Definitional Mission to Evaluate ICT Projects in Argentina: Volume 2: Salta Smart City Project

Final Report

Submitted by
Hellerstein & Associates

December 2017

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Salta Smart City Project

Definitional Mission Report

I. EXECUTIVE SUMMARY

Grantee: Salta Municipal Government (MGS)

Activity Budget: US$869,200

U.S. Export Potential: Total export potential is approximately US$23.3 million. Fiber optic cables; optical electronics; wireless equipment such as antennas, transmitters, and receivers; systems and application software, sensors for street traffic, traffic control cameras, ITS - Intelligent Transportation System; Adaptive Traffic Signal Control System; Automatic Enforcement Solutions; Video Content Analytics; Public Building Monitoring; Disaster Identification and Prevention System; Geo-referencing and Communication System; Solutions for Government Monitoring and Evaluation (M&E); Sensors - all kind of sensors that can be used in a city context (sensors for air quality, water quality, fire, pluviometers etc.).

The MGS seeks technical assistance for an international consultancy financed by USTDA to do the following:

1) Determine best practices related to implementation of smart cities using ICT mechanisms and tools, especially in cases similar to Salta.
2) Review the existing situation of the Salta fiber optic metropolitan network and perform the following:
3) Review existing MGS ICT resources for possible updating of technologies and addition of new components like:
4) Undertake a full feasibility study for the *Salta Ciudad Inteligente* (Salta Smart City) project using the IDB/ESCI methodology identifying the elements required to make Salta a smart city
5) Specify equipment and software needed and possible sources for acquisition thereof.

II. PROJECT DESCRIPTION

A. INTRODUCTION

Argentina

The Information and Communication Technology (ICT) Sector in Argentina is undergoing rapid changes which evidence the current Federal Government's intention of attracting investments to the sector.[1] In principle, those changes are related to:

- Reduction of administrative bureaucracy by: (i) Creating a new and unified control authority (National Communications Entity – ENACOM) in charge of the ICT sector; and (ii) speeding up certain administrative proceedings to obtain licenses (e.g., Internet service provider), and converting the transfer of ICT licenses to "post-closing regulatory approval," or changes in the shareholdings of such licensees.
- Promoting the development of new telecommunications infrastructure: (i) Deployment of fiber to the home "FTTH" networks – increasing bandwidth to offer new services (e.g., video & audio streaming); (ii) developing a market of providers of passive infrastructure (e.g., cell sites, towers); (iii) facilitating Argentine state premises to deploy cell sites; (iv) working with local authorities to reduce legal obstacles for the construction of cell sites; (v) reframing certain radio spectrum frequencies (e.g., 2.4 and 5.8 GHz) related, among others, to mobile data offloading; (vi) granting of provisory and experimental authorization in favor of DirecTV Argentina to provide Internet satellite access on the basis that the use of this technology may be favorable to reach Internet-unserved areas such as rural zones; (vii) granting of landing rights to foreign satellites to operate within the Argentine territory; and, (viii) issuance of Mobile Virtual Operator licenses (MVNO).
- Reduction of the Digital Divide: (i) Elimination of import tariffs on computers, notebooks and tablets; (ii) a large-scale National Broadband Plan has been launched through the state-owned infrastructure operator ARSAT for the amount of US$290 million to extend broadband services to some 1,200 rural localities with the aim to carry Internet service by fiber optics, at a low cost and high speed; (iii) the Argentine Government announced the Digital Country Plan in order to provide, among others, public and free Wi-Fi to 1,000 localities; (iv) furthermore, the ENACOM approved a Project of Access to ICT Services through a Federal Fiber Optic Network ("REFEFO"). REFEFO includes the development of 120 distribution network nodes within the Argentine territory. The total amount allocated for REFEFO is US$85 million and funding will be made by ARSAT with funds from the Universal Service Trust Fund.
- Convergence of services. In principle, from January 1, 2018, onwards the historical providers of basic fixed telephony and the three (3) principal mobile carriers (Personal, Movistar and Claro) will be allowed to offer pay TV services (except satellite television services).
- Open dialogue between private companies and regulators; and regulators and third

[1] See http://doingbusinessinarg.com/ict-sector-in-argentina/ (Accessed July 14, 2017)

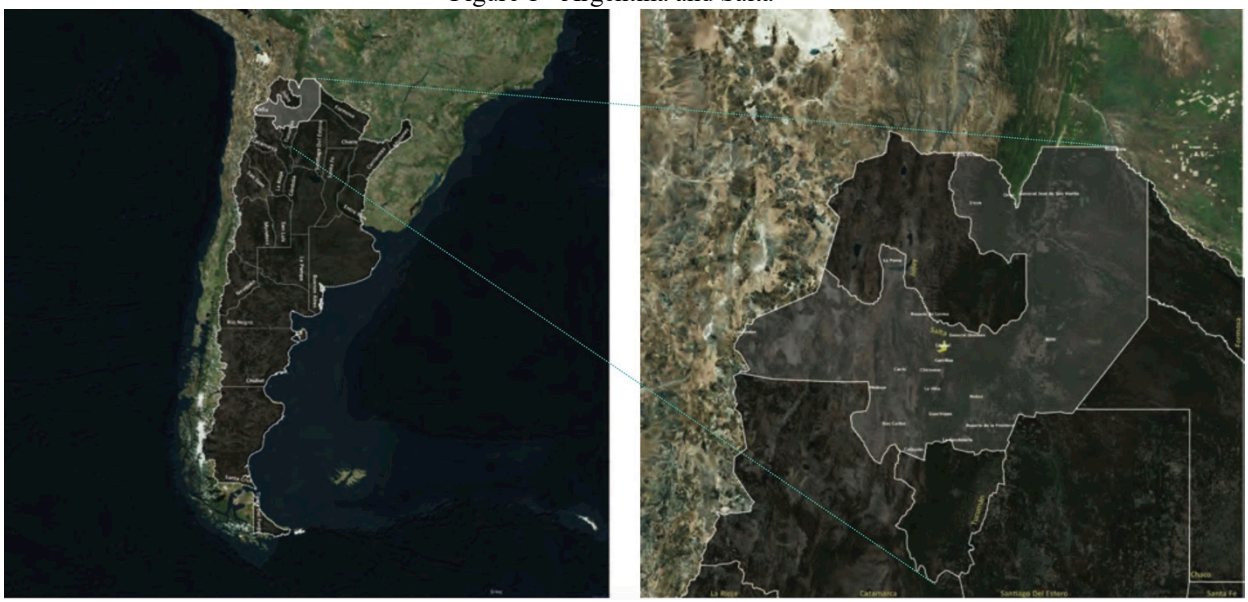
country regulators (e.g., the U.S. Federal Communications Commission).

- Upcoming new convergent law regulating ICT services. A special committee, appointed by a Presidential Decree, is currently working on drafting a bill.

The Province of Salta

The province of Salta is located in the Northwest of the country, in the region known as the Great North Argentine, bordering to the west with Chile, to the north with the province of Jujuy and the Republic of Bolivia, with Paraguay towards the northwest, with the provinces of Formosa and Chaco to the east and with the province of Santiago del Estero, Tucumán and Catamarca to the south (see Figure 1). With 155,488 km, it is the sixth largest province, behind Buenos Aires, Santa Cruz, Chubut, Rio Negro and Cordova.

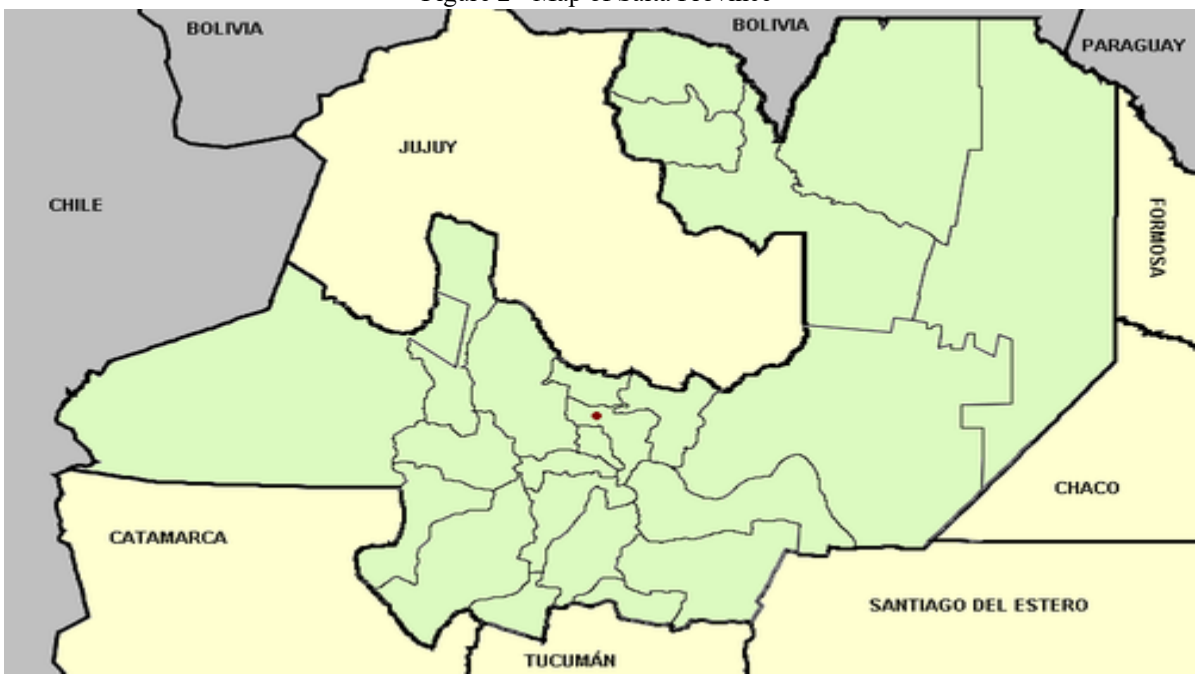
Figure 1 - Argentina and Salta



Source: geoadaptive.com

The capital of the province is the City of Salta. The province is divided administratively into 23 departments, subdivided into 58 municipalities and 2 municipal delegations, as shown in Figure 2.

Figure 2 - Map of Salta Province



Source: Municipal Government of Salta

The City of Salta

The City of Salta with a municipal area of 60 km had a registered population of 535,303 inhabitants in 2010 (according to the National Census and Statistics Institute (INDEC)). In the last seven years the population grew an estimated 20%, which makes the City the most populous in the province and the sixth behind Buenos Aires, Santa Cruz, Chubut, Rio Negro and Cordoba. Its metropolitan area, named "Gran Salta," consists of eleven municipalities and has a population of 554,125 inhabitants (INDEC, 2010). It is located east of the Andes, at 1,187 meters in altitude in the Valle de Lerma, near the source of the Salado River (Río Salado)–a major river which empties into the Parana River–and is crossed by the Arenales River which divides it into three sections: Center, North and South.

Figure 3 - City of Salta

Source: Google Maps

The City of Salta is a member of the "*red Mercociudades*" along with 180 other cities of the member countries of Mercosur.

The City is nicknamed "The Beautiful" ("*La Linda*"), because of its architecture, charming natural environment, pleasant climate and warm, welcoming people. In the last 20 years, it is also one of the cities with the highest growth in Latin America and it is regularly cited as one of the most relevant urban concentration phenomena of recent times, along with other cities in region.

Every city, as any social construction, has life, spaces, a center or downtown, history and present, inorganic development, and constant evolution. Accelerated growth at any level, is difficult to plan and settle. The *Salteños* (demonym for people living in Salta) can attest to it. This has brought a number of growth problems that have become significant challenges. For example, there are numerous urban settlements that are a result of multiple social issues that took place over time without, or in spite of, proper planning.

For this reason, the City of Salta has been working diligently with the province's Modernization Secretariat in a number of programs, among them the "Urban and Environmental Development" (PIDUA I and PIDUA II), the Central Downtown Redesign, the Emissions Reduction Project (RES) which reduces landfill methane gas emissions, and the Metropolitan Area Development Program (DAMI). The Secretariat was created one and a half years ago by the current government administration and it promotes change within MGS.

Historically, municipal services could not keep up with technology advances, city growth and citizens' needs. The Modernization Secretariat in an effort to reduce the gap between current and optimal services, proposed to concentrate on ten priority areas. Today, these areas are handled by multidisciplinary teams, which include officials, advisors and municipal staff from different departments. Each area of work has objectives with specific projects that are measured against goal achievements. A team leader is selected for each project. The leader works with a diverse team from different areas to help him/her achieve the pre-established goals.

The central concept behind this approach is to develop MGS's leadership by encouraging business culture change, redesigning processes, giving back to the community, providing citizens open access to the municipality, connecting the municipality with the world and enhancing transparency and participation. To achieve these goals, the municipality seeks to rebuild its infrastructure services and envisions a smart city that provides connectivity and access to services from any point of the city with the speed and quality of response that the citizens deserve.

The main objective of the smart city project is to improve the citizens' quality of life and in the process enhance their comfort and enjoyment of their city. Naturally, any infrastructure changes required for the project will need to safeguard the city's cultural heritage and its natural environment.

Urban Aspects

The City of Salta is the heart of the metropolitan area. The city is divided into numerous sectors and neighborhoods, among which the following stand out:

a) The historical, financial and commercial center: Established in the year 1582 and where the oldest buildings of the city are located

b) The South of the Arenales River: San Antonio, Villa Cristina, María Esther, Casino, and the set of neighborhoods Miguel Ernesto Aráoz, El Tribuno, Intersindical, Limache and Santa Ana

c) The West: Where the headquarters of the province's government known as the "Grand Bourg" are located The building was moved to this part of the City in 1987 to alleviate the commercial center's congestion

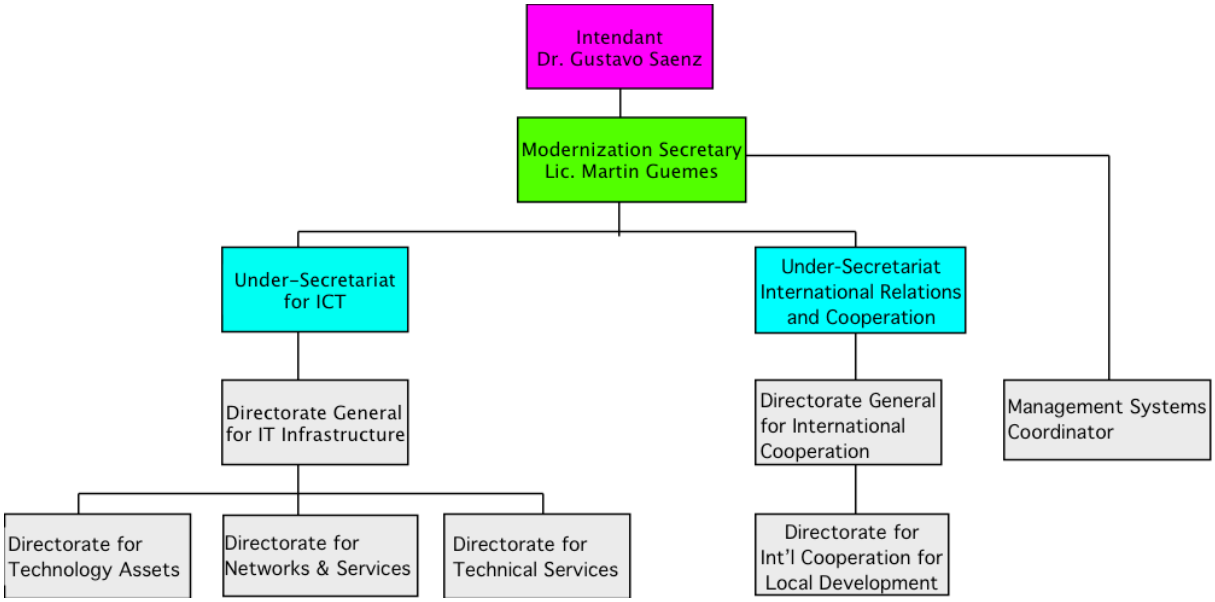
d) The East: The entrance to the city known as "El Portezuelo," and also where the hiking path to the San Bernardo hill begins

e) The North: The "Tres Cerritos" area and the neighborhoods: Parque General Belgrano, Universitario, Castañares, Ciudad del Milagro

The Metropolitan Area of Salta (MAS) is one of the largest cities and regions in Argentina. In the last two decades, the population in MAS increased by 44% to 620,000 inhabitants, becoming one of the fastest-growing urban agglomerations in the country (higher than San Juan, Tucumán, Cordoba and the City of Buenos Aires) and one of the most important urban centers of the Great North. The MAS hosts about half of the population of the province of Salta. It is also the economic and administrative center of the province. The last decade has seen a gradual departure of the population towards urban centers in Cerrillos, San Lorenzo and Vaqueros. This shift is due to low-density spatial patterns combined with gradual disintegration of the central urban area and unemployment. This type of growth increases pressure on basic infrastructure (urban transportation, water supply and drainage systems), which when built is to catch up with the outgrowth and is costly. In addition, the growth has a negative environmental impact. Vulnerability to flooding and other natural disasters increases as a result of these deficiencies and the lack of planning, which in turn perpetuate inequality and poverty conditions. MGS is fully aware of this challenge and is working to overcome these and other problems it faces. These are some of the challenges that the MGS hopes to address with this smart city project.

The municipality of the City of Salta is a government entity led by a municipal Intendant, Dr. Gustavo Sáenz. Dr. Sáenz assumed this position on December 9, 2015 and he is committed to identifying resources within the federal government to execute the infrastructure projects in the municipality. The Modernization Secretariat within the municipal structure will lead the implementation of the project, in accordance to the organizational structure shown in Figure 4.

Figure 4 - Structure of Municipal Government of Salta



Source: Municipal Government of Salta

In 2012, Salta was selected by the Inter-American Development Bank's (IDB's) Emerging and Sustainable Cities Initiative (ESC)[2] as one of six additional pilot cities in Latin America to be part of an in-depth study using a two-stage methodology:

Stage one begins by executing a rapid diagnostic tool to identify the sustainability challenges of a city. Afterwards, topics (i.e., water, air-quality, transparency, etc.) are prioritized through the use of multiple filters, environmental, economic, public opinion and sector specialist expertise to identify issues that pose the greatest challenges in a city's pathway towards sustainability. Finally, an action plan is formulated, containing prioritized interventions and a set of strategies for their execution across the short, medium, and long-term.

In stage two, the execution phase begins with the preparation of pre-investment studies for prioritized interventions and the implementation of a citizen monitoring system.[3]

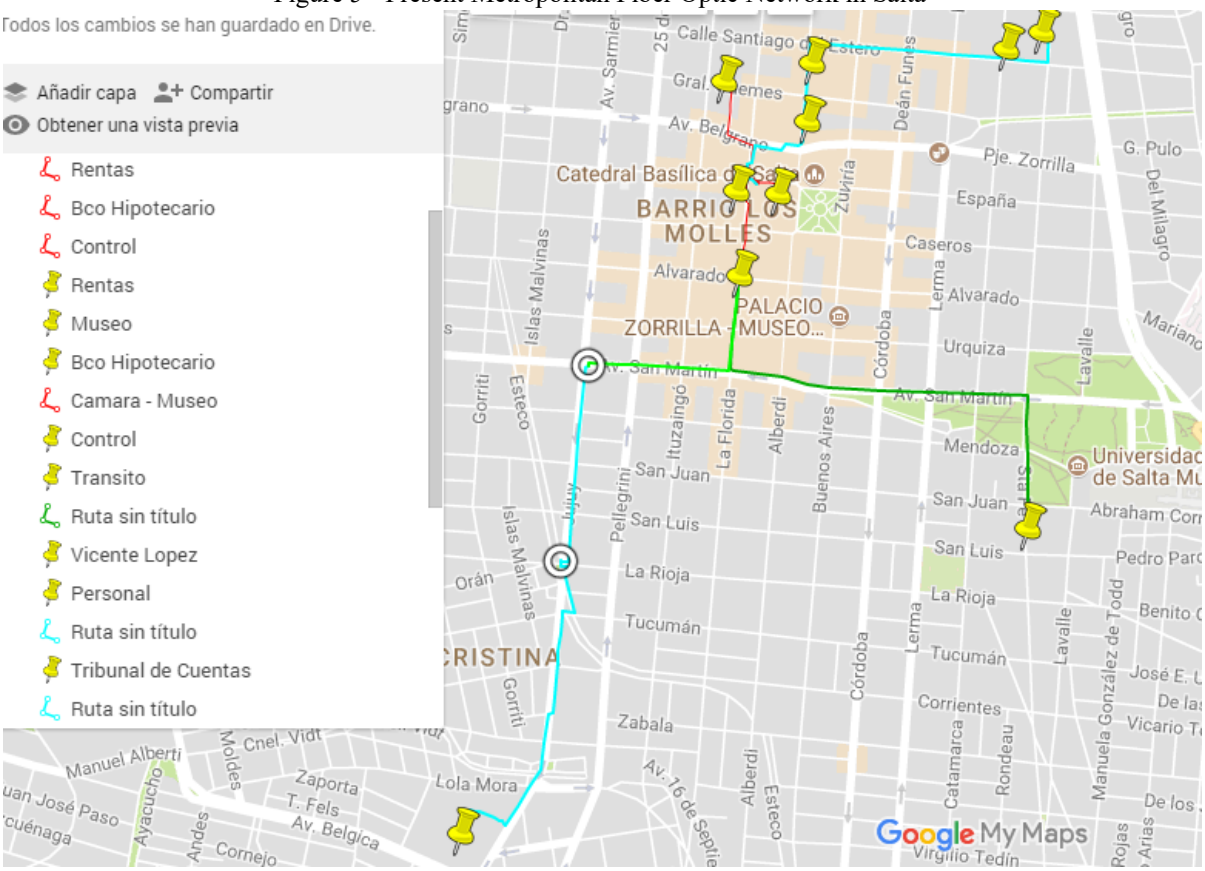
ESC's methodology is "based on the premise that urban development strategies that are well-planned, integrated, and cross-sectoral, can ensure improvements in the quality of life for citizens and help materialize a more sustainable, resilient, and inclusive future for emerging cities in Latin America and the Caribbean."[4]

[2] See http://www.iadb.org/en/topics/emerging-and-sustainable-cities/emerging-and-sustainable-cities-initiative,6656.html (Accessed July 14, 2017).
[3] See http://www.iadb.org/en/topics/emerging-and-sustainable-cities/implementing-the-emerging-and-sustainable-cities-program-approach,7641.html (Accessed July 14, 2017).
[4] *ibidem*

B. THE PROJECT

The DM Consultants were originally charged with evaluating the expansion of a metropolitan fiber optic network which was built using several different fiber technologies and vendors to connect the Municipality of Salta dependencies, as shown in Figure 5. The different sections of the existing fiber are shown in different colors in the map, which gives an idea of the difficulties the municipal government faces in making those fiber segments work coherently as a single network.

Figure 5 - Present Metropolitan Fiber Optic Network in Salta



Source: Municipal Government of Salta

MGS seeks to expand this project and so seeks technical assistance from USTDA to:

1) Determine best practices related to implementation of smart cities using ICT mechanisms and tools, especially in cases similar to Salta.
2) Review the existing situation of the Salta fiber optic metropolitan network and perform the following:
   a) Assess the suitability of the network for performing the basic functions required to provide the transport network services to a smart city.
   b) Suggest the modifications and expansions needed in the network to perform as the backbone for the ICT services in the long and medium term taking into consideration:

i) Network reliability (fault tolerance)

ii) Capacity

iii) Flexibility

iv) Ease for maintenance

v) Avoidance of visual contamination

c) Examine the suitability of different technologies and suggest the most advantageous taking into consideration its future use for the provision of ICT services for smart city applications.

d) Estimate the costs and level of effort required to expand or rebuild the fiber optic metropolitan network.

e) Suggest a business case for offsetting the operational costs of managing the fiber optic metropolitan network (via dark fiber lease or other means) and minimize reliance on municipal funds.

3) Review existing MGS ICT resources for possible updating of technologies and addition of new components like:

a) Traffic control and possibly a system of automatic RFID-based real-time, possibly variable, tariffs for congested areas of the city

b) Adaptation of project data collection and analysis components for open data, encouraging development of applications using this data by private sector, public sector, and civil society entities

c) Enhanced e-government system for internal government use and interaction with citizens

d) Visual dashboard and situation rooms

e) Use of parking sensors to collect information about zoning code violations, new buildings

4) Undertake a full feasibility study for the *Salta Ciudad Inteligente* (Salta Smart City) project using the IDB/ESCI methodology identifying the elements required to make Salta a smart city, focusing in the following areas:

a) Public transportation and urban mobility

b) Competitiveness, public management and transparency connectivity

c) Public safety

d) Planning and management of the expansion of the urban areas

e) Disaster management and adaptation to climate change (resilience)

f) Citizen engagement

g) Urban Internet access

5) Specify equipment and software needed and possible sources for acquisition thereof.

The DM Consultants met with the representatives of the Modernization Secretariat, Municipal Government of Salta, on June 19, 2017, to discuss the scope of the project. The meeting started with a discussion on how to make the different segments of the network compatible in their operation and it derived into a presentation of the plan to increase the reach of the metropolitan fiber network to cover the entire city of Salta. It soon became clear that the final objective was not just to expand an optical fiber network, but also to use it as a building block to attain a more ambitious objective, which is turning Salta into a smart city.

A smart city is a vision to integrate multiple ICT solutions in a secure fashion to manage a city's assets–the city's assets include local departments information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services. The goal of building a smart city is to improve quality of life by using technology to improve the efficiency of services and meet residents' needs. ICT allows city officials to interact directly with the community and the city infrastructure and to monitor what is happening in the city, how the city is evolving, and how to enable a better quality of life. Through the use of sensors integrated with real-time monitoring systems, data are collected from citizens and devices and then processed and analyzed. The information and knowledge gathered are keys to tackling inefficiency.

ICT is also used to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to improve contact between citizens and government. Smart city applications are developed with the goal of improving the management of urban flows and allowing for real time responses to challenges. A smart city may therefore be more prepared to respond to challenges than one with a simple 'transactional' relationship with its citizens.

Smart cities make more efficient use of physical infrastructure (roads, built environment and other physical assets) through artificial intelligence and data analytics to support a strong and healthy economic, social, cultural development. They do this by engaging with citizens in local governance and decision making by using open-data applications, improving the collective intelligence of the city's institutions through e-governance, citizen participation and co-design.

ICT is also used for cities to make more efficient use of their physical infrastructure (roads, built environment and other physical assets) by using artificial intelligence and data analytics to support a strong and healthy economic, social, cultural development.

Identification of Areas with Problems to Solve

In 2015, an IDB team, working in collaboration with the MGS, completed and published a 192-page document entitled *Salta Sostenible: Inclusiva, Resiliente y Competitiva* (Sustainable Salta: Inclusive, Resilient and Competitive), thereby completing stage one of the ESC methodology. This report prioritized five areas for intervention:

1. Public safety
2. Urban inequality
3. Noise
4. Land use
5. Transparency

In addition to assisting in the provision of services, the network, platforms and technology that will be implemented in the smart city project will help MGS gather information to design public policies aimed at the improving the five priority areas.

Some of the areas that the project will address include:

1) Public transportation and urban transportation
2) Competitiveness, public management connectivity and transparency
3) Public security
4) Planning and management of the expansion of the urban area
5) Disaster management and adaptation to climate change (resilience)
6) Citizen participation
7) Urban Internet access

General Objectives of the Project

The MGS is committed to promoting the integral development of the community with an efficient management based on transparency and citizen participation to build a sustainable, inclusive, healthy and safe city where work culture and respect and care for the environment are promoted. Thus, as a starting point, it is important to convert the City of Salta into a smart city to provide the needed infrastructure to allow MGS to provide better communications and services. The smart city will also allow MGS to collect on-line, real time information for better decision-making and communicating with on-duty municipal employees for more efficient and effective work.

A smart city as defined by the IDB's ESC program, "… place people at the center of development, incorporates information and Communication technologies into urban management, and uses these elements as tools to stimulate the design of an effective government that includes collaborative planning and citizen participation. By promoting integrated and sustainable development, smart cities become more innovative, competitive, attractive, and resilient, thus improving lives."[5]

Specific Objectives of the Project

The project will focus on four main areas:

1) Public safety
2) Decentralization of public administration
3) Environment
4) Transportation

PUBLIC SAFETY

A smart city also includes the concept of a safe city. MGS plans to implement proactive closed-circuit television (CCTV) surveillance system that will be used to monitor the city and

[5] See https://publications.iadb.org/bitstream/handle/11319/7743/The-Road-towards-Smart-Cities-Migrating-from-Traditional-City-Management-to-the-Smart-City.pdf (Accessed on July 16, 2017)

its assets. In addition, automatic traffic counters and classifiers will be implemented at all entry and exit points of MAS to monitor traffic flows and other parameters. Environmental sensors will also be implemented at strategic locations for monitoring various parameters such as pollutant levels, which will enable MGS to continuously track the environmental impact of the city. An integrated vehicle tracking system for city vehicles will be implemented for automatically tracking locations of all city vehicle assets at the Smart City Control Center (SCCC). Additionally, for solid waste management, it is also desired to automatically dispatch waste collection vehicles based on various parameters and inputs including trash bin level sensors.

Among the components that will be required are:

- Cameras with event detection
- Intelligent light-emitting diode (LED) lighting
- Dashboard with dynamic billboard
- Emergency phones
- River/flood alarm sensors
- Smart shelters

DECENTRALIZATION OF PUBLIC ADMINISTRATION

- Integration of delegations
- Access points for agents and mobile or temporary dependencies
- Self-management terminals

ENVIRONMENT

- Sensors:
    - Meteorological stations
    - Air quality
    - Solar radiation
    - Generation of early fire and flood alarms
- Dynamic Billboard

TRANSPORTATION

- Monitoring and surveillance
- Self-management terminals
- Smart traffic lights
- Parking sensors

Integration

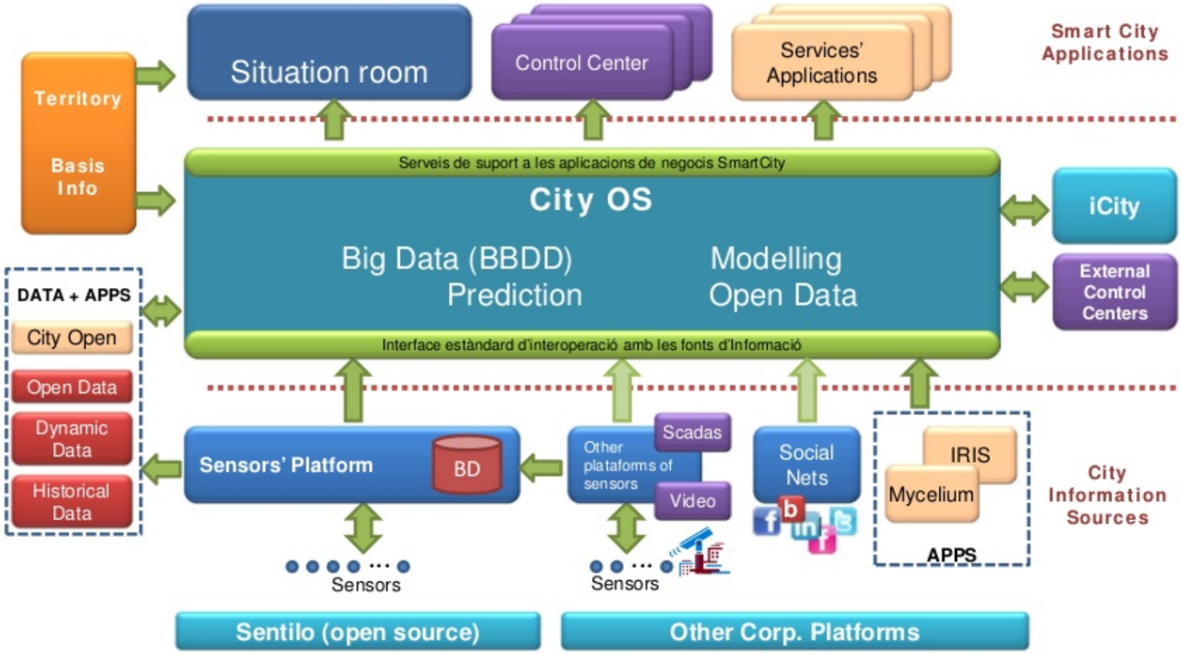
To achieve the aforementioned services, it is necessary to have at least the following operational applications:

- Incident monitoring
- Alerts management
- Image analysis
- Geographic Information System (GIS)
- e-Government systems

The integration of data and information for governmental management requires the following resources:

- Business intelligence tools (BI)
- Control panels
- Geo-referenced alerts
- Key performance indicators (KPIs)
- Web portal
- Integration platform

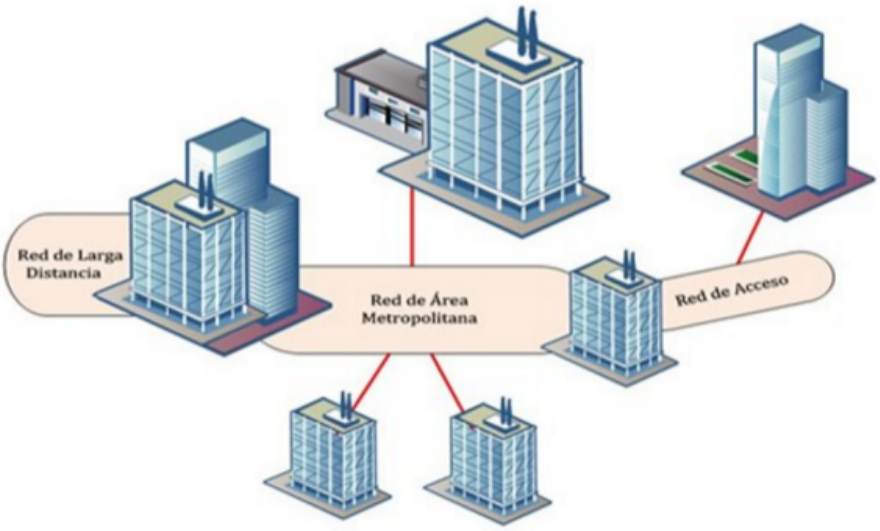
Figure 6 - Urban Platform



The infrastructure necessary to support what is described above consists of:

- Metropolitan fiber optic network
- Data center
- Crisis room
- Communications center and social networks
- Communications for voice, data and video
- Wireless networks
- Security and access control

Figure 7 - Metropolitan Area Network Architecture



Legend:
Red de Larga Distancia = Long distance network
Red de Área Metropolitana = Metropolitan area network
Red de Acceso = Access network

Existing Fiber Optic Status

The current fiber optic layout is not only insufficient in its physical (quantitative) extent but also suffers from ineffectiveness and unreliability (qualitative). Its status can be summarized as follows:

- Age, in some sections, it is approximately 12 years old
- Its growth was by stages, at different times and installed with different suppliers
- It is observed that there are sections with different fiber technologies, largely due to its disorderly and unplanned growth. This mix of technologies affects the overall network performance
- In many sections of its route the actual location or the fiber is unknown and its present state is unknown
- Sections are located in places with very difficult access, for instance along rain drainages
- Aerial sections without tension and adequate supports
- Existence of hub fiber nodes with active elements (dependent on electrical supply).
- Undocumented interventions

Adequacy and Improvements to the Existing Network

An underlying enabler of a smart city is a highly reliable and available fiber optic infrastructure. MGS aims at having an end-to-end fiber optic infrastructure with an overall FTT-X architecture for all its services. This infrastructure will be used for both intelligent transportation system (ITS) and non-ITS services including ITS tenants. It is expected that overall, fiber optic infrastructure will be used for connectivity to all 'things' being implemented as part of Salta Smart City and will be the underlying enabler for connectivity.

This will require at an initial stage expansion of the metropolitan fiber optic network and all necessary accessory equipment to reach coverage in the entire municipal area to provide external services to citizens and interconnect the internal services of municipal agencies. The integration of the services will be done through a municipal operations command center.

OPTICAL FIBER

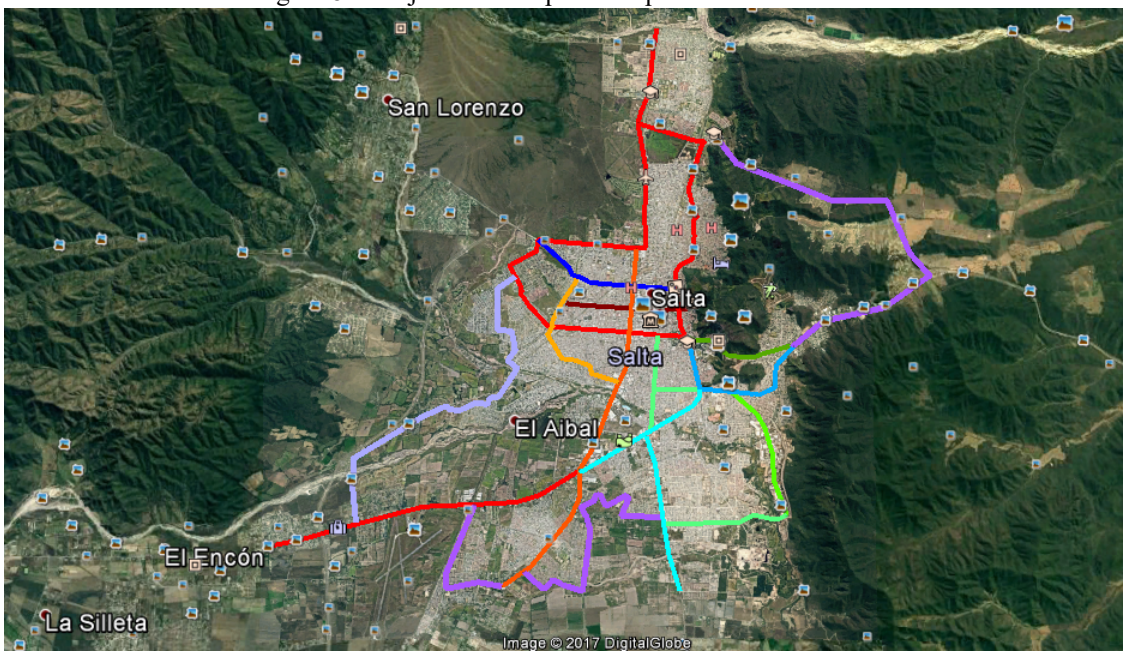
Deployment of optical fiber is measured in terms of kilometers. This metropolitan network needs to reach all areas where the Salta Smart City project intends to provide services. The services will be deployed in:

- Critical urban routes
- Municipal buildings and facilities
- Buildings and public green spaces

Updating and improving the existing fiber network involves, among others, the following steps:

- Secure its route
- Adapt its route to the new system of wiring for the downtown central area
- Address the deficiencies noted above
- Introduce new access points in the route
- Adjust the entire network for expansion

Figure 8 - Projected Metropolitan Optical Fiber Network



Source: Municipal Government of Salta

The objective is to deploy a fiber backbone that offers sufficient coverage in the municipal urban area to allow for the deployment of the smart city elements to provide:

- Public protection
- Development and education
- Environmental sustainability and protection

- Citizen participation and open government (transparency)

It is envisioned that, at minimum, the following hardware elements will be needed:

- Single-mode fiber, suitable for air and underground lines.
- Support overhead lines 150 meters
- A minimum of 48 strands
- Devices to achieve a multiservice network

The following technical support will also be required:

- Personnel/technician to:
  i. Perform basic diagnostic of current optical fiber installations in the city
  ii. Train of municipal staff, mostly technicians, whose employment status is permanent (remain in office despite changes of government)
  iii. Supervise work: expert fees, travel, per diem and accommodation

- Technical assistance: carrying out diagnostic and repair fiber optic (FO) system, mapping, manuals and procedures
- Secure economic resources for: providing optical time-domain reflectometer (OTDR), portable tools and spare-parts basic

ACTIVE ELECTRONICS FOR FIBER OPTIC NETWORK

It is expected that all network switches at access level (field) shall be Layer 2-based and shall be industrial grade, suited to perform as per on-site conditions.

All network switches at the distribution level hall also be Layer 2-based, but may not be industrial grade. Furthermore, all network switches for backbone shall be Layer 3-based.

POINT OF PRESENCE

Point-of-presence (POP) rooms are where all telecom services (MGS and non-MGS) will originate/terminate. This space will be shared between MGS services and tenants including telecom service providers and cellular among others. A primary POP and several secondary POPs will be distributed geographically at locations across the City of Salta. The POPs shall have dedicated space for each of the tenant and MGS services. They will also have the main cellular towers co-located in the same plot location with dedicated space for cellular services.

The POPs area requirements are normally 2,000 square ft. It is expected that the POP will cater to MGS's present and future needs and growth in terms of space requirements; as well as support tenant co-locations. It might also be necessary to set back the POP so it will be in compliance with the development guidelines.

City-Wide Wi-Fi

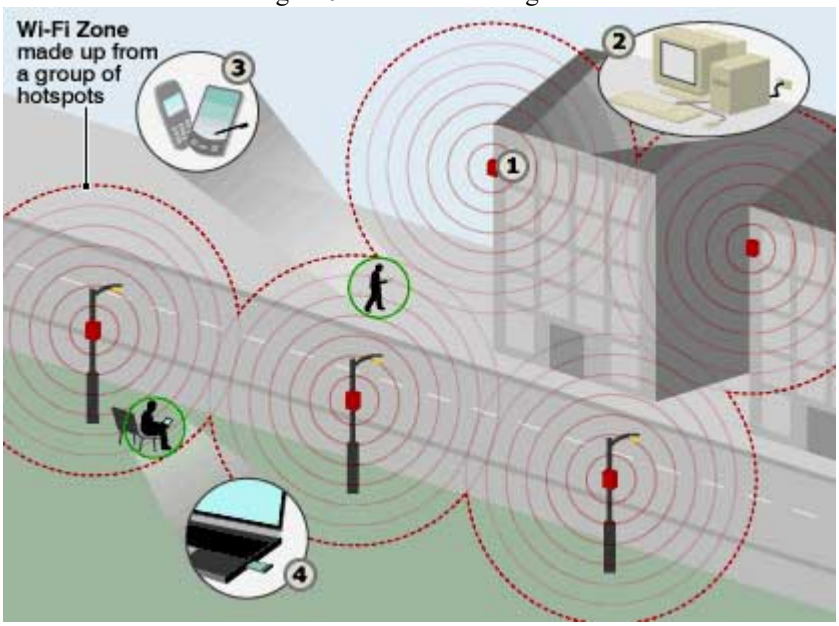
The approach for city-wide Wi-Fi is that MGS will invest in building the Wi-Fi infrastructure including access points and associated hardware and software, and will provide fiber to each of the access points for backhaul purposes. However, MGS will have a neutral operator responsible for operating the Wi-Fi network and providing the raw bandwidth for it. This neutral operator will act as an operator of operators (i.e., tenant-based model who in-turn will offer Wi-Fi services from various telecom service providers). The MSI can offer additional value-added services such as music, videos, games, etc. over this Wi-Fi LAN network and can also use this network for 3G/4G offloading.

The Wi-Fi access points (APs) and multi-services digital kiosk will be connected using dedicated fiber optic infrastructure. Each of the Wi-Fi APs will have dedicated fiber counts that will connect back to the POP. For redundancy, the APs shall use wireless frequency for creating a mesh to ensure continuous communications in case of a fiber link not being available.

Wi-Fi network shall also include a Wi-Fi management software and application with a secure login procedure. The city Wi-Fi network shall also support mobility (i.e., people driving or walking within Salta will be able to access the Wi-Fi network on the move).

The overall concept of operations for city Wi-Fi is such that MGS will provide Wi-Fi as a service to its citizens. It will allow citizens to use Wi-Fi for various e-governance applications, use Wi-Fi with a one-time login, coupon based login or premium plan. The summary of the overall concept is shown in Figure 9.

Figure 9 - Wi-Fi APs Diagram



Data Center Expansion

The Salta Smart City project will represent a quantum leap in orders of magnitude regarding the present computing capabilities of MGS. The collective needs for data hosting over the next years and the size of data center requirements related to the growth of Salta Smart City will soon outgrow the present capacity, even in required physical space. Hence, it becomes necessary to forecast the Data Center needs for at least the upcoming five (5) years, taking into consideration factors such as technology obsolescence and different growth scenarios. For efficiency and data safety, cloud services should also be considered, especially when e-government applications are at stake. Some alternatives to be considered are:

a) Expansion of one of the existing data centers and

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

c) Analyze the possibility for a cloud option combined with the current expansion satisfying the expansion needs. The Contractor should examine public, private, and

hybrid cloud options for both cost and security to gain a better understanding on how this office incorporates cloud storage into their planning

From a physical perspective, the data center is going to be an office-grade multi story building whose lower level floors will be used to house data center active equipment like application servers, Ethernet switches, IP communications network, for Salta smart city operation, and higher level floors will be standard office space used for the smart city control center (SCCC).

For the proper open settlement protocol (OSP) design of city communications network, the physical aspect of the Data Center is more important and shall cater for the following:

- The Data Center will serve all communications and service needs of the whole city of Salta
- The Data Center could also have a collocated Primary POP hosting communications network active and passive equipment
    - It is highly recommended to have a standalone building fully owned (not shared), controlled and monitored
    - It shall have separate floors or rooms for different job functions of SCCC like Network Operations Center (NOC), Data Center Operations Center (DCOC), Network Security Operations Center (SOC) and Security and Facility Operating Center (SFOC) and Smart City Control Center (SCCC)
- For citywide operations, space needs to be allocated based on the size and the number of Smart Services to be provided within the city of Salta. A minimum Tier III Data Center is recommended for running Smart City Services

Based on the proposed Smart Services for Salta Smart City for the next seven to ten years, it is assumed it will occupy at least 20 Racks within the Data Center Computer Room. A Tier III Data Center it will require at least a 100 square meters space that would include the computer room and the ancillary spaces for the Data Center. The total power required for operating such a Data Center is approximately 240 kW.

Salta e-Governance and Enterprise Resource Planning (ERP)

As part of the MGS e-Governance and Enterprise Resource Planning (ERP) systems, multiple applications will be provided for both citizen facing and MGS specific requirements. The e-governance system broadly includes citizen-facing applications that will become the point of interface for the citizens with MGS. The applications will be made available over different mediums including citizen application, portal and website. Further, the ERP system will effectively be the backbone for MGS that will enable efficient and integrated operations and maintenance of the city. The ERP system will be closely integrated with the e-governance system and will become the main system used by MGS for city governance and operations.

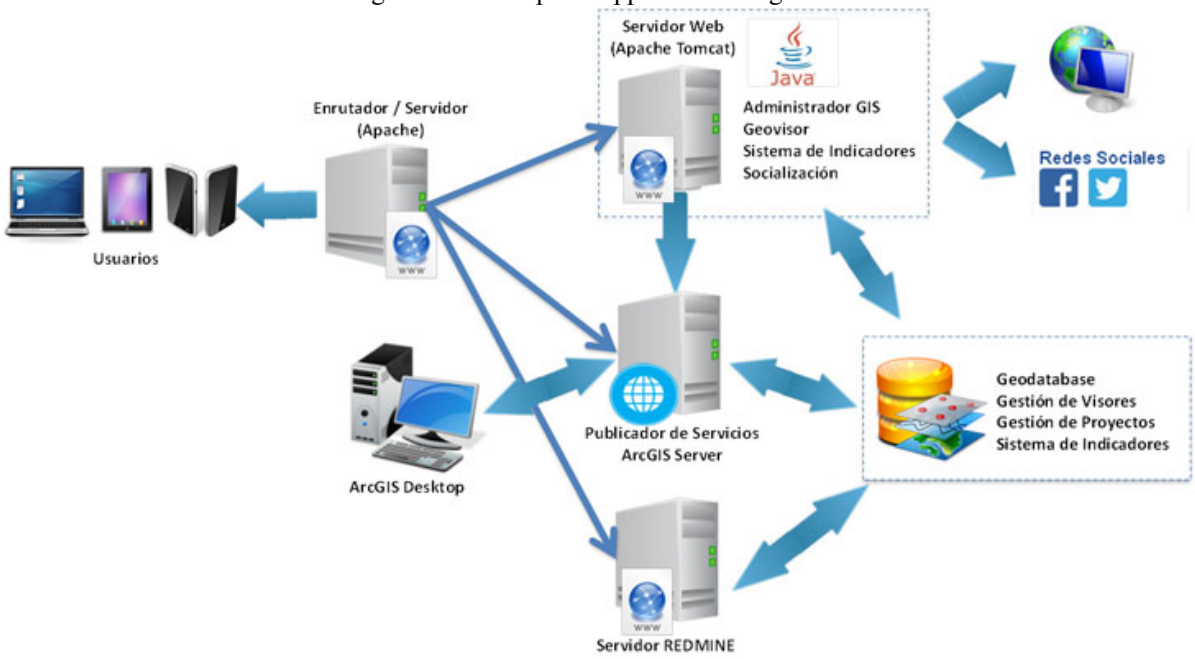
The ERP system shall be required to be implemented to automate the internal business functions at MGS. The ultimate goal of ERP is to create one holistic system, which allows MGS to be lean and efficient in their business processes and functions and provide 100% online services to the citizens. Since Salta is bound to become a smart city, most of the key functionalities available in standard software shall be configured meeting the business requirements in key functions of MGS. Besides the standard state-of-the-art ERP system, functionalities like Document Management System, Portal for customer communication

(Service requests/Complaints), Bespoke solutions for e-Government functions, web enablement of GIS foundation layer, and SOA based integration framework for integrating various application systems, etc., are required to be developed/customized (see Figure 10).

Main system components for ERP:

- MGS Institutional Website – there is an existing website which will be revamped as part of this Project (http://www.gobiernodelaciudad.gob.ar);
- Customer Facing Systems: Multi-Channel Communication Center for citizens, Portal, e- governance functions, m-Governance Functions, Social Governance, Web based GIS layer, Digital Locker, citizen smart card, Kiosk and Mobile Applications, Management Information System along with KPI and Dashboards;
- Back office Systems (i.e., ERP: Comprising of Finance and Accounts, Purchasing, budgeting, contract management system, Asset Management, Electricity and water connection, Billing, Maintenance, Projects, Stores, HR and Payroll);
- Framework for integrating various applications;
- Foundation Layer: A SOA based integration solution, document management system, will be an integral part of the overall solution.

Figure 10 – Enterprise Application Integration



The vision of MGS is to use IT towards establishment of people-centered, responsive, well-governed functions and to provide a single, easy, secure, and reliable means of access to municipal information and services to the citizens of this area. A Citizen Facilitation center, multi-services digital kiosk, mobile application and website backed with an integrated portal are the front-end of these applications.

At the core of the stakeholders service experience will be MGS portal, which will be a gateway to various stakeholders including citizens. The portal will have an intuitive user interface for rendering various services and providing role based access to various systems in use. Through the portal, any user can seek service, status check on service request, lodge an incident/complaint, get information, and provide suggestions. It is envisaged that the citizen

shall interact with MGS via the portal, which shall direct the query/grievance to the relevant department using workflows.

The face-to-face contact point for the citizens will be a Citizen Facilitation Center (CFC). Trained employees of MGS would man the Citizen Facilitation Center. These employees shall assist the citizens with information, application or complaints. The employees shall also take care of e-mail, postal service letters and phone calls. The employees shall log into the portal and conduct the business required for the citizen. The CFC may be used to verify and upload documents to the digital locker.

E-GOVERNANCE

MGS recognizes the importance of Information Technology (IT) to enhance the efficiency and effectiveness of service delivery to citizens and stakeholders. As such, MGS has set up a vision to develop a fully digital organization by comprehensive deployment of IT across its departments of conduct business. As part of the vision, it has been envisaged to implement electronic delivery of MGS services to citizens for greater efficiency, transparency and accountability. Intent is to allow citizens and stakeholders to access and use MGS services online in order to provide ease of use and promote paperless and digital platforms. The following modules shall be implemented as part of envisaged e-Governance solution of the MGS:

- **Institutional Website:** to provide useful information to citizen and stakeholders
- **MGS Portal and Mobile Applications:** It shall provide a gateway to all stakeholder experience including citizens.
- **Citizen Facilitation Center (CFC):** It shall provide in person contact point for all citizens
- **Trade Licenses:** It shall be an online module for periodic review and approval of licenses
- **Right to Information (RTI):** It shall provide information to accept applications, register requests, disposal to relevant department, track status, maintain an appeal register and status of appeals
- **Legal – Related to Land only:** It shall assist the legal cell of MGS to monitor and analyze all land related cases and expenditures
- **Citizen Grievance Redress:** It shall be an online module for citizens through MGS portal and mobile application to register and track all public grievances associated with MGS functions
- **GIS Platform with Web GIS:** It shall consist of implementation of GIS Map of Salta, which shall be a common platform across all MGS solutions. It shall also include web enabled version of the GIS map shall be implemented for citizens and MGS employees
- **Management Information System (KPI Dashboard):** Performance management framework shall be implemented to demonstrate 'Open Data' initiatives
- **Digital Locker:** It shall be an online file storage facility for citizens and businesses
- **Smart Card System:** citizens, workers and businesses shall use this Smart System as a digital identity

- **Automated Building Plan Approval System:** Online solution to MGS for building layout plans scrutiny.

All the above-mentioned modules shall be closely integrated with the back-end ERP system to perform as one cohesive and holistic system, which shall play a vital role in electronic and automated service delivery to citizens. Considerable encouragement shall be provided to citizens and businesses to adopt digital and online services.

INSTITUTIONAL WEBSITE

The MGS institutional website is the face of MGS and shall present Salta to various stakeholders. It will be accessed by citizens, investors and private sector alike and shall provide factual and attractive information to investors. The Institutional website should clearly communicate a sense of 'identity' at first glance.

MGS's website should serve as a cutting-edge communication tool that clearly conveys its mission, vision, offerings and purpose. The site shall help citizens to better understand and engage with the MGS's mission. The website shall be a useful tool for the target audience, while being visually appealing, user-friendly, and state-of-the-art. It must allow easy navigation. The site must have an attractive mix of text, images, audio and video. The website should:

- Increase traffic and visitor engagement through architecture, design, and other features such as social media integration
- Help visitors easily understand the MGS's mission and obtain information about Salta's offerings
- Deliver content concisely and clearly. This content includes dynamic information

The Institutional website should have links to login for visitors, residents and employees. This login shall redirect the user to the portal with rights to view or transact as per user status.

The home page shall be clean and visually compelling that quickly conveys to the visitor, the MGS's mission and what the MGS does. This shall include dynamic 'Call-Outs' which highlight what's new on the website as well as information sliders.

City Surveillance System including Automatic Traffic Counters and Classifiers (ATCC)

As part of the project, an all IP based video surveillance system shall be deployed across strategic areas of the Salta. The objective of the surveillance system is to provide an integrated platform for enabling real-time communication between multiple departments responsible for safety and security across the city while creating an interactive response management system. Surveillance cameras shall be installed at all strategic locations including roads, intersections, public spaces/buildings, and other critical/sensitive facilities like MGS City Hall Building, MGS Command and Control Center (CCC) Building and POP Rooms. All video captured from these locations shall be transmitted back to the MGS Command and Control Center (MCC) for live viewing and performing pro- active monitoring and response management activities as part of city administration.

The primary purpose of the CCTV surveillance system shall be to provide proactive security as opposed to reactive security. This means that for every CCTV camera that will be installed as part of the project, there will be a certain objective. This objective may include – monitor, recognize, or detect. The CCTV surveillance system shall leverage city's fiber optic network

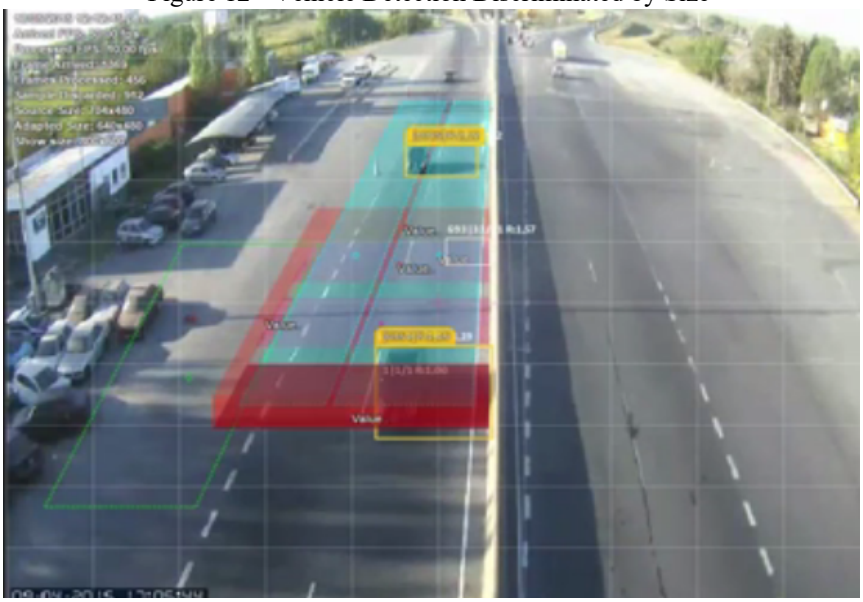
for communication. All recording of the CCTV surveillance system shall be in such a way that there is no single point of failure. CCTV surveillance system shall support both edge analytics and central video analytics. It will be necessary for the cameras implemented as part of this project to be rated for outdoor installations and depending on the objective/application, shall be of different configurations (i.e., PTZ, fixed cameras).

Throughout Salta i.e. along city roads, intersections and at the entry/exit points of the city, CCTVs shall be co-located with the street light poles and Wi-Fi access points, as shown in Figure 11.

Figure 11 - Street Lights, Cameras and Environmental Sensors

Along with CCTV Cameras, Automatic Traffic Counter and Classifier (ATCC) sensors shall also be installed at all entry/exit points of Salta. ATCC shall be capable of automatically counting and classifying all types of vehicles under all lighting conditions, as shown in Figure 12.

Figure 12 - Vehicle Detection Discriminated by Size



As the CCTVs shall be co-located at the street light poles, the same switch (as used for Wi-Fi) shall be used to backhaul to the CCC via dedicated fiber optic infrastructure. For connectivity, CCTVs will be connected to the nearest Point of Presence (POP) through a dedicated switch and fiber optic infrastructure. At the POP, there will be dedicated infrastructure like Network Video Recorder (NVR) that will be connected to the CCTV surveillance system for real-time recording purposes. Further, using the fiber optic infrastructure, real-time monitoring of CCTV surveillance videos shall be enabled at CCC video wall and workstations.

Multi-Services Digital Kiosks and Emergency Communications

Multi-Services Digital Kiosks will be deployed across Salta to give the citizens access to various services via one integrated platform. This will be a dedicated and fixed structure which will include Wi-Fi access point, emergency call button, charging points, solar panels, access to citizen services including capabilities to make payments for citizen services and bills using touch screen (see Figure 13), static advertising around three (3) faces, Smart Card Reader and CCTV. Multi Services Digital Kiosks shall be installed at strategic locations such as MGS building, public parks, Exhibition Pavilion, etc.

Figure 13 - Self-Service Terminal

The Multi-Services Digital Kiosks shall be connected with the CCC using the fiber optic infrastructure. A switch shall be housed inside each multi-services digital kiosk from where the data will be backhauled to the nearest POP over the fiber optic infrastructure. Visual Dashboards with similar capabilities will be installed outdoors in Smart Shelters in public places such as the one shown in Figure 14 mounted in one panel of a bus stop.

Figure 14 - Smart Shelter with Visual Dashboard

Environmental Sensors

Environmental parameters, specifically air and noise pollution, are a major concern for the citizens and administrators of any city. As Salta aspires to also be an environmentally sustainable smart city, integrated environmental monitoring stations comprising of various sensors (see Figure 15) shall be implemented in Salta. The objectives of the system include:

- An example of an integrated ambient air and noise pollution monitoring stations comprising of various environmental sensors for monitoring and trending of various ambient air and noise parameters, can be seen in Figure 16
- Tracking of Salta's contribution to environment with respect to these parameters and adjusting any framework for the city
- Environmental sensors shall be integrated with MCC for central monitoring and analysis
- Environmental sensor parameters shall be available through the City Portal and Applications for citizens as part of 'open data' initiative and to create citizen awareness

Figure 15 - Meteorological Station

Figure 16 - Sensor Diagram

Automatic Vehicle Location (AVL) System

For efficient city operations, it is essential for city operators to monitor the location of fleet of city vehicles. Specifically in the case of mission critical emergencies, vehicle tracking is imperative for a quick, prompt and efficient response. Through integration of AVL systems with city vehicles, response route optimization and calculation of response time for the city vehicles can also be done. This greatly improves the service of city operations.

The vehicle and resource categories to be covered under this package are:

- **Emergency Vehicles:** Fire, police and ambulances shall be tracked for ensuring dispatch can happen in a proactive manner
- **Municipal Vehicles:** Tracking of the water and other municipal vehicles shall be tracked to enhance efficiencies and improve decision-making. Process management of people, vehicles and other components involved shall be monitored
- **Solid Waste Management Vehicles:** Tracking of vehicles integrated with computer-aided dispatch

Components of AVL system include:

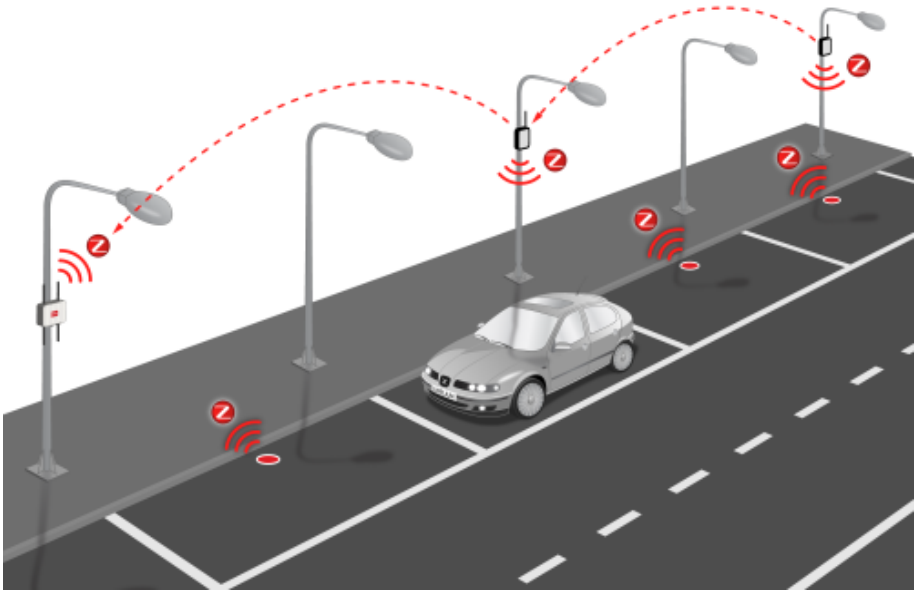
- On-Board equipment such as GPS antenna
- AVL application software for tracking and monitoring vehicles along with managing alerts
- Integration with CCC for vehicle tracking

Note that the AVL system software shall be common for all vehicles including solid waste, water, police, fire, ambulance, etc.

Advanced Parking Management

Advanced Parking Management will be deployed in Salta public parking areas and outside the buildings. Salta visitors, tenants and employees can use the advanced parking management to easily find an available parking spot and to pay for their usage. The sensors will detect free parking spots. Correlation of sensors will enable the generation of meter violations, as shown in Figure 17.

Figure 17 - Connectivity of Parking Sensors



Typical List of Sensors and or End Points to be monitored

- Sensors on parking spots (see Figure 18)
- New generation parking meters
- Video camera with analytics

Figure 18 - Parking Sensor

IP NETWORK CONNECTIVITY

For advanced parking management all the endpoints shall connect using an IP gateway that shall have the capability to connect to the Salta network using either wired network or wireless network. The connectivity can be one or more of the following types:

- GSM/ 3G/ LTE
- City Wi-Fi
- Smart city fiber network

The end points or sensors from the advanced parking management shall connect to the IP based router or gateway using 10/100/1000 PoE based Ethernet copper using Cat6 Cable and RJ45 Connectors. Some of the sensors can also connect using the integrated Wi-Fi network on the Gateway. The passengers can also use the Salta Wi-Fi Network on their mobile device to find a parking spot and get a turn-by-turn guidance to the available parking spot.

The end points or sensors from the advanced parking management shall communicate with their respective applications within the Salta data center using standard protocols like TCP/IP, Bacnet/IP, Modbus and DPN3. The devices shall also support protocols such as DHCP, FTP, HTTP, HTTPS, NTP, RTP, RTSP, SMTP, SNMP, SSL / TSL. The devices shall support quality of service, minimum DCSP.

CENTRALIZED MANAGEMENT

Different end points shall communicate to their respective application in the Salta data center to enable management and operations of the services defined for the advanced parking management. The services can be a combination of more than one application in the Salta data center that are but not limited to the following:

- LAN/ WAN/ Wi-Fi/ Security management server
- Digital signage manager
- CCTV management server
- Command and control server
- Data virtualization server
- GIS server

Other In-Facility Systems

BUILDING MANAGEMENT SYSTEM

Building Management Systems (BMS) will be implemented in all the POP rooms across Salta as part of Salta Smart City ICT components. Building management system shall provide a central platform over which various mechanical and electrical parameters of the building (e.g. power feeder system, HVAC, DG sets etc.) shall be monitored, controlled and automated in an integrated manner.

BMS shall be integrated with CCC for central monitoring and control of all the POP rooms from a single location.

ACCESS CONTROL SYSTEM OVERVIEW

Access Control System will be implemented in all the POP rooms and MGS Command and Control Center (CCC) as part of Salta smart city ICT components. Access Control system is intended to control physical access to the premises and detection of unauthorized access. Access control system shall be a combination of card based and fingerprint system along with attendance management system.

Access Control System shall be integrated with the BMS, which in turn shall integrate with CCC.

Solar Panel with Batteries

POLE MOUNTED SOLAR PV MODULE

The solar PV module shall include solar panel, controller, batteries, etc. and shall provide the primary power to all field devices (i.e., ruggedized switches) mounted on the existing

streetlight pole, as required to support the power connectivity needs of this Project. The Solar PV module shall be installed at all streetlight poles that have co-located field equipment.

IT Infrastructure

OPERATOR WORKSTATIONS

The operator workstations shall be specifically installed for the operators at the control center. Other than this, there will also be a need to provide regular workstations. The specification for all the workstations (including operator workstation) shall be common. The only difference between an operator workstation and a workstation shall be that for an operator workstation, the workstation unit will be installed at the rack room.

OTHER IT INFRASTRUCTURE

Other IT infrastructure that will be required is:

- Communication cabinets with racks
- Servers
- Uninterruptable power supply (UPS)
- Data security
- Databases

Hosting – On-Premises and Cloud

Hybrid cloud architecture is the integration of on-premises resources with cloud resources. For most organizations with on-premises technology investments such as MGS, operating in a hybrid architecture is a necessary part of cloud adoption. Migrating legacy IT systems takes time; therefore, implementing a hybrid strategy that optimizes use of on-premises hardware and software is important to simplify operations and more easily achieve results.

The hosting requirements of the project shall be met via a hybrid architecture that includes:

- On-premises and
- On-cloud

Overall, the objective of this architecture is to optimize the number of on-site servers without compromising the overall performance of the system. The MGS through a cloud service provider shall provide the hosting infrastructure (i.e., servers with OS for hosting all applications and services that will be implemented on-cloud). The following indicative systems are envisaged to be hosted on-cloud:

- ERP
- e-Governance
- Smart city platform (Historian)
- Solid waste management, CAD and all AVL systems
- Environmental sensors

For the above-mentioned systems, additional servers will be required for local processing and storage as per the respective solution. Apart from the above-mentioned systems, all other systems will be hosted on-site. For all hosting on-site, the MGS will provide the required

infrastructure as part of the project. The server specifications are part of the IT Infrastructure. Detailed hosting requirements in terms of servers and storage that will be required for hosting the respective applications and services on-cloud shall be determined according to the storage/processing requirements. Details on the bandwidth requirement of the connectivity link required between Salta and the respective cloud service provider facility should also be defined. The MGS is required to provide an overall solution meeting the below mentioned minimum requirements for various applications. It is expected that all applications for on-cloud hosting shall support cloud-ready architecture.

Smart City Control Center (SCCC)

Salta Smart City Control Center (SCCC) will be the 'nerve-center' of the city of Salta that will assist in enhancing efficiencies of city operations and management. The SCCC will help in making the city operations intelligent, integrated and efficient.

The SCCC leverages information provided by multiple city systems, which further helps in providing an integrated, seamless, proactive and comprehensive response mechanism for day-to-day city operations and challenges. It includes the city command and control center with the necessary hardware and software to support city operations. An essential feature of the SCCC is a smart city platform, which is a combination of system layers that when combined make use of Big Data, ICT and other infrastructure, advanced computing, analytics, and visualization to enhance a city's intelligence while normalizing the data. In addition, it provides a tool for the city to better manage the services it provides to its citizens.

There are a number of functions and systems that will be managed out of the SCCC. Depending on the type of system and the respective functions, they may be monitored and/or controlled from the SCCC, and will have the option of sharing a feed to another agency as required via the SCCC. The electrical, street lighting, water and wastewater systems will be provided by third-party vendors. These systems will be SCADA based using their respective individual system deployments and will only be integrated at the SCCC for critical alarms and functionality. It is not expected that there is an entire duplication of these systems for the purposes of monitor and control at the SCCC. As part of the SCCC, there are few components that are also required:

- **Applications and Web Browsers** – Multiple software applications shall be a content input into the ACC Systems
- **Audio System and Speakers** – A system of audio components to provide annunciations in the operations and boardroom spaces within the ACC
- **Boardroom Display** – Large format LED monitor shall be provided in the boardroom
- **Call Center** – A 24 x 7 Call Center shall be setup to support city operations. The call center shall have the capability of expansion as required to support City Services
- **CATV** – Cable TV shall be an input source into the ACC Systems. This content source shall be managed by the DCMS and be available anywhere in the ACC. Inputs such as weather, news, etc. can be obtained via this CATV feed
- **City CCTV Cameras and ATCC** – These are the primary video inputs into the Video Systems

- **City Managed Systems** – Content for a number of city systems to be managed and monitored at the ACC
- **Cloud and Disaster Recovery Site** – Are external to the City limits and used for system applications and data storage for some of the systems
- **DCMS** – The Display Content Management System shall manage all networked visual content throughout the facility, including the video display wall and the boardroom display. This system will manage a dashboard for City Management Systems to be displayed and monitored on the video wall
- **Monitors** – Consist of operator monitors, cabin monitor, and other displays that are connected to the ACC network
- **Network Video Recorder (NVR)** – Network video recorders shall be dedicated for recording and archiving of camera video
- **Operator Workstations** – These workstations shall be dedicated for ACC System use at the operator consoles. They are the point of control for the various systems at the ACC
- **Smart City Platform** – Various smart city dashboards, Key Performance Indicators (KPI's), and analytics that is available as display visuals to aid city operations and better manage the City. This platform will also input and output feeds from other systems and agencies such as fire, education, healthcare, etc.
- **Video Display Wall** – The Video Display Wall shall be located in the Operations Room and shall be the primary visual display for operators at the ACC
- **Video Management System** – The Video Management System shall manage CCTV streaming video, PTZ control, and video archiving

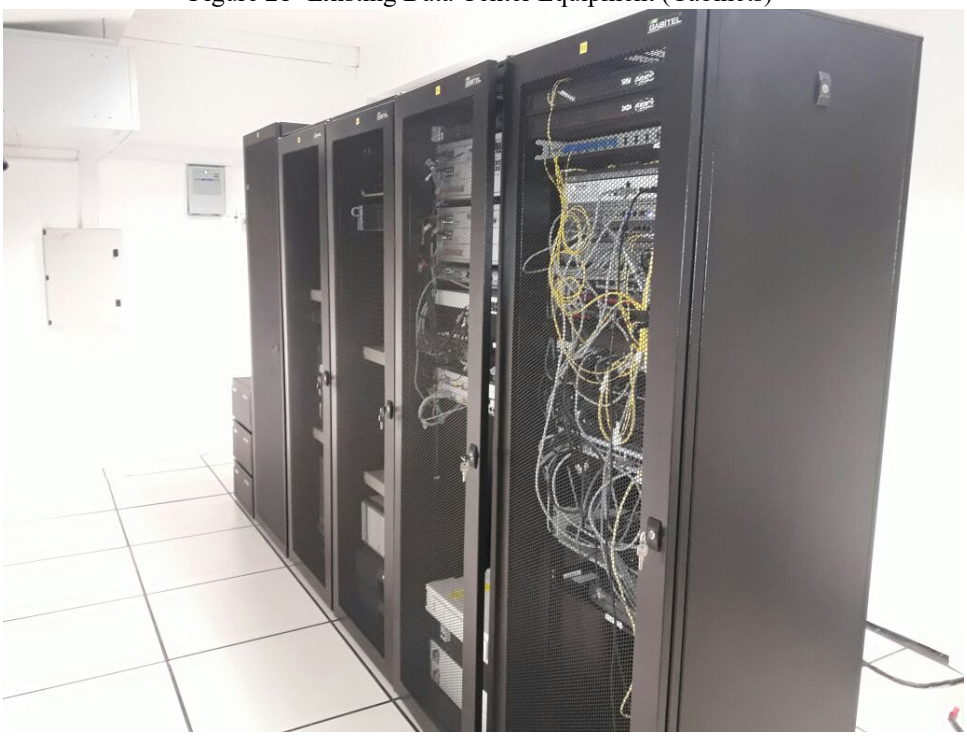
Existing Equipment

Besides the existing Metropolitan Fiber Optic network, MGS presently has some equipment that could possibly be used to implement the Salta Smart City project. The DM Consultants had the opportunity to visit the data center and noticed some of the ICT equipment presently in use by the ICT Sub Secretariat. Manufacturers of the ICT equipment in the data center include IBM, Hewlett-Packard, Dell, Fortinet AMP and Cisco. Below are photographs of the existing equipment:

Figure 19 -Existing Data Center Equipment (Servers)

Figure 20 - Existing Data Center Equipment (Racks)

Figure 21 -Existing Data Center Equipment (Cabinets)



III. MUNICIPAL GOVERNMENT OF SALTA COMMITMENT

In November 2016, the MGS contacted the U.S. Embassy in Buenos Aires seeking assistance with its plan to expand the city's fiber optic network. The request was submitted to USTDA, and as a result, the DM Consultants arrived in Salta on June 19, 2017, for a preliminary assessment of the project.

As described in Annex II of this Volume, during the meeting with the DM Consultants, the MGS officials expressed interest and commitment to expanding the fiber optic network and building a smart city. In that regard, Mr. Martín Güemes, Secretary for Modernization, pledged MGS's commitment during the discussions and at closing of the meeting. Moreover, Ms. Constanza Figueroa, Subsecretary for International Cooperation, the official assigned to coordinate the project proposal with the DM Consultants, has consistently delivered on time the information requested by the DM Consultants. Ms. Figueroa has also followed up a number of times to ensure that the submission of the project proposal is on track.

Moreover, the MGS has published extensively in its online newsletter the efforts that it has made to date and its plans to provide and improve its citizens' access to the Internet. The expansion of the fiber optic network has been a political priority for some time as evidenced by the number of stories published in the local and national newspapers regarding the implementation of REFEFO and its expansion in the province.

Furthermore, at the provincial level, Governor Juan Manuel Urtubey has taken specific steps to demonstrate Salta's commitment to the country's modernization efforts. On April 18, 2017, the Governor was one of 13 provincial leaders who signed the National Commitment for State Modernization in a ceremony with President Macri. The ceremony, which took place at the

National Palace, can be viewed at the following link http://www.salta.gov.ar/prensa/noticias/salta-suscribio-el-compromiso-federal-para-la-modernizacion-del-estado/51849.

MGS has already carried out some of its modernization goals, among them open government and transparency measures.

IV. POSSIBLE SOURCES OF PROJECT FINANCING

After an adequate diagnosis and feasibility study, the project will be presented to various national and international cooperation agencies for funding.

An important fact to note is that the initiative is in line with REFEFO, which, as mentioned above, the federal government is deploying throughout the country to close the economic development and opportunities gap between large urban centers and small towns. Also, as mentioned above, the province of Salta is part of the Belgrano Plan, a social, economic development and infrastructure program that the federal government set in motion to pay back what is considered a historical debt that Argentina has with the 10 Northern provinces and their populations. The federal government based its decision on a number of inequality economic factors. That is, the northern region of Argentina has the largest number of poor households in the country with 77% or more unable to meet basic needs. The percentage of poor children living in the region is more than five times that of the City of Buenos Aires and almost three times of Patagonia's (Southern Region of the country). In addition, the Northern provinces have some of the lowest employment rates in the country, where Salta is no exception. As for economic progress, there are also factors that inhibit the development of the area. For example, it is not easy to export goods produced in the Northern provinces. The average logistical cost for the region is between 30% and 40% higher than in the rest of the country. For example, for every three trucks of corn produced in Salta, shipped out through the port in the province of Rosario, the profits of one truck are used solely to pay the transportation cost of the other two trucks. Against this scenario, the authorities involved in the Belgrano Plan, in coordination with the relevant federal ministries, are identifying external funding sources for priority projects in the region.

Domestically, an additional funding source is the Federal Ministry of Science, Technology and Innovation and its associated agencies, which have a wide range of financing instruments to support innovative and technology projects, research in science and technology, training and repatriation of human resources, infrastructure modernization and equipment.

Moreover, there are a number of funding opportunities with multilateral financing organizations that the MGS intends to approach to request funding for the project. As mentioned above, since 2012 the City of Salta is part of the IDB's ESC**,** which is a technical assistance program that provides support to central and local governments in the development and implementation of urban sustainability plans.

ESC employs a comprehensive and interdisciplinary approach to identify, organize and prioritize urban interventions that address the main obstacles to sustainable growth in emerging cities in Latin America and the Caribbean. This crosscutting approach is based on three pillars: (i) environmental sustainability and climate change; (ii) urban sustainability and; (iii) fiscal sustainability and governance.

The City of Salta is one of the 15 cities that participate in the ESC program and already has a published an action plan, which allows it to access financing of projects that have an appropriate feasibility plan.

The ESC methodology promotes the idea that well-planned, comprehensive and multi-sectoral urban development strategies can bring improvements to the quality of life and to draw a more

sustainable, resilient and inclusive future for the emerging cities of Latin America and the Caribbean. More recently, the Program has been working on strengthening the methodology, including issues related to local economic development, competitiveness and the creation of productive employment. This update will facilitate a more robust analysis of the local economy, allowing better identification of strategies to promote sustainable and equitable economic development at the city level. The Salta smart city project complements and enhances the efforts already underway through ESC.

Financing from the Development Bank of Latin America (CAF) is also another funding resource that will be considered for the implementation of the project. CAF's Latin American Network of Governance program promotes strengthening the public sector and management leadership to enhance governance. The program focuses on training civil servants and increasing citizens' participation. More importantly, CAF also addresses specific urban problems and telecommunications needs, with a program called TICAF**,** which is aimed at preparing Latin America countries address t sustainable development and information-oriented society.

TICAF develops regional studies on telecommunications infrastructure, as well as on software applications and industry businesses. The program also identifies business opportunities in leading technologies in the telecommunications sector, such as design and operation technology of satellites and radar technologies. It provides financial and technical support to countries that face entry barriers to regional markets. In conjunction with transport- and energy-related infrastructure, TICAF supports financing of fiber optic networks including cable ducts, when building highways or power lines that can also provide connectivity and universal access (voice, Internet and digital television) to remote populations. This approach allows TICAF generate savings in construction and operational costs.

The MGS also plans to approach the World Bank as the multilateral financial organization is already working with Argentina in modernization and innovation projects that improve public services.

The work of the World Bank Group in the ICT sector aims to empower people in social, economic and political terms to reduce poverty and a balanced distribution of resources. The World Bank has financed several projects that have provided Internet access and mobile technology to remote areas, created jobs, and improved efficiency and transparency in the public sector. Some recent examples of the World Bank work can be found at the following link: http://www.worldbank.org/ict.

Lastly, another project financing option that can be explored would be to structure the project under a public-private partnership initiative**.** In principle, MGS would obtain financing to pay for the project deployment, reducing the risks to private parties, which in turn would be responsible for the maintenance, upkeep and possibly operations of selected components of the project.

V. POTENTIAL FOR U.S. EXPORTS AND FOREIGN COMPETITION

Most of the companies providing goods and services for this type of projects are from the U.S. and their market share in Argentina is high. It is also important to point out that American companies are already well known and are providing services in the country. For instance, the current MGS data center uses technology developed by IBM, Dell and HP.

While the DM Consultants have not visited smart city locations in Argentina or other integrated operational centers, we have knowledge of the equipment, hardware, and software that are used in these types of centers. We know that U.S. manufacturers are prevalent and essential in this area. There are various approaches to smart cities and each one is slightly different from the other, but what they have in common is a core focus on infrastructure, IT hardware and software for which American products are often the first choice. Smart cities also have a large reliance on sensors, cameras, GPS and IT equipment to help with the identification of problems and make sure the right resources are available.

The network and operations center envisioned by the MGS is heavily based on IT equipment, sensors in the roads, buildings, cameras, to enable the city to be more efficient and effective in traffic monitoring, and provide immediate resources for emergency, health crises, and disaster management.

The cost of expanding the Metropolitan Fiber Network could be in the order of ARS75M (US$5.7 million). The data center upgrade could be in the order of ARS243M (US$15.3 million) and the Smart City hardware, software and installation about ARS145M (US$9.1 million). The export potential for U.S. producers of hardware, software and services would be US$2.8 million for the expansion of the fiber optic metropolitan network, US$12.9 million for the data center upgrade and US$7.5 million for smart city hardware, software and installation for a total of U$23.3 million in exports estimated (Table 1). Full detail of the breakdown of these estimates may be found in Annex B.

Table 1 - Estimated Costs and Export Potential for the Salta Smart City Project

Total Costs and Export Potential, 3 subprojects				
Item	**Total Cost ARS**		**Total Export Potential USD**	
Fiber Network	$	75,147,693	$	2,819,495
Data Center Upgrade	$	243,182,550	$	12,909,450
Smart City Equipment	$	144,952,350	$	7,522,380
Grand Total 3 subprojects	**$**	**463,282,593**	**$**	**23,251,325**

The DM Consultants believe that U.S. technologies will continue to be very competitive for future smart city projects; as well as integrated operational centers that rely on expanded data centers. A number of U.S. products continue to be viewed as best in class for most major equipment required for data center construction. Many of the data centers we have 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.

U.S. firms are very strong in the ICT sector. Those that might bid on RFPs for this project include:

- Fibertronics, DuPont (Optical Fiber)
- GE (Smart Building, Smart City Infrastructure, Intelligent Lighting & Public Building Monitoring)
- ESRI and AppGeo (Geospatial Software and applications, GIS services)
- Hexagon/Intergraph (Geospatial Software and applications)
- Rhythm Engineering (Adaptive Traffic and Signal systems)
- Climatronics (weather sensors and components)
- McCain Inc. (Traffic controllers)
- Siemens USA (made ACS-Lite adaptive control under contract for the FHWA)
- IBM (Smart City Infrastructure, servers, application software, and cloud services)
- Cisco (Network Infrastructure, wireless, data centers)
- HP (servers and storage, and cloud services)
- Dell (servers)
- Hitachi (Servers)
- Oracle/Sun (Database, BI, Storage, and Cloud services, adaptive traffic control signals)
- Microsoft (Data center Software, Database, OS, Smart City, and Azure cloud services)
- VMware (virtualization software, data centers)
- BMC Software, Inc. (Infrastructure software)
- CA Technologies (Infrastructure software)
- Cloudflare (web performance and security)
- Xterra Solutions (cloud services, optical networking platforms)
- Sensys Networks (Traffic Detection Solutions and Wireless Sensors)
- Transcore (integrated traffic management systems, RFID)
- Ciena (consulting on intelligent networks, software and services)
- Blue Planet (broadband, network virtualization, orchestration, and management software)
- Amazon Web Services (AWS)
- Google Cloud Services and software
- American Traffic Solutions, Brekford Corp., Redflex Traffic Systems Inc., Vigilant Solutions (Automatic Enforcement Solutions)
- Aventura Technologies, Inc., Mango DSP Ltd., Diamond Digital LLC, (Video content Analytics, Cameras)
- Eaton Corporation, Schneider Power Inc., Chatsworth Products, Inc., S&C Electric Company Inc. (Power supply & Generation, data center components including power distribution, cooling, and fiber guides)
- Fortinet, McAfee, Norton, and Symantec (Security Systems & Software)

Other U.S. firms that manufacture equipment that could be used in the project and might interested in bidding include Qualcom (Wireless and Cellular), Motorola (Portable radios with GPS, battery chargers, mobile terminals with GPS, Repeaters); 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); Underwriters Lab, CH2M, Sensus, Itron (Smart city Infrastructure), AMD and Intel (CPUs

and servers); 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, U.S. firms in the ICT sector are very competitive. Several U.S. suppliers with Argentine operations contacted by the DM Consultants are open to providing supplier financing: Cisco, Oracle, EMC, IBM, Dell, and Hewlett Packard. Most U.S. suppliers have subsidiaries in Argentina and market entry should not be an issue for them.

VI. FOREIGN COMPETITION AND MARKET ENTRY ISSUES

Potential foreign competitors could include the following companies:

- Transportation Research Lab
- Jenoptics
- Axis Communications (CCTV cameras, video encoders)
- Mirasys
- Sydney Coordinated Adaptive Traffic System,
- Swarco (urban transport management systems)
- Huawei (Network Infrastructure)
- Lenovo (Servers)
- Hitachi (Storage)
- NEC (Storage, servers, telecom)
- Alcatel Lucent (Network)
- Videotec (traffic management systems)
- ZTE (Network)
- SAP (BI)
- BMW
- Kaperski (Security software)
- Allied Telesis
- Siemens (Network)
- Fujitsu (Network)
- Gill
- SuperMicro
- Samsung
- LG
- Benq
- Hikvision
- Dahua
- ATOS
- Furukawa
- MikroTik
- Alvarion

VII. DEVELOPMENT IMPACT REVIEW

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, the DM Consultants evaluated the development impact from the USTDA Development Impact Criteria. 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.

After a careful review of the USTDA Development Impact Indicators and a discussion with MGS the the following USTDA Indicators have been chosen.

Telecom	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.)	N

While this indicator appears to be a good way of gathering metrics, it also might not be a good indicator for the Salta Smart City project. Although the Salta Smart City network will be used directly by the population, which will only occur in very specific situations. Baseline: 0

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	N

Additionally, MGS has also selected the following indicators to more closely evaluate and monitor the smart city components of the program:

Dimension	Category	Indicator
Environmental Intelligence	Infrastructure	City Buildings with sustainability certification (LEED)
		Percentage of commercial and industrial infrastructure with intelligent counters
		Percentage of homes with intelligent counters
		Percentage of clean energy (hydroelectric, nuclear, geothermal, solar and others) over total energy usage
		Legislation to improve energetic efficiency
		Electric energy consumption (kWh) per inhabitant per year
	Carbon Trace	CO2 emission per capita in Tons/Year (total emissions)
	Air Quality	Average daily concentration of NO2 (µg/m3)
		Concentration of fine particles (µg/m3)
	Waste Generation	Total volume of solid waste generated by the city, in kg per person per year
		Percentage of recycled solid waste
	Water Consumption	Total water consumption per capita (liters/day)

Dimension	Category	Indicator
	Urban Planning	m2 of usable green space (urban) per inhabitant (excludes rural areas)
		Number of trees in urban spaces
		Existence of resilience plans and adaptation to climate change
Smart Citizenship	Citizen Involvement	Electoral participation
		Number of registered third-sector organizations
	Universal Accessibility to Internet	% of households with Internet access
		Number of free Wi-Fi hotspots
		% of active population in social networks
		% of population with smartphones
	Education and Culture	Number of universities
		% of population with higher education
		Number of museums and art galleries
Smart Transportation	Security	Number of traffic accidents per 1,000 inhabitants
	Efficiency	Number of kilometers of bicycle roads, per 100,000 inhabitants
		Number of charging stations for electrical vehicles
	Public Transportation	% of trips in public transportation/total number of trips
		Tariff integration of public transportation system
		Public transportation network density (m/km2)
		Number of metro stations per 100,000 inhabitants
		Number of active buses per 100,000 inhabitants
	Real-Time Tactics	Price definition as a function of demand (no indicator)
		Real-time information, for a score from 1 to 5 in the following categories: Bus, metropolitan trains, Metro, Rapid transportation system (Tram, BTR, etc.) and sharing modes (bike, car, etc.)
Smart Government	Institutionalism	(Polls)
	On-line Services	Bidirectional communication via social networks
		Existence of different information exchange channels between the administration and the citizen
		On-line finished procedures/total procedures
	Information Gathering and Processing	Diversity of sensors installed for monitoring the following categories, in a 1 to 5 scale: Pollution (air, sound, water), solid waste, emergencies and parking.
		Centralization of information gathering and processing.
	Open Data	Number of reusable open databases (excludes laws, regulations, etc.) with information from the last 3 years
	Privacy and Security	Security and privacy legislation, protecting citizens from the Administration and third-parties
	Emergency Attention	Number of ambulances per 100,000 inhabitants
		Number of firemen per 100,000 inhabitants
		Average response time to medical emergencies from the time they are reported (minutes)
		Number of policemen per 100,000 inhabitants
Smart Economy	Productivity	Number of new patents per year per 100,000 inhabitants
		GDP per capita (thousands of dollars)
	Work	Unemployment index
	Internationalization	Percentage of population born overseas/total population
		Number of airports
		Number of hotel rooms (thousands)
		Number of tourists visiting the city (millions per year)
		Number of international events (congresses and workshops) per year, validated by the ICCA
Smart Quality of Life	Universal Accessibility	Tactile floor plans for the visually impaired in government dependent infrastructures
		Public services for people with reduced mobility (ramps, elevators, electrical stairs, reserved parking lots, etc.)
		Audible communication in public services (acoustic signals at intersections, etc.)
		% of people with disabilities with work, in working age
		Adequacy of sidewalks for people with disabilities
	Health	Life expectancy at birth (years)
		Number of births
		Work legislation

Dimension	Category	Indicator
		Number of hospitals
		Online integration of medical services (electronic prescriptions, medical histories in the cloud, etc.)
		Number of suicides per 100,000 inhabitants
	Social Inclusion	Percentage of population in poverty levels
		Number of homeless people per 100,000 inhabitants
		Gini inequality index

Source: https://www.esmartcity.es/comunicaciones/herramienta-diagnostico-evaluar-smart-cities

VIII. EVALUATION STRATEGY

In addition to the benchmarks listed below to evaluate the success of the project, the US contractors will address the following items 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 MGS 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. The faster it is accomplished, the better managed is the MGS and the executing agencies.
- Bids received and winners selected. Metric: the percentage of total won by U.S. firms
- Purchases completed. Metric; time in months from selection of winning bids.
- Percentage of total software and equipment purchased provided by U.S. 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 metropolitan fiber optic network in operation. Metric: time in months from completion of construction. Includes time for fiber laying and testing.
- Full planned data center and SCCC in operation. Metric: time in months from completion of construction. Includes time for installing software and testing.
- Percent of MGS data center operations not previously integrated into MGS data center that now use the MGS data center (principal and backup). The higher the better.
- Number of partners sharing costs of municipal network and extent of cost reduction compared with MGS 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 U.S. firm's consultancy reports for the fiber optic network expansion, data center upgrade and smart city hardware/software procurement	8
3	Preparation of the RFPs for equipment, software, and services	4
4	Bidding process, including selection of winners	9

5	Expansion of the fiber optic network, installation of the Smart City Control Center and linking sensors in the field to each subsystem and the communication network	15
6	Acquisition and installation of data center equipment and software	8

In the first instance this timetable provides for the implementation of the project in four years. So, it should be considered that the project might go through two different municipal administrations.

Likelihood of development

As Salta is part of the IDB's ESC initiative, the likelihood of development of this project is very high. The Municipal Intendant will most likely remain in his post through 2019, and he is committed to develop the infrastructure works required to implement the Salta Smart City project. The involvement of the Secretary of Modernization as the leader in the implementation of the Project is also a highly positive factor.

Potential difficulties

The project needs to be introduced in the MGS budget for next year and although there is a firm commitment for it, the uncertainty about its approval could raise some concerns about its immediate implementation. In addition, Argentine parliamentarian elections this year might shift the political scenario, which could have an indirect effect in municipal governments due to an eventual struggle of power at the federal government level, notwithstanding the independence of the MGS.

Other entities needed to approve project

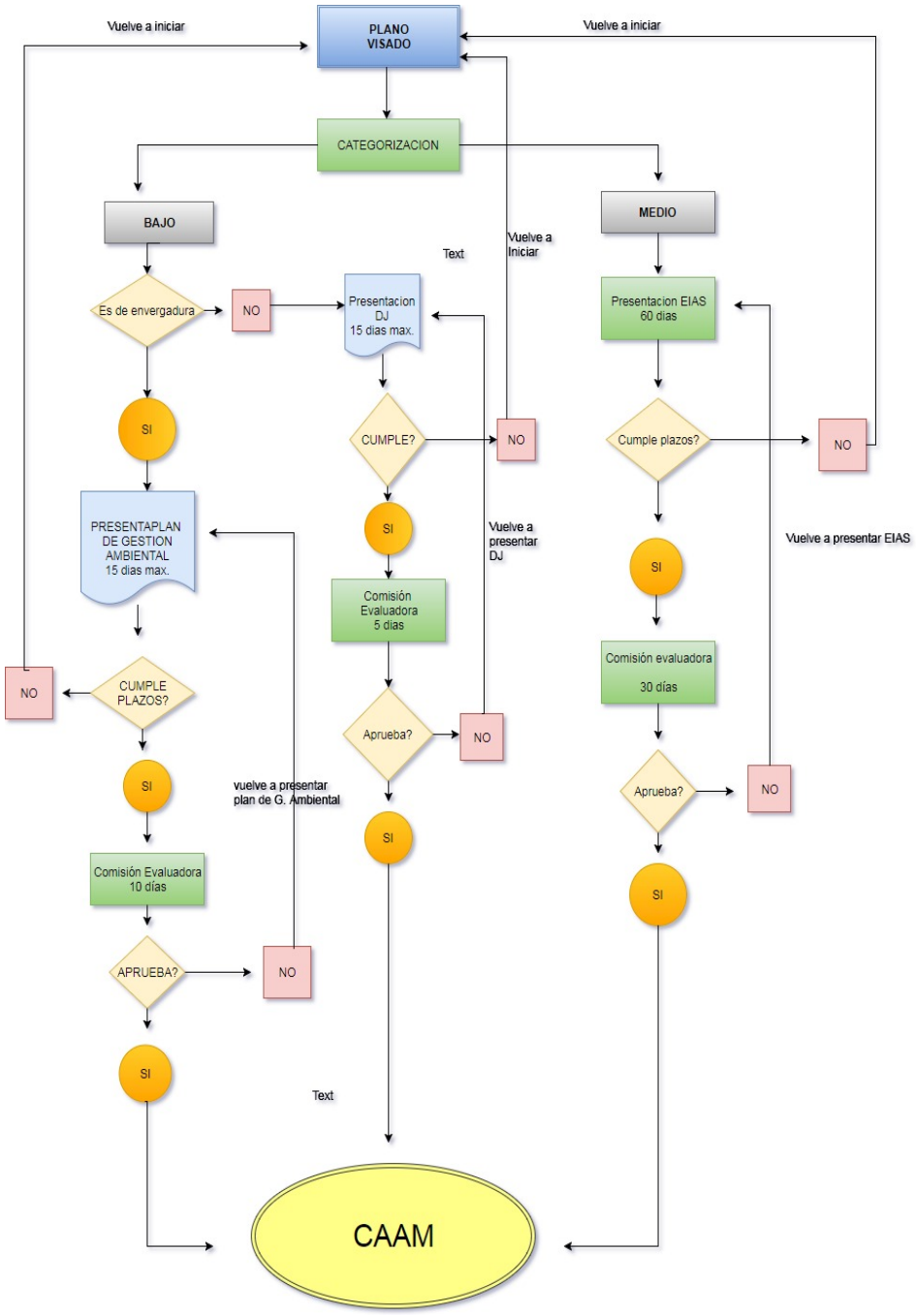
MGS's internal approval process is initiated by the department responsible for the project, in this case the Modernization Secretariat, which submits the project file to the General Intake Desk. The Modernization Secretariat will be in charge of the project from submittal through approval. Once a file number is assigned, the Legal Department of the Modernization Secretariat issues an opinion on the project's implementation legal feasibility and the regulations that apply. At the same time, an Executive Order (Intendant's Decree) to implement the project is drafted. This procedure is followed by a review of the different departments within MGS. The Finance Secretariat evaluates and analyzes the project's economic, financial, and budgetary feasibility taking into consideration the type of contracts that will be awarded. The Public Works and Environmental Secretariat also reviews the project, see Section IX below. Lastly, the General Secretariat conducts a closing legal review of the file and the proposed Executive Order for final authorization and approval by the Municipal Intendant.

Once the project is approved and is being implemented, digging or installation of cable networks through national or provincial roads might require approval by third parties. Depending on the case, authorization approval will be processed with the corresponding National or Provincial Roadway Directorate, which have a separate internal approval process.

IX. ENVIRONMENTAL IMPACT AND CLIMATE RESILIENCE

MGS has an established environmental impact assessment process for infrastructure works called the Municipal Suitability Certification ("Certificación de Aptitud Municipal" – CAAM). This process is based on Provincial Decree No. 7070 and Municipal Order No. 12745. In this case, the project will be submitted to the Public Works and Environmental Secretariat for review and approval. The Secretariat will verify the environmental impact and suitability and assign a classification of low, medium or high depending on the magnitude of the project.

If after an initial CAAM assessment and following USTDA's Climate Resilience screening recommendations, it is estimated that the expansion of the fiber optic network might have a low to medium environmental impact and, therefore, an in-depth analysis is warranted.



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. This screening would involve current and projected climate conditions and trends at proposed project location. The analysis would consider current climate trends and future scenarios at the proposed project location. The analysis will focus on those climate parameters that are relevant for certain projects. Climate screening should consider vulnerabilities to extreme events as well as longer-term changes. Screening will consider current and future conditions, bearing in mind the relevant timeframe for the project. The Grantee has determined that a climate screening is required and has requested that an in-depth analysis be conducted. It is envisioned that the in-depth analysis would be part of the Environmental Impact Assessment. The in-depth analysis will evaluate a

more complete range of technical, social, economic, and political aspects of climate risks, uncertainties, and adaptation options. It can consider alternatives and produce recommendations on how to best move forward with the project based on the assessment. The Climate Resilience analysis has been included in the project's TOR under the Environmental Impact Assessment section. This sub-section will include the information and answers to the results of the in-depth analysis that was conducted and its findings. These results will also include alternatives and recommendations on how to mitigate climate risks and maximize climate opportunities that were identified during the analysis.

X. IMPACT ON U.S. LABOR

The impact on U.S. labor would be negligible or positive. Argentine government data centers and broadband networks do not displace U.S. data centers such as those of Amazon, Microsoft or Google. For broadband networks, there is no displacement of U.S. facilities. Thus, the impact on U.S. labor is expected to be positive to the extent that U.S.-based firms provide equipment, software and services produced in the U.S.

XI. JUSTIFICATIONS & RECOMMENDATIONS

As this report has documented, the Salta Smart City project including the Data Center and Metropolitan Area Network expansion will have high developmental impact in the City of Salta. The benefits of the Salta Smart City project are many and varied, distributed in three main areas:

People

- Improvements in public safety
- Natural disasters (earthquakes) prevention
- Increased traffic efficiency
- Better implementation of public services
- Efficiency in care at public hospitals
- Monitoring in urban centers
- Educational centers applicability

Services

- Contributes to reducing climate change effects
- Improves waste collection services
- Incorporates warning system against natural disasters and accidents
- Better coordination between public agents during accidents
- System incorporates intelligent traffic lights

Public Management

- Increases public administration efficiency
- Incorporates efficiency in distribution of tasks
- Improves internal cybersecurity
- Increases use of electronic records
- Reduces use of paper in internal management
- Modernizes the spaces for customer attention
- Updates internal communication
- Helps to map new urban spaces
- Develops a diagnostic system for vulnerable areas

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 Argentine government agencies and U.S. 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, the DM Consultants recommend the funding of the feasibility study on behalf of the Municipal Government of Salta would represent a good use of USTDA resources.

XII. SUGGESTED EVALUATION CRITERIA

It is suggested that the selection of the U.S. firm for 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**

XIII. QUALIFICATIONS OF PROFESSIONALS IN SALTA SMART CITY PROJECT

Our analysis has shown that we would require a staff of 15 experts 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 (Data centers, hybrid fiber optic and wireless broadband networks, integrated e-Government systems, Smart Cities, Transportation planning, Definition of SLAs, economic and financial project analysis)
- Both a U.S. 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 data centers, broadband networks and integrated e-Government 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 with all stakeholders, including public sector entities and potential private sector partners
- Experience in working and leading multi-cultural and multi-disciplinary teams and with organizations in Latin America, Eastern Europe, Africa, Asia, and the Middle East
- Experience with project finance and in working with multilateral development banks, private or public sector banking institutions or other institutions that could help finance development 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 Spanish language skills, written and spoken is required

Senior GIS Planner

- At least fifteen (15) years' experience in the GIS industry
- At least ten (10) years' experience in Real Time Systems, Spatial Analysis, Location Based Services and Emergency Response Systems
- At least ten (10) years' experience in Systems Integration, including GIS with other expert systems and sensors.
- 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
- Spanish Language skills both conversational and written are preferred.

Junior GIS Planner

- At least five (5) years' experience in the GIS industry
- At least five (5) years' experience in Real Time Systems, Spatial Analysis, Location Based Services and Emergency Response Systems
- At least five (5) years' experience in Systems Integration, including GIS with other expert systems and sensors.
- 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
- Spanish Language skills both conversational and written are preferred.

ITS System Engineer

- At least fifteen (15) years' experience in the ITS industry
- At least five (5) years' experience in Adaptive Traffic Signal Control Systems and Law Enforcement Systems (bus lane invasion, over-speed, red light violation, illegal parking, turn violation etc.)
- Expertise in sensors and linking sensors to a data center
- Expertise in integration (legacy systems/equipment with new 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
- 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
- Spanish Language skills both conversational and written are preferred.

Video Contents Analysis Expert

- At least fifteen (10) years' experience in VCA – Video Content Analytics
- Expertise in hardware and software solutions to identify events in images, such as illegal parking, forest fire, flooding, car accident, incidents, illegal garbage disposal, lost child and others.
- Detail-oriented and able to prioritize
- Experience serving in technical consultative role
- Excellent ability to clearly explain advanced technical issues in manner that is easily understood
- Strong sense of personal responsibility and accountability for delivering high quality work
- Ability to work well both independently and on teams
- Spanish Language skills both conversational and written are preferred.

ITS Architecture Engineer

- Bachelor's degree (Master's preferred) in electrical engineering, computer science, Information Technology, or related field
- Some exposure to information and communication technologies, including fiber optic communication design, video systems engineering, traveler information, electronic payment, or traffic control systems.
- At least 5 years of experience in the transportation sector
- 5+ years minimum experience in ITS Engineering/Design
- Knowledge of Intelligent Transportation Systems including video display systems, camera control systems, signal systems, video distribution systems, dynamic message sign systems and connected vehicle technology.
- Experience with some of the following transportation technology: Advanced Traffic Management Systems, Connected Vehicles, Electronic Toll Collection, CCTV surveillance systems, electronic signage, traffic detectors, automated incident detection, video wallboards, transport based telephony, Automatic Vehicle Locators (AVL), Traffic Signals, Transit Signal Priority, Adaptive Signal Control and communication networks
- Experience with intelligent transportation solutions, traffic modeling/engineering and telematics is strongly desired.
- Good technical writing, analytical and communications skills essential, including ability to present concepts verbally.
- Working knowledge of Microsoft Office products, including Word, Outlook, PowerPoint, Excel, and Access is essential Experience with learning and operating new software systems is desired.
- Experience with databases and/or database design or querying using SQL or a reporting software a plus.

- Ability to develop and review engineering plans for ITS.
- Ability to apply general ITS planning and engineering principles to solve specific ITS-related problems.
- Ability to assist in the design and development or review of ITS concepts, including requirements analysis, technology review and selection, development and communication of operational concepts, specifications development, and testing.
- Knowledge of IT engineering guiding principles and practices, including Layer 2 / Layer 3 network design, data throughput capacity analysis, network security, and Frame Relay communications.
- Knowledge of design theories and applications of video multicast traffic, including field experience on deployment of leased lines, wireless, fiber optic, and twisted pair Ethernet network devices and systems.
- Familiarity with current and emerging best practices on the design, delivery and operation of Intelligent Transportation Systems, Smart Mobility technology, Integrated Corridor Management (ICM) systems, High Occupancy Tolling (HOT) roads and Traffic Management Centers.
- Knowledge of network components, device integration procedures, techniques, IT network design, architecture and compliance standards.
- Knowledge of theories, practices, procedures, and methods applied to the installation, maintenance, repair, and modification of serial to Ethernet, RS-232 / RS-422 data, and other RS-232 analog control systems.
- Knowledge of methods and techniques of troubleshooting and diagnosing equipment failure.
- Knowledge of use, operation, calibration, and maintenance of a variety of specialized electronic equipment and control systems.
- Knowledge of analog and video transmission methods, practices, and modes of transmission.
- Basic understanding of ITS architecture and standards.
- Skill in integration of analog and digital video systems into an IP environment.
- Skill in writing, compiling, and reviewing technical data, specifications and documentation.
- Skill in interpreting technical information and producing deployment plans.
- Skill in installing, maintaining, integrating, and testing IT electronic and network systems.
- Skill in operating specialized electronic testing tools, diagnosing problems in sensory and control equipment, and recommending corrective action.
- Skill in creating, reading and interpreting maps, electrical diagrams and specifications. Skill in assessing and prioritizing multiple tasks, projects and demands.
- Skill in operating a personal computer utilizing a variety of business software.
- Skill in effective communication, both verbal and written.
- Ability to effectively train team members on new architecture
- 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
- Spanish language skills, written and spoken are 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 data centers and outsourcing contracts for data centers
- 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
- Spanish language skills, written and spoken are required

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 data center 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 data centers
- 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
- Spanish language skills, written and spoken are required

Data Center Security Expert

- Post-graduate degree in electrical engineering or related discipline
- At least ten (10) years of 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
- Spanish Language skills both conversational and written are strongly preferred.

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
- Spanish language skills, written and spoken are required

Fiber Optic Network Electrical Engineer

- Post-graduate degree in electrical engineering or related discipline
- At least ten (10) 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
- Spanish language skills, written and spoken are required

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
- Spanish language skills, written and spoken are required

Senior Economist

- At least a master's degree in economics, PhD preferred
- A minimum of ten (10) years' experience in economic analysis of ICT projects in the developing world
- Experience with project finance strongly preferred
- 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 in teams
- Spanish language skills, written and spoken are preferred

Local Environmental Expert

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

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, 24x7, 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
- Fluency in written and spoken Spanish and English is required

XIV. TERMS OF REFERENCE

SALTA SMART CITY PROJECT

Objective

The objective of these terms of reference is to set forth the terms and specifications for the performance of a Feasibility Study (the "FS)" in connection with the planned (i) consolidation and upgrade of the data center; (ii) expansion of the state broadband network; and (iii) the integration of various Smart City components. The Contractor shall ensure the quality and accuracy of the translations. The Grantee is the Salta Municipal Government or MGS.

MGS seeks technical assistance for an international consultancy financed by USTDA to

6) Determine best practices related to implementation of smart cities using ICT mechanisms and tools, especially in cases similar to Salta.
7) Review the existing situation of the Salta fiber optic metropolitan network and perform the following:
8) Review existing MGS ICT resources for possible updating of technologies and addition of new components like:
9) Undertake a full feasibility study for the *Salta Ciudad Inteligente* (Salta Smart City) project using the IDB/ESCI methodology identifying the elements required to make Salta a smart city
10) Specify equipment and software needed and p*ossible sources for acqui*sition thereof.

All deliverables for all tasks shall be provided in both English and Spanish.
For illustrative purposes, it is estimated that the Contractor shall travel to Salta for the approximate number of visits as follows:

- Three trips to Salta for the Team Leader;
- Two trips each for the senior wireless/fiber optic engineers;
- Two trips for the senior data center engineer;
- Two trips for the junior data center engineer;
- Two trips for the junior ICT and network engineer;
- One trip for the security expert; and
- One trip each for the ICT specialist/economist.
- 2 trips for Senior GIS Planner.
- 2 trips for the Junior GIS Planner.
- 2 trips for the ITS Architect.
- 2 trips for the ITS Engineer.
- 2 trips for the Video Analyst.
- 1 trip for the security expert.

SALTA SMART CITY PROJECT

SCOPE OF WORK

TASK 1: PREPARATION AND BACKGROUND RESEARCH FOR FIBER NETWORK EXPANSION, DATA CENTER, AND SMART CITIES

The Contractor selected to implement the feasibility study shall research past and current provincial and federal government initiatives in the planning, financing, construction, and operation of municipal broadband networks and data centers in Argentina and internationally, including security and emergency arrangements, disaster/crisis management, identifying best practices in technology, finance, big data, and construction and operation. The Contractor shall analyze the demands on such networks of typical e-government applications, including internal administration, tax collection, operation of citizen service centers, distance education, telemedicine, cloud computing, and big data analysis. The Contractor shall identify and analyze a minimum of four Argentine government data center projects 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. Particular attention should be given 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 Contractor should also identify and analyze a minimum of four case studies of cities that have become smart and sustainable cities and have incorporated the type of intelligent transportations systems (ITS) and non-ITS systems changes and monitoring systems that Salta plans.

Smart cities are a complex network of components—citizens, businesses, transport, communications, water, energy, city services, and other systems—and each city has its own unique strengths and weaknesses. A city should also have a vision of what it would like to become and how it would like to be perceived. Understanding how a city can improve and change through the lens of these elements offers new perspectives on the progress a city is making toward achieving their goals and visions. Cognitive computing and its capacity for building citizen engagement introduces fresh opportunities for government organizations to improve citizens' lives and the business environment, deliver personalized experiences, and optimize program and service outcomes.

The Contractor shall perform an assessment of the current crisis management practices and disaster recovery/business continuity plans that exist for MGS and provide recommendations for new capabilities. The purpose here is to collect and provide benchmark and provide recommendations for emergency management system solution(s) enhancements.

The Contractor shall identify at least three cases of success for each one of the following systems: Adaptive Traffic Signal Control, Public Protection, Automatic Enforcement (including non ITS related) and Incident Detection and Management. In the case of Adaptive Traffic Signal Control System, the optimization should occur throughout the entire area and not just in intersections or corridors. Among others, one of the main sensors to be used in these systems is related to image capture and analysis.

Deliverable: The Contractor shall prepare a report detailing the case studies and best practices identified for broadband networks, data centers and Smart Cities;

TASK 2: INITIAL VISIT AND ASSESSMENT OF CURRENT SITUATION

The consultant team members shall travel to Salta to familiarize themselves with the current situation and to meet with the Secretariat of Modernization personnel in charge of the Salta Smart City project. Prior to traveling the team should become familiar with the project documents prepared by the IDB on smart cities. The Contractor should also be familiar with disaster/crisis management. The Contractor should already be very familiar with the Argentine municipal public budget finance and project analysis.

Deliverable: The Contractor shall prepare: 1) A list of references studied in Task 1; 2) a timetable, list of needed data, and proposed mode of operation for the main mission of the feasibility study team.

TASK 3: CONDUCT A NEEDS/REQUIREMENTS ANALYSIS FOR THE BROADBAND NETWORK, DATA CENTER SYSTEM AND SMART CITY (ITS & NON-ITS)

The Contractor Shall Travel To Salta To Review The Current Situation; Meet With MGS Officials And Key Stakeholders In The Project:

DATA CENTER ANALYSIS SHOULD INCLUDE A DETAILED SECURITY AND BUSINESS CONTINUITY ANALYSIS

The Contractor shall meet with Secretariats and government agencies and conduct a needs/requirements analysis for the upgraded MGS data center, and options for the proposed containerized backup data center in other Government data centers. The Contractor should already be very familiar with e-Government initiatives, as well as Governmental public budget finance and project analysis in Argentina and Salta.

The basic objectives here are to meet the growing demand for ICT to support MGS's smart city program (broadband network management, applications, services, and portals) with agility, flexibility and efficiency under the strategic management of the MGS.

HYBRID METROPOLITAN BROADBAND NETWORK

The Contractor shall meet with the MGS Secretariat of Modernization (MGSSM) and other key stakeholders in the project and other Secretariats and government agencies; and conduct a needs/requirements analysis for hybrid broadband network. The Contractor should also analyze the needs and capabilities of potential partners in the hybrid network, how much expansion is needed for the current network, including the main provincial electrical energy distribution company (EDESA), the Ministry of Education and Sports (MEyD), the Ministry of Communications, the Ministry of Modernization and private telecommunications companies (e.g., Movistar, Nextel, Personal, Claro) and local Internet service providers.

The Contractor should already be very familiar 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 Argentina and Salta.

The basic objectives in this Sub-Task are to meet the growing demand for broadband connectivity to support the growing demands of the Smart City Infrastructure needed, the vision of the Smart City in terms of broadband infrastructure and promote digital inclusion of the population with agility, flexibility and efficiency under the strategic management of the state. The Contractor shall provide detailed recommendations for best practice disaster and crisis management solutions, including recommendations on the required infrastructure; a roadmap for phased implementation; and detailed budgets for each of the recommended phases, which include all aspects related to implementation (consulting, capital expenses, implementation, training, maintenance and others as necessary).

The Contractor shall:

- Meet with MGSSM and major stakeholders to gain additional insights into their needs, interests, and expectations
- Identify factors which would help MGSSM get other municipal governments to become clients of the broadband network
- Conduct basic cost/benefit analyses for the hybrid broadband network, taking into consideration the needs of its prospective clients.

DATA CENTER

The Contractor shall:

- Meet with MGSSM and major stakeholders to gain additional insights into their needs, interests, and expectations
- Visit the existing data centers of MGS and also visit any other significant data centers in other municipalities to conduct a needs and requirement analysis for the MGS data center system and backup data centers, including cloud services.
- Conduct basic cost/benefit analyses for the largest potential client secretariats/agencies of the MGS, to determine if a new data center is needed or just an upgrade of the existing data center and potential backup facilities for all the data centers.
- Conduct a security analysis, both physical and electronic, of all data centers expected to remain in the data center system, including backup facilities, determine the best course of action to take to ensure the security and privacy of the information contained in the data centers
- Quantify the benefits in unit cost reduction and improved quality for data center services that can be achieved with the proposed new integrated data center system.
- Analyze at least three options for operation of the data center, including backup facilities and use of cloud services.
- Inventory of Requirements for Supporting Critical and Non-Critical MGS 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

Estimate future demand for services of the integrated MGS data center and also the demand in the Province of Salta for data center services of municipal governments given the possibility

that the centralized data center might serve additional clients other than MGS's secretariats and agencies.

IT & NON-IT NEEDS/REQUIREMENT ANALYSIS

The Contractor shall travel to Salta to review the current situation; meet with the MGSSM and the other key stakeholders in the project. The Contractor shall develop detailed guidelines for the identification, development and implementation of smart transportation services, both on a big picture (sector-wide) and on an individual project basis. The guidelines shall specify the way services should be provided in the future to increase people's access to information about infrastructure and social services, increase the efficiency of service delivery, and enhance the economic competitiveness of the city. The guidelines shall cover the identification of smart capital improvement projects, with a view to attracting private investment in the delivery of smart urban services.

The Contractor should already be very familiar 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 Argentina and Salta.

- The basic objectives in this Sub-Task are to:
    - Survey the existing, already installed equipment in the City of Salta, to develop ways to integrate with new systems that will be proposed
    - Develop detailed guidelines for the identification, development and implementation of smart transportation services, both on a big picture (sector-wide) and on an individual project basis
    - Develop emergency management solutions to provide sophisticated analytics to process available data and provide intelligent insights into key performance indicators and trends. These solutions would require the implementation of additional infrastructure, road and building sensors, video surveillance systems and other recommend technologies to provide the needed data for emergency management oversight and decision making
    - The Contractor shall develop an inventory of the existing control centers and assess the current control center environment. The Contractor shall provide with recommendations on the methodology to integrate the control center.
    - Become familiar with the traffic characteristics and public parks network to review solutions already proposed and identify new ITS applications for the city of Salta
    - Interview MGS staff working on urban mobility to identify needs and problems.
    - Interview MGS staff operating the data center to identify the necessary hardware and software infrastructure that would be needed where the Smart City transportation components should be integrated and the adjustments to be made in non-ITS systems.

Deliverable: The Contractor shall prepare a report of all work done under Task 3, including a Needs/Requirement Assessment report and Security Analysis report for the hybrid broadband network, the data center and the Smart City network. These will include, a report assessing the current disaster management practices and disaster recovery/business continuity plans that exist with recommendations for new capabilities. A report with detailed recommendations for

best practice disaster and crisis management solutions, including recommendations on the required infrastructure; a roadmap for phased implementation.

TASK 4: DIMENSIONING AND ALTERNATE SCENARIOS FOR THE DATA CENTER

DATA CENTER

Based on the findings in Task 3, the Contractor shall project the collective needs for data hosting over the next five years and estimate the size of data center requirements related to the growth of the Smart City. Then, the Contractor shall develop alternate scenarios for data hosting in the MGS:

a) Expansion of the existing data centers and

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

c) Analyze the possibility for a cloud option combined with the current expansion satisfying the expansion needs. Conduct a review of whether an expansion is needed or will a hybrid of cloud storage and expansion accomplish this goal. The Contractor should examine public, private, and hybrid cloud options for both cost and security to gain a better understanding on how this office incorporates cloud storage into their planning;

In consultations with MGS the Contractor shall recommend the optimum strategy for the integration of the existing data centers, and recommend a redundancy strategy utilizing the current storage capacity.

Deliverable: A report summarizing the options studied and recommendations for the optimum strategies for both data center integration and consolidation and the development of the broadband network.

TASK 5: STUDY OF ROLES AND RESPONSIBILITIES FOR THE BROADBAND METROPOLITAN NETWORK, DATA CENTER AND SMART CITY CONTROL CENTER (SCCC)

ROLES AND RESPONSIBILITIES FOR THE HYBRID BROADBAND NETWORK

The Contractor 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. These will include proposing several different business models for the operation and maintenance of the network, including leasing and/or *intercambio* of fiber pairs with partners such as telecommunications and electric power distribution companies.

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 Salta Municipal government?
- Who will administer the hybrid broadband network?
- What will be the role of the secretariats and agencies that will use the network and have applications stored in the data center?

- How will performance of the broadband network be measured?
- If there are private partners, how should they be remunerated?
- What should be the role of MGS once the new fiber network is operational?
    - One possibility that should be studied is whether is should serve as the supervisory authority for a private partner operating the new network with the support or an interagency committee, including any public or private enterprises sharing fiber or other links.
    - Where would the policy-making function reside? Should the MGS be responsible for supervisory and operating functions?. The feasibility study should suggest at least two more options for MGS future role.

DATA CENTER

The Contractor 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 data center. Questions to be addressed in this study include:

- Will MGS continue to operate the data center (and other components of the proposed data center system) 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 MGS with the support of an interagency committee?
- What will be the role of the secretariats and agencies with applications stored in the data center?
- How will performance of the data center system be measured?
- If there are private partners, how should they be remunerated?
- What should be the role of MGS once the new data center system 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 data center, with MGS setting policies both for the partner and for submissions of data from the various municipal agencies, subject to review by an interagency committee. Another would be to continue the present arrangements under which MGS both sets policy and operates the principal data center for municipal entities. A third is that MGS sets policy, operates the data center system, and contracts some cloud services for backup of the data centers. The feasibility study should suggest at least two more options for MGS future role.

The Contractor shall also analyze alternative legal arrangements necessary should it be decided to contract with a private sector partners to provide cloud services or operate the data center system. The analysis should include a complete discussion and evaluation of the legal and tax conditions for housing the data center and the backup data center under each of the options discussed.

ROLES AND RESPONSIBILITIES FOR THE SMART CITY CONTROL CENTER (SCCC)

The Contractor 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 data center. Questions to be addressed in this study include:

- Which systems can be operated by a private sector company under policies set by MGS with the support of an interagency committee?
- What will be the role of the secretariats and agencies in the operation of each system?
- How will performance of the systems be measured?
- How will the results, effects and outcomes of the systems be measured? Which are the Key Performance Indicators (KPI) for each system? The KPI will be used in the decision making process of expanding the system to the whole city and even to other cities
- If there are private partners, how should they be remunerated?
- What should be the role of MGS once the systems are operational? The feasibility study should suggest at least three options for MGS future role

The Contractor shall also analyze alternative legal arrangements necessary should it be decided to contract with a private sector partners to provide and/or operate the systems. The analysis should include a complete discussion and evaluation of the legal and tax conditions for all potential situations.

Deliverable: The Contractor shall prepare a report of all work done under Task 5 including a Study of roles and responsibilities for the hybrid metropolitan broadband network, the data center and the ITS Network.

TASK 6: DEVELOP FUNCTIONAL SPECIFICATIONS, ARCHITECTURE AND DESIGN FOR EXPANSION OF THE BROADBAND NETWORK, AN UPGRADED OR NEW DATA CENTER AND A SMART CITY CONTROL CENTER (SCCC)

HYBRID BROADBAND NETWORK ARCHITECTURE

The Contractor shall:

- Analyze the findings from Tasks 3 and 4 and develop specifications regarding the architecture and design of the expanded broadband network;
- Develop detailed estimates of network designs, equipment needs and capacity, and resulting capital expenditure and operating costs
- Prepare a list of prospective U.S.-based sources of supply for the network and contact information, as required by USTDA

THE DATA CENTER SYSTEM

The Contractor shall:

- Analyze the findings from Tasks 3 and 4 and develop specifications regarding the architecture and design of the data center and backup data center

- Develop detailed estimates of data center design, equipment needs and capacity, and resulting capital expenditure and operating costs
- Propose service level agreement (SLAs) for the upgraded centralized data centers
- Prepare the standard list of prospective U.S.-based sources of supply for the data centers, cloud services, and contact information, as required by USTDA.
    - The recommended infrastructure shall include the cloud, big data environment, data center and communications capabilities necessary to support access, storage and processing of the data received from devices and other sources related to the aforementioned initiatives. This shall require a thorough review of the current Grantee infrastructure, assessment of the current IT environment and associated IT infrastructure and provide recommendations for a proposed infrastructure capable of supporting the planned needs

SMART CITY CONTROL CENTER

The Contractor shall:

- Analyze the findings from Tasks 3 and 4 and develop specifications regarding the architecture and design of ITS and non-ITS systems, such as: Salta Smart City Layer 1 (probably a GIS that can perform spatial and non-spatial analysis on objects from ITS systems and non-ITS systems), automatic enforcement (illegal parking, illegal garbage disposal), adaptive traffic signal control, advanced traveler information, non-conformity report (comparison between the plan and the operation – public transit for instance), public building monitoring, object location, incident management, disaster prevention and management, geo-referencing and communication of people and vehicles, ad-hoc data acquisition and other systems proposed by the firm.
- Develop detailed estimates of the systems designs, equipment needs and capacity, and resulting capital expenditure and operating costs
- Propose service level agreement (SLAs) for all ITS and non-ITS systems
- Prepare the standard list of prospective U.S.-based sources of supply for the network and contact information, as required by USTDA
- Demonstrate in detail the proposed systems working both in real environment and in the laboratory. The laboratory demonstration should deal with situations best illustrated in a controlled environment. If the proposed solution has not been implemented anywhere, the Contractor can only demonstrate its operation in the laboratory. If the complete system has not been implemented, the Contractor can show system components operating in isolation. If the proposal involves interfacing with legacy equipment (existing in the City of Salta and to be reused), the demonstrations should preferably use the same type of equipment. If the cost of research and development for interfacing with legacy equipment is high, demonstrations will be accepted with other equipment but a cost estimate must be presented and time to develop interfacing with legacy equipment. The demonstrations should be made for a group of up to four MGS technicians. The demonstrations should be made by specialists with deep knowledge of the technology and who should be available to respond to questions from MGS. The equipment and real system should be presented. It should demonstrate to the MGS that the proposal is technically feasible and available. Presentations that use only films,

slides, written or verbal descriptions or presentations only in the laboratory for equipment and systems that have been deployed in a real situation will not be accepted. After the technical demonstrations, MGS's technical staff should be interviewed and feedback provided by them should be incorporated into the specifications. At the end of this activity MGS's technical staff must be convinced that the proposed solution is viable for the City of Salta.

- The MGS seeks to consolidate the current control centers that have been implemented in the past to support existing services. The MGS shall require assistance in determining which control centers to integrate, methodology for integration and the cost associated with each integration initiative.

Deliverable: The Contractor shall prepare a report of all work done under this task including a hybrid broadband network design, data center and Smart City (ITS & Non-ITS) Architecture and design, functional specifications and a roadmap for an architecture report.

TASK 7: ECONOMIC AND FINANCIAL ANALYSIS OF THE PROJECT

The Contractor shall:

- Quantify the benefits in unit cost reduction and improved quality for the data center system and broadband connectivity services that could be achieved with the new hybrid broadband network
- Assess all aspects of the project's feasibility (technical, economic, financial, political, legal and organizational) and their interrelations for the data centers and broadband network; and
- Business Continuity and Disaster Recovery Plan both subprojects
- Evaluate Total Cost of Ownership of the MGS-operated data centers and broadband network
- Develop Implementation Plans for the MGS data centers and broadband network
- Develop Implementation Finance Plans for the MGS-operated data centers and broadband network
- Prepare economic scenarios, risk analysis, rate return analysis, analysis of total cost of operation
- Provide the MGS with sufficient information to responsibly manage and maintain the infrastructure for each of the projects
- Develop a Life Cycle Cost Analysis (LCCA) as part of the overall project cost estimate. The LCCA shall examine the total initial capital costs to plan, design, develop, and build the project, and also shall include a detailed analysis of the costs associated with the long-term operation of the project, which includes maintaining the facilities, equipment and other assets financed as part of the project. Such costs include, but are not limited to, warranties, operation, maintenance, acquisition, installation, refurbishment, and disposal costs that could be encountered throughout the life of the project.

Deliverables: The Contractor shall prepare a report of all work done under this task, including a Economic and financial analysis report and a report recommending the most effective structure of these two projects and their supporting legal, economic and financial rationales

TASK 8: CONDUCT AN ENVIRONMENTAL ASSESSMENT

The Contractor shall:

- Conduct, in consultation with the SSMSM and Salta municipal authorities, a preliminary review and evaluation of the expected environmental impacts of the broadband network and data centers and their compatibility with regulations of federal, provincial and municipal governments and the requirements of potential lending agencies, especially the World Bank, the IFC, and the IADB.
- Conduct a climate resilience study;
- Discuss how any potentially significant negative impacts can be mitigated;
- Identify Agency/Department expectations priorities, opportunities, and trends;
- Analyze the environmental impact on legislative and judicial branches of government and other levels of government (federal and municipal); and
- Verify possible transfers of effects, identify and adopt preventive measures and actions to obtain synergies with other departments and agencies involved

Deliverable: The Contractor shall prepare a report of all work done under this task, including an Environmental Assessment Report.

TASK 9: DEVELOPMENTAL IMPACT ANALYSIS

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. Here are some examples of indicators and baseline data. We selected to following indicators:

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.)	N

While this indicator appears to be a good way of gathering metrics, it also might not be a good indicator for Salta Smart City project. Although the Salta Smart City network will be used directly by the population that will only occur in very specific situations. Baseline: 0

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	N

Deliverable- Development Impact Report

TASK 10: ESTABLISHMENT OF OPERATIONAL AND ADMINISTRATIVE REQUIREMENTS

In consultations with MGSSM, the Contractor shall recommend the organizational structure, personnel requirements, and support resources that would be required to effectively manage a consolidated broadband network and data center.

- Review the current organization and define the new corporate governance structures
- Identify institutional issues that are needed to support their 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
- Clearly define any outsourcing contract objectives (scope, service levels, metrics, requirements, etc.)

Deliverable: Operational and Administrative Requirements Report

TASK 11: PROJECT PLANNING & IMPLEMENTATION

The Contractor shall assess and determine whether the critical success factors for project implementation have been met and the project risks identified have been accounted for and mitigated to the extent possible. The analysis should include the following risk factors and specify how they can be mitigated:

- 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;
- Clear definition of contract objectives for any private or public sector partners (scope, service levels, metrics, requirements, etc.);
- Support from top government managers;

- Priority for any payments to private sector partners for strategic and critical activities outsourced;
- Establishment and application of penalties for non-compliance with contract conditions;
- Definition of a clear process exiting from the contract and transition to one or more other private sector partners with operating responsibilities for either of both project components or sharing infrastructure of the hybrid broadband network;
- Other critical success factors inherent in any outsourcing for ICT services

The Project Implementation Report will recommend the most appropriate structure for the project, summarize the steps that need to be undertaken by the government to implement the project according to recommended structure for handling any outsourcing or infrastructure sharing arrangements with private sector firms, and also address the phased approach/evolving scope of the MGS data center and hybrid broadband network. The report should address the issue of how to structure any service contract or infrastructure sharing arrangements to incorporate the evolving scope of the project.

Deliverable: The Contractor shall prepare a report of all work done under this task including a Project Impact Report and Planning and Implementation Report

TASK 12: PRESENTATION OF THE DRAFT FINAL REPORT

Upon concluding all tasks listed above, the lead participants in the technical assistance conducted by the Contractor shall travel to Salta to formally present to MGS the findings and recommendations and a near final version of the report. The Grantee 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 Contractor shall

- Create accompanying PowerPoint presentation
- Identify any additional suggestions or recommendations derived from the responses of the Project sponsor to the presentation

Deliverable: The Contractor shall deliver the Draft Final Report and PowerPoint Presentation

TASK 13: FINAL REPORT

After the Presentation, the Contractor shall make the final changes suggested by MGS and submit the Final Report to both MGS and to USTDA.

The Contractor shall prepare and deliver to MGS and USTDA a substantive and comprehensive report of all of the work performed in accordance with 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 MGS. The Contractor shall provide one copy of the Final Report in Spanish to MGS. 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 Contractor must identify prospective U.S. sources of supply in Final Report to be submitted to the Grantee and USTDA in accordance with Clause I of Annex II of the Grant Agreement.

Deliverable: Final Report

ADDITIONAL COMMENTS

Comment 1: All Deliverables are to be supplied in both the English and Spanish language versions. The Contractor shall ensure the quality and accuracy of the translations.

Comment 2: More specific requirements concerning the composition of the consultant team are given in Section 12 of the Definitional Mission report.

Comment 3: Successful execution of the feasibility study presupposes that a) the Contractor shall establish a close working relationship with MGSSM; b), that the team is prepared to spend the necessary amount of time on-site in country; and c) the consultant team has appropriate access to the Salta metropolitan network.