# Definitional Mission to Evaluate ICT Projects in Brazil: Volume 2: Bahia

**Final Report**

**Submitted by**

**Hellerstein & Associates**

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# The U.S. Trade and Development Agency

The U.S. Trade and Development Agency (USTDA) advances economic development and U.S. commercial interests in developing and middle income countries. The agency funds various forms of technical assistance, feasibility studies, training, orientation visits and business workshops that support the development of a modern infrastructure and a fair and open trading environment.

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# Bahia Hybrid Broadband Network, Data Center, and eGovernment System Project

# Definitional Mission Report

## I.      EXECUTIVE SUMMARY

### Grantee: Government of the State of Bahia

**Activity Budget:** $898,330

**U.S. Export Potential:** Fiber optic cables; optical electronics; wireless equipment such as antennas, transmitters, and receivers; systems and application software, Servers, Switches, Storage, virtualization software, and other data center equipment, and eGovernment software; total approximately US$250 million.

The Government of the State of Bahia (SAEB) seeks technical assistance for an international consultancy financed by USTDA to develop detailed plans to for the execution of three Project components summarized below.

1. Extend the existing Bahia hybrid fiber/wireless public broadband network to reach all 417 (*municípios*) in Bahia, to offer (a) Internet connectivity to all government offices in the state (including schools, health clinics, fiscal posts, and police stations, and telecenters), (b) wholesale Internet connections to small and medium internet service providers (ISPs) so that they can increase the population's access to broadband Internet, (c) e-government services to the entire population of the state through telecenters and schools as well as commercial ISPs – all using a Public-Private Partnership (PPP model). This project to be executed by the Bahia State Secretariat for Science, Technology and Innovation – SECTI/BA), a secretariat of the State of Bahia Government.
2. Upgrade the equipment of the existing State of Bahia Data Processing Company (*Companhia de Processamento de Dados do Estado da Bahia* – PRODEB) data center and design and equipping of a backup data center. This project would be executed by PRODEB.
3. Design an improved integrated and interoperable eGovernment system and (*Projeto de eGov – Cidadão 360º*) and a digital transformation strategy making use of the upgraded PRODEB data center and the statewide broadband network. This project would be executed by PRODEB.

PRODEB is a public company operating under private sector law (*empresa pública de direito privado*), with the Chairman of its board being the Secretary of Administration.

Summaries of all meetings held and contact details for participants are included as Annex 1 to this Final Report. The scope of work of the DM requires the development of detailed terms of reference (TOR) for activities recommended by the consultants, detailed consultant qualifications and a detailed Project budget, with final approval of the activities by USTDA. This Final Report contains a summary of the DM process and findings. The DM Contractor's recommendations, the TOR, consulting team qualifications, and budget for the project are presented here.

## II.    PROJECT DESCRIPTION

## A.    Introduction

### Brazil

Brazil is a recognized leader in ICT and in e-government in Latin America and among major emerging market economies worldwide. In keeping with Brazil's strong federal system, not only the national government but all state governments and a growing number of municipal governments have expanding e-government and ICT programs, of increasing sophistication. Ever more powerful, flexible and economical, ICT presents formidable new opportunities to accelerate economic, social and political development. But realizing this potential requires an enabling environment: appropriate incentives, policies and programs structured by governments that can also catalyze private investment. Brazil's national, state, and municipal governments recognize that a strong effort to bridge the digital divide is necessary in a country known for its high degree of income inequality.

In July 2016 Brazil was estimated to have 139 million Internet users, fourth largest in the world after China, India, and the United States. According to the annual survey conducted by the Brazilian Internet Steering Committee (*Comitê Gestor da Internet no Brasil* - CGI.br), in 2014 50% of Brazilian private homes, that is 32.3 million, had an Internet connection in 2014, up from 15% in 2006. Over the same period the percentage of individuals above 10 years of age who accessed the Internet (in the three months prior to the annual survey conducted by CGI.br) rose from 28 to 55. So despite the undeniable progress, there is still a long way to go to achieve true digital inclusion. As of May 2016 the number of fixed broadband subscribers had reached only 26 million, or 12.7 per 100 inhabitants. Of these connections, 69% were over 2 Mbps and only 31% greater than 12 Mbps. But mobile broadband subscriptions had exploded to 173 million, of which 21.2% were 4G (LTE). While 3G and 4G mobile connections are useful, smart phones are less than ideal for many applications, especially e-learning, e-health, and e-government.

Brazil is the largest country in Latin America, with an estimated population of 206.3 million in August 2016, it is also the most populous. According to the World Bank, in 2014 Brazil's economy was the seventh largest in the world.  Per capital income was US$11,790 in 2014. The five largest cities are São Paulo, Rio de Janeiro, Salvador, Fortaleza, and Belo Horizonte. There are 29 cities of over 500,000 people, and 5,570 *municípios*[1]. With almost 30 million people in the rural areas, provision of affordable broadband to this group, which has the lowest average income levels, presents a particularly severe problem.

In 1999 the federal government launched an "information society program". The program focused on universal access, business competitiveness & e-government. After an initial push during the second government of President Fernando Henrique Cardoso (1999-2002), this effort stalled. Under the governments of President Luis Inácio Lula da Silva (2003-2010) and Dilma Rousseff (2003-May, 2016 when she was replaced by the Vice President, Michel Temer while she undergoes an impeachment trial in the Senate), the emphasis has been more on digital inclusion than e-

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[1] A *município* is the lowest level of government in the Brazilian federal system, after the federal and state governments. It includes the municipal seat and surrounding territory. The closest US equivalent is a county.

government. As of July, 2016 the new government is in the early stages of evaluating its ICT policies.

To help improve broadband coverage and reduce the cost of broadband access, the government launched a major broadband infrastructure development initiative in 2010, setting ambitious targets to triple broadband uptake by 2014. The National Broadband Plan (*Plano Nacional de Banda Larga* – PNBL) aimed to ensure that broadband access is available to low-income households, especially in areas that have so far been poorly served. Many States created strategic plans and are implementing the projects in these plans. Most state Governors understand that they need to modernize their government secretariats and agencies, and support them with a modern information infrastructure so they can become transparent and nimble, focused on producing excellent public services in essential areas, such as public safety, education, health, and welfare. These states are creating public and private partnerships to help achieve these goals. For example, the Rio de Janeiro Government states that Government's role should be as an articulator, motivator and facilitator by creating conversations with public and private entities in their effort to modernize the Government and create a 21st century public administration.

At one end of the spectrum there is a high density of access in the industrialized urban areas, mostly in the southeast and south of the country. In these areas, and in the richer strata of the population, Brazil has achieved high levels of Internet use. But at the other end there are the vast hinterlands of unconnected rural and remote areas, particularly in the north, northeast, and west of the country. For example, in the Northeast region, rural fixed broadband penetration is only 1.5%, while it is over 11% in the more industrialized Sao Paulo state. The pattern of uneven access also repeats itself at the local level. Most cities have wealthy areas with high levels of domestic broadband access, while close by, in the informal settlements (called *favelas*) that house most of the country's urban poor, there is little fixed broadband and residents mostly depend on lanhouses (small businesses offering Internet access and related services), telecenters (free public Internet access providers) or relatively slow and more expensive 3G wireless connections.

Despite receiving considerably less investment resources than announced on various occasions by government official (that can be considered a sign of less than urgent priority for the PNBL), Telebras has gradually created a national network of fiber optic cables, in large part through public-public and public-private partnerships that involve leasing or exchanging existing dark fiber. As of 2016, the Telebras network includes 28,000 km of fiber. In 2011 Telebras established long-term rental contracts for use of fiber pairs some 16,000 km in the optical ground wire (OPGW) cables of electric power companies that are run by Eletronet, a company that is owned by Eletrobras and AES, an American company. Telebras also leased some 2,200 km of fiber from Petrobras. Another 2,200 km were obtained in an exchange of use of fiber with a private operator, TIM, in 2013. These arrangements allowed expansion of Telebras trunk lines in rings that provide redundant links in case of failure at any point in the system. Telebras has also invested in its own fiber optic links to provide high capacity redundant links to the six cities where the Confederations Cup soccer matches were played in 2013 & to the 12 cities that hosted the World Cup matches in 2014.

Traditional private telecommunications providers complement Telebras in implementation of the PNBL. ISPs that offer access of at least 1 Megabit per second (Mbps) to their customers at PNB prices – R\$35 (US\$15) or R\$29 (US\$12) in states that have eliminated the ICMS on PNBL subscriptions – qualify for wholesale bandwidth from Telebras at below-market prices. Small and medium ISPs and the large operators – like Oi, Telefônica, Embratel, TIM, and Algar Telecom – offer the PNBL packages, in some cases benefiting from state tax exemptions. The operators are

discovering that many PNBL customers soon want faster and more expensive connections. In this way, the PNBL is opening new markets for the private operators.

The growth of the Telebras network has increased competition and thereby led to lower prices offered by private providers. Telebras says it has not cut the wholesale prices it charges as far as it could and still cover costs so as not to drive the private operators, needed for meeting Internet penetration goals, out of the market. The federal government encourages private operators to expand digital inclusion of populations in underserved markets. Telebras is also investing in a Brazilian geostationary satellite providing military X band and civilian KA band communications covering all of Brazil's territory. The satellite is scheduled to be launched in late 2016 and enter service in the first quarter of 2017. Telebras also has plans for submarine fiber optic cables to Africa, Europe, and the United States to reduce costs for Internet connectivity. It is unclear whether the necessary resources will be forthcoming to undertake these investments.

Expansion of high-speed connections has been spurred by growth in demand for Internet access by the emerging lower middle class. This group provides voting support for the government, but also is courted by opposition parties. These new consumers are buying smart phones, tablets, and laptops (encouraged by exemptions from taxes on production of these products as discussed below) and want broadband connections.

Another strategy to support the PNBL is requiring coverage of rural areas when auctions are held for mobile spectrum allocation. Operators bidding on 450 MHz frequencies were required to provide voice and data services in rural areas and remote regions as well as free access to rural public schools. Winning bidders were required to offer these services on a commercial basis within a radius of 30 km from the municipal seat (capital) in all *municípios* by the end of 2015, thus covering 91% of the rural population. They also had to provide free broadband connections to all the public schools in these areas, thus serving 96% of public schools. Winners were determined according to the lowest price on commercial connections. In 2012 federal law 12,715 provided a full exemptions from federal taxation for telecommunications services offered on this frequency and for small satellite antennas as well as for network equipment, terminals, and transceivers for these services.

For primary and secondary education, beginning in 2008 telecommunications operators were required to provide broadband connections at increasing speeds to all urban public schools. This was obtained at virtually no budgetary cost by the so-called "exchange of obligations" agreed in April 2008 whereby the operators were relieved of the requirement to provide thousands of outmoded Telecommunication Services Posts with public phone booths, fax machines and Internet-connected computers. By 2014 all 62,925 urban public schools had free broadband connections, though the quality and speed of the connections still left much to be desired.

Prior to the establishment of the PNBL, a large number of municipal and state-supported efforts to improve access to the Internet were already underway, including the use of tax incentives and provision of low-cost, or even free broadband services in public access facilities (telecenters) and schools. These efforts are now accelerating as implementation of the PNBL proceeds. For example, the state of Sao Paulo has exempted broadband from the state value-added, and developed a network of 850 telecenters with more than 3 million registered users supported by 1,211 supervisors in 600 *municípios*.

A growing number of states and *municípios* are participating in the PNBL and others, such as Ceará, Pará and Rio Grande do Sul, have built their own terrestrial networks making use of various kinds of partnerships, usually with the National Education and Research Network (*Rede Nacional*

*de Educação e Pesquisa* – RNP), electric power distributors, and companies such as Petrobras and Vale that own fiber networks of their own. There objectives have been to reduce costs of connectivity and reach previously underserved or unserved residents.

In 2005 RNP began a program to build fast metropolitan fiber optic networks in Brazil's major cities in association with a variety of partners. This program is called Redecomep, and as of December 2015 had 36 metropolitan networks in operation with some 3,650 km of fiber optic cables. Redecomep achieved this by partnering with electric power companies, state and municipal governments and other entities that provided rights or way, ducts or poles in return for access to fibers in these cables.

The Ministry of Science, Technology and Innovation (MCTI) finances fiber optic cables and equipment for operation of the fibers in these cables that serve academic and research institutions. But the number of pairs of fiber in these cables is much larger than needed for the academic and research institutions, allowing allocation to other partners that provide services in kind or for direct leasing payments. For example, metros, light rail lines, urban toll roads, and state and municipal governments can offer rights of way and ducts. Electric power companies can provide poles on which the cables can be hung. And Telebras can offer fibers in its backbone network.

RNP's newest program is called *Veredas Novas* (New Paths). It is a joint program with MCTI, the Ministry of Communications, the Ministry of Education, and Telebras. Its objective is to provide fiber connections to research and educational institutions in the interior of the states, and also digital inclusion of the as yet unserved population in the vicinity of these institutions. In each city RNP is establishing a local access point, with radio and eventually fiber connections to ISPs that agree to offer Internet service of at least 1 Mbps at PNBL prices. These ISPs can also offer faster connections at market prices. To obtain cheaper broadband service, several states are building their own fiber optic networks outside the capitals. The leaders are Pará and Ceará.

In Ceará the state ICT Company, ETICE, has built a 3,000-kilometer ring of fiber optic cables around the state that, with its wireless extensions, reaches 88 percent of the state's population. Called the Digital Beltway (*Cinturão Digital do Ceará - CDC*), its nucleus is Gigafor, co-financed by RNP's Redecomep program in the state capital, Fortaleza. At various points along the fiber trunk lines there are towers from which *municípios*, not on the CDC, can connect through wireless links, allowing them to communicate with the state government and other *municípios*. In 2015 ETICE held a public auction of dark fibers in the CDC using a RFP designed with USTDA-funded technical assistance. A consortium of Ceará-based ISPs won the right to a lot of fibers. The income from the lease of these fibers covers all of ETICE's operating costs, making the company independent of the state budget and contributing to the expansion of private sector ISPs in Ceará. There are plans to expand the CDC to reach more interior points in the state as part of contracts to be signed with future private sector partners to be selected in new auctions using the improved RFP design and through the RNP's *Veredas Novas* program.

In Paraná the state government has used another route to building a state network, namely purchasing bandwidth from Copel Telecom, a subsidiary of the state electric power company. Copel Telecom has an extensive fiber optic network launched in 2010 that by the end of 2012 reached all 399 *municípios* in the state.

Among the characteristics of the best state and municipal networks are:

- The state or *município* takes advantage of dark fiber allocated to it in the state capital's Redecomep;

- Partnerships are established with RNP; *municípios*, state and federal public enterprises, private telecoms, and Telebras to extend the network's reach and share costs of operation and maintenance;

- Complementary fiber and wireless networks are built to fill in gaps and provide capillarity (urban as well as rural);

- Maintenance and operation are outsourced to private firms; and

- States or *municípios* lease dark fiber in their networks to private operators to generate additional revenue, helping to cover operating and maintenance costs.

Rapid technological change and increased competition among providers of telecommunications services promoted by Brazil's successful privatization and liberalization of this sector help reduce the cost of connectivity, as many of the PNBL's and various state and municipal initiatives aim to provide free or low-cost wireless Internet service to low-income populations. Continued technological progress, the availability of free and open source software, and increasingly favorable financing terms have reduced the cost of computer equipment and software. Brazil's commitment to macroeconomic stability and already high tax burden have made it difficult to increase public financial resources for ICT and e-government-related investments, including telecommunications and IT infrastructure, public digital inclusion programs, connectivity, distance education programs, and the like.

**Bahia**

The state of Bahia is the southernmost state in the Northeast Region, bordering the Atlantic Ocean on the East; Alagoas, Pernambuco, and Piauí on the North; Tocantins and Goiás the West and Minas Gerais and Espírito Santo to the South (Figures 1 and 2).
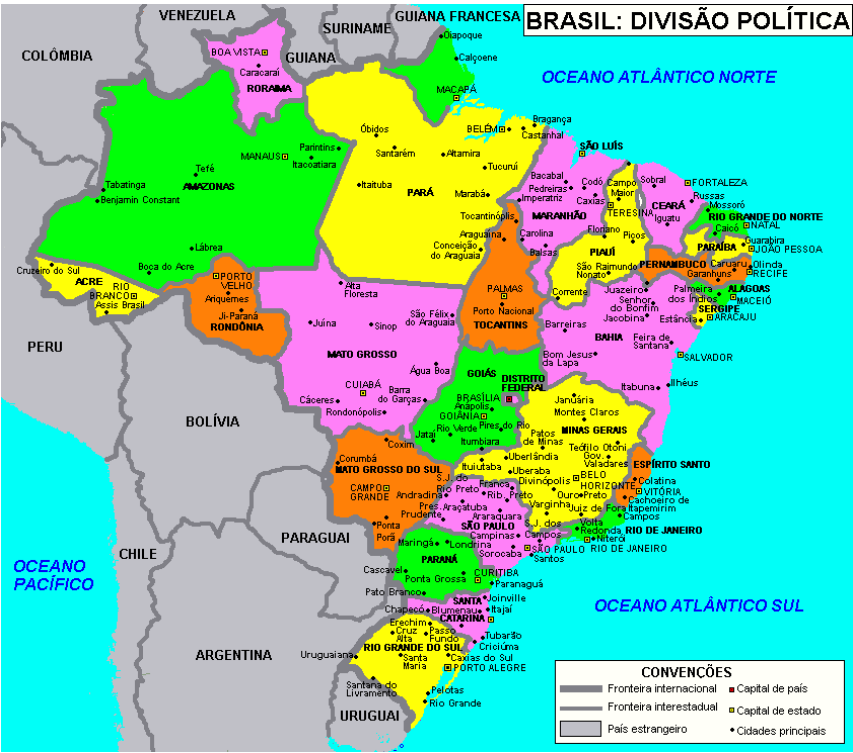
Figure 1: Political Map of Brazil

Figure 2: Map of Bahia

Bahia occupies an area of 564,733 square kilometers, a little more than France, and is the largest state in the Northeast Region of Brazil. The state's estimated population in 2016 is 15.3 million living in 417 *municípios*. Bahia's estimated per capita GDP was about US$6214 in 2011, 53% of the national average. Bahia's geographical regions comprise the Atlantic Forest (including the cocoa producing region centered on Itabuna); the maritime region (*Recôncavo*) radiating from the Bay of All Saints (*Bahía de Todos os Santos*), the site of sugar and tobacco cultivation; and the *Planalto*, which includes the *sertão* region of Bahia's far interior. The state is crossed from north to south by the Diamantina Tableland (*Chapada Diamantina*), which divides it into two distinct geographical zones. To the east, the soil is fertile and the rain falls regularly. The western area is more arid, and its predominate vegetation is savanna (*cerrado*). Bahia's semi-arid region is the largest in Brazil and this area has a great potential for developing renewable energy sources (wind and solar).

Bahia's GDP is Brazil's fifth largest. The state's economy is diverse, including agricultural activities, industry, mining, tourism and services.

In agriculture Bahia stands out nationally as producer of cocoa, sisal, castor, coconut, beans and cassava. Near Ilheus and Itabuna conditions are favorable for cocoa production, helping to preserve Brazil's Atlantic Forest. Bahia is the sixth largest livestock producing state in Brazil. Recently the state has been emerging as a major soybean producer. The state also has a diverse agro–industrial system, which encompasses a wide range of products, such as soybeans, coffee, corn, rice, cotton sugarcane, beans, sorghum, fruits, grapes, wines, eucalyptus, beef, milk and dairy products.

In extractive activity, specifically in mining, the state produces petroleum, natural gas, gold, copper, magnetite, chromite, rock salt, barite, magnesium, lead and talc. Bahia's economic potential is supported by an energy supply with approximately 80% of renewable origin: hydroelectric plants, wind power and solar power. There are 8 hydroelectric plants, 5 thermoelectric plants, 170 thousand km of electricity grid, and 286 power substations installed in the state. The seven hydro power stations on the São Francisco River have a capacity of 6,849 MW), wind (Bahia is the second largest producing state in Brazil, and solar (the largest solar energy generation in Latin America is scheduled to enter operation in 2017.

Bahia has the largest industrial and integrated petrochemical complex in the southern hemisphere – the Industrial Hub of Camaçari. Located 50 Km from Salvador, it is composed of more than 100 companies in electric power, chemicals, petroleum, petrochemicals, automobiles, textiles, metallurgy, pulp, copper, beverages, and services.

Tourism is an important activity, based on the state's impressive colonial architecture, Afro-Brazilian traditions, Salvador's colorful carnival and two National Parks.

In addition to good road, rail, ship, and air transport facilities, Bahia is crisscrossed by fiber optic networks built by major telecommunications companies (Figure 3).

Figure 3: Fiber optic backbones of four major telecommunications companies
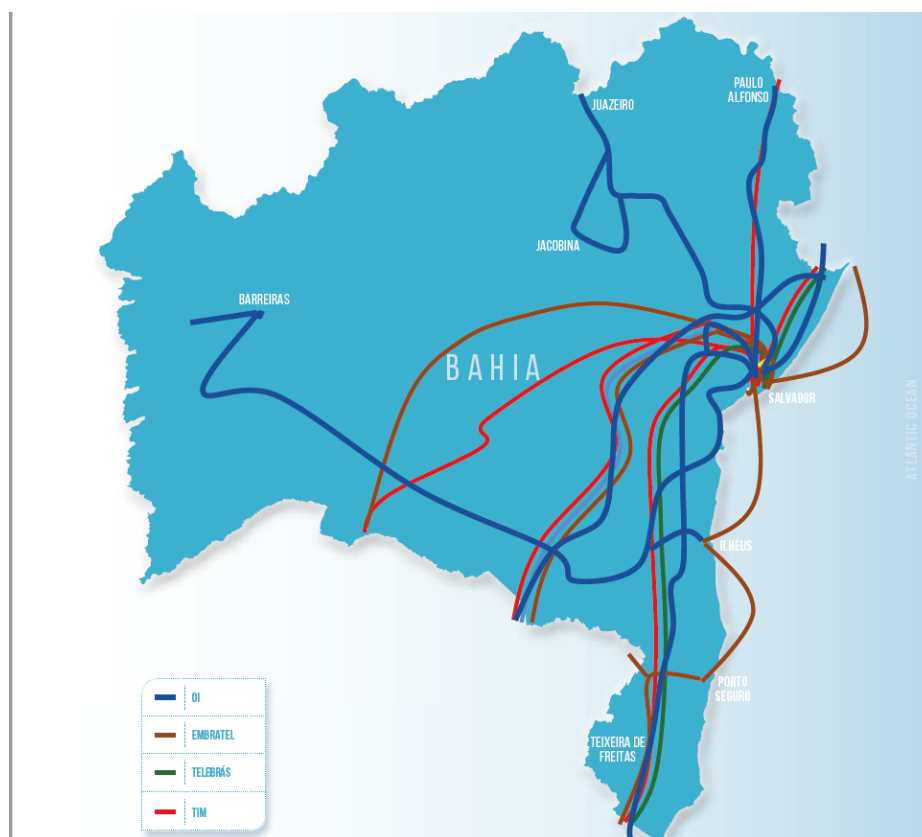
Source: Governo do Estado de Bahia: *Bahia Brasil*

## The Secretariat for Science, Technology and Innovation of the State of Bahia (*Secretaria de Ciência, Tecnologia e Inovação do Estado da Bahia* - SECTI/BA)

SECTI/BA is a Secretariat of the Government of the State of Bahia and is responsible for elaborating and implementing policies in the areas of science, technology and innovation, including those for the Bahia State Broadband Project.

### The Bahia State Data Processing Company (Companhia de Processamento de Dados da Bahia - PRODEB)

Prodeb is a public company operating under private sector law (*empresa pública de direito privado*). It was founded as a public/private company (*Sociedade de Economia Mista* with majority state control. In July 1987, as specified in state Law 4,697, PRODEB became part of the Bahia State Secretariat of Administration.

PRODEB's mission is to provide Information and Communications Technology solutions to modernize and improve governmental management and relations with society. The Chairman of its Board of Directors (*Conselho de Administração*) is the Bahia State Secretary of Administration and the Board includes the State Secretary of Science, Technology and Innovation.

PRODEB is a corporation of mixed economy that is independent of the state treasury funds to pay their personal expenses or cost in general. The resources for its operation come from the billing service. Currently PRODEB's annual revenue is on the order of R$ 100 million. Providing its services requires constant investment in technological updating and management, which implies continued investment of both its own resources and capital contributions made by the State of Bahia, its main shareholder. PRODEB's new business plan establishes a markup of approximately

5%, over the cost of all services provided by the company to generate resources for investment in priority projects.

## B.      The Project

The Government of the State of Bahia seeks technical assistance for an international consultancy financed by USTDA to develop detailed plans to:

1.  Extend the existing Bahia hybrid fiber/wireless public broadband network to reach all 417 *municípios* in Bahia, to offer (a) Internet connectivity to all government offices in the state (including schools, health clinics, fiscal posts, and police stations, and telecenters), (b) wholesale internet connections to small and medium internet service providers (ISPs) so that they can increase the population's access to broadband internet, (c) e-government services to the entire population of the state through telecenters and schools as well as commercial ISPs. This project to be executed by the Bahia State Secretariat for Science, Technology and Innovation – SECTI/BA), a secretariat of the Government of the State of Bahia.
2.  Upgrade the equipment of the PRODEB's data center and design and equipping of a backup data center. This project would be executed by PRODEB.
3.  Design an improved integrated and interoperable eGovernment system and (*Projeto de eGov – Cidadão 360º*) and a digital transformation strategy making use of the upgraded Prodeb data center and the statewide broadband network.  This project would be executed by Prodeb.

### The Bahia State Broadband Project

Bahia considers the intensive use of information technology as a strategic tool for economic and social development and improving the quality of education in the state of Bahia. The objective of this project is to expand the horizons of the state and the citizen, democratizing access to the media and communication, generating improvements to teaching and opportunities for economic and social development.

The project includes two principal lines of action:

1.  Bringing Bahia's population closer to the government, establishing a two-way communication process. Improved e-government services should improve public access to government services and provide greater transparency to public management.
2.  Facilitating the digital inclusion of Bahia's population by connecting connect all 417 *município*s in Bahia through a high-speed broadband network.

Once the project is implemented, it will be possible to develop an integrated governance system to link all departments and public agencies, provide greater speed and efficiency in the delivery of public services, thereby reducing costs to the state through the use of an efficient multiservice communications infrastructure.

This project also has a social objective. The population will gain access to broadband Internet connectivity, allowing every citizen to have free access through public telecenters and schools. At the municipal level, priority will be given to population groups with the lowest Human Development Index (HDI).

To achieve the Broadband project objectives, it will be necessary to build a digital superhighway that allows efficient exchange of information. For this it is necessary to build a high performance network infrastructure based on state-of-the-art technology, allowing the exchange of information in

various formats and for multiple purposes. A public-private partnership (PPP) model of financing is proposed, whereby a private enterprise or consortium of private enterprises would bid to construct the network.

A hybrid fiber and wireless data network should reach all Bahia's 417 *municípios,* providing efficient and low-cost telecommunications service. Then each point of presence (POP) will require at least a minimal ICT infrastructure allowing use of this network.

In pursuit of greater effectiveness and better efficiency, this project intends to work with existing federal government projects such as the National Program for Educational Technology – ProInfo, One Computer per Student (*Um computador por Aluno* – UCA), the e-Tec Brasil program that offers technical courses using distance education, and Technological Vocational Centers (CVT), such as the Digital Towns (*Cidades Digitais*), Smart Brazil (*Brasil Inteligente*) and Technological Vocation Centers (*Centros Vocacionais Tecnológicos*).

SECTI/BA is responsible for implementing this project, the more specific objectives of which are to:

- Promote and disseminate the use and supply of goods and ICT services, in order to democratize access to information;
- Promote digital inclusion by helping to reduce socioeconomic inequalities and to promote the generation of employment and income and thus accelerate economic and social development;
- Expand the eGovernment services and facilitate citizens' use of state services such as health, education, security, culture, economy;
- Promote the training of the population for the use of information technology;
- Increase Bahia's capacity for innovation, technological autonomy and competitiveness;
- Facilitate interaction between educational and research institutions in the interior and the capital, giving greater dynamism to research, and thus contribute to encouraging researchers to remain in their *municípios* and increase scientific production in those *municípios*;
- Improve public safety by facilitating the transmission of surveillance camera images;
- Strengthen telemedical services like transmitting (MRIs, CAT scans, Xrays, etc.) and videoconferences for consultation with medical specialists;
- Increase the availability of distance training for training public school teachers, as well as allow students to benefit from access to updated content;
- Increase provision of Internet services to citizens and the business community.
- Better the performance of public administration through integration of state secretariats and agencies;
- Improve access to government enterprise systems;
- Improve communication between public officials and between the public and public agencies;
- Reduce communication costs;
- Improve access to the Internet in schools and telecenters;
- Interconnect schools;
- Facilitate creation of public communication services in *municípios*, such as blogs, online radio and newspapers;
- Create and deploy virtual libraries;
- Use distance education for supplementing existing means of education; and

- Disseminate information about and interactive participation in cultural and scientific activities;

SECTI/BA seeks to extend its existing broadband network to reach all 417 *municípios,* using a combination of optical fiber and radio links. A fiber backbone would link major regional pole cities with fiber or radio backhaul links to the remaining *municípios*, and last-mile extensions to points of interest to the state, such as estate educational and health units, citizen service centers (*Serviço de Atendimento ao Cidadão* – SAC), and telecenters), police stations, re-socialization centers, electronic surveillance points (e.g. video monitoring cameras, and decentralized Secretariat of Finance units, among others (Figure 4).

Figure 4: Conceptual design of the Bahia Statewide Broadband Network
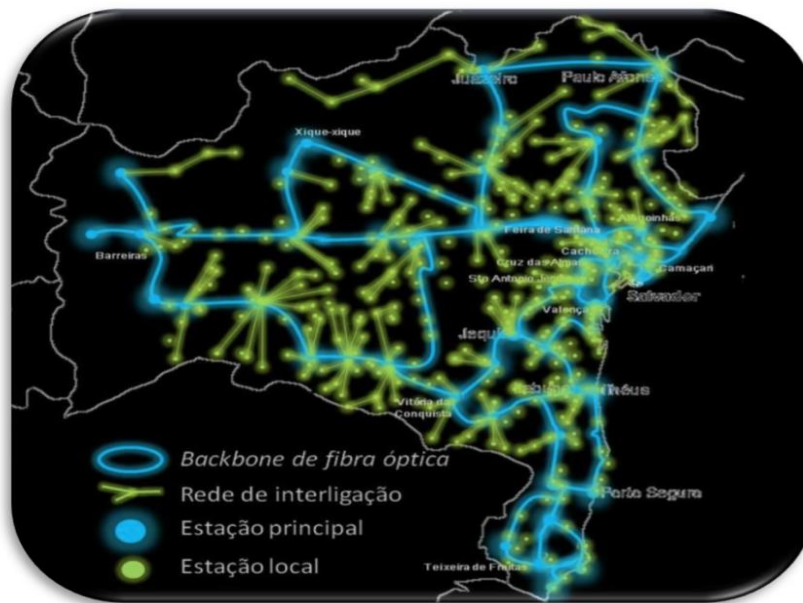


Source: SECTI/BA

The current network consists primarily of links leased from two major telecommunications operators, Oi and Embratel, and the state government's share of fibers in the National Educational and Research Network (*Rede Nacional de Ensino e Pesquisa* – RNP) metropolitan fiber networks in Salvador (Remessa) and Juazeiro (Rede VASF) that also covers the neighboring Pernambucan city of Petrolina on the other side of the São Francisco River.

Figure 5 shows the Salvador metropolitan network (Remessa), one of the RNP's Redecomep networks, in which the Bahia state government has 2 pairs, initially dark fiber, that has been lit by PRODEB and will serve as the starting point for the state broadband network. The RNP has another fiber network in Juazeiro in the northwest corner of the state (Figure 5). It also extends to Petrolina, a city on the other side of the São Francisco River, in the State of Pernambuco. The RNP is interested in connecting the two metropolitan networks and also research and higher education institutions in the interior of the state. Table 1 shows a list of those institutions and their locations. There are 52 campi in 31 of the 415 *municípios* not already served by metropolitan networks (Table 1). As of May 2016, RNP expects to have resources on the order of R$1.6 million (about US$450 thousand) to invest in Bahia, and is eager to be a partner in the Bahia broadband network.

Figure 5: Existing Salvador Metropolitan Network (Remessa)



Source: RNP

Figure 6: The RNP's VASF Network in Juarez, Bahia and Petrolina, Pernambuco
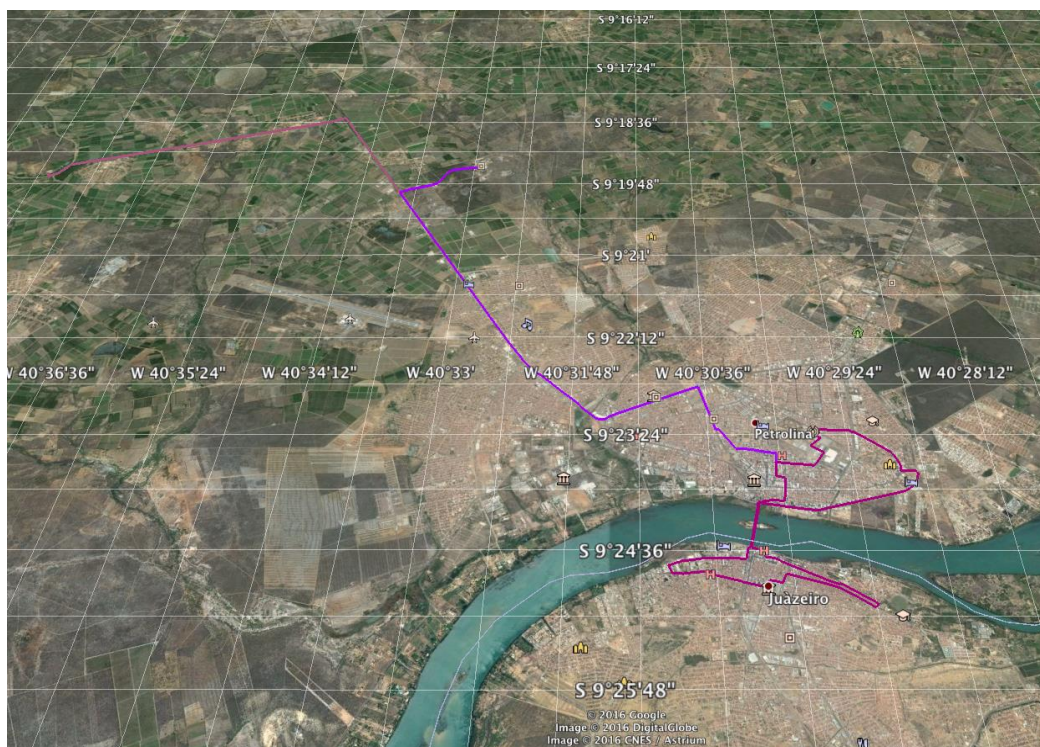


Source: RNP

Table 1: Research and Higher Institutions in the Interior of Bahia

| Organization | Institution | Município |
|---|---|---|
| COMISSAO NACIONAL DE ENERGIA NUCLEAR | CNEN CAETITE | CAETITE |
| *COMISSAO NACIONAL DE ENERGIA NUCLEAR* | | |
| **ESCOLA AGROTECNICA FEDERAL** | | |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA TECNOLOGIA BAIANO | CAMPUS GUANAMBI | GUANAMBI |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA TECNOLOGIA BAIANO | CAMPUS GOVERNADOR MANGABEIRA | GOVERNADOR MANGABEIRA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA TECNOLOGIA BAIANO | CAMPUS URUCUCA | URUCUCA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA TECNOLOGIA BAIANO | CAMPUS VALENCA | VALENCA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA TECNOLOGIA BAIANO | CAMPUS ITAPETININGA | ITAPETINGA |
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|---|---|---|
| TECNOLOGIA BAIANO | LAPA | LAPA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA I TECNOLOGIA BAIANO | CAMPUS ITABERANA | ITABERABA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO | CAMPUS SANTA INES | SANTA INES |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO | CAMPUS XIQUE | XIQUE-XIQUE |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO | CAMPUS BOM JESUS DA LAPA | BOM JESUS DA LAPA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO | CAMPUS BOM JESUS DA LAPA | BOM JESUS DA LAPA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO | CAMPUS BOM JESUS DA LAPA | BOM JESUS DA LAPA |
| ***INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA BAIANO*** | ***Subotal 11*** | |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS PAULO AFONSO | PAULO AFONSO |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS BARREIRAS | BARREIRAS |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS CAMACARI | CAMACARI |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS EUNAPOLIS | EUNAPOLIS |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS FEIRA DE SANTANA | FEIRA DE SANTANA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS PORTO SEGURO | PORTO SEGURO |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS JACOBINA | JACOBINA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS JEQUIE | JEQUIE |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS PAULO AFONSO | PAULO AFONSO |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS IRECE | IRECE |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SANTO AMARO | SANTO AMARO |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS VALENCA | VALENCA |
| INSTITUTO FEDERAL DE EDUCACAO, | CAMPUS JACOBINA | JACOBINA |

| | | |
|---|---|---|
| CIENCIA E TECNOLOGIA DA BAHIA | | |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SIMOES FILHO | SIMOES FILHO |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SANTO ANTONIO DE JESUS | SANTO ANTONIO DE JESUS |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS BARREIRAS | BARREIRAS |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS VITORIA DA CONQUISTA | VITORIA DA CONQUISTA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS EUCLIDES DA CUNHA | EUCLIDES DA CUNHA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SEABRA | SEABRA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SEABRA | SEABRA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS SEABRA | SEABRA |
| INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA | CAMPUS BARREIRAS | BARREIRAS |
| *INSTITUTO FEDERAL DE EDUCACAO, CIENCIA E TECNOLOGIA DA BAHIA* | *Subotal 22* | |
| UNIVERSIDADE DA INTEGRACAO INTERNACIONAL DA LUSOFONIA AFRO-BRASILEIRA | CAMPUS SAO FRANCISCO DO CONDE | SAO FRANCISCO DO CONDE |
| *UNIVERSIDADE DA INTEGRACAO INTERNACIONAL DA LUSOFONIA AFRO-BRASILEIRA* | *Subtotal 1* | |
| UNIVERSIDADE FEDERAL DO OESTE DA BAHIA | CAMPUS BARREIRAS | BARREIRAS |
| UNIVERSIDADE FEDERAL DO OESTE DA BAHIA | CAMPUS DE LUIS EDUARDO MAGALHAES | LUIS EDUARDO MAGALHAES |
| UNIVERSIDADE FEDERAL DO OESTE DA BAHIA | CAMPUS BARREIRAS | BARREIRAS |

| | | |
|---|---|---|
| UNIVERSIDADE FEDERAL DO OESTE DA BAHIA | CAMPUS DE BOM JESUS DA LAPA | BOM JESUS DA LAPA |
| UNIVERSIDADE FEDERAL DO OESTE DA BAHIA | CAMPUS DE SANTA MARIA DA VITORIA | SANTA MARIA DA VITORIA |
| *UNIVERSIDADE FEDERAL DO OESTE DA BAHIA* | *Subtotal 5* | |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CRUZ DAS ALMAS |

| | | |
|---|---|---|
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CAMPUS FEIRA DE SANTANA | FEIRA DE SANTANA |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | COORDENADORIA DE PROCESSAMENTO DE DADOS | CRUZ DAS ALMAS |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CAMPUS CACHOEIRA - CASA DA MOEDA | CACHOEIRA |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CAMPUS CACHOEIRA | CACHOEIRA |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CAMPUS SANTO ANTONIO DE JESUS | SANTO ANTONIO DE JESUS |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | COORDENADORIA DE PROCESSAMENTO DE DADOS | CRUZ DAS ALMAS |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CENTRO DE CULTURA LINGUAGENS E TECNOLOGIAS DA UFRB EM SANTO AMARO | SANTO AMARO |
| UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA | CAMPUS SANTO ANTONIO DE JESUS | SANTO ANTONIO DE JESUS |
| *UNIVERSIDADE FEDERAL DO RECONCAVO DA BAHIA* | *Subotal 9* | |
| UNIVERSIDADE FEDERAL DO SUL DA BAHIA | CAMPUS TEIXEIRA DE FREITAS | TEIXEIRA DE FREITAS |
| *UNIVERSIDADE FEDERAL DO SUL DA BAHIA* | *Subotal 1* | |
| UNIVERSIDADE FEDERAL DO VALE DO SAO FRANCISCO | CAMPUS SENHOR DO BONFIM | SENHOR DO BONFIM |
| UNIVERSIDADE FEDERAL DO VALE DO SAO FRANCISCO | CENTRO DE FORMACAO PROFISSIONAL DE PAULO AFONSO | PAULO AFONSO |
| *UNIVERSIDADE FEDERAL DO VALE DO SAO FRANCISCO* | *Subtotal 2* | |
| **Total without connections to REMESSA and VASF** | **52** | **31** |

Source: RNP

On September 18, 2014 SECTI/BA signed a five-year agreement with the Bahia Educational Broadcasting Institute (*Instituto de Radiodifusão Educativa da Bahia* - IRDEB) for sharing IRDEB's telecommunications infrastructure (mainly re-transmission towers – *estações de repitidora de televisão* - RTVs), for implementation of the Bahia Broadband Project. Each implementation of the agreement is subject to prior technical analysis.  SECTI/BA would be responsible for providing its own cabinets, allowing their use of electric energy through IRDEB's connections to the Bahia State Electric Power Company (Companhia Elétrica da Bahia – COELBA) grid. COELBA is another probable partner that would probably agree to use of its poles in return for a pair or two of fibers.

As part of its New Paths (*Veredas Novas*) program, RNP plans to put in fiber links to 52 *municípios* outside Salvador in addition to that in Juazeiro. This opens the possibility of a partnership with RNP similar to that in REMESSA and VASF.

Another encouraging development that should help the project advance is a planned agreement between Telebras (the national state telecommunications company resurrected in 2009 and the Brazilian Association of State ICT Entities (*Associação Brasileira de Entidades Estaduais de Tecnologia da Informação e Comunicação* – ABEP). This agreement would permit Bahian entities, including SECTI/BA and PRODEB, to use Telebras fiber and Telebras to use state-owned fiber, a swap, known in Brazil as a *permuta*.  On May 5, 2015, Telebras and SECTI/BA signed a five-year technical cooperation agreement that includes possible sharing of fiber and other telecommunications infrastructure between Telebras and the SECTI/BA in the latter's capacity as coordinator and implementing agency of the Bahia Broadband Network Project.

Thus like the RNP, that also has agreements with Telebras under the *Veredas Novas* program, this would open up cost-sharing opportunities for Bahia's planned state network, a component of the project presented to USTDA.

A basic economic characteristic of fiber optic networks is that the cost of increasing the numbers of fibers in a cable before it is deployed is much less than proportional to the number of fibers. Doubling the number of fibers increases the price of the cable from 30 to 40 percent. But the total cost per kilometer of the deployed cable increases much less, from 10 to 20 percent if aerial and less than 5% if underground, since the cost of hanging or burying the fiber is about the same irrespective of the number of fibers in the cable. So when costs are shared among partners, usually in proportion to the number of dark (unlit) fibers to which each partner has rights, the result in a win-win situation, since each partner's costs are much less than if they had created their own fiber links. This provides a substantial incentive for the entity investing in the fiber link to find partners. Each partner usually "lights" its own pairs of fiber, though some other aspects of the infrastructure, like cabinets holding the electronic equipment, can also be shared.

Swaps are another way to reduce costs, and are widely used in the telecommunications industry between commercial telecommunications operators, though this fact is not widely known and it is extremely difficult to obtain maps showing each company's network and those parts that are shared or traded with other companies.[2] Several other Brazilian states, led by Pará and Ceará have invested in their own fiber networks and engaged in sharing of fiber cables with partners including RNP, Telebras, Petrobras, and federal and state electric power distribution companies. A number of other

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[2] See Knight, Peter T. (May, 2014) *The Internet in Brazil: Origins, Strategy, Development, and Governance*. Bloomington, IN: Author House, especially Chapter 1, "The Strategic Importance of the Internet for Brazil's Development" for further analysis. A Portuguese language version of the book is also available.

states have begun or are planning to do the same, among them Rio de Janeiro, Rio Grande do Sul, Santa Catarina, Sergipe, and Tocantins.[3]

There are existing fiber networks in Bahia operated by Oi, Embratel, Telebras, TIM, and a toll highway concessionaire, Via Bahia shown in Figure 3 above. Other possibilities could be Petrobrás e ChESF. There could be others. There is thus the possibility of swaps or leasing of dark fiber with these fiber owners. As mentioned above, Telebras already has an umbrella agreement with SECTI/BA that envisions swaps, COELBA could offer use of poles and ducts and IRDEB transmission towers that could be a swapped for dark fiber or transmission of data in the network.

The Multi-Year Plan (*Plano Plurianual* – PPA) for the period 2016-2019[4], approved by the state legislature on 22 December 2015, assigns to SECTI/BA responsibility to extend access to broadband greater than 25 Mbps in 1,200 government units in the state (600 in Salvador and 2,600 in the interior) and to the State Secretariat of Economic Development responsibility to set up an inter-agency Broadband Management Committee, deploy and operate a data communication network (backbone), and deploy and operate last mile connections. The PPA allocates R$ 230 million for this project. This responsibility is also included in the report of the Integrated Planning, Accounting and Finances unit as Goal 4, p. 39-42 of the document, and R$230 million is the estimated cost shown in the document.

In sum, the Government of the State of Bahia seeks USTDA funding for an international consultancy to conduct a full feasibility study for the expansion of the state broadband network.

**Upgrading the Existing Datacenter and Designing a Backup Datacenter**

The US consulting firm would conduct an evaluation of PRODEB's existing data center as regards current and forecast demand for its services, its equipment and physical facilities and prepare a plan for upgrading the datacenter equipment to a state-of-the-art facility capable of serving forecast demand over the next ten years. PRODEB has a modern safe room constructed by Aceco located on its premises in the Bahia Administrative Center in Salvador. It was inaugurated in 2015 (Figure 7). Much of this equipment is either obsolescent or of insufficient capacity to handle expected demand, including cloud services to be made possible by the statewide Broadband PPP project that will provide reliable high-speed connectivity to state installations in both in Salvador and the interior of the state.

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[3] See *Ibid*, Chapter 5, "What Is Being Done to Improve Internet Connectivity". Also Carvalho, Feferman, Knight and Woroch, "Public-private partnerships for the expansion of access to broadband: lessons of Ceara's Digital Beltway", Chapter 13 in Knight, Feferman, and Foditsch, eds. (2016) *Broadband in Brazil: Past, present and future*. São Paulo: Figurati/Novo Século (free eBook in PDF format available from Google books). The Portuguese version was published in July 2016 and is available as an eBook in Kindle and Google Books.

[4] Governo do Estado da Bahia (2015). *PPA Participativo 2016-2019: Projeto de Lei*. Available at http://www.al.ba.gov.br/PublitaoPHP/Uploads/31082015151213000000_PPA_2016-2019_.pdf.  Lei 13.468 de 29 de dezembro de 2015, *Diário Oficial do Estado da Bahia*,  March 8, 2016. Available at http://www.escavador.com/diarios/DOEBA/executivo/2016-03-08   Both accessed June 6, 2016.

Figure 7: PRODEB Data Center



*PRODEB Data center control room*



*Layout of PRODEB data center safe room*



*Entry to Vault Room*



*Cisco routers*



*IBM Mainframe*



*Old tape backup about to be retired*

*Remessa fiber connections*


*Fiber connections from government buildings*


*EMC Storage*
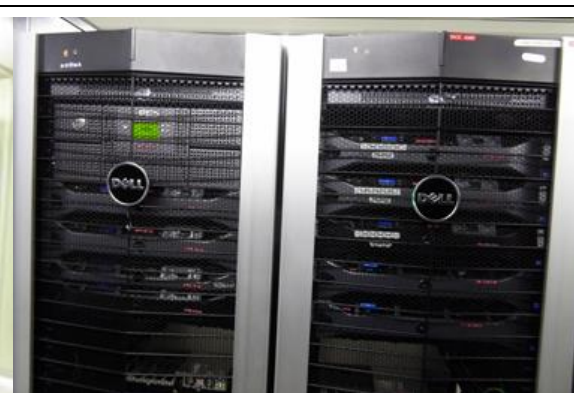

*Co-located servers*

1. – *Connectivity*

- Rede Governo, 3.052 Pts, 413 *municípios*, with access speeds from 256Kbps to 50Mbps;
- Bahia Administrative Center Infovia, 30 km of optic fiber linking the State Secretariat of Finance at a speed of 1 Gbps;
- Remessa, 160 km of optical fiber with a speed of 1 Gbps, interconnecting UNEB, FAPESB, CONDER BAHIATURSA, PRODEB, IAT;
- *Infovia Digital da Bahia* (Bahia Information Highway) linking, 300 state organs at speeds of 25 Mbps m velocity at 25Mbps to 1Gbps;
- Internet connection, 5Gb/s.

2 - *Processing*:

| Equipment | CPU | Memory | Specifications |
|---|---|---|---|
| Pool VMWARE1 4 units | 4 Processors x 6 nuclei per unit | 512 GB | 2,096 (524 each) |
| Pool VMWARE2 3 units | 4 Processors x 8 nuclei per unit | 1,152 GB | 2349 (783 each) |

| Pool VMWARE3 | 4 Processors x 10 nuclei per unit | 2,048 GB | 4,320 (1080 each) |
|---|---|---|---|
| Pool OVM  3 units | 4 processors x 15 nuclei per unit | 1,406 GB | 3,743 |
| | **TOTAL** | **5,118 GB** | **12,508** |

3 - *Storage*

| Storage | Gross (TB) | Net  (TB) |
|---|---|---|
| EMC VMAX 20k | 543 | 341 |
| HP EVA 4400 | 71 | 38 |
| EMC VNX | 142 | 102 |
| EMC VMAX 100k | 526 | 370 |
| **TOTAL** | **1282** | **851** |

Tape Library – The storage equipment has 1.5 Peta Bytes (Pb) in roboticized tapes.

4 - *Energy Supply*

UPS 240 KVA and two backup diesel generators, one 430 KVA and second 450 KVA

5 - *Updates currently underway*

- Expansion of processing capacity by contracting hyper-convergence environment;
- Contracting and implementation of cloud computing services composed of a hybrid cloud, with the PRODEB Data Center being a private cloud and a public cloud, to be contracted.

The Secretariat of Finance (SEFAZ/BA) has a substantial data center and in June 2016 was in the final stages of construction (by Aceco) of a new vault room with enough space to house a backup of the PRODEB data center (Figure 8). Whether this opportunity should be taken advantage of, whether it should be a full active-active backup of the PRODEB data center, and what kind of equipment and software should be installed should one the answer be yes is one of the issues for which SECTI/BA seeks USTDA-funded technical assistance in addressing.

Figure 8: Old and New SEFAZ/BA data centers



*Entrance to existing SEFAZ/BA data center*



*Existing SEFAZ/BA data center*

*Equipment awaiting transfer to new SEFAZ/BA data center*



*Construction site for new SEFAZ/BA data center*



*Z/BA data center building*



*Entrance to new SEFAZ/BA data center*



*Fire control new SEFAZ/BA data center*



*Generator for new SEFAZ/BA data center*

Equipment and software of SEFAZ data centers

**Size (m²):**

| | |
|---|---|
| Safe room | 43,00 |
| NOC room | 23,51 |
| UPS room | 24,63 |
| Tecnichal corridor. | 5,20 |
| Telecommunications room | 11,15 |
| Restrooms | 5,00 |
| Waiting room | 45,40 |

*Total*          *157,89*

**Capacity:**  The safe room will be able to accommodate future expansions through use of the waiting room.

**Servers:**

| | |
|---|---|
| Physical | 81 |
| Virtual | 217 |
| Storage | 2 |
| Virtual library | 1 (Data Domain-EMC) – Total: 62 TB – Free space: 40% |
| Backup robot: | 01 |

**Storage (available space):**

| | |
|---|---|
| IBM | Total: 307 TB – Free space: 40% |
| HP | Total: 65 TB Free space: 62% |

**Monitoring:**
          24 x 07 x 365  – with four 50'' screens_____

**Designing an integrated eGovernment system (*Projeto Cidadão 360º*)**

Government involves a complex network of interconnected components or systems that constitute its basic infrastructure, such as transportation, energy, communications, education and health. The Government of the State of Bahia (GEBA) has two principal objectives that are critical for taking decisions relating to these systems:

*Efficiency and control of administrative processes* through systems, such as budget and financial management, procurement, human resources, and payroll that are vital for budget execution and supplying strategic information for decision-making. These systems are exclusively for the use of public administration and made available on the web in portals for top-level supervision, procurement, human resources, and payroll among others.

*Provision of services to citizens* where the appropriate use of technology can play a key role in expanding access to government services directly through web portals or indirectly by civil servants in integrated Citizen Service Centers (*Serviço de Atendimento ao Cidadão - SAC*) that were

pioneered in Bahia as early as 1995 and served as a model that was emulated by many other Brazilian states, including São Paulo, Rio de Janeiro, Minas Gerais, Rio Grande do Sul, and Goiás.

PRODEB wants to develop enhance its citizen-centered approach to service delivery. This requires better understanding citizens' needs, make eGovernment services secure, accessible, widely available and delivered by a variety of channels, with an emphasis on mobile devices.

As for internal eGovernment services (G2G), PRODEB seeks to provide public sector managers with tools that make available a thorough knowledge of citizens and their needs for government services. The tools should facilitate the creation of more dynamic management models with rapid access to information, allowing the development of situation rooms with electronic "dashboards" to monitor government programs, emergency situations, and the like. The conceptual model to be used for the development of an integrated eGovernment system is show in Figure 9.

Figure 9: Conceptual model for developing an integrated eGovernment system
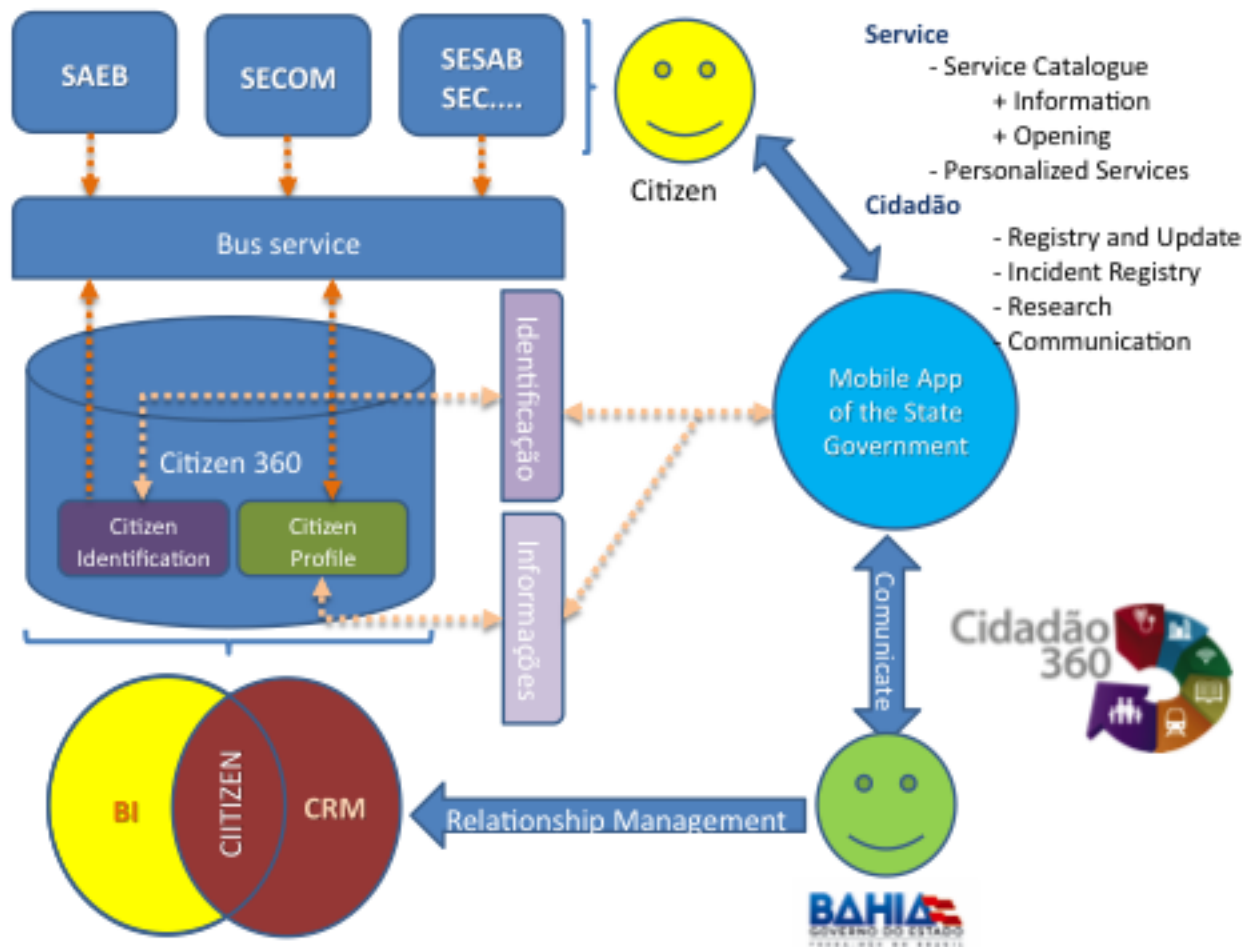


Source: PRODEB

PRODEB seeks to initiate the following transformations.

1. Institutional:

- Identity and alternative service channels and standardized direct access to Government

2. Service Model:

- Citizen identification for two-way relationship
- Citizen Relations Management (CRM) for managing access to services
- Standardization of delivery processes
- Provision of value-added services for the citizen (0800 data, push notification, etc.) in short cycles
- Management of service channels

3. Management model

- Dashboard and Situation Room with information about:
  o Citizens
  o Their needs and status regarding services
  o Their intentions regarding delivery of services
  o Their direct demands

PRODEB expects to obtain the following benefits by implementing the project:

1. Improving priority government actions through access to up-to-date information on the legitimate needs of citizens;
2. Minimizing costs of service delivery to citizens;
3. Improving the quality of services delivered to citizens, generating satisfaction and social gains; and
4. A complete vision of the citizen needs, making possible proactive actions that will generate confidence in the government.

PRODEB seeks a USTDA-funded consultant team to conduct a viability study for the integrated eGovernment system to:

1. Review the project concept,
2. Review the architecture of the solution,
3. Define the technological platforms to be adopted to support the project and its associated services,
4. Develop terms of reference for contracting technological platforms and associated services, and
5. Supervise the execution of the project through its implementation.


## III.    GOVERNMENT COMMITMENT

The projects are mentioned, in the latest Multiyear Development Plan (*Plano Plurianual* – PPA) for the years 2016-2019 (see specifically pages 16, 39-42, 51, 52, 100, 151, 152, 425, and 547). This rolling plan includes the first year of the government to be elected in October 2018's mandate, and is the strongest indication of priority.  As regards the broadband network, the Governor and Secretary of Science, Technology and Innovation have made numerous statements indicating the

importance of this project.[5] PRODEB' Strategic Plan includes the data center and eGovernment projects, and is an elaboration of a strategic goal set forth in the PPA (Vol 2, pp 74-75).

## IV.    POSSIBLE SOURCES OF PROJECT FINANCING

Domestic sources of finance include The National Bank for Economic and Social Development (BNDES) or direct financing of the State of Bahia budget (SECTI/BA and PRODEB expect that budgetary resources for SECTI/BA and for PRODEB and its client secretariats and state agencies will help finance the project). GEBA hopes that the consultant team can identify complementary sources of funding, including a PPP for the for the Bahia Broadband Network, under which arrangement the GEBA budget would finance operational expenses (OPEX), and the private sector partner (that could be a consortium) would finance its participation from its own resources, including stock offerings, debentures and/or loans. Another source of finance could be through suppliers of equipment.

Regarding the data center and eGovernment components, PRODEB currently has annual revenues of around R$ 100 million.  PRODEB expects to have a profit in 2017 in excess of R$ 3.5 million.

It notes that PRODEB is a corporation of mixed economy that is independent of the state treasury funds to pay the personal expenses or cost in general. The resources for its operation come from the billing service.

The challenge for an organization like the State Public Administration, requires a company like PRODEB a high degree of qualification and performance. This profile requires constant investment in technological updating and management, which implies continued investment using both internally generated resources and capital contributions made by the State of Bahia.

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[5] For example, see the following;
http://www.mcti.gov.br/noticia/-/asset_publisher/epbV0pr6eIS0/content/governador-da-bahia-planeja-expandir-infraestrutura-tecnologica-estadual;jsessionid=966DC604AB30E1C29DB1F7636AFF4F09?p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1&p_r_p_564233524_tag=banda+larga
http://www.cmg.ba.gov.br/2015/07/126796,20/Rui-solicita-mais-recursos-para-banda-larga-na-Educacao-e-Saude.html
http://www.jornalgrandebahia.com.br/2016/06/governador-rui-costa-apresenta-propostas-para-o-desenvolvimento-do-nordeste-em-forum-do-tcu-no-ceara/
https://www.brasil247.com/pt/247/bahia247/189991/Rui-pede-recurso-para-expans%C3%A3o-da-banda-larga.htm
http://bahianoar.com/rui-costa-busca-recursos-em-brasilia-para-combate-a-dengue-construcao-de-encostas-e-ampliacao-de-internet-banda-larga/
http://www.dsvc.com.br/2016/sem-categoria/banda-larga-nas-escolas-publicas-estaduais-baianas/
http://www.jornaldosol.com.br/index.php/bahia/1543-desenvolvimento-da-ct-i-na-bahia-inclui-universalizacao-da-banda-larga
http://www.secti.ba.gov.br/2016/02/1063/Entrevista-com-secretario-Manoel-Mendonca-balanco-e-perspectivas.html
http://www.secti.ba.gov.br/2015/11/990/Reuniao-com-provedores-busca-solucoes-para-levar-Banda-Larga-ao-interior.html
http://www.secti.ba.gov.br/2015/06/833/Projeto-Banda-Larga-da-Bahia-vai-levar-tecnologia-de-alta-velocidade-a-todo-o-estado.html
http://www.secti.ba.gov.br/2015/07/852/Secti-e-Secult-firmam-parceria-para-Semana-Nacional-de-Ciencia-e-Tecnologia.html
http://agentediz.com.br/governo-baiano-quer-ajuda-de-ministerio-para-levar-banda-larga-ao-interior/

In the case of own resources, the current PRODEB business plan calls for markup of approximately 5% on all services provided by the company to generate funds for reinvestment in priority projects.

The US Overseas Private Investment Bank is another alternative. They have an active portfolio in Brazil and all over Latin America. OPIC mobilizes private capital to help solve critical development challenges and in doing so, advances U.S. foreign policy. The DM Contractors have spoken with OPIC and were told that they are active in underwriting investments in mobile and fixed broadband operators (using both licensed and unlicensed spectrum) in Latin America and are also interested in infrastructure products that relate to these investments. OPIC originates and underwrites project finance, commercial finance and risk sharing frameworks for investments in emerging markets.

Other international sources include the World Bank. They have some active program on Digital Identity and on broadband infrastructure and possibly could work to get Brazil into these current programs they are doing in other countries.  Or possibly it might be possible to reprogram an existing loan to the state or the federal government having categories that embrace the projects' objectives and are not disbursing. This could be of interest to the federal government, given that the Ministry of Communications and other ministries, for example the Ministry of Health for its hospitals, clinics, and health posts) have an interest in using the network.

The Inter-American Development Bank (IADB) is another potential source of international funding, under conditions similar to the World Bank.

A fourth potential international source is supplier's credits from firms interested in providing equipment and/or software. Smaller US companies and other manufacturers who want to participate in this project can seek funding from the Export-Import Bank for low cost loans.

For the data center and the network, H&A ascertained that one option is to convert a capital expense into a current expense via a contract with a private enterprise or consortium of private enterprises. This could be in various institutional arrangements – concession lease, or a formal PPP. In the case of broadband, with a PPP the company with the winning bid would raise financing for project implementation in the market. This funding could be from international sources if appropriate sharing of exchange risks were negotiated. In any institutional framework, these companies then finance the project from their own and/or borrowed funds. The Firms below all have equipment in the data center and would likely continue to supply this equipment.

Cisco. Cisco works closely with Aceco and other companies like EMC and Oracle. For this kind of project their main competitors are Hewlett Packard and IBM. They could participate in a PPP. It would also be possible to do an operation under Law 8666 to turn the investment cost into a series of rental payments. These would be higher in the first 3-4 years, because the 8666 operations cannot exceed five years each (4+1, 3+2) and, not knowing with certainty what would happen after the end of the contract, the consortium of suppliers would have to recover their entire investment, the costs of operation and maintenance, and their profit over only five years. The principle obstacle Cisco sees is how to guarantee that the payments, that could be monthly or quarterly, could be guaranteed to take place on time, in the contracted amounts, without interruption. The Cisco representatives also had a basic question: who would be the owner of the data center, the State of Bahia, or the consortium.

- <u>EMC</u>. EMC is interested. It is possible to do this kind of operation. EMC would not construct the building, but frequently collaborates with Aseco, but it could participate in a consortium, for example with Aceco and Oracle and/or Cisco. VMware and EMC are now merged, and RSA is a subsidiary of EMC.

- <u>Oracle.</u> Oracle is now merged with Sun Microsystems, so it could supply both hardware and software. Oracle prefers not to participate in consortiums. But it has partnerships with firms like Deloitte and Odebrecht. It also has a financing department. It could do the kind of operation envisaged.

- <u>IBM.</u> IBM is interested in participating in the project, and can work as part of a consortium. But again, the problem is how to guarantee that the payments by SECTI/BA/PRODEB would take place on time and in the amounts contracted.

## V.    POTENTIAL FOR US EXPORTS AND FOREIGN COMPETITION

The cost of the hybrid fiber/wireless network could be on the order of R$705 million (about US$215 million), the datacenter project about R$$124 million (US$38 million). The export potential for US producers of hardware, software and services would be US$147 million for the network and US$101 million for the data center, and US$1.5 million for eGovernment software, for a total of U$250 million in exports estimated for the three components of the project (Table 2). Full detail of the breakdown of these estimate are in the Appendix.

Table 2: Total Costs and Export Potential

| **Total Costs and Export Potential** | | |
| --- | --- | --- |
| **Item** | **Total Cost R$** | **Total Export Potential USD** |
| **Broadband Network** | **$705,489,194** | **$146,825,474** |
| **Data Center Upgrade and Backup** | **$402,112,750** | **$101,309,200** |
| **eGovernment software** | **$6,012,500** | **$1,480,000** |
| **Grand Total** | **$1,113,614,444** | **$249,614,674** |

In each data center we visited, we also noted that U.S. firms were extremely well represented in technologies in use. Oracle (or Sun Microsystems, which was acquired) servers and racks were extremely common. Cisco switches and routers were present in some degree at each data center. Storage and storage area network solutions from EMC were very common. Microsoft server software was very common. IBM solutions for mainframe computing and tape backup were either present or the first choice for new investment. HP user terminals, servers, and storage were also noted.

In our view U.S. technologies will continue to be very competitive for data center projects in Brazil. A number of U.S. products continue to be viewed as best in class for the majority of the major equipment types required for data center construction. The state data centers we visited already have a history of employing U.S. technologies and this installed base creates incentives for continued

employment of these technologies, such as seamless interoperability of new systems and old and reduced need for training of technical personnel.

US firms are very strong in the ICT sector. Those who might bid on RFPs for this project include:

- Cisco (Network Infrastructure),
- HP (servers and storage, and cloud services),
- Dell (servers),
- Oracle (Database, BI, Storage, and Cloud services),
- Microsoft (Datacenter Software, Database, OS, and cloud services (Azure)),
- IBM (servers, application software, and cloud services),
- VM Ware (virtualization software),
- BMC: (Infrastructure software),
- CA Technologies: (Infrastructure software)
- Cloudflare (software)
- Xterra (SDN solutions, Optical networking platforms)
- Ciena (consulting on intelligent networks)
- Blue Planet (network virtualization, orchestration, and management software)
- Microsoft Azure (cloud services)
- Amazon Web Services (AWS),
- Google Cloud Services and software
- APC & Eaton (Power supply & Generation)
- Fortinet and Symantec (Security Systems & Software)

Other US firms that manufacture equipment that could be used in the project and might interested in bidding include Corning (fiber); Brocade, Juniper, Force 10, and Extreme (high performance switches and routers); Supermicro (servers), Fusion IO (SSD Storage), Kingston (memory chips), Western Digital (storage); Emerson, Schneider, Chatsworth, APC, and ADC (data center components including power distribution, cooling, and fiber guides); AMD and Intel (CPUs and servers); Fortinet, McAfee, Norton e Symantec (anti-virus, network security); Clearfield (wireless and fiber broadband equipment); and Ubiquiti Networks, Streakwave, Netgear and Belkin (wireless broadband equipment). Despite increasing competition, especially from Chinese companies like Huawei and ZTE and for fiber optic cable, Furukawa (that has a factory in Brazil), US firms in the ICT sector are very competitive. Several US suppliers with Brazilian operations contacted by H&A are open to providing supplier financing: Cisco, Oracle, EMC, IBM, Dell, and Hewlett Packard. Most US suppliers have Brazilian subsidiaries, so market entry should not be an issue for them.


## VI.     FOREIGN COMPETITION AND MARKET ENTRY ISSUES

Potential foreign competitors could include

- Huawei: Network Infrastructure
- Lenovo: servers
- Hitachi: Storage
- NEC: Storage, servers, telecom
- Alcatel Lucent: Network
- ZTE: Network
- SAP: BI

- Siemens: Network
- Fujitsu: Network
- Kaperski: Security software

## VII.    PRELIMINARY DEVELOPMENT IMPACT REVIEW

The U.S. firm shall identify and assess the developmental outcomes that would be expected if the project is implemented in accordance with the recommendations of the study.

Development Impact Measures are designed to help quantify the impact of USTDA's support for infrastructure development in emerging economies. This information is essential to USTDA's ability to set clear goals and measure the results of its programs, relative to the Agency's core objective of promoting United States private sector participation in development projects around the globe. Understanding the local impacts of USTDA's program supports the Agency's ability to design projects with a higher likelihood of implementation and a higher likelihood of U.S. export generation, thus supporting the Agency's mission.

Development Impact Measures should be viable, realistic and quantifiable. During the initial stages of project definition, we evaluated the development impact from the attached list. At least one realistic and quantifiable Development Impact Measure is selected for each USTDA activity. In close consultation with the proposed project sponsor, a baseline measurement is established for each indicator, which is used to compare future outcomes. The baseline is also used to set an anticipated timeline and determine how the information will be measured and collected once a project moves to implementation. This baseline information is incorporated into the Terms of Reference, which provides reporting guidance to the contractor performing the USTDA activity. We selected the following indicators

SECTI/BA chose this indicator as their main development impact for the Broadband Project:

| Telecommunications | Infrastructure Development and Efficiency Gains | Improved Digital Communication Access | Number of people affected by expansion in telecommunications infrastructure to both metropolitan and rural areas including Broadband, Wireless, Voice, and Data (particularly of note if reaching populations without prior access to internet, telephone, etc.) | Number of Individuals |
|---|---|---|---|---|

In this indicator they wanted to add the amount of locations of the Government units attended by the project. This indicator may be a subset of the Improved Digital Communication Access.

As a secondary indicator they chose Improved Output Advanced through Technology to assist them in measuring the impact on the Internet providers that would be customers of the infrastructure built by the project

| All | Infrastructure Development and Efficiency Gains | Improved Output through Advanced Technology | New technologies introduced to a host country resulting in an increase of efficiency, capacity, or output/process improvement | $ Value or Y/N |
|---|---|---|---|---|

For the Data center the main indicator is

| Telecommunications | Infrastructure Development and Efficiency Gains | Improved Data Management and Security | Capacity added, security/redundancy gained or reliability improved through implementation of data centers, cloud computing systems, or other storage infrastructure | Y/N* |
|---|---|---|---|---|

The U.S. firm selected will update the indicators chosen and anticipated measurable outcomes, based on the recommendations resulting from the USTDA Activity. The consultant will then incorporate the baseline analysis and adjust the findings, as needed, to explain how the proposed activity will directly impact development in a host country. The contractor works closely with the project sponsor as well as USTDA personnel at this stage to ensure that the final report for the activity clearly displays the anticipated outcomes that will be achieved when the project is implemented. These updates are used in future evaluation efforts to monitor progress and expected timeframes when the development impact will be realized

## VIII.  EVALUATION STRATEGY

In addition to the following benchmarks to evaluate the success of the project the FS/TA contractors will also address the following questions within the Evaluation Strategy:

> (1) The proposed project implementation timeline;

> (2) How will the project be developed (Engineering, Procurement and Construction, Turnkey, Build-Own-Transfer, Build-Own-Operate, etc.);

> (3) Any potential difficulties SECTI/BA/PRODEB might encounter during project implementation and how can these challenges be mitigated.

> (4) What regulations, if any, should be in place before the project can be implemented; and
> (5) What other entities must authorize or approve the project for implementation.

*Benchmarks to help USTDA evaluate success of project*

- Financing for project is obtained. The amount from each source should be specified.
- Issue of RFPs for purchase of software and equipment with international competitive bidding, in months from date finance approved. This is a complex process in Brazil and

sometimes takes months. The faster it is accomplished, the better managed is the state and the executing agencies.
- Bids received and winners selected. Metric: the percentage of total won by US firms
- Purchases completed. Metric; time in months from selection of winning bids.
- Percentage of total software and equipment purchased provided by US firms
- Construction and equipping initiated. Metric: time in months from purchase of equipment.
- Construction and equipping completed. Metric: time in months from the initiation of construction.
- Full planned network and datacenters in operation. Metric: time in months from completion of construction. Includes time for installing software and testing.
- Percent of state datacenter operations not previously integrated into the PRODEB data center that now uses the PRODEB datacenter (principal and backup). The higher the better.
- Number of partners sharing costs of statewide network and extent of cost reduction compared with SECTI/BA undertaking all investments and operational costs itself. Divide into capital and current costs.

*Proposed project implementation timeline*

| Stage | Objective | Months to Execute |
|---|---|---|
| 1 | Signing of the contract with USTDA | 4 |
| 2 | Preparation of US firm's consultancy reports for the datacenter and network | 6 |
| 3 | Preparation of the RFPs (editais) for equipment, software, and services | 4 |
| 4 | Bidding process, including selection of winners | 4 |
| 5 | Acquisition and installation of fiber optic cables and wireless equipment to reach 75 municipalities | 15 |
| 5 | Acquisition and installation of datacenter equipment and software | 6 |

- According to this timetable the datacenter should be operational in 24 months from the time the project bids are received, the broadband network in 33 months.

*Likelihood of development*

- Is the project in the States' Multiyear Plan (*Plano Plurianual* – PPA)?
  The project has been under preparation for some time, improved coverage and speed of broadband is mentioned are seven separate pages of the PPA for 2016-2019[6], and there is a

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[6] Governo do Estado da Bahia (2015). *PPA Participativo 2016-2019: Projeto de Lei*. Available at http://www.al.ba.gov.br/PublitaoPHP/Uploads/31082015151213000000_PPA_2016-2019_.pdf. The projects are mentioned on pages 16, 39-42, 51, 52, 100, 151, 152, 425, and 547). This rolling plan includes the first year of the government to be elected in October 2018's mandate, and is the strongest indication of priority. The PPA was made a law at the end of December 2015 as Lei 13.468 de 29 de dezembro de 2015 that provides for annual allocations

mention of the Bahia Digital Information Highway (*Infovia Digital da Bahia*) that refers to the deployment of last mile connections in metropolitan Salvador. The resources for this come from the Banco do Brasil (about R$19 million). The resources for the links in the interior of the state are estimated at R$232 as shown above. In section III additional information regarding statements of the Governor and Secretary of Science, Technology, and Information regarding the broadband network were provided. PRODEB' Strategic Plan includes the data center and eGovernment projects, and is an elaboration of a strategic goal set forth in the PPA (pp 74-75). There is thus a high probability the project will be executed and have the kind of development impact specified in Section VII above.

*Potential difficulties*

- Changes in SECTI/BA and PRODEB management team that result in poorer project management
- Unfavorable changes in government policies under the Government to be elected in October 2018 such that the project no longer has strong political support

*Other entities needed to approve project*

- For domestic financing, approval of budgetary allocations for project finance and operation by Secretariat of Finance or higher authorities (Governor, *Casa Civil*). BNDES and any domestically approved suppliers' credits.
  For new international operations (e.g. loans by the World Bank or Inter-American Development Bank), approval by Federal authorities: Ministry of Planning (*Comissão de Financiamentos Externos* – COFIEX), STN with validation by PGFN, and finally by the Federal Senate.

## IX.    ENVIRONMENTAL IMPACT – CLIMATE RESILIENCE

The major potential impact for a data center is via generation of electric energy to power it. Modern data centers are much less intensive in energy than they were some years ago. Brazil has one of the "greenest" energy matrices of any country, given its extensive use of hydropower and growing use of solar and wind-generated electricity. The impact is not normally in the immediate vicinity of the data center, but rather where the power is generated. As for fiber optic networks, the impact is minimal, and for wireless extensions of the fiber network, there are clear regulations in Brazil regarding acceptable strength of signals and potential interference with other users of the electromagnetic spectrum.

A climate resilience assessment looks at the impact of climate on a potential project and involves two phases: (1) screening and (2) in-depth analysis. Screening identifies potential climate risks, vulnerabilities, and opportunities pertaining to a program or investment, determines if additional analysis is required, and if so, helps to scope that analysis. In other words, it is intended to either identify what further study is required or determine that further analysis is not warranted.

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according to the objectives set forth in the PPA are to be incorporated in the annual budget laws, and performance monitored according to specified pezrformance indicators. Available at http://www.escavador.com/diarios/DOEBA/executivo/2016-03-08   Both documents accessed June 6, 2016.

Where needed, In-Depth Analyses evaluate relevant technical, social, economic, and political aspects of climate risks, uncertainties, and design options. They produce recommendations on how to address the climate risks identified, both in the short term and the long term.

The DM Consultants along with senior staff in the Bahia Government reviewed USTDA's Climate Resilience requirements for screening and in-depth analysis and determined that an in-depth analysis is not warranted for both the Broadband and the Data Center. The Government is already looking at buying ecologically correct electronic products. The Bahia Government is taking care of the same issues highlighted in the Climate Resilience study so no need for an in-depth screening or analysis. Environmental management of resources is critically important during the consultants' recommendation deployment, but we find that there is no need for a special screening or in-depth analysis.


## X.      IMPACT ON US LABOR

The impact on US labor would be negligible or positive. Brazilian government data centers and broadband networks do not displace US data centers like those of Amazon, since the Brazilian governments (federal, state, and municipal) want the data centers to be in Brazilian territory, usually with a preference for their own states or *municípios*. For broadband networks, there is no displacement of US facilities. Thus the impact on US labor is expected to be positive to the extent that US-based firm provide equipment, software and services produced in the US.


## XI.      JUSTIFICATIONS & RECOMMENDATIONS

As this report has documented, the new data center and broadband network will have high developmental impact in the State of Bahia by supporting enhanced competition in the provision of broadband internet connectivity, hence reducing the prices for such connectivity. The statewide broadband network will allow improved delivery of e-government services throughout Bahia, and promote private sector development. The project will also be a tool for developing an integrated governance system to link all departments and public agencies, provide greater speed and efficiency in the delivery of public services, thereby reducing costs to the state through the use of an efficient multiservice communications infrastructure.

The project also has a social objective. The population will gain access to broadband Internet connectivity, allowing every citizen to have free access to the Internet, educational opportunities, and e-government services through public telecenters and schools. At the municipal level, priority will be given to the poorest strata of the population, the *quilambolas* (settlements established at the end of the 19th century by freed slaves), and indigenous communities.

The project will directly benefit U.S. companies that win contracts to provide goods and services needed in the project. It will also help create partnerships between Government agencies and US IT companies by bringing proven private sector solutions to the challenges that the Government faces. This project meets USTDA's goals of providing technical assistance in cases where that assistance helps create partnerships based on the premise that private sector experience, technology, and ingenuity are integral to development and project sustainability.

Moreover, the involvement of a U.S.-based Consultant Team in carrying out the proposed feasibility studies should work to the advantage of U.S.-based suppliers of telecom, IT, database solutions, such as Cisco, EMC, HP, VMware, IBM, Oracle and Microsoft as well as others

mentioned above in forming key partnerships with different Government agencies. These suppliers are strong in the major technological areas but face growing competition from foreign suppliers.

Accordingly, H&A believes that funding of the feasibility study on behalf of the government of the State of Bahia would represent a good use of USTDA resources.

## XII.  QUALIFICATIONS OF PROFESSIONALS IN BAHIA BROADBAND NETWORK AND DATA CENTER PROJECT

Our analysis has shown that we would require 15 staff for this project, including a Team Leader and Project Coordinator. Below you will find specific descriptions for each of the staff we are recommending.

*Team Leader*

- At least fifteen (15) years' experience in the ICT industry
- Strong background in at least one of major areas of the feasibility study (Datacenters, hybrid fiber optic and wireless broadband networks, integrated eGovernment systems, Definition of SLAs, economic and financial project analysis)
- Both a US and an international perspective on the ICT industry, with the international perspective preferably gained through on-the-ground project work, ideally in the area of datacenters, broadband networks and integrated eGovernment systems
- Management, organizational and cross-cultural skills and perspective to structure, oversee and carry out the Feasibility Study effectively
- Ability to communicate findings effectively and to liaise appropriately within the SECTI/BA and PRODEB frameworks and with other stakeholders, including the Secretariat of Finance, other public sector entities and potential private sector partners
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Strong Portuguese language skills, written and spoken is required

*Senior Data Center Electrical Engineer*

- Post-graduate degree in electrical engineering or related discipline
- At least ten (15) years' experience in the telecom/ICT industry, including hands-on experience with datacenters and outsourcing contracts for datacenters
- At least five (5) years' experience in defining and monitoring service level agreements (SLAs) for ICTs
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills

- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills, written and spoken, preferred

*Junior Data Center Electrical Engineer*

- At least an undergraduate degree in electrical engineering or related discipline
- At least five (5) years' experience in the telecom/ICT industry, including hands-on experience with datacenter design and implementation
- Knowledge of configuration management, problem management, change management, help desk, distribution and control of software, managing of service levels (SLM), capacity management, contingency planning, availability management, and cost management – as applied to datacenters
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills, written and spoken required

*Senior Wireless Engineer*

- Post-graduate degree in electrical engineering or related field
- At least fifteen (15) years' experience in the telecom/ICT industry, including extensive experience with wireless network design and operation
- At least five (5) years' experience in defining and monitoring service level agreements (SLAs) for ICTs.
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills, written and spoken, preferred

*Senior Fiber Optic Network Electrical Engineer*

- Post-graduate degree in electrical engineering or related discipline
- At least fifteen (15) years' experience in the telecom/ICT industry, including hands-on experience with the design, operation and maintenance of fiber optic networks and their interface with wireless extensions
- At least five (5) years' experience in defining and monitoring service level agreements (SLAs) for ICTs.
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills, written and spoken, preferred

*Data center Security Expert*

- Post-graduate degree in electrical engineering or related discipline
- At least ten (10) years experience in data center construction and operations
- Specialization in data center security, both logical and physical
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills preferred

*Junior ICT/Network Engineer*

- At least an undergraduate degree in electrical engineering or a related discipline
- At least five (5) years' experience in the ICT industry including hands-on experience with the design, operation and maintenance of fiber optic networks and wireless extensions of such networks
- Experience in defining and monitoring service level agreements (SLAs) for ICTs.
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams

- Portuguese language skills, written and spoken required

*Senior eGovernment specialist*

- Post-graduate degree in political science or public administration
- At least fifteen (15) years' experience in eGovernment consulting and/or operations, including hands-on experience with the design, operation and maintenance of integrated eGovernment solutions
- At least five (5) years' experience analyzing requirements for and/or implementing integrated eGovernment software solutions.
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Portuguese language skills, written and spoken, preferred

Junior eGovernment specialist
- At least an undergraduate degree in political science or public administration
- At least five (5) years' experience in eGovernment consulting and/or operations, including hands-on experience with the design, operation and maintenance of integrated eGovernment solutions
- Experience in defining and monitoring service level agreements (SLAs) for eGovernment systems.
- Expertise in the economic and financial analysis of projects and feasibility studies involving rapid technological change, including total cost of operations (TCO) and return on investment (ROI) analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing

ICT Strategist & Regulatory Specialist
- Post-graduate degree in economics, public policy/administration or electrical engineering, preference for a multi-disciplinary background
- At least ten (10) years' experience in elaborating and/or analyzing national and sub-national ICT strategies from technical, economic, and social perspectives
- Knowledge of Brazilian telecommunications legislation and regulations demonstrated by publications and employment record
- Experience in cost-benefit analysis
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Excellent ability to clearly explain advanced technical issues in manner that is easily

Senior Economist
- At least a masters degree in economics, PhD preferred
- A minimum of ten (10) years experience in economic analysis of ICT projects
- Experience with cost/benefit analysis
- Experience analyzing the development impact of ICT projects
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent written and verbal communication skills, including technical writing
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong interpersonal and customer service skills
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Strong Portuguese language skills, written and spoken, preferred

*Brazil Environmental Expert*
- Post-graduate degree in environmental engineering or related discipline
- At least five years' experience with applying Brazilian environmental legislation in project analysis;
- Knowledge of environmental impact of data center and telecommunications projects
- Knowledge of Brazilian telecommunications regulations.
- Strong English language skills, written and spoken is required

*Brazilian Lawyer Specializing in Brazilian legislation and regulation (regulamentação)*

- Familiarity with the federal, São Paulo, and other state legislation and regulations governing telecommunications and data centers in Brazil as well as with the legislation governing government purchasing (Law 8666), concessions and service contracts
- Ability to conduct necessary research and legal/regulatory diligence
- High degree of fluency in English preferred

*Project Coordinator/Local Manager*
The responsibilities of the Project coordinator include, but are not limited to, the following:
- Basic support logistics for everyone on team and their support people to ensure a smooth running of the project, such as deliverable coordination (formatting, timeliness, and other coordination),
- Travel coordination,
- Arranging workshops and conferences in person and by telephone.
- Managing and editing of deliverables, thereby ensuring that the deliverables closely follow the scope of work outlined. This way there are no surprises.
- Reviewing, coordinating and distributing presentation materials, both the electronic and paper versions of presentations.
- Developing and creating a library of resource material so that all consultants have easy access to any resource material, 24 x7, maintaining the library
- Arranging housing and payments for project related expenses,
- Coordinating with Project Manager on Project Finance issues such as expense payments, consultant time
- Arranging logistics for conferences and workshops
- Fluency in written and spoken Portuguese and English is required

## XIV.  SUGGESTED EVALUATION CRITERIA

It is suggested that the selection of the U.S. firm for both of the studies be based on the following criteria:

| Criterion | Max. Points |
|---|---|
| Expertise and skills of proposed personnel | 50 |
| Proposed approach to the TA and to the individual tasks | 30 |
| Pertinent international experience and cross-cultural skills | 20 |
| **Total:** | **100** |

[REDACTED]

broadband networks, datacenters, and e-Government systems (reviewing at least four Brazilian and four international case studies), including security and emergency arrangements. In analyzing each of these Brazilian and international examples, the U.S. Firm shall identify, analyze and detail the best practices in technology, finance, construction and operation. The U.S. Firm shall also analyze and detail the demands on these networks of typical e-Government activities, including:

- internal administration;
- tax collection;
- operation of citizen service centers;
- distance education;
- telemedicine;
- cloud computing, and
- big data analysis.

The U.S. Firm shall identify and analyze four Brazilian government broadband networks involving both fiber and wireless technologies and identify four international case studies drawing on these case studies and a review of the relevant literature on state-of-the art hybrid (fiber/wireless) networks. The U.S. Firm shall devote particular attention to business models that include infrastructure sharing under different leasing, exchange of rights for use of infrastructure, including fiber optic cables, towers, poles and ducts.

The U.S. firm shall familiarize itself with e-Government communications initiatives, partnership and business models for fiber and hybrid broadband networks as well as Governmental public budget finance and project analysis in Brazil and Bahia.

> **Deliverable #1:** The U.S. Firm shall prepare a report detailing all work performed under Task 1, including the case studies, demand analyses, and best practices identified and recommended for Bahia's data centers, hybrid broadband networks, and integrated e-Government systems.

**TASK 2:     Kick-Off Meetings and Assessment of Current Infrastructure**

The US firm shall familiarize themselves with the Brazilian governmental public budget finance and project analysis via Internet research and any documents provided by SAEB. The U.S. Firm shall then travel to Salvador, Bahia to familiarize themselves with the data center and broadband network infrastructure and to meet with the SAEB, the Secretariat of the Government of the State of Bahia (Secretaria de Ciência, Tecnologia e Inovação do Estado da Bahia – SECTI) and the Bahia State IT Company (Companhia de Processamento de Dados da Bahia – PRODEB). Prior to this travel the TA team shall read the project documents prepared by SECTI and PRODEB and provided to the U.S. Firm.  These documents will include planning strategies for SECTI and PRODEB, in addition to a series of other documents to be provided by SAEB, SECTI and PRODEB that are relevant to the Project.

**Deliverable #2:** The U.S. Firm shall prepare a list of documents and other materials studied in Task 2, and all relevant findings and conclusions.  The U.S. Firm shall also prepare a timetable, list of needed data, and proposed work plan to carry out these Terms of Reference.

**TASK 3:     NEEDS/REQUIREMENTS ANALYSIS**

**DATACENTER**
The U.S. Firm shall travel to Salvador, Bahia to review the current datacenter situation; meet with SAEB and the key stakeholders in the project: SECTI, PRODEB, the Secretariats of Finance, Education, and Health; Military Police, Civil Police, DETRAN, other Secretariats and government agencies, and the state judiciary (Tribunal de Justiça)) and conduct a needs/requirements analysis for the planned expansion of the PRODEB datacenter, its proposed backup datacenter in the new Secretariat of Finance (SEFAZ) data center (safe room). The analysis should include recommendations on the optimal methods for providing backup services in the upgraded PRODEB datacenter for the Secretariat of Finance, which already has a modern datacenter, but lacks backup facilities.  The basic objectives of the expansion of the data center are to meet the growing demand for information and communications technology in connection with SAEB's eGovernment program (broadband network management, applications, services, and portals) with agility, flexibility and efficiency under the strategic management of SAEB.

The U.S. Firm shall:

- Meet with SAEB and other major stakeholders (with guidance from SAEB) to develop an assessment of their needs, priorities, and expectations;

- Visit the two current datacenters in PRODEB and the Secretariat of Finance and conduct a needs and requirement analysis for the planned expansion of the PRODEB

datacenter and backup of the Secretariat of Finance Datacenter in the upgraded PRODEB datacenter;

- Conduct basic cost/benefit analyses for to help PRODEB to determine the appropriate scale of the new datacenter considering the six largest potential client secretariats/agencies of the State of Bahia (Finance, Education, Health, Public Safety, Transportation (DETRAN), and the state judiciary;

- Conduct a security analysis, both physical and electronic, of the proposed new datacenter and its backup datacenter to be located in the SEFAZ safe room and determine the best course of action to take to ensure the security and privacy of the information contained in the datacenters;

- Quantify the benefits in unit cost reduction from integrating these new clients into the upgraded, expanded data center and providing backup as well in the new backup data center and improved quality for datacenter services (using standard telecommunications network metrics) that can be achieved with the proposed centralized and integrated data center;

- Analyze at least three options for operation of the data center (i.e., options for data storage, mix of usage of cloud versus local data center, etc.) that would best suit Bahia;

- Inventory of Requirements for Supporting Critical and Non-Critical State Applications;

- Estimate and project Data Center Power Supply Requirements and Cost;

- Specify and project Data Center Cooling Requirements and Cost;

- Specify Standby Power Requirements and Fire Safety requirements;

- Specify Guidelines for Selecting Data Center Construction Contractors; and

- Estimate future demand for integrated state data center services of (a) the Bahia state government secretariats and agencies and (b) municipalities in the state of Bahia.

### HYBRID BROADBAND NETWORK

The U.S. Firm shall travel to Salvador, Bahia to review the current hybrid broadband network situation; meet with SAEB and the key stakeholders in the project: SECTI, the Secretariats of Finance, Education, and Health; Military Police, Civil Police, Prodeb, DETRAN, and other Secretariats and government agencies; and conduct a needs/requirements analysis for the expansion of the hybrid broadband network. The U.S. Firm shall also analyze the needs and capabilities of potential partners in the upgraded hybrid network, including The São Francisco Hydro Power Company (CHESF), the main state electrical energy distribution company (COELBA), Telebras, the National Education and Research Network (RNP), the Ministry of Education and Culture (MEC), and private telecommunications companies (e.g. Oi, Vivo, Embratel, Claro) and local internet service providers. The U.S. Firm shall also assess the interest of such potential partners and conditions under which they would be willing to partner with SECTI to operate the expanded network under a concession or PPP. The expanded

network should reach all 417 municipalities in the State of Bahia, with preference for a fiber optic connection where economically viable, but allowing some wireless extensions for small municipalities.

The basic objectives are to meet the growing demand for broadband connectivity to support the State of Bahia's e-Government program (broadband network management, applications, services, and portals) and promote digital inclusion of the population with agility, flexibility and efficiency under the strategic management of the state.

The U.S. Firm shall:

- Meet with SAEB and major state government stakeholders (with guidance from SAEB) to develop an assessment of their needs, priorities, and expectations;

- Recommend marketing strategies which would help SECTI get municipal governments in the state to become clients of the hybrid broadband network;

- Conduct basic cost/benefit analyses for the expansion of the hybrid broadband network, taking into consideration the needs of its prospective clients; and

- Quantify the benefits in unit cost reduction and improved quality (using standard telecommunications network metrics) for broadband communications that can be achieved with the state-owned hybrid network compared with continued contracting with commercial operators (Oi and Embratel).

## E-GOVERNMENT SYSTEM

The U.S. Firm shall review relevant information related to e-Government provided by SAEB and via Internet searches and then travel to Salvador, Bahia to review the current status of e-Government; meet with SAEB and the key stakeholders in the project: SECTI, the Secretariats of Finance, Education, and Health; Military Police, Civil Police, PRODEB, DETRAN, and other Secretariats and government agencies; and conduct a needs/requirements analysis for the proposed improvement of Bahia's integrated eGovernment system.

The U.S. firm shall familiarize themselves with e-Government systems, software, partnership and business as well as public budget finance and project analysis in Brazil and Bahia. The objective is to meet the growing demand for eGovernment services with an integrated eGovernment system drawing on the expanded PRODEB data center and Bahia State Broadband Network.

The U.S. Firm shall:

- Meet with the SAEB and major state government stakeholders (with guidance from SAEB) to develop an assessment of their needs, priorities, and expectations;

- The U.S. Firm shall survey a limited number of municipal governments and identify factors that would help PRODEB get municipal governments in the state to become users of the integrated eGovernment system;

- Conduct basic cost/benefit analyses for the proposed improvement of the hybrid broadband network, taking into consideration the needs of its prospective clients; and

- Quantify the benefits in unit cost reduction and improved quality eGovernment services (using standard telecommunications network metrics) that can be achieved with the integrated eGovernment system compared with current practices.

**Deliverable #3:** The U.S. Firm shall prepare a report of all work done under this Task, including a Needs/Requirement Assessment report and Security Analysis report for the integrated e-Government system, the data center, and the hybrid broadband network.

## TASK 4: DIMENSIONING AND ALTERNATE SCENARIOS FOR BROADBAND NETWORK

### DATA HOSTING

Based on the findings in Task 3, the U.S. firm shall project the collective needs for data hosting over the next five years and estimate the size of data center requirements. Then the U.S. firm shall develop two alternate scenarios for data hosting in the State of Bahia:

a) Expansion of one of the existing data centers; and

b) Construction of a new state-owned data center (Tier III).

In consultations with SECTI, the U.S. firm shall recommend the optimum strategy for the integration of the existing data centers detailing the strengths and weaknesses of each strategy, and recommend a redundancy strategy utilizing the current storage capacity.

### BROADBAND NETWORK

Based on the findings in Task 3, the U.S. firm shall project the collective needs for broadband data communications over the next five years and estimate the need for bandwidth and links, taking into consideration the needs for redundant high-bandwidth connectivity between the integrated and consolidated data centers and the demands of cloud computing for all state secretariats, agencies, and other entities. Then the U.S. firm shall develop three alternate scenarios for broadband data communications in the State of Bahia:

a) Expansion and upgrading of the existing arrangements for outsourcing connectivity requirements;

b) Building a statewide broadband network of its own in partnership with other companies and entities requiring or owning telecommunications facilities; and

c) Some combination of options a) and b).

In consultations with SECTI, the U.S. firm shall recommend the optimum strategy for expanding and updating the needs for broadband connectivity, detailing the strengths and weaknesses of each strategy and recommend a redundancy strategy to assure continuous service if links are broken due to accidents or disasters.

**Deliverable #4:** The U.S. Firm shall prepare a report on all work done under this

Task, including summarizing the alternative strategies studied and recommendations for the optimum strategies for both data center integration and consolidation and the development of the broadband network.

## TASK 5: DEVELOP FUNCTIONAL SPECIFICATIONS, ARCHITECTURE, AND DESIGN

### DATACENTER
The U.S. firm shall:
- Analyze the findings from Task 3 and develop specifications regarding the architecture and design of the datacenter and backup data center;
- Develop precise and detailed estimates of data center design including building security, air conditioning, power provision, uninterruptable power supply, storage, processing, and fire prevention, equipment needs and capacity, and resulting capital expenditure and operating costs;
- Propose and draft service level agreement (SLAs) to cover speed of recovery from incidents and amount of capacity provided for the upgraded centralized datacenters; and
- Prepare a list of prospective US-based sources of supply for the datacenters. The business name, point of contact, address, telephone and e-mail address shall be included for each commercial source.

### BROADBAND NETWORK

The U.S. firm shall:
- Analyze the findings from Task 3 and develop specifications regarding the architecture and design of the hybrid broadband network;
- Develop precise and detailed engineering estimates of network designs, equipment needs and capacity, and resulting capital expenditure and operating costs;
- Propose and draft service level agreement (SLAs) to specify degrees of redundancy, maximum response times to incidents, percentage of "up time" and other technical metrics for the statewide hybrid broadband network; and
- Prepare a list of prospective US-based sources of supply for the network. The business name, point of contact, address, telephone and e-mail address shall be included for each commercial source.

### INTEGRATED E-GOVERNMENT SYSTEM
The U.S. firm shall:
- Analyze the findings from Task 3 and develop specifications regarding the architecture and design of the integrated eGovernment system;
- Develop precise and detailed estimates of network designs, software requirements, and resulting capital expenditure and operating costs;
- Propose and draft service level agreement (SLAs) for the statewide e-Government system; and
- Prepare a list of prospective US-based sources of supply for the e-Government system. The business name, point of contact, address, telephone and e-mail address

shall be included for each commercial source

**Deliverable #5:** The U.S. Firm shall prepare a report on all work performed under this Task, including a report on the datacenter, hybrid broadband network design, and integrated eGovernment system design functional specifications and architecture report.

## TASK 6:    ROLES AND RESPONSIBILITIES

### DATACENTER

The U.S. firm shall conduct a study of the future roles and responsibilities of the various actors involved, including the legal, institutional, structural and service levels for the operation of the datacenter. Questions to be addressed in this study include:

- Will PRODEB continue to operate the data center (and the proposed backup in SEFAZ) with its own personnel?

- Could the operation of the new data center and its backup data center be conducted by a private sector company under policies set by PRODEB with the support of an interagency committee?

- What will be the role of the secretariats and agencies with applications stored in the datacenter?

- How will performance of the datacenter be measured?

- If there is a private partner, how should it be remunerated?

- What should be the role of PRODEB once the new datacenter is operational? One possibility that should be studied is that it would be re-structured to serve as the supervisory authority for a private partner operating the new datacenter, with PRODEB setting policies both for the partner and for submissions of data from the various state agencies, subject to review by an interagency committee. Another would be to continue the present arrangements under which PRODEB both sets policy and operates the data center. The U.S. Firm shall suggest at least two more options for PRODEB's future role.

The U.S. firm shall also analyze alternative legal arrangements, including scenarios in which PRODEB contracts with a private sector partner to operate the datacenter. The analysis shall include a complete discussion of the strengths and weaknesses of each alternative arrangement, including recommendations on the best option(s) and evaluation of the legal and tax conditions for housing the datacenter and the backup datacenter under each of the options discussed.

## BROADBAND NETWORK

The U.S. firm shall conduct a study of the roles and responsibilities of the various actors involved, including the legal, institutional, structural and service levels for the operation of the network.

Questions to be addressed in this study include:

- Will the new broadband network be part of the administrative structure of the executive branch of the Bahia government?
- Who will administer the hybrid broadband network?
- What will be the role of the secretariats and agencies that will use the network?
- How will performance of the broadband network be measured?
- If there is a private partner, how should it be remunerated?
- What should be the role of SECTI once the new network is operational? One possibility that should be studied is that it would serve as the supervisory authority for a private partner operating the new network with the support or an interagency committee. The U.S. Firm shall suggest at least two more options for SECTI's future role.

The analysis of business models should present at least three viable options for the operation and maintenance of the network, including leasing and/or exchange of infrastructure with partners such as telecommunications and electric power distribution companies, and shall include a discussion of the strengths and weaknesses of each alternative arrangement, including recommendations on the best option(s).

## INTEGRATED E-GOVERNMENT SYSTEM

The U.S. firm shall conduct a study of the roles and responsibilities of the various actors involved, including the legal, institutional, structural and service levels for the operation of the system.

Questions to be addressed in this study include:

- Will the new eGovernment system be part of the administrative structure of the executive branch of the Bahia government?
- Who will administer the eGovernment system, PRODEB or some other government body?
- What will be the role of the secretariats and agencies that will use the system?
- What kinds of interaction will be sought from citizens, private sector enterprises, and organizations of civil society (third sector) and how will they be encouraged?
- How will performance of the integrated eGovernment system be measured?
- If there is a private partner, how should it be remunerated?
- What should be the role of PRODEB once the new eGovernment system is operational? One possibility is to have the policy-making function located in the Secretariat of Management (Secretaria de Administração), but supervisory and operating functions in PRODEB. The U.S. Firm shall suggest at least two more options for PRODEB's future role.

The analysis of business models should present at least three viable options for the operation and maintenance of the integrated eGovernment system, including a discussion

of the strengths and weaknesses of each option and a recommendation as to the best option(s).

**Deliverable #6:** The U.S. Firm shall prepare a report on all work performed under this Task, including a report of the roles and responsibilities for the management and operation of the datacenter, the broadband network, and the integrated eGovernment system.

## TASK 7:    ECONOMIC AND FINANCIAL ANALYSIS

The U.S. firm shall prepare an economic and financial analysis report and a report recommending the most effective structure and their supporting legal, economic and financial rationales.  As a basis for these reports, the U.S. Firm shall perform the following assessments and analysis, which shall be detailed in one or both of the reports:

- Quantify the benefits in unit cost reduction and improved quality (using standard telecommunications network metrics) for the data center and broadband connectivity services that could be achieved with the new hybrid broadband network as compared with the current connectivity arrangements;
- Assess the technical, financial, and organizational aspects of the broadband network, data center expansion and integration, and eGovernment system.
- Evaluate Total Cost of Ownership of the PRODEB data centers, broadband network, and eGovernment system;
- Develop Implementation Plans for the PRODEB data centers, broadband network, and integrated eGovernment system; and
- Prepare risk analysis, rate return analysis, and analysis of total cost of operation for each technological option presented during the technical assistance.

**Deliverable #7:** The U.S. Firm shall deliver a report of all work performed under this Task, including the economic and financial analysis report and a report recommending the most effective structure and their supporting legal, economic and financial rationales.

## TASK 8:    PRELIMINARY ENVIRONMENTAL ASSESSMENT

The U.S. firm shall:

- Conduct, in consultation with the Bahia Secretariat of Environmental Protection and municipal authorities, a preliminary review and evaluation of the expected environmental impacts of the data center and broadband network and their compatibility with both regulations of federal, state, and municipal governments and the requirements of potential lending agencies, especially the World Bank, the IFC, and the IADB;
- Discuss how any potentially significant negative impacts can be minimized; and
- Identify Agency/Department expectations priorities, opportunities, and trends.

**Deliverable #8:** The U.S. Firm shall prepare a report of all the work performed and findings under Task 8.

**TASK 9:     DEVELOPMENTAL IMPACT ANALYSIS**

The U.S. firm shall identify and assess the developmental outcomes that would be expected if the Project is implemented in accordance with the recommendations of the TA. Development Impact Measures are designed to help quantify the impact of USTDA's support for infrastructure development in emerging economies. This information is essential to USTDA's ability to set clear goals and measure the results of its programs, relative to the Agency's core objective of promoting United States private sector participation in development projects around the globe. Understanding the local impacts of USTDA's program supports the Agency's ability to design projects with a higher likelihood of implementation and a higher likelihood of U.S. export generation, thus supporting the Agency's mission.

At least one realistic and quantifiable Development Impact Measure is selected for each USTDA activity. In close consultation with the project sponsor, a baseline measurement is established for each indicator, which is used to compare future outcomes. The baseline is also used to set an anticipated timeline and determine how the information will be measured and collected once a project moves to implementation.

Improved Digital Communications Access is the main development impact for the Broadband Project:

| Sector | Category | Indicator | Description | Baseline Outcome |
|---|---|---|---|---|
| Telecomm | Infrastructure Development and Efficiency Gains | Improved Digital Communication Access | Number of people affected by expansion in telecommunications infrastructure to both metropolitan and rural areas including Broadband, Wireless, Voice, and Data (particularly of note if reaching populations without prior access to internet, telephone, etc.) | Number of individuals |
| | Infrastructure Development and Efficiency Gains | Improved Output through Advanced Technology | New technologies introduced to a host country resulting in an increase of efficiency, capacity, or output/process improvement | $ value or Y/N |

For the Data center the main indicator is

| Telecomm | Infrastructure Development and Efficiency Gains | Improved Data Management and Security | Capacity added, security/redundancy gained or reliability improved through implementation of data centers, cloud computing systems, or other storage infrastructure | Y/N* |
|---|---|---|---|---|

The U.S. Firm shall update the indicators chosen and anticipated measurable outcomes, based on the recommendations resulting from the technical assistance. The U.S. Firm shall then incorporate the baseline analysis and adjust the findings, as needed, to explain how the proposed activity will directly impact development in Brazil. The U.S. Firm shall work closely with the project sponsor as well as USTDA personnel at this stage to ensure that the final report clearly displays the anticipated outcomes that will be achieved when the project is implemented. These updates are used in future evaluation efforts to monitor progress and expected timeframes when the development impact will be realized.

**Deliverable** #9: The U.S. Firm shall prepare a report of all the work performed and findings under Task 9.

## TASK 10: ESTABLISH OPERATIONAL AND ADMINISTRATIVE REQUIREMENTS

In consultation with PRODEB and SECTI, the U.S. firm shall:

- Recommend the organizational structure, personnel requirements, and support resources that would be required to effectively manage a consolidated data center and broadband network;
- Review the current organization and define the corporate governance structures;
- Identify organizational structure needed within the agency to support the respective business plans;
- Define the qualifications, respective roles and relationships of the staff;
- Identify the support resources needed for effective management;
- Define training programs for professional development and a regular training schedule; and
- Clearly define any outsourcing contract objectives (scope, service levels, metrics, requirements, etc.).

**Deliverable #10:** The U.S. Firm shall prepare a report of all the work performed and findings under Task 10, including an Operational and Administrative Requirements Report.

**TASK 11:     PROJECT PLANNING AND IMPLEMENTATION**

The U.S. firm shall assess and determine what the critical goals and success factors are for Project implementation, and shall identify relevant risks and mitigants in order to achieve these goals/success factors.  The analysis shall address the following goals/success factors:

- The government shares with any private sector partners the benefits of productivity increases arising from technological change, and not just the costs;
- Continual monitoring of the contractual conditions in relation to the market is carried out – provisions for this need to be incorporated in the contract itself;
- Contract objectives for any PPP, concession, Build Operate Transfer (BOT) agreement or other legal arrangement for the relationship between public and private entities involved (scope, service levels, metrics, length of contract, renewability, terms for renewability, requirements, etc.) are clearly specified;
- Top government managers necessary to achieve efficient Project implementation are involved and supportive of the Project;
- Priority is obtained for any payments to private sector partners for strategic and critical activities outsourced;
- Potential difficulties SECTI/PRODEB may encounter during project implementation and how these challenges can be mitigated;
- Any new regulations that need to be enacted or whose enactment may be detrimental to the Project;
- What other entities must authorize or approve the Project for implementation;
- Penalties for non compliance with contract conditions are established and applied if violations are detected;
- A clear process is defined for exiting from the contract and transition to one or more other private sector partners with operating responsibilities for either of the projects or sharing infrastructure of the hybrid broadband network; and
- Other critical success factors inherent in any outsourcing for ICT services and means to achieve them defined.

The U.S. Firm shall prepare a Project Implementation Report, which shall include (i) a detailed recommendation concerning the most appropriate administrative structure for the Project, (ii) a detailed breakdown of the steps that need to be undertaken by SAEB and other partners to implement the Project according to the recommended structure, including recommendations for handling any outsourcing or infrastructure sharing arrangements with private sector firms, and (iii) recommendations on planning and implementing the phased approach/evolving scope of the State datacenter and hybrid broadband network. The Project Implementation Report shall also describe how to structure any service contract or infrastructure sharing arrangements to incorporate the evolving scope of the Project.

**Deliverable #11:** The U.S. Firm shall prepare a report of all the work performed and findings under Task 11, including a Project Impact Report and a Project Implementation Report

**TASK 12:       PRESENTATION OF THE DRAFT FINAL REPORT**

Upon concluding all tasks listed above, the U.S. firm shall travel to Salvador, Bahia to formally present to SAEB, SECTI and PRODEB the findings and recommendations and a near final version of the report. SAEB will be able to use this opportunity to ask questions or provide further comments and suggestions based on the presentation and draft of the Final Report. To support the presentation of the study the U.S. firm shall:

- Create an accompanying PowerPoint presentation; and

- Identify any additional suggestions or recommendations derived from SAEB, SECTI, and PRODEB's responses to the presentation.

**Deliverable #12:** The U.S. Firm shall travel to Salvador to present the draft Final Report and PowerPoint Presentation.


**TASK 13:       FINAL REPORT**

The U.S. Firm shall prepare and deliver to SAEB and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report").  The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to SAEB.  The U.S. Firm shall provide one copy of the Final Report in Portuguese to SAEB.  The Final Report shall be prepared and delivered to USTDA, in English, in accordance with Clause I of Annex II of the Grant Agreement.   The U.S. Firm must identify prospective U.S. sources of supply in the Final Report to be submitted to the SAEB and USTDA in accordance with Clause I of Annex II of the Grant Agreement.

The Final Report shall be a comprehensive document covering and synthesizing the findings of all the preceding tasks, providing SAEB with the appropriate information, recommendations and guidelines.