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REGIONAL

DIGITIZATION AND TECHNOLOGICAL OPTIMIZATION FOR SMES IN WORKS SUPERVISION

(RG-T3292)

DONORS MEMORANDUM

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PROJECT SUMMARY

DIGITIZATION AND TECHNOLOGICAL OPTIMIZATION FOR SMES IN WORKS SUPERVISION

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Unmanned aerial vehicles ("drones") are poised to become a major disruptor in the infrastructure sector in the next 10 years, due to their impact on costs in activities relating to works supervision, according to the "Clarity from Above" report prepared by PricewaterhouseCoopers. Within the infrastructure sector, the report notes, works supervision alone represents a potential market of around US$9 billion, which is to say that this market is driving the development of new drone-powered solutions to lower supervision costs and streamline decision-making.

At present, companies in the sector are actively seeking to boost efficiency in the processes associated with the design, supervision, and maintenance of works, and updating inventory of physical assets. Although the infrastructure sector calculates and assumes that the costs associated with managing an infrastructure project amount to approximately 3% to 5% of the total project amount, the reality is that cost overruns and delays in execution remain a challenge for the sector. For example, with the IDB's active portfolio of transportation projects standing at nearly US$13 billion, the resources dedicated to works supervision in this portfolio could be as much as US$650 million.

Collecting data using drones, converting visual data into information, and communicating the results to all parties involved in the construction process require knowledge and a multidisciplinary team with technical skills that add value and efficiency in the activities related to infrastructure works supervision. However, technology adoption in the sector in Latin America is a slow process, since only large construction companies are able to make investments and train in-house personnel in these new techniques. Thus, the low levels of digitization in the construction sector and limited supply of providers of information services to harness technologies and improve decision-making processes stand in the way of lowering supervision costs, and also generate a bias whereby foreign firms are being hired to provide more sophisticated services (imaging, photometry, data analysis, etc.) until they can be offered by firms in the region.

This creates an opportunity to explore innovative solutions that offer the infrastructure sector collaboration alternatives to keep costs down and improve decision-making processes. In this regard, the Multilateral Investment Fund (MIF) and IDB Transport Division (TSP) propose implementing a regional project to develop technical skills at small firms and incubate businesses that can target the emerging market driven by robotics and information and communication technology (ICT) in the infrastructure sector, to perform activities relating to works supervision more efficiently. The proposal focuses on training providers of civil works data capture and processing services, implementing pilot projects to support infrastructure works supervision, and establishing networks of service providers. The intervention model, once developed, will be tested under variable conditions in the Dominican Republic, Bolivia, and Panama before being documented for regional scaling via the IDB Group.

ANNEXES

APPENDICES

INFORMATION AVAILABLE IN THE TECHNICAL DOCUMENTS SECTION OF THE MIF PROJECT INFORMATION SYSTEM

ABBREVIATIONS

ICT	Information and communication technology
PCSD	Parque Cibernético de Santo Domingo [Santo Domingo Cyber Park]
SMEs	Small and medium-sized enterprises
TSP	IDB Transport Division

EXECUTIVE SUMMARY

DIGITIZATION AND TECHNOLOGICAL OPTIMIZATION FOR SMES IN WORKS SUPERVISION

(RG-T3292)

Country and geographic location:	Dominican Republic, Bolivia, and Panama		
Executing agency:	Parque Cibernético de Santo Domingo, S.A. [Santo Domingo Cyber Park] (PCSD)		
Focus area	Knowledge Economy		
Coordination with other donors/Bank operations:	The proposed project will take advantage of operations being implemented in autonomous robotics (e.g., DR-M1049, Drones and Health in the Dominican Republic, and PN-T1185, Flying Labs in Panama) to promote knowledge transfer so that similar entities in different countries can expand training service offerings in the subject matter of the proposed project.		
Direct and indirect beneficiaries:	The direct beneficiaries will be small businesses and individual providers that add information capture and processing services to their business models. The enterprises benefiting from technical assistance will be small businesses with an average of 10-20 employees.		
Financing:	Technical cooperation:	US$1,180,900	69%
	Counterpart:	US$ 528,350	31%
	Total budget	**US$1,709,250**	100%
Execution and disbursement period:	36 months for execution and 36 months for disbursement.		
Special contractual conditions:	The conditions precedent to the first disbursement are as follows: (i) submission of the Operating Regulations; (ii) submission of the annual work plan; (iii) formation of the advisory committee; and (iv) selection of the project coordinator and signature of coexecution agreements between the beneficiary country agencies, including a fiduciary protocol for the reporting and justification of expenditures.		
Environmental and social impact review:	This operation was prescreened and classified pursuant to the IDB's Environment and Safeguards Compliance Policy (Operational Policy OP-703). Given the limited impacts and risks, the proposed classification for the project is category "C."		

I. THE PROBLEM

A. Diagnostic assessment of the problem to be addressed

1.1 **Background.** Unmanned aerial vehicles ("drones") are poised to become a major disruptor in the infrastructure sector in the next 10 years, due to their impact on costs in activities relating to works supervision, according to the "Clarity from Above" report prepared by PricewaterhouseCoopers.[1] The report estimates the addressable market value of drone-powered solutions at over US$127 billion, with demand led by the infrastructure[2] (US$45 billion), agriculture (US$32.4 billion), and transportation (US$13 billion) industries. Within the infrastructure sector, works supervision alone represents a potential market of around US$9 billion. This market is driving the development of new drone-powered solutions to lower supervision costs and streamline decision-making, improving governance among stakeholders and standardizing information through digitization, to minimize cost and/or schedule overruns in infrastructure projects.

1.2 In the infrastructure sector, companies are actively seeking to boost efficiency in the processes associated with the design, supervision, and maintenance of works and updating inventory of physical assets. Although the sector calculates and assumes that the costs associated with managing an infrastructure project amount to approximately 3% to 5% of the total project amount, the reality is that cost overruns and delays in execution are a fixture of the sector. In the region alone, costs are estimated to be overrun by approximately 48% in infrastructure works, 71% higher than the international average (28%).[3] For example, with the IDB's active portfolio of transportation projects standing at nearly US$13 billion, the resources dedicated to works supervision in this portfolio (excluding projects in energy, water, sanitation, and social infrastructure) could be as much as US$650 million.

1.3 **Use of technology in monitoring infrastructure projects** Collecting data using unmanned aerial vehicles (drones), converting visual data into information, and communicating the results to all parties involved in the construction process requires knowledge and a multidisciplinary team with technical skills that add value and enhance efficiency in the activities associated with infrastructure works supervision. Although drone imaging represents an unprecedented mechanism that has lowered the costs of making photogrammetric measurements,[4] analyzing and processing captured information represents the greatest challenge, since highly specific technical skills are needed to translate the data into information for decision-making.[5]

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1 "Clarity from Above," PricewaterhouseCoopers, 2016.

2 Refers to industries within the infrastructure sector such as construction, transportation, energy, fuel, and gas that require the design, development, and supervision of physical assets.

3 Development in the Americas, DIA-2018, Better Spending for Better Lives, Chapter 5: Public Infrastructure, IDB, 2018.

4 Drone mission definition and implementation for automated infrastructure inspection using airborne sensors. Sensors, MPDI.

5 Visual monitoring of civil infrastructure systems via camera-equipped Unmanned Aerial Vehicles (UAVs). Visualization in Engineering, 2016.

1.4 Despite increasing use of information and communication technology (ICT) in infrastructure works supervision worldwide, technology adoption in the infrastructure sector in Latin America and the Caribbean is a slow process, since only large construction companies are able to make investments and train in-house personnel in new techniques for project implementation and management. For example, information on the progress of horizontal infrastructure projects is largely collected manually, thus limiting the level of detail of the information and the frequency with which it is updated, which affects the quality and efficiency of the supervision work.

1.5 As part of the La Paz–El Alto Highway Rehabilitation project in Bolivia, the IDB Transport Division (TSP) has developed Infradinámica, a software prototype to improve the implementation of infrastructure projects in the region and, above all, as a tool for enhancing project transparency. Its main objective is to engage the stakeholders associated with a project and involve them in a more effective and efficient management and supervision. To this end, Infradinámica prepares and provides detailed and up-to-date information on the scope of projects and fosters collaboration among the stakeholders.[6] Software such as this, which combines robotics and ICT, has in specific cases been shown, on average, to lower the cost of the project by over 25%, and shorten the time employed to design highways, bridges, and roads by up to 10 times.[7] However, scant adoption of such solutions poses a challenge for standardizing information that limits deviations in terms of the project time and cost.

1.6 **Problem addressed.** The low levels of digitization at the various stages of execution of an infrastructure project, particularly the design and monitoring phase, as well as the limited supply of information service providers to enable the sector to harness technologies and improve decision-making processes, stand in the way of lowering the overall costs of the works and create a bias toward hiring foreign firms to provide more sophisticated services (imaging, photometry, data analysis, etc.) until such services can be offered by companies in the region. The main causes include:

- **Limited supply of vendors.** In the region this technology is used mainly by the media, film, and entertainment. For applications with a more advanced level of sophistication, too few skills have been developed to meet the potential demand requiring a higher level of analysis, especially considering that the next generation of drones is expected to replace the aerial systems that currently exist in various sectors, such as 3D mapping, infrastructure supervision and monitoring, surveillance of facilities, etc. The absence of technical training programs limits the supply of services and, therefore, new

[6] The core of the solution is a digital platform that processes critical information about the status of infrastructure projects at each phase of execution and enables monitoring of construction. Whereas, traditionally, the parties involved in the process of executing infrastructure projects (the executing agency, the IDB, the contractor, and the supervisor) exchange information on progress through unspecified channels, the platform developed by the Infradinámica project attempts to implement standardized processes, facilitating the exchange of information and collaboration among all participants and improving the management and supervision of projects, as well as decision-making processes among the parties.

[7] See in this connection the Andalusian construction company Sando and the photogrammetric systems group at Universidad de Jaen in Spain.

startups in the sector. In the region, only one group of small businesses, such as Real Grupo Interactive in Colombia, have added new services enabling them to use the information generated by drones to create technical content, such as the digital terrain models used by engineers to make decisions about works.

- **Low level of digitization.** In Latin America, construction remains the second least digitized sector.[8] Although there are some technological solutions to manage vertical infrastructure projects (for example, building information modeling),[9] few are dedicated to horizontal infrastructure projects (such as highways). Information on the progress of horizontal infrastructure projects is largely collected manually, which generates asymmetries and limits the level of detail of the information and the frequency with which it is updated, affecting the quality and efficiency of the supervision work and giving rise to deviations in time and final costs in the implementation of infrastructure projects.

1.7 The sector's limited digitization, along with the lack of technological services and the potential of new solutions, creates an opportunity for the development of skills and incubation of business that can target the emerging market driven by robotics and ICT.

1.8 The growth of this market also offers an opportunity to create more jobs for women, who traditionally have been underrepresented in jobs in the transportation sector[10] and concentrated mainly in less skilled jobs, which pay less and are less stable. Given this set of problems, the IDB's transportation projects work to mainstream a gender perspective that contributes to equal access and benefits for women in works construction and project implementation. Efforts are made to position them more frequently in the operation of heavy machinery or as project engineers, among other areas.[11]

II. THE SOLUTION

A. Project description

2.1 The Multilateral Investment Fund (MIF) and the IDB Transport Division (TSP) have joined forces to implement a regional project to develop technical skills at small and medium-sized enterprises (SMEs) and incubate businesses that can target the emerging market driven by robotics and information and communication technology (ICT) in the infrastructure sector, to perform activities relating to works supervision more efficiently. The project's **final objective** is to lower the costs

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8 McKinsey Global Institute Industry Digitization Index, 2016, McKinsey Global Institute.

9 Building information modeling mimics the actual construction process. Instead of creating drafts with 2D lines, buildings are virtually constructed by modeling them with real building elements, such as walls, windows, slabs, roofs, etc. This allows architects to design buildings in same way they are built.

10 For more information see: Duchéne, C. (2011). Gender and transport. International Transport Forum on Transport Society (pp. 7-20). Leipzig, Germany; and Peters, D. (2006). Gender issues in transport: applying an integrative perspective. Center for Metropolitan Studies, Technische Universität Berlin; ILO (2013). Women in the transport sector: promoting employment by preventing violence against women transport workers. Geneva.

11 https://blogs.iadb.org/moviliblog/2018/02/21/mujeres-en-botas/.

associated with infrastructure works supervision through the use of ICT and robotics. The **specific objective** is to professionalize networks of geospatial capture and processing service providers for the infrastructure sector.

2.2 The intervention model to achieve the project objectives will focus on training providers of drone-powered civil works data capture and processing services, implementing pilot projects to support infrastructure works supervision, and establishing networks of service providers. The project will use a suite of tools as a platform to transform the captured geospatial data into actionable information for small businesses engaged in civil works supervision and construction. The intervention model will be tested under variable conditions in the Dominican Republic, Bolivia, and Panama before being documented for regional scaling via the IDB Group.

2.3 **Innovation.** The project seeks to substantially change the way works are monitored in the region with three fundamental outcomes: (i) lower costs related to supervision, motivating supervision and/or construction firms to subcontract SMEs able to perform the work of monitoring and analyzing the progress of works; (ii) optimization of the analysis and calculation of civil works, minimizing inaccuracies during execution in time and costs; and (iii) moving the labor force away from less skilled, manual work where demand may decline, and toward more technical work in ever greater demand. The project also promotes the use of technology to increase business productivity while building technological capacity to access new jobs with greater value-added and better pay.

B. Project beneficiaries

2.4 The direct beneficiaries will be SMEs and individual providers that add information capture and processing services to their existing business models. New ventures are also expected to be started, to offer measurement and monitoring services based on geospatial data capture. The project will work with at least 30 businesses with an average of 10-30 employees. Approximately 150 people (at least 30% women) will also benefit from the various training programs under the project. The knowledge products (such as evaluations, use cases, case studies, etc.) developed under the project will impact the management of works supervision by key actors in the public sector, such as ministries of public works, public works supervision agencies, and professional associations of architects and engineers, with the benefits of the technology solution in terms of cost and time.

2.5 This project will also contribute to the digitization and modernization of the infrastructure sector in the Dominican Republic, Bolivia, and Panama, making supervision, an activity at the heart of works execution, increasingly transparent, effective, and efficient.

2.6 **Component I: Market profile of suppliers and demanders of geospatial information (MIF: US$86,250; Counterpart: US$0).** This component seeks to determine the potential demand in the infrastructure sector for geospatial measurement services relating to infrastructure works supervision. The outcomes of this component will make it possible to articulate the skills and training to be offered, to increase the quality of the offerings of the small businesses providing works design, management, and supervision services.

This component will finance the following activities: (i) the definition of minimum general standards and protocols for SMEs to have in place, in order to provide geospatial measurement services for works supervision; and (ii) a market study to identify niches, suppliers, and demanders by type of firm. The expected outcome is a market study and the protocols and service standards for enterprises to have in place, in order to engage in data measurement for works supervision.

2.7 **Component II: Capacity-building through the use of drones for photogrammetry and data analysis and processing solutions (MIF: US$451,550; Counterpart: US$99,150).** The objective of this component is to train providers of geospatial measurement and data analysis and processing services. This component will seek to build capacity through a minimum number of hours of classroom and hands-on training, to ensure that new technical skills are developed that integrate the use of drones and data analysis for works supervision.

This component will finance: (i) a training curriculum structured around works supervision using drones and information technologies; (ii) a certification course introduced on geographic measurement tools; (iii) workshops to develop skills in the use of geographic measurement tools; (iv) workshops to design, equip, and maintain drones for geospatial measurement services. The expected outcomes are: (i) 150 professionals certified in the use of geospatial measurement tools and in information analysis and/or data processing, where at least 30% are women leaders of enterprises or ventures related to works supervision;[12] and (ii) 30 companies trained to provide services related to photogrammetry and geospatial data analysis and processing.

2.8 **Component III: Implementation of pilot projects (MIF: US$251,550; Counterpart: US$265,200)**. This component seeks to demonstrate efficiency with a works supervision model assisted by IT and robotics (drones) in at least 10 infrastructure projects. This component will be implemented with the participation of works ministries, associations of engineers and/or architects, and the construction-related private sector.

The activities to be implemented are as follows: (i) identification and prioritization of infrastructure projects for piloting the supervision model established in the program; (ii) structuring and support of works supervision; (iii) upgrades to the Infradinámica 2.0 image capture, works management, and community integration tool. The expected outcome is that at least 10 infrastructure projects have implemented a works supervision model using drones to facilitate photogrammetry and Infradinámica 2.0.

2.9 **Component IV: Structuring of supplier networks (MIF: US$19,700; Counterpart: US$14,400).** This component will support the establishment of networks of suppliers of photogrammetry and data processing and analysis services,[13] to create an information base that provides exposure for SMEs offering

[12] The 150 certified professionals will be spread across the three countries where the project will be implemented.

[13] A technique that precisely determines the shape, dimensions, and position in space of any object, essentially using measurements made on one or more photographs of that object. After measuring the dimensions, the types of objects photographed must be determined and selected in order to compare them against measurements of these objects taken previously, and to turn the variations into useful information for decision-making by infrastructure works managers.

such services. It will also support their representation within the construction sector. A number of minimum criteria must be met for firms to join the supplier networks.

The activities to be financed include: (i) development of rules for firms to join the network; (ii) activities to support network promotion; and (iii) development of a Web portal with a directory of firms and a catalogue of general services in each country. The expected outcomes are: (i) three networks of providers of photogrammetry and data analysis and processing services established in each participating country; and (ii) a Web portal in each country containing the directory and services of the member firms.

2.10 **Component V: Knowledge and dissemination (MIF: US$182,000; Counterpart: US$56,000).** The objective of this component is to compile and systematically document the experience and knowledge generated by the model for infrastructure supervision using information technology and robotics. This component will focus on the details of technical implementation, the related operating costs and time to complete each pilot's activities, thus allowing for comparison against the conventional methods of infrastructure supervision so as to document and support with evidence the efficiency of the implemented techniques. The component will seek to identify and document the knowledge generated by the project, to facilitate scaling of the model at the regional level.

The activities to be financed by this component are: (i) design of a communication plan to promote the benefits of technology in works supervision; (ii) a regional event in coordination with TSP; (iii) preparation of case studies on the experience and level of efficiency in implementing this technology in the monitoring of infrastructure projects (the results of this component will raise awareness among construction SMEs on the economic benefits of using drones for services relating to photogrammetry and data analysis using robotics and information technology); and (iv) analysis of the legal framework and regulations relating to the private professional use of drones in the region's 26 countries. This analysis will make it possible to assess the level of complexity of scaling the model at the regional level. The expected outcomes are as follows: (i) three case studies compiling the methodology used and efficiency-related data from the pilot projects; (ii) a thematic study on the status and promotion of ICT and robotics for the infrastructure sector; (iii) a regional event presenting market trends in the use of ICT and robotics in works supervision and other areas; and (iv) a report-analysis on the legal framework and regulations for 26 countries with strategic recommendations for the implementation of a plan for scaling the business model.

C. Project outcomes, impact, monitoring, and evaluation

2.11 The project's main indicators include: (i) a 20%[14] average cost savings on infrastructure works supervision using ICT and drones in at least half of the piloted projects; (ii) 30 firms demonstrating a change in behavior by implementing ICTs and drones as tools of infrastructure works supervision; and (iii) the creation of 45 jobs related to running geospatial measurement software and robotics at the firms participating in the program.

[14] Subject to verification and validation via the baseline survey.

2.12 The monitoring system of Parque Cibernético de Santo Domingo, S.A. (PCSD), which is project executing agency, will be used for project monitoring and supervision, based mainly on the indicators defined in the Results Matrix. The information will be broken down by type of firm, gender,[15] and relevant sector, among other factors. Based on the PCSD monitoring system, the project coordinator will complete the six-monthly project status report (PSR) twice a year. The project will include a final evaluation to assess the project results, conducted by an external consultant engaged and monitored by the executing agency following guidelines agreed upon with the MIF. Together with the other knowledge products, the final evaluation should answer the following and other questions: To what extent have the platform and technologies designed generated efficiencies and improved costs relating to works supervision? What type of efficiencies have been attained in the analysis, processing, and use of the information generated by the drones? How has it been received by the beneficiaries? How relevant were the beneficiary selection criteria? How much did they contribute to lowering costs for the beneficiaries? How involved are the technical teams of the firms, communities, and other government entities in ensuring proper implementation of the model and its replicability? What elements can be improved in the project for another similar exercise? Did the business model gain traction in the market?

III. Alignment with the IDB Group, Scalability, and Project Risks

A. Alignment with the IDB Group

3.1 The proposal is aligned with the IDB's vision: "Partnering with the region to meet its development challenges," as part of the IDB Group's **Update to the Institutional Strategy 2010-2020**,[16] since it contributes to the aims of improving regional infrastructure and inserting firms into value chains.

3.2 This project is also aligned with the **Transportation Sector Framework Document** in dimension of success 5 for the implementation of new technologies and innovative trends in the sector in an efficient and timely manner, and specifically with the line of action related to maximizing the utility of ICTs to generate value added in operations.

3.3 **The Bank's country strategies.** The project is in line with the efforts to be made by the Bank in the Dominican Republic in 2017-2020 in the priority area of "expansion of productive opportunities," in terms of sovereign guaranteed and non-sovereign guaranteed operations to be offered in the logistics and transportation sector. In particular, it is aligned with the strategic objective of improving productive infrastructure and improving preparation for the effective use of technological infrastructure and digital content. The project is also aligned with the country strategy with Bolivia for 2016-2020 by promoting innovation and contributing to improved transportation infrastructure. Lastly, the project is aligned with the country strategy with Panama for 2015-2019 by contributing to enhance the logistics services, efficiency, and connectivity of the productive infrastructure in the country through the use of technological innovations.

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15 Whether the company is led by women is to be determined.

16 IDB. Update to the Institutional Strategy 2010-2020, March 2015.

3.4 **IIC Business Plan 2016-2019**. The initiative fits into two of the five strategic priority areas of IDB Invest's business plan: (i) support of the development of micro, small, and medium-sized enterprises; and (ii) promotion of innovation and technology.

3.5 **Knowledge Economy.** The project is part of the MIF's focus area of Knowledge Economy, in terms of building capacity at firms to increase their productivity and developing skills for people to enter the workforce in positions with greater value-added and, therefore, higher pay. The proposed project will build on MIF operations focusing on autonomous robotics, "DR-M1049: Drones and Health" in the Dominican Republic and "PN-T1185: Flying Labs" in Panama, to promote knowledge transfer so that similar entities in different countries can expand the training service offerings in the thematic area of the project. The initiative will leverage resources of the Transport Division (TSP), which has already developed the Infradinámica platform for the analysis of geospatial information captured by drones.

3.6 **National development strategies.** The project is aligned with the Economic and Social Development Plan of Bolivia 2016-2020, Toward the 2025 Patriotic Agenda, under major focus area 2, "Universalization of basic services," in terms of support for the country's integration through different modes of transportation appropriate to the characteristics of Bolivia by means of roads, inland navigation, air, and rail. It is aligned with the "Panama 2030" National Strategic Plan and Vision Statement in the major area of strategic focus, "Grow more and better," in terms of the performance of activities and projects to promote resilient infrastructure and foster innovation. It is aligned with the National Development Strategy of the Dominican Republic 2010-2030 in the third major area of strategic focus, "A coordinated, innovative, and sustainable economy with a productive structure that generates sustained, high growth with decent jobs, positioned competitively in the global economy," in terms of the activities to expand coverage and improve the quality and competitiveness of transportation and logistics infrastructure and services, geared toward integration of the territory, support for productive development, and competitive positioning in international markets.

3.7 **Sustainable Development Goals.** The project is aligned with Goal 9, "Industry, innovation, and infrastructure," in terms of promoting innovations in the infrastructure sector to lower the costs of supervision. It also contributes to Goal 8, "Decent work and economic growth," in terms of promoting the development of new ventures and job creation in a market with high growth potential in the coming years.

B. Scalability

3.8 The scaling potential relies on the project's key partner, the Transport Division (TSP), which will promote and replicate the work methodology, harnessing its Infradinámica tool and lessons learned in the use of drones for the infrastructure operations it finances. As key partner, TSP will provide close support for project execution and participate along with the MIF and the executing agency in defining the scope of the studies and knowledge products generated under the project. Accordingly, the lessons learned will be directly communicated to the TSP team participating in the project and more widely disseminated by the TSP and its partners through jointly organized dissemination workshops. As part of this

process, a spillover effect is expected at consulting firms that supervise IDB-financed operations to other works supervised by them, as well as to other works unrelated to the IDB. Partnerships will be formed with strategic stakeholders (trade associations of construction firms), to promote the model's benefits. The legal frameworks and regulations relating to the private professional use of drones in the countries of the region are factors to be considered as one of the main constraints on scaling.

C. Project risks

3.9 **Permits.** The main risk relates to the necessary permits from the civil aviation authorities. To mitigate this risk, a process to raise awareness among stakeholders with the necessary decision-making authority will be conducted, so that flights can take place in controlled environments. As a recommendation from the experience in the Dominican Republic, civil aviation authorities will be brought into the Operations Committee that monitors project implementation.

3.10 **Costs.** Despite the low cost of the drones, they may be more than certain SMEs can afford.[17] Similarly, software costs may prove to be a disincentive to technology adoption.[18] To mitigate this risk, the project provides for agreements with leading software developers for image processing and photogrammetry, so that such services can be purchased at a lower price.

3.11 **Decommissioning of Infradinámica software.** One of the project's important elements is the relationship between the new business model to be supported and the Infradinámica software produced by the IDB. As with any computer software, there is a risk that the application will be decommissioned to give way another solution. In such case, the project calls for basic training in the processing of photogrammetric information and data analysis that can be employed with any geospatial measurement software.

D. Cost and financing

3.12 The project has a total cost of US$1,709,250. Of that amount, US$1,180,900 (69%) will be contributed by the MIF as a nonreimbursable contribution, and US$528,350 (31%) will be contributed by the Dominican Republic, Bolivia, and Panama as a counterpart contribution.

Project components	MIF	Counterpart	Total
Component I: Market profile of suppliers and demanders of geospatial information	86,250	-	86,250
Component II: Capacity-building through the use of drones for photogrammetry and data analysis and processing solutions	451,550	99,150	550,700
Component III: Implementation of pilot projects	251,550	265,200	516,750
Component IV: Structuring of supplier networks	19,700	14,400	34,100
Component V: Knowledge and dissemination	182,000	56,000	238,000
Program administration	143,100	93,600	236,700
Project monitoring and evaluation	46,750	-	46,750
Grand total	**1,180,900**	**528,350**	**1,709,250**

[17] The DJI M600 costs around US$6,000 per unit without additional rechargeable batteries.

[18] For example, the perpetual PIX4D license costs approximately US$6,500, Dronedeploy US$400/month, Dronemapper US$350/month, etc.

IV. PROJECT PARTNERS AND IMPLEMENTATION STRUCTURE

A. Description of the project executing agency

4.1 The entity proposing to lead the execution of the initiative is Parque Cibernético de Santo Domingo, S.A. [Santo Domingo Cyber Park] (PCSD), which is the principal ecosystem for innovation and support to technology-based ventures in the Caribbean region. The PCSD has several interrelated components, including the Centro de Innovación de Drones [Drone Innovation Center] (CID), Instituto Tecnológico de Las Américas [Technological Institute of the Americas] (ITLA) for technology training, the EMPRENDE technology company incubator, and the first technology free trade zone, where about 20 companies operate, generating direct jobs for some 2,000 people in the areas of IT-BPO services, high-tech manufacturing, and biotechnology. The PCSD is a self-sustaining entity: its resources come from administrative services and rental of space to technology companies to carry on their productive activities. In 2017, the park's total revenue exceeded US$2.5 million. Its prior experience in the execution of robotics-related programs, the use of autonomous unmanned vehicles, and the training of young people in cutting-edge technology make the PCSD and its Drone Innovation Center a strategic partner to identify new stakeholders and forge partnerships in the Dominican Republic, as well as in Panama and Bolivia. The PCSD will be the project executing agency supporting the technical execution of the coexecuting agencies in Bolivia and Panama.

4.2 In Panama, Ciudad del Saber has been identified as an entity engaging in knowledge transfer management focused on building the innovation and competitive capacity of entrepreneurs. Ciudad del Saber and the PCSD have a collaboration agreement to conduct research and technology projects that would be a springboard for the initiative.

4.3 In Bolivia, a potential partner will be Fundación Trabajo Empresa in Santa Cruz de la Sierra, an entity engaged in promoting the development and strengthening of micro and small enterprises in the Department of Santa Cruz, where it develops innovation-based business training programs in collaboration with different stakeholders in the public and private sectors.

4.4 Replacement of a coexecuting partner in Panama or Bolivia will require the approval of the Lead Specialist for project supervision.

4.5 In the countries where the operation is executed, strategic partnerships will be formed with the various federations, associations, and/or chambers of construction firms. Asociación Dominicana de Constructores y Promotores de Vivienda [Dominican Association of Housing Builders and Developers] (ACROPROVI) and Cámara de Constructores de Santa Cruz [Chamber of Construction Firms of Santa Cruz] (CADECOCRUZ) in Bolivia have been identified on a preliminary basis.

B. Structure and implementation mechanism

4.6 The executing agency, PCSD, will execute the project and enter into the agreement with the IDB/MIF. It will work in close collaboration with key local stakeholders, such as local universities, government institutions, and key private sector stakeholders such as associations of construction firms and/or architects.

The PCSD will serve as technical advisor on all management issues to the other coexecuting agencies in Bolivia and Panama during project implementation

4.7 **Program coordination unit.** The program coordination unit will be at the PCSD and will comprise an administrative unit and project coexecuting units in Panama and Bolivia. A project coordinator will be appointed to act as regional coordinator, based at the PCSD, who will be responsible for executing the program activities while at the same time coordinating tasks with those responsible for execution in the other countries. In addition to regional coordination duties, the project coordinator will also execute the operation in the Dominican Republic.

4.8 **Administrative unit**. An administrative unit will be established for the administrative and financial aspects of the project. This unit will be set up in the Dominican Republic within the offices of the executing agency for the operation, the PCSD. It will be responsible for financial and accounting control of the operation at the regional level. For such purposes, it will consist of a full-time financial manager and a part-time administrative/accounting assistant. Unit staff will report functionally to the project coordinator, and indirectly to the PCSD representative.

4.9 **Coexecuting agencies**. The execution of project activities in Bolivia and Panama will rely on the program's coexecuting agencies in those countries. For such purposes, Ciudad de Saber in Panama and Fundación Trabajo Empresa in Bolivia will enter into a coexecution agreement with the PCSD, in which they undertake to jointly execute the program and appoint and/or identify a coordinator in each of the countries. The distribution of responsibilities by executing agency will be recorded in the program Operating Regulations.

4.10 **Supervision committee.** A supervision committee will be formed that meets once a year to track the operation's progress and ensure that it continues to pursue the program's development objectives. Recommendations regarding the redirection of funds, adjustments of indicators, and/or any substantive changes must be agreed upon and approved by the committee, which will have as members the project coordinator, the coexecuting agencies in the countries, a representative from the public and private sector related to the construction sector, all of whom will have the right to speak but not to vote, and a representative of the MIF, who will have the right to speak but not to vote. Meetings will be once a year at a place agreed upon by the majority of the members. Six months before the end of the project, a sustainability workshop will be held to identify the specific actions necessary to ensure the continuity of the project activities before the project financing runs out.

4.11 Periodic coordination meetings will be held to determine action and implementation strategies. The MIF will support the executing agency in project implementation and will be involved in its strategic decision-making.

V. FULFILLMENT OF MILESTONES AND SPECIAL FIDUCIARY ARRANGEMENTS

5.1 **Results-based disbursements and fiduciary arrangements.** The executing agency will commit to the MIF's standard arrangements relating to results-based disbursements, the Policies for the Procurement of Goods and Works Financed by

the IDB (document GN-2349-9),[19] and the Policies for the Selection and Contracting of Consultants Financed by the IDB (document GN-2350-9),[20] or such policies as may replace them.

5.2 Based on the results of the diagnostic needs assessment (DNA) of the executing agency contained in Annex IV, the PCSD has a low level of risk and is therefore eligible for ex post review of both the procurement processes for goods and services and matters relating to disbursements and financial management.

VI. ACCESS TO INFORMATION AND INTELLECTUAL PROPERTY

6.1 **Access to information**. The information contained in this document is classified as "public upon approval" under the Bank's Access to Information Policy.[21] Regarding the technology platform developed in Component III and all studies and knowledge products, the Bank will retain the intellectual property rights relating to the products and studies developed under the project and will grant the executing agency a free, nonexclusive license to use them for noncommercial purposes. This will ensure maximum dissemination of the lessons learned from the project in Colombia and in Latin America and the Caribbean.

[19] Link to the procurement policies.

[20] Link to the Financial Management Guidelines for IDB-financed Projects.

[21] Link to the Bank's Access to Information Policy.