**TERMS OF REFERENCE**

**IFD/ICS**

**Feasibility study of the broadband networks (backbone, backhaul and last mile) in Ecuador including the connection with the Galápagos Islands**

**(EC-T1289)**

1. **BACKGROUND**

There is evidence that the acceleration of broadband penetration, adoption and effective use brings clear social inclusion and economic benefits. In particular, it is estimated that increases of 10% in broadband penetration in Latin American and Caribbean (LAC) countries, on average, have associated increases of 3.19% in GDP, 2.61% in productivity and a net generation of more than 67,000 jobs[[1]](#footnote-1). Additionally, according to a study by Arthur D. Little and Ericsson, 1% increase in broadband penetration can bring 4.3% increase in exports.

Unfortunately, the LAC region is lagging behind other regions with regards to broadband penetration and usage and the same is true for Ecuador. Whereas broadband penetration for OECD countries is nearly 25.7% and for IDB countries is around 7.6%, that in Ecuador is only of 4.2%[[2]](#footnote-2). Not only there is a divide with the LAC countries and the OECD ones but also within Ecuador. The department of Quito averages 10.88% in broadband penetration[[3]](#footnote-3) whereas departments like Los Rios, Manabí, or Santa Elena do for 1.64%, 2.08% and 2.37% respectively.

Additionally, the international connectivity in Ecuador, despite being above the LAC average, is far from other countries. Whereas the bandwidth in Ecuador is 33,14 Kbps/user, in other economies in the region like Uruguay and Chile there are more than 40 Kbps/user. The divide is much bigger when comparing with OECD countries, that average 73,39 Kbps/user and have countries with more than 200 Kbps/user, like Iceland, Switzerland and Sweden.

Having a broadband network that links Ecuador to other countries in the LAC Region will provide abundant bandwidth, easier connectivity and reduced costs. It will also help to integrate Ecuador by facilitating trade, social, and cultural exchange between countries. Through connectivity new ways of trade appear in a digitalized world where there are no boundaries.

This situation has led the Government of Ecuador (GoE) to recognize the importance of increasing broadband connectivity in the country in an effort to facilitate social inclusion for all the population strata, economic growth and contribute to the integration of the country both nationally and regionally. In fact, the GoE is already working on the development of a national broadband plan[[4]](#footnote-4) that sets the objectives and milestones that will help promoting broadband access, adoption and usage.

Thus, the GoE has identified the deployment of new infrastructure as a necessary step to improve the capabilities of the national broadband. This will imply the construction of new optical backbone and backhaul networks, including the connection with the Galápagos Islands, as well as improved last mile coverage and international connectivity that would present several advantages for Ecuador and its regions, related to the improved cost-efficiency of their inter-connection. First, it will allow all of the main cities to access each other through the network directly, without paying transit fees. Second, traffic to other countries from cities near the Pacific coast could be sent through the terrestrial network across the country connecting thus the west and east, the north and the south. Similarly, traffic to other countries from different cities could be achieved thanks a better interoperability. And the citizens will be benefited from the improved quality and performance of the last mile access networks as well as lower prices.

1. **CONSULTANCY OBJECTIVES**

The general objective of this Technical Cooperation (TC) is to support the GoE in their efforts to increase access, adoption and use of broadband services. Therefore, the specific objectives of this TC are:

1. To quantify and to evaluate the Divide in terms of infrastructure among the different regions in Ecuador, analyzing the gap between supply of demand.
2. To quantify and to evaluate the needs in terms of infrastructure for the connection with the Galápagos Islands.
3. To understand the socio-economic dynamics of the different regions to propose an adoption and usage plan with a focus on achieving social inclusion, economic growth and integration of the less developed regions through education, health and key government services. This plan should include a set of public policies that foster the deployment of the infrastructure and the adoption and usage plan in the different regions that will contribute to the integration of the country both nationally and regionally.
4. To analyze the financial and economic feasibility of the project and the amount of the necessary subsidy coming from the GoE.
5. To review and update the regulatory framework with the aim of ensuring that the network deployment fosters competition and allows a smooth interconnection with the existing networks.
6. To support CONATEL in regulatory issues related to the supervision of the networks operation.
7. To conduct additional environmental, institutional and administrative analyses supporting a possible incoming loan operation.
8. To develop a dialogue that shows the benefits that broadband connectivity has for the integration of rural and urban areas as well as the integration among different countries. In addition it will be presented success cases and the policies that have been implemented to maximize the effects on trade and integration.
9. **CHARACTERISTICS OF THIS CONSULTANCY**

**Type of consultancy:** Firm

**Starting date and duration:** maximum of 6 months (starting as soon as possible)

**Working place / travels:** Although the tasks may be carried out in the country of origin, the firm will be required to travel at least twice to Ecuador, one at the beginning of the consultancy for the kick-off of the project and one at the end to present and disseminate the results. That being said, the Bank expects the firm to travel as much as necessary to the country to guarantee the best quality of the work.

**Qualifications**: The firm will have extensive experience in the telecommunications sector, with senior team members involved in projects in LAC and other developing regions. Specific domain of domestic and international broadband infrastructure is required, including but not limited to terrestrial and undersea cables. The firm must have a proven capability to deliver detailed and accurate market studies, particularly as the results of Component 1 will serve as critical inputs for the development of the feasibility studies in Components 2 and 4 of the project.

1. **ACTIVITIES AND PRODUCTS**

The consultancy will have to be structured around the following components and activities.

**Component 1: Market Study**

The objective of this component is to improve the understanding of the market dynamics in the different regions of Ecuador including one specifically for the Galápagos Islands, by preparing a market study for each one, including an analysis of the socio-demographic and economic conditions of the different geographic areas and how these impact broadband availability; an analysis of current supply and demand of telecommunication services; and a forecast of the demand, including the potential demand for international connectivity.

***Activity 1.1: Study of the current supply of telecommunications services***

Study of the current supply for each region. For last-mile networks: type of service, technology, coverage, speed, price, penetration and owner of the infrastructure. For backbone and backhaul networks: type of technology, coverage, real usage in terms of used capacity, owner of the infrastructure, existence and location of Internet Exchange Points (IXP) and location and bandwidth of international connectivity links.

***Activity 1.2: Study of the infrastructure planned to be deployed***

The plans for new infrastructure will be analyzed at every network level: backbone, backhaul and last mile, including coverage, capacity, purpose, user, timing and owner.

***Activity 1.3: Study of the physical infrastructure***

Study of the physical infrastructure that can support broadband infrastructure (e.g. roads, electricity, ducts) where the results of the ESW RG-K1294 (Development of Broadband Maps for Latin America and the Caribe) may be used as an input.

***Activity 1.4: Socio-demographic study***

Socio-demographic study that will include an analysis of how the population is distributed geographically, the density of population per geography, their occupation and their purchasing power measured as the monthly salary

***Activity 1.5: Demand Estimation***

Study to estimate the current demand for broadband-enabled services specifying the service and the device used to access that service, including the demand coming from citizens, enterprises and public institutions (schools, health centers and government facilities).

***Activity 1.6: Demand Forecast***

Forecast of the demand (estimate the demand for broadband-enabled services after the improvement of infrastructure not only by carrying out surveys but also by benchmarking with other countries where such a deployment has happened before), including the demand coming from citizens, enterprises and public institutions (schools, health centers and government facilities).

***Activity 1.7: Demand Curves***

Based on the surveys performed in previous activities, develop an estimation of the demand curves for the different broadband speeds.

***Products***

The product from this component will be structured in two main parts: (1) analysis of current broadband supply, (2) estimation and forecast of broadband demand.

**Component 2: Technical Study**

The objective of this component is to identify the technical considerations for deploying the infrastructure (backbone, backhaul and last-mile as well as international connectivity and the interconnection with the Galápagos Islands), including the structure of the network and the different technological alternatives through the development of a technical study. The geographic scope of the study should be at least the province level. In all the activities below, the connection with the Galápagos Islands will have to be considered.

***Activity 2.1: Orographic study***

Taking as an input the results of the socio-demographic study developed in the previous activity, an orographic study will be performed to identify possible difficulties and considerations for the network deployment.

***Activity 2.2: Logic Diagram***

Design of the logic diagram of the network (nodes and links) taking into account the results of the previous component as well as the orographic study.

***Activity 2.3: Technological Alternatives***

Identification of technological alternatives associated to the physical design (for last mile, backhaul and backbone as well as interconnection with the islands) indicating the advantages and disadvantages of each of them and calculating the costs associated.

***Activity 2.4: Physical Design***

Physical design of the network defining the specific location and typology of the nodes, the links between the nodes (the design will consider and show the existing infrastructure), and the necessary physical supporting infrastructure indicating whether some of the existing can be reutilized (e.g. high-tension, roads, paths).

***Activity 2.5: Sizing***

Determination of the requirements in terms of capacity and sizing of each of the elements of the networks according to the expected traffic that results from the demand study conducted in the Component 1.

***Activity 2.6: Auxiliary Elements***

Determination of the auxiliary elements associated to each of the elements of the network that are necessary indicating whether they exist (e.g. facility to host the nodes).

***Activity 2.7: Technology selection***

Recommendation of selection of the best technology to attend the estimated traffic.

***Activity 2.8: Implementation plan and recommendations***

Deployment Plan for the proposed network and implementation schedule including a set of public policies/regulation recommendations that would facilitate the deployment.

***Products***

The product from this component will be the detailed technical study with enough information to serve as an input for the financial study and rest of components.

**Component 3: Adoption and use study**

The objective of this component is to analyze and define an adoption and usage strategy that guarantees that the infrastructure foreseen to be deployed in Component 1 would be used by citizens and government with a special focus on schools, health centers and government facilities and services. This study will have to consider at least the province level.

***Activity 3.1: Proposal of services***

A proposal of a set of services for the population prioritizing education (e.g. tele-education), health (e.g. tele-medicine) and government (e.g. e-transactions) but also financial services (e.g. e-banking) and productivity and competitiveness improvements and others suitable to the occupation of the local people

***Activity 3.2: Services structure***

For each of the proposed services, a detailed description of the content (e.g online books, online classes), specific applications (e.g. virtual classroom) and devices required (e.g. computer/smartphone).

***Activity 3.3: Training Plan***

A training plan on the use of ICTs (and internet) and on each of the services proposed both for specialists (e.g. doctors, teachers, government officials), citizens and professionals, identifying the specific audience and the objective

***Activity 3.4: Budget and Implementation Plan***

Budget for the proposed services and activities and implementation Schedule to guarantee the sustainability of this component later in time.

***Activity 3.5: Public policies recommendations***

Specific set of public policies to guarantee and promote the usage considering the three pillars aforementioned (content, applications/services and devices).

In addition to the previous activities, the study will recommend a few selected centers (schools, health and government-related facilities, SMEs and Telecentres) in which to concentrate the intervention so as to showcase the potential social benefits of broadband-related services. The specific criteria for the selection will be proposed by the consultants (and cleared by the IDB) but will prioritize potential social impact on population as well as the existence of a minimum set of capabilities and conditions to ensure a productive and sustainable use of the new technologies. Additionally, there will be a recommendation in terms of the elements that will be part of each of the pilots.

**Component 4 – Financial Study and Governance model**

The objective of this component is to analyze the economic and financial feasibility of the deployment (of the network and of the adoption & use component) and select a governance model for the possible future bidding and exploitation phases. This study will have to consider at least the province level.

The activities for the financial analysis should include a three-step analysis. The first step will consist of a financial analysis of the network deployment and a financial analysis of the usage and adoption modules. The second step will consolidate those two financial analyses into a single one. The third step will estimate the amount of subsidy necessary to make the project feasible. An additional step will include a sensitivity analysis on the critical variables (e.g. price, users that sign into the service, traffic per user, discount rate)

***Activity 4.1.Network Financial Analysis***

For the financial analysis of the network the analysis should include: (i) an estimation of the required investment and operating costs (CAPEX and OPEX) for each of the technological alternatives that aims at satisfying the demand (output of Component 2); (ii) development of a business model and an exploitation model for the network; (iii) estimation of revenues that could arise from the network exploitation; (iv) financial estimates of the sustainability and feasibility conditions of the project, such as: Net Present Value (NPV), Internal Rates of Return (IRR), and break-even point given the estimated cash flows for each of the options identified. This analysis will be done on a regional basis and then consolidated for the whole country.

***Activity 4.2. Adoption and Usage Financial Analysis***

For the financial analysis of the adoption and usage component, the analysis will be analogous and should include: (i) an estimation of the required investments and operating costs (CAPEX and OPEX) for each of the modules and the totals for the entire component; (ii) business model for those services; (iii) estimation of the revenues; (iv) financial estimates of the sustainability and feasibility conditions of the project, such as: Net Present Value (NPV), Internal Rates of Return (IRR), and break-even point given the estimated cash flows for each of the options identified. This analysis will be done on a regional basis and then consolidated for the whole country.

***Activity 4.3. Consolidated Financial Analysis***

The combination of both financial analyses (technical and adoption & usage) into a single one will have an analogous structure and will consider only the most cost-efficient technological alternative. For that purpose, the analysis should include: (i) an estimation of the required investments and operating costs (CAPEX and OPEX); (ii) estimation of the revenues; (iii) financial estimates of the sustainability and feasibility conditions of the project, such as: Net Present Value (NPV), Internal Rates of Return (IRR), and break-even point given the estimated cash flows. Obviously, the analysis will be consolidated on a region basis and then consolidated for the whole country.

***Activity 4.4. Development of a governance model****.*

The goal of this activity will be to develop a governance model that assigns responsibilities and promotes coordination and concerted efforts among the various stakeholders involved in the implementation of the proposed network deployments and adoption and use strategy, and specifically for the network bidding and exploitation phases.

***Products***

The product from this component will be both the detailed financial analysis and the governance model.

**Component 5: Cost Benefit Analysis (CBA)**

The objective of this component will be to conduct a CBA by identifying all the economic and social benefits that will be derived from this project (quantitative and qualitative) and adding them to the cash flows that have been identified and quantified in the Financial Study described in Component 4.

***Activity 5.1. Cost-Benefit Analysis***

This activity will focus on developing the CBA Analysis, by firstly reviewing the IDB’s current methodology for the CBA, and proposing changes that adapt it to the particular case of Ecuador including detailed references to published papers and recent literature regarding impact evaluation of broadband development programs.

Once the methodology is set and agreed, the CBA will have to consider (i) the financial costs and revenues calculated as a result of the financial study in Component 4; (ii) estimate and calculate the quantitative benefits that can be incorporated to the cost-benefit analysis; (iii) cost-benefit analysis with specific indicators such as: ERR (economic rate of return) and economic NPV; (iv) Identification of the qualitative benefits (i.e. indirect benefits and positive externalities) that, although not incorporated to the numeric study, are relevant.

It is important to note that the CBA will have to take into account the demand curves estimated in Component 1.

**Component 6: Revision of the regulatory framework and support to CONATEL**

The objective of this component is to revise and propose updates to the regulatory framework and legislation in order to boost broadband development in the selected areas. This component is particularly relevant as the decision of investing in the deployment of broadband infrastructures by the private sector requires a stable and predictable regulatory framework that creates the conditions to facilitate investments, thus promoting universality in access. The analysis will cover technical, legal and economic aspects.

***Activity 6.1. Regulatory Recommendations***

The goal of this activity will be to come up with a set of recommendations customized to the reality of Ecuador. Examples of regulatory recommendations are: (1) efficient use of spectrum, (2) interconnection and unbundling regulation, (3) cost accountability frameworks, (4) market analysis, (5) generation of sector sustainable economic models; (6) efficient use and structuring of universal service funds; (7) regulation of rights of way; (8) infrastructure sharing regulation; or (9) regulatory and policies on price, coverage and quality. All the regulatory recommendations will be condensed in a plan that will contain the budget and timing per proposed activity (e.g. if one activity recommended is to develop regulation of infrastructure sharing, then the effort will have to be estimated in monetary and timing terms)

Particular attention should be paid to the interconnection regulation between networks (including the development of a draft for RIO and RUO[[5]](#footnote-5)), sharing infrastructure schemas, open/equals access formulas and rights of way since the deployment of the backhaul and last-mile networks may require crossing private properties.

The regulatory support will also include tasks to strengthen CONATEL in regulation of wholesale services to foster competition not only by reviewing the existing regulatory framework but also by providing technical support and capacity building.

***Products***

The product from this component will be a set of regulatory recommendations.

**Component 7: Support to the preparation of a possible related loan operation**

The objective of this component is to support the preparation of additional environmental, institutional and administrative studies that will support the preparation of a possible loan proposal with Ecuador. This component includes the following activities:

***Activity 7.1. Environmental and social impact studies***

Elaboration of environmental and social impact studies related to the proposed investments, including a detailed methodology. To complete the environmental and social impact studies, the firm will be asked to make field trips and public consultations

***Activity 7.2. Execution and governance mechanism***

Elaboration of a study to design the execution and governance mechanism for the loan operation.

***Activity 7.3. Administrative, financial and technical inputs***

Preparation of administrative, financial and technical inputs for the preparation of the loan operation according to the templates and guidelines defined by the IDB.

1. **METHOD OF PAYMENT**
   1. Payment will be made as per the following schedule, upon approval by the Team Leader responsible for this TC (see item VI below):
   2. **Schedule of payments:**
2. 30% upon contract signature;
3. 30% upon approval of draft report; and
4. 40% upon approval of final report
5. **COORDINATION**

The supervision and coordination of this consultancy will be the responsibility of   
Antonio García Zaballos (IFD/ICS), Team Leader of this operation ([antoniogar@iadb.org](mailto:antoniogar@iadb.org)) and Felix Gonzalez Herranz (IFD/ICS), Alternate Team Leader of this operation ([felixg@iadb.org](mailto:felixg@iadb.org))

1. García-Zaballos, A. / López-Rivas, R.: Governmental control on socio-economic impact of broadband in LAC countries. IDB, 2012. [↑](#footnote-ref-1)
2. Broadband Development Index, Inter-American Development Bank, 2012 (study is in process of being published) [↑](#footnote-ref-2)
3. Broadband Maps, Inter-American Development Bank, 2012 (study is in process of being published) [↑](#footnote-ref-3)
4. <http://www.telecomunicaciones.gob.ec/plan-nacional-de-desarrollo-de-banda-ancha/> [↑](#footnote-ref-4)
5. RIO stands for Reference Interconnection Offer and RUO stands for Reference Unbundling Offer [↑](#footnote-ref-5)