and (iv) five institutions with access to new transport model for replication and scale up.

D. Project Governance and Execution Mechanism

- 2.17 The executing agency, Emprende, will be responsible for the implementation of the project and will sign the agreement with the IDB/MIF. Matternet, a high-tech company based in Silicon Valley, California, will provide the drones as counterpart and contribute with the accompanying software. Emprende will work in close cooperation with local key stakeholders such as local universities, government institutions, and key private stakeholders. Emprende has an approved sole sourcing contract with Matternet due to its unique qualifications for the activities to be undertaken. Matternet will act as a technical advisor to Emprende during the implementation of the Project on all matters regarding the management of a UAV network. Matternet will also develop training curriculums, partner with local universities and NGOs for the baseline and the monitoring system and will help with the communication campaign. Matternet will incorporate knowledge from the formal air space management systems and together with Emprende use participatory planning techniques in each major phase of the project. In addition, local institutions and public authorities will be collaborating in the implementation of the project.
- 2.18 A project steering committee consisting of Emprende, Matternet, and other key stakeholders such as local universities, the Dominican Aviation Agency and the National Health Service, will be set up to follow implementation and adjust the strategy during

the course of the project. Three months before the project ends, a sustainability workshop will be held with all key stakeholders to identify specific actions needed to ensure the continuity of the project's activities before project funding has been expended. One year before the project ends, a **sustainability workshop** will be held with all key stakeholders to identify specific actions needed to ensure the continuity of the project's activities.

E. Sustainability

- 2.19 The results of the pilot phase will be evaluated by the executing agency and the partners with the purpose of extending the model and scaling up to other provinces and eventually at a national level, together with the National Health Services and other interested partners in the private sector and donor community. The aforementioned Innovation Center for UAV will develop a scale up strategy and create research and capacity and develop proposals for take up and expansion by the government for supporting a scale up and secure sustainability. The core of the sustainability lies in the successful execution of the pilot project and thereby proving that the concept works. This will enhance the possibility of attracting addition donors and sponsors for a replication and scale up to other regions in the DR and possibly to other countries, both in the health and other sectors.

F. Experience and Lessons Learned from MIF or other Institutions

- 2.20 This is the first project of its kind in Latin America and the Caribbean using UAVs for health delivery systems. However, Matternet recent experiences include experiments conducted together with the UN in Bhutan and MSF in Papua New Guinea in 2014. Multi-partner projects were set up to operate small UAV networks for the distribution of diagnostics between rural clinics and hospital labs. The main challenge was the lack of adequate ground infrastructure for uninterrupted delivery of diagnostic samples from the collection centers in the rural clinics to the hospital labs. Both experiences have demonstrated proof of concept. The main lessons were: (i) the bigger the need the bigger the impact. It is important to set up the initial UAV network in locations where there are none or unreliable mechanisms to deliver healthcare goods and services; (ii) the initial set up of the UAV network needs to be done by the technology provider in close partnership with the local health authorities. This guarantees the successful implementation of the network and the best possible design to optimize results; (iii) the communities where the UAV network will operate need to be well aware and supportive. The beneficiary communities need to understand the advantages, the technology, potential risks to embrace the system and the model. Workshops should be organized where inhabitants can be shown the technology, learn what to do if there is a malfunction and if they come across a UAV, and do some visible tests for the public; (iv) National regulatory environments that apply must be beneficial or flexible enough for this type of technology. It is important that both the public and private sector is supportive and involved for financial and social sustainability.

G. MIF Additionality

- 2.21 Non-Financial Additionality. MIF is known for promoting innovative pilot initiatives that can have impact at scale. This Project will test an innovative concept and technology that can lead to a financially and socially sustainable business model in partnership with the government. This, together with MIF ability to bring regional and local partners, both public and private, to the project, and its project implementation expertise, bring a unique set of capabilities required to successfully implement a complex test of concept pilot project. The MIF contribution will be complimentary to an existing IDB loan, DR-L1067, “Strengthening of the Health Sector Results Management” currently under implementation by the Ministry of Health.
- 2.22 Financial Additionality. MIF’s financial contribution to this project positions it at the forefront of development organizations, and proves that MIF is willing to experiment with new technologies to solve underlying development problems. The technology components of this project (the UAV networks) are being developed with funds from venture capitalists and other investors. MIF funds would test the concept, evaluate, improve and transfer knowledge to local operators in the region, thus laying the ground for a new ecosystem and market in this field.

H. Intermediate results (Results)

- 2.23 The project will prove that by using UAVs the local health system can be more efficient, testing more amounts of samples per day, delivering faster and more reliable diagnostics while saving costs and using resources more efficiently and decongesting the regional hospitals. It is estimated that the initial amount of people visiting UNAPs will increase by at least a 75% and all samples would be delivered to hospitals in time, or at least the same day they are collected from UNAPs, eliminating almost all cold chain requirements. The Project will measure cost decrease in the pilot areas with regard to reduced transport costs and frequency and quality of service¹². The results indicators are: (i) a new transport model to deliver diagnostics and health care goods established; (ii) 40% of time reduced to deliver health care goods between UNAPs and hospitals; (iii) 50% increase of lab results delivered; (iv) 5 hours maximum time to deliver health lab results to patients.

I. Final results (Impacts)

- 2.28 The project will improve rural and remote primary health services through a cost-effective model that increases access and program coverage, therefore improving local communities living conditions. In addition it will create jobs and capacity building in the transportation industry, providing a new method and a unique set of technical skills and capabilities. The final outcome indicators are: (i) 75% increase in people attendance to UNAPs; (ii) (iii) 80% increase in satisfaction related to the health service provision in

¹² The Ministry of Health’s acquisition plan for FY 2013 estimated that over DOP\$ 304 million would be dedicated to transportation which is 67 times the budget allocated for the functioning of the entire Barahona’s health system.

rural areas; iv) 40% decrease of the transportation budget for the UNAPs participating in the project; v) a 50% decrease of transportation costs per kilometer in comparison to current means of transport.

J. Systemic Impact

- 2.29 While the Project promotes the adoption of a new aerial transportation system, and the introduction of a new technology and business concept in the Dominican Republic, the project also creates natural synergies between the public and the private sector - both beneficiaries from a highly efficient UAV network. The private sector gets to contribute to the development of a new market for faster delivery of healthcare goods, and take advantage of new opportunities to create and grow new high-tech jobs to provide basic health services. The public sector contribute to solving a problem negatively affecting the health care system, by offering faster and more reliable services to poor and low-income rural populations. Proving the concept of a UAV network would be a catalyst for further deployment, with the potential to cover other remote rural areas in the DR Public Health Care System. There are at least 20 other provinces throughout the country that experience the same problems that could potentially be solved by using this model. The indicators for systemic impact are: (i) number of key public institutions (health ministry) applying new practices based on MIF funded Project, and (ii) number of MIF-introduced models scaled.

3 MONITORING AND EVALUATION STRATEGY

- 3.1 Baseline and Monitoring: The National Health Service will collect baseline data on the relevant indicators in the areas of implementation, as well as transport time, lab samples collected and distributed and the overall costs of the UNAPs and hospitals that can be reduced. This information will be analyze by a consulting firm who will develop a monitoring tool to track the project's beneficiary level changes and indicators. This monitoring tool will take into consideration other indicators that could be collected through the project lifecycle such as additional Corporate Results Framework indicators.
- 3.2 Evaluation: An intermediate and a final evaluation of the project will be undertaken by external consultants contracted directly by the Bank with project funds. The mid-term evaluation will be prepared 12 months after the commencement of the project, or when 50% of project resources have been disbursed. A final evaluation will be conducted three months after the end of project execution, or when 95% of the Bank's contribution has been disbursed. The tentative evaluation questions are: "Are drones an appropriate technology for the objective at hand and can this model be scaled?", and "What are the challenges when testing a new business model for deploying innovative technologies in poor areas?"
- 3.3 Closing Workshop. The executing agency will organize a closing workshop at the appropriate time to assess along with other key stakeholder the outcomes achieve, identify additional tasks to guarantee sustainability and identify and disseminate lessons learned and best practices.

4 COST AND FINANCING

- 4.1 The project has a total cost of US\$1,153,015, of which US\$539,980 (47%) will be provided by the MIF, and US\$613,035 (53 %) by the counterpart. The execution and the disbursement period will be of 24 months.

	MIF	Counterpart	Total
Project Components			
Component 1 Create and implement UAV network	US\$159,970	US\$362,450	US\$522,420
Component 2 Training and know how transfer	US\$25,160	US\$51,405	US\$76,565
Component 3 Create drone innovation center	US\$42,500	US\$155,580	US\$198,080
Component 4 Knowledge Management and Communications Strategy	US\$81,150	-	US\$81,150
Execution and Supervision Components			
Executing Agency/ Administrative	US\$129,000	US\$43,600	US\$172,600
Baseline and Monitoring System	US\$35,000	-	US\$35,000
Mid-Term Evaluation	US\$ 7,500	-	US\$7,500
Final Evaluation	US\$7,500	-	US\$7,500
Ex post reviews	US\$15,000	-	US\$15,000
Contingencies	US\$30,000	-	US\$30,000
Institutional Strengthening	US\$7,200	-	US\$7,200
Total:	US\$539,980	US\$613,035	\$1,153,015

5 EXECUTING AGENCY

- 5.1 Emprende will be the Executing Agency of the Project and will sign the agreement with the MIF/IDB. Emprende is a business incubator for the strengthening of technology-based businesses in the Dominican Republic. Founded in 2006, as a non-profit private organization part of the Cybernetic Park of Santo Domingo, established to support the entrepreneurial ecosystem and help in the overall process of creating, growing and consolidating businesses, creating new jobs, markets and expertise. Its main goal is to raise awareness and promote the culture of technological entrepreneurship by providing the physical space, technical and financial assistance, support services and help develop new companies, specifically in the areas of high technology, information technology and research and development. Emprende will execute this project together with the technology provider partner and the Ministry of Health. Emprende has previous experience executing MIF projects (DR-M1017) "Apoyo al Emprendimiento Dinámico". Emprende executed the project achieving all objectives. In this previous project Emprende helped create the first Angel Investors Network in DR as well as the first venture capital fund which serve as a sidecar fund and is currently funding the expansion of business with high growth potential therefore supporting the entrepreneurial ecosystem in the country. Emprende also maintains high levels of transparency, accountability and integrity during project implementation, using best practices, general accounting software, a visual accounting system, and external audits on a yearly basis.

- 5.2 The other partners to this project are Matternet as a technology provider, and the Ministry of Health as the healthcare provider. Matternet, Inc. is a Silicon Valley-based company founded in 2011 and funded by top venture capitalist firm Andreessen Horowitz, pioneering the creation of UAV networks to allow low cost and automated transportation of healthcare goods in hard-to access areas. The Ministry of Health of the Dominican Republic manages the Dominican Public Health System and is responsible of over 1,714 UNAPs, 1,413 Local Health Centers, and 38 diagnostic centers.
- 5.3 Emprende will establish an executing unit and the necessary structure to effectively and efficiently execute project activities and manage project resources. Emprende will also be responsible for providing progress reports on project implementation. Details on the structure of the execution unit and reporting requirements are in Annex 7 in the project technical files.

6 PROJECT RISKS

- 6.1 The potential risks of this project are related to reputational risks associated with social acceptance and perception about the use of UAVs for civil and commercial purposes; and financial and sustainability risks affecting the continuity of the project after its implementation.
- 6.2 UAVs have a somewhat negative reputation worldwide as being a tool associated with war and military activity. This risk is mitigated by increasing public awareness in the communities where the network will be operating while testing the model and demonstrating the positive benefits of UAVs. This will be done by organizing workshops where the local population can get hands-on experience with the technology, learn what to do if there is a malfunction and if they come across a UAV, and also conduct some demonstrations transporting objects that the people value or that would otherwise not be possible if it weren't for the existence of this technology. The technology itself is an inherent risk to the successful implementation of the project since it is new and complicated. The project mitigates and prepares for this risk by having a relatively high contingency item in the budget for any known or unknown misfortune when testing the pilot. Further, there is a risk that the National Aviation Authority does not provide the Project with flight permits for the pilot to be launched according to schedule. This risk is being dealt with before the Project launch and during the preparation of the pilot by including the Aviation authorities in all the planning activities of the pilot. There is also an inherent risk that the communication of the know-how from the pilot experience is not transmitted effectively to the next phase and the scale-up. This risk will be mitigated by placing operational and financial emphasis on internal and external communication throughout the project cycle.
- 6.3 On the financial and sustainability risks, the Ministry of Health, under a different government administration, might decide to not support the continuation of the project, even if the economic benefits and savings are proven by the Project. By measuring results and demonstrating real and clear benefits of reduced costs and

improved services it is anticipated that the government will continue supporting the Project and the model in the longer term.

7 ENVIRONMENTAL AND SOCIAL EFFECTS

- 7.1 No negative environmental or social spillover effects are expected from this project.

8 COMPLIANCE WITH MILESTONES AND SPECIAL FIDUCIARY ARRANGEMENTS

- 8.1 **Disbursement by Results and Fiduciary Arrangements.** The Executing Agency will adhere to the standard MIF disbursement by results, procurement and financial management arrangements specified in Annex 7.