

**THE IMPACT OF SMART
TECHNOLOGIES IN THE
MUNICIPAL BUDGET:
INCREASED REVENUE AND
REDUCED EXPENSES
FOR BETTER SERVICES**

URAIA NICOSIA GUIDELINES 2016

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THE IMPACT OF SMART TECHNOLOGIES IN THE MUNICIPAL BUDGET:

INCREASED REVENUE AND REDUCED EXPENSES FOR BETTER SERVICES

This document is the result of the discussions held during the 2016 Uraía Workshop which took place in Nicosia, Cyprus on April 19 and 20th, 2016. It is a working paper made in collaboration with the participants who attended the workshop including representatives of local governments, city networks, service and technology providers, civil society, international organizations and research institutes from all around the world. It gathers general recommendations on the use of SMART technologies to improve municipal finances and it is based on the participants' experiences.

This report was prepared by the consultant Mariana Nascimento Collin within the Uraía Platform framework and under supervision of Diana López Caramazana, Head of the local government and decentralization unit at UN-Habitat and Jean François Habeau, Executive Director of FMDV.

This report was produced in December 2016.

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COLLABORATORS

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INTRODUCTION

THE UN-HABITAT AND FMDV COLLABORATION

The Uraía Platform is a project in collaboration between two international institutions that work to improve urban citizen's life around the world: the FMDV and UN-Habitat.

FMDV (Global Fund for Cities Development)¹ is an alliance of local and regional governments, dedicated to identify, promote and develop solutions for financing urban development and local economic development with a resilient and sustainable approach. FMDV acts as a match-maker between local governments and their partners, and provides solutions and expertise to create the enabling environment allowing local governments to access the necessary resources to fund their urban development strategies. FMDV promotes a holistic approach on urban economy and urban finance, both in terms of their traditional tools (local taxation optimization, bank loan, bond emission, public-private or public-public partnerships) and in their endogenous variation (local socio-economic revitalization, urban productivity and attractiveness, responsible green economy, local resources valorisation and mobilization, and social and solidarity economy). FMDV also leads the debate between multi-scale urban stakeholders via the publication of reference works on the topic, thematic case studies and the organization of dedicated international conferences and thematic workshops. Its operating and coordination methods promote a multi-stakeholders culture based on dynamic cooperation and exchanges between local governments.

UN-Habitat² is the focal point for cities within the United Nations System. It supports local and territorial governments as essential agents for development and general welfare, as the closest entity to the citizen and primary responsible for the provision of basic urban services. The UN-Habitat Local Government and Decentralization Unit works closely with local governments and their associations to strengthen their capacity in three main areas. First, to foster urban governance by focusing on the need to establish permanent structures of dialogue between the local and central governments on one side, and the public and private sectors on the other. Second, to increase institutional and financial sustainability, by building good public financial and management systems and to ensure that public services and capital generated in cities reach and benefit the poor. And third, to promote transparency, as governing without the citizen has become nearly impossible in the world today, as citizens request increased



1 More information on: www.fmdv.net

2 More info on: www.unhabitat.org

participation and better instruments to monitor the use of scarce public resources, leading local governments to develop instruments to better communicate and understand the needs of their constituency.

THE URAÍA PLATFORM

The FMDV and the Local Government and Decentralization Unit of UN-Habitat launched the Uraía Platform in June 2014. Uraía supports innovation in local public management by encouraging the introduction of SMART technologies in three main areas: municipal finances, public services and infrastructure; and transparency and accountability. With this aim, the Uraía Platform brings together local governments and their partners (networks of cities, private sector service and technology providers, research institutes, international organizations and civil society, etc.). By October 2016, it has built a network of more than 100 partners from all the 5 continents. The platform offers a space to exchange experiences with cities from all around the world. It also provides the opportunities for match-making and networking with actors that work in city management, such as development institutions and private sector companies. Uraía organizes workshops, roundtable discussions and provides access to a systematized collection of inspiring practices and SMART solutions to cities and their partners.

Every year, the Uraía Platform chooses to focus its work on a specific topic, identified as a priority for local governments. The topic is addressed during the “Citizenship Series”, which includes a multi-stakeholder workshop plus its consequent annual “Guidelines”, a document produced as a result of the discussions of the meeting. In 2014, the Platform met in Santander, Spain, to exchange experiences about municipal innovation in general, and discussed the needs and defined the strategic priorities and activities of Uraía. In 2015, the Platform organized a meeting in Oslo, Norway, to discuss city-business collaboration for the implementation of SMART projects. Based on the experiences of the participants, the Platform elaborated the document “Public-Private Partnerships for SMART City Management. Recommendations for local governments to prepare and implement SMART PPPs”¹.

URAÍA 2016 CITIZENSHIP SERIES

In April 2016, the Uraía Platform organized its annual workshop in Nicosia, Cyprus, under the title: “The Impact of SMART technologies in the municipal budget: tax recovery and energy savings for better public services”. With the objective to discuss the trending topics regarding the current use of SMART



What does Uraía mean?

“Uraía” means “citizenship” in the Swahili language. This name was chosen because SMART technologies can be used as tools to build citizenship in cities, big and small, allowing citizens to access public services and facilitate their participation in public decisions.

¹ The Uraía 2015 publication is available to download in English, French and Spanish, here: <http://www.uraia.org/activities/activity/uraia-2015-publication-SMART-public-private-partnerships>

technologies for increased municipal efficiency and potential impacts on the municipal budget. The exchanges focused particularly in exploring how technological innovation can help cities to increase municipal revenue by improving tax collection and generate savings through energy efficient policies. And, even more important, how these increased municipal resources can be transformed into better, more efficient and inclusive public services.

This report focuses on how SMART technologies can be applied by local governments to increase their revenue or to decrease their expenses. It displays a series of concrete case studies, experiences and point of views of cities and their partners; stresses challenges, opportunities and lessons learned shared by local governments around the world, and it establishes concrete recommendations addressed to decision makers who face similar situations and wish to find innovative ways to address the citizen's demands for better services. We sincerely hope that this document will inspire local governments to use SMART technologies to improve municipal management and to bring insights that might assist them in choosing the SMART solution that is most adapted to their needs and capacities.



SMART TECHNOLOGIES AND MUNICIPAL FINANCES

The rapid pace of urban population growth and urban sprawl¹ confirm urbanization as one of the most significant trends of the century, positioning cities at the core of the development agenda. Unprecedented urban dynamics such as the demographic rise, urban sprawl, climate change and environmental issues, engender inequality and social segregation, economic downturns and other challenges. In parallel, urban citizens demand more accessible and qualitative public services, and call for improved transparency

¹ According to the UN Habitat World Cities 2016 Report (<http://wcr.unhabitat.org/wp-content/uploads/sites/16/2016/05/WCR-%20Full-Report-2016.pdf>): in 2016, 54% of the world's population lived in urban centers and this figure is expected to reach 66% by 2050, and more than 60 percent of the total area expected to be urban in 2030 still remains to be built. Cities consume over 70% of produced energy, are responsible for the emission of more than 70% of greenhouse gas, and generate around 80% of global GDP.

and accountability on how resources are being used and for increased participation in decision-making. At the frontline, local governments encounter difficulties to effectively adapt to changing urban realities and respond to citizens' demands and needs. Fragile institutional capacities and limited access to diversified and sustainable funding sources are the main reasons preventing local governments to do so.

As local governments throughout the world seek innovative approaches to respond to the challenges of urbanization and build more resilient and inclusive territories, SMART technologies offer interesting solutions to improve city management and the quality of life. As technological innovation evolves at a very rapid pace, it is difficult to capture precisely the extension of what SMART technologies are. In this publication, we understand that SMART technologies applied to the urban context encompass a new generation of Information and Communication Technologies (ICT) which allow local governments to capture, store, analyse and share data regarding urban life in a timely manner and transform it into actionable information to support decision-making by city administrators and stakeholders. Technically speaking, SMART technologies applied to local public management can be grouped in different digital layers¹.

- **The connectivity layer** is composed of internet and mobile broadband networks, facilitating the transportation of data and information from the sensor level to data aggregators and storage for further analysis and use by actuators and end-users.
- **The sensor layer** is composed of devices such as sensors, smartphones, actuators remotely controllable devices, SMART meters, etc. that measure and collect data regarding different parameters. When devices inserted in different objects and equipment are connected between themselves and to the Internet, we refer to them as Internet of Things (IoT). Mobile technology, in particular, represents huge opportunities for SMART city projects.² Thanks to greater availability and affordability of smartphones, they already account for more than 65% of internet connections in the developed world, and around 40% of connections in the developing world.³
- **The data analytics layer**, which uses advanced cloud-based software analytics systems to process and analyse the enormous amounts of data collected in real time by the interconnected sensors and devices (Big Data). Data analytics comprise three levels: descriptive, that uses business intelligence and data mining to better understand the current state; predictive, that uses statistical models and forecasts to predict future states; and prescriptive, that uses optimization and simulation to act upon the situation.

SMART technologies help cities to improve their finances and strengthen their investment capacities.

JEAN FRANÇOIS
HABEAU, EXECUTIVE
DIRECTOR, FMDV

1 Source : http://unctad.org/meetings/en/SessionalDocuments/CSTD_2015_Issuespaper_Theme1_SMARTCitiesandInfra_en.pdf

2 According to the 2016 GSMA Mobility Economy Report, the total number of mobile subscriptions in 2015 averaged 7.4 billion (representing 4.7 billion unique subscribers), with a global subscribers' penetration rate of 63% and regional penetration rates ranging from 43% in Sub-Saharan Africa to 85% in Europe.

3 Source : <http://www.gsma.com/mobileeconomy/>

- **The automation layer** enables automation and scalability for a large number of devices across multiple domains and verticals, and allows city administrators and other actors to develop SMART services and applications.

The action field of SMART technologies is immensely vast and the opportunities presented by their use in municipal management are being tested and proved each day in different cities around the world in a variety of sectors such as transportation, energy efficiency, waste and water management, e-administration, health care, safety and security, education, etc. SMART technologies can improve governance and increase efficiency in services management through a better use of resources and stronger citizen dialogue and participation.

While there is extensive literature about the opportunities and challenges regarding the use of SMART technologies to improve cities' management, its application to the specific sector of municipal finances haven't been thoroughly studied. **The following report shows how cities can use SMART technologies to cope with budgetary restraints and find innovative sources of revenues to reinforce their investment capacities and offer better services to their citizens.** It tries to assess in a very practical way, the state of the art regarding how local governments around the world have been using SMART technologies to improve municipal management and services and how these initiatives could have a positive direct or indirect impact on the municipal finances either by increasing revenue or reducing expenses¹. To better understand this link, it is useful to understand what are the main sources of revenue and the main expenditures of local governments. Although it may vary according to national context, level of decentralization and responsibilities granted to local governments, we can identify the typical main traits of the municipal budget composition:

Cities' main sources of revenue are usually a combination of: (i) transfers from central governments; (ii) local tax, tariffs and fees collection (property tax, sales' tax, fines and administrative penalties, fees deriving from public services, etc.); (iii) national or international loans from private national banks, international markets, or financial institutions; (iv) conditional or unconditional grants from central governments or international institutions; and (v) collaboration with the private sector to develop big urban infrastructures projects. The report will present how SMART technologies can be particularly useful to local governments to improve tax and fees collection and administration, but it can also contribute to attract investments, improve creditworthiness and facilitate access to international markets.

As municipal functions are becoming increasingly complex, encompassing issues of employment generation, social inclusion, and climate change, expenses also increase. **Main expenses of local governments** typically comprise operating expenditures and investment expenditures. The first one, which usually represents up to 70% of total municipal budget include day-to-day operations and delivery of services such as: salaries of municipal

Why S.M.A.R.T. technologies?

The Uraía Platform uses the expression SMART technologies in capital letters because SMART doesn't refer only to the ICT technologies but also to a specific approach regarding their use by local governments in public management to build sustainable, resilient and liveable cities. Traditionally, the S.M.A.R.T. goals are criteria used in public and private management. When applied to the innovation in municipal management, it means "Sustainable - Measurable - Actionable - Realistic - Transparent".

¹ Note that this report will not focus on how municipalities can finance SMART city projects, but how SMART projects can have a positive financial impact for the municipality.

employees, operating costs of municipal buildings, repairs and maintenance of public infrastructure and service delivery (water provision, sewage treatments, roads, transportation, waste management, recreational and cultural activities, street lighting, energy provision, social services, housing, etc.). Investment expenditures represent around 30% of the total municipal budget and concern servicing of long-term debt (principal and interest); capital expenditures (for new infrastructure); and property acquisitions. The following report presents different examples of how cities can use SMART technologies to increase efficiency and reduce expenditures in services and administration management. They can be particularly useful to reduce energy consumption which often comes second after payroll expenditures in the municipal budget.

ISSUES ADDRESSED IN THE PUBLICATION

Although an increasing number of local governments around the world are using SMART technologies in local management, they are still hesitant to adopt them as many technological options are still too expensive or in experimental phase, with returns on investment still unknown. As such, city managers often wonder:

- ➔ **How to choose the best technology and make sure it is adapted to local capacity and needs?**
- ➔ **What are the existing SMART tools that work and those which don't?**
- ➔ **What are the mistakes to avoid and the key actions that ensure the success of SMART projects implementation?**
- ➔ **How to ensure the sustainability of the solutions when technology evolves so quickly?**
- ➔ **How to build an adequate and enabling environment to SMART solutions?**

While there are no simple or unique answers to these questions, the following report tries to give some insights. It analyses in a very practical way and without trying to be exhaustive, trends and opportunities regarding existing technologies and solutions, as well as risks, challenges and lessons learned encountered by city managers that uses such tools, in different sectors that fall under cities' responsibilities. Each chapter comprises concrete case studies of cities' experiences or partners' SMART solutions, as well as interviews with key actors in the field, and concludes with recommendations about the elements that ensure the success of SMART initiatives. Topics addressed in each chapter include:

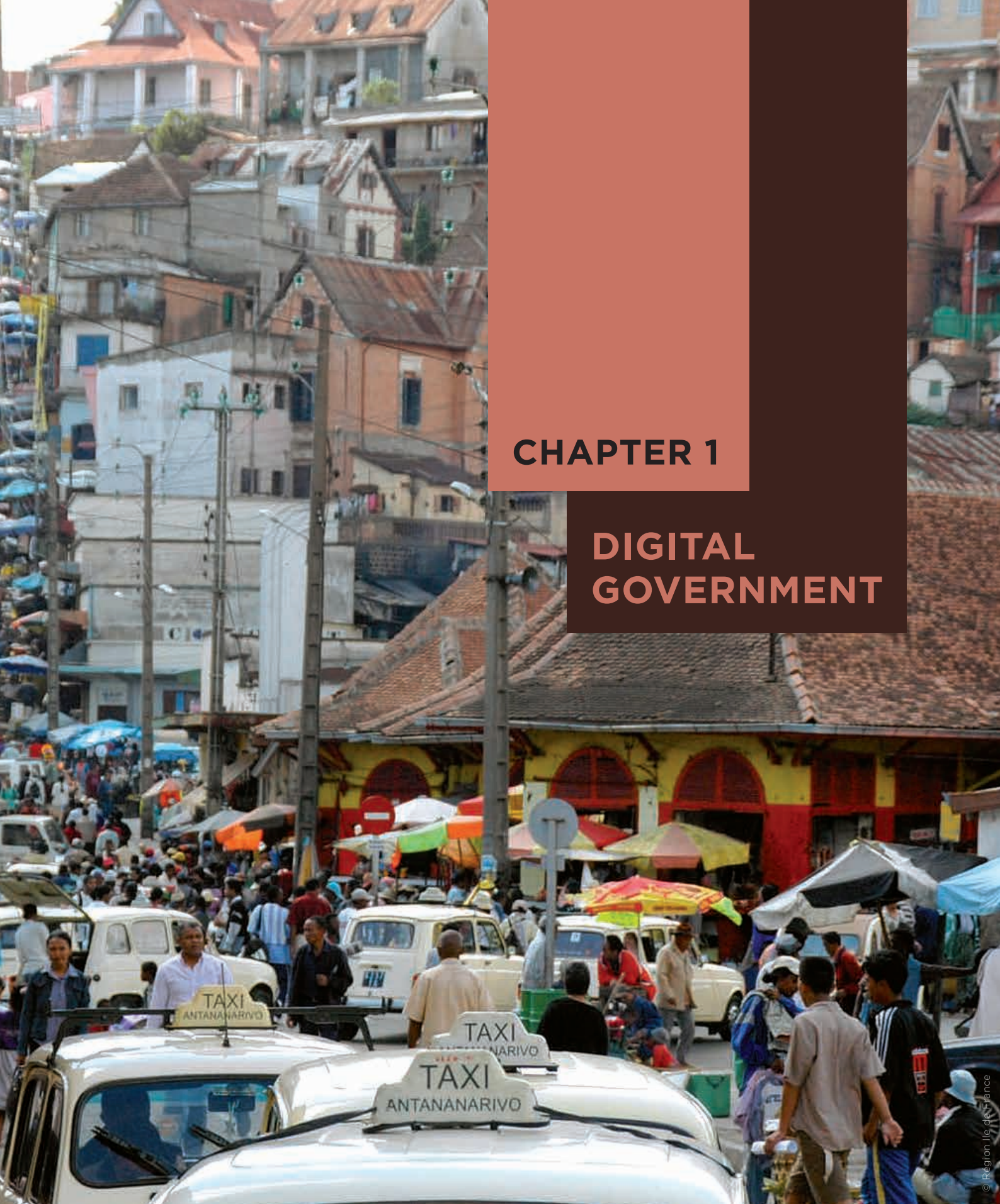
Chapter 1 – Digital government. This first chapter highlights a few ways in which local governments can use SMART technologies in municipal management to reduce the cost of government operations and contribute to increase municipal revenues. More specifically it will focus on SMART

solutions that: a) optimize municipal management such as management platforms and online services to citizens; b) encourage smarter payment systems such as e-procurement and Mobile Money; and c) increase revenue through better tax collection and administration and local economic development promotion.

Chapter 2 - Transparency and citizen participation. This chapter shows how cities can use SMART technologies to improve transparency, accountability and citizen participation, and how can this produce a positive impact on municipal finances. The chapter presents a series of SMART solutions that may strengthen the trust of citizens in the local government, and thus on the long run, lead to an increase in tax revenues; as well as other tools that may help combat corruption and fraud and reduce financial losses due to misuse of resources.

Chapter 3 - Energy efficiency of municipal assets. The third chapter of the publication focuses on how local governments can apply SMART technologies in the energy generation, distribution and consumption level, in order to reduce the municipal energy bill, while at the same time, providing a growing population with universal access to energy services, and reducing energy consumption to protect the environment. It covers topics such as street lighting, building efficiency and SMART grid technology.

Chapter 4 - Efficiency of public services and infrastructure. This chapter focuses on the main issues and solutions regarding how local governments can use SMART technologies to improve cost-efficiency in the management of three main municipal services: transportation, waste and water. Although the equation between SMART technologies - efficiency improvement - impact on municipal budget it is not easily quantifiable, the impacts are concrete and verifiable. Initiatives such as SMART parking, SMART cards, intelligent waste collection, and sensors network to detect water leakages are addressed and have proved to generate savings for local governments around the world.



CHAPTER 1

DIGITAL GOVERNMENT

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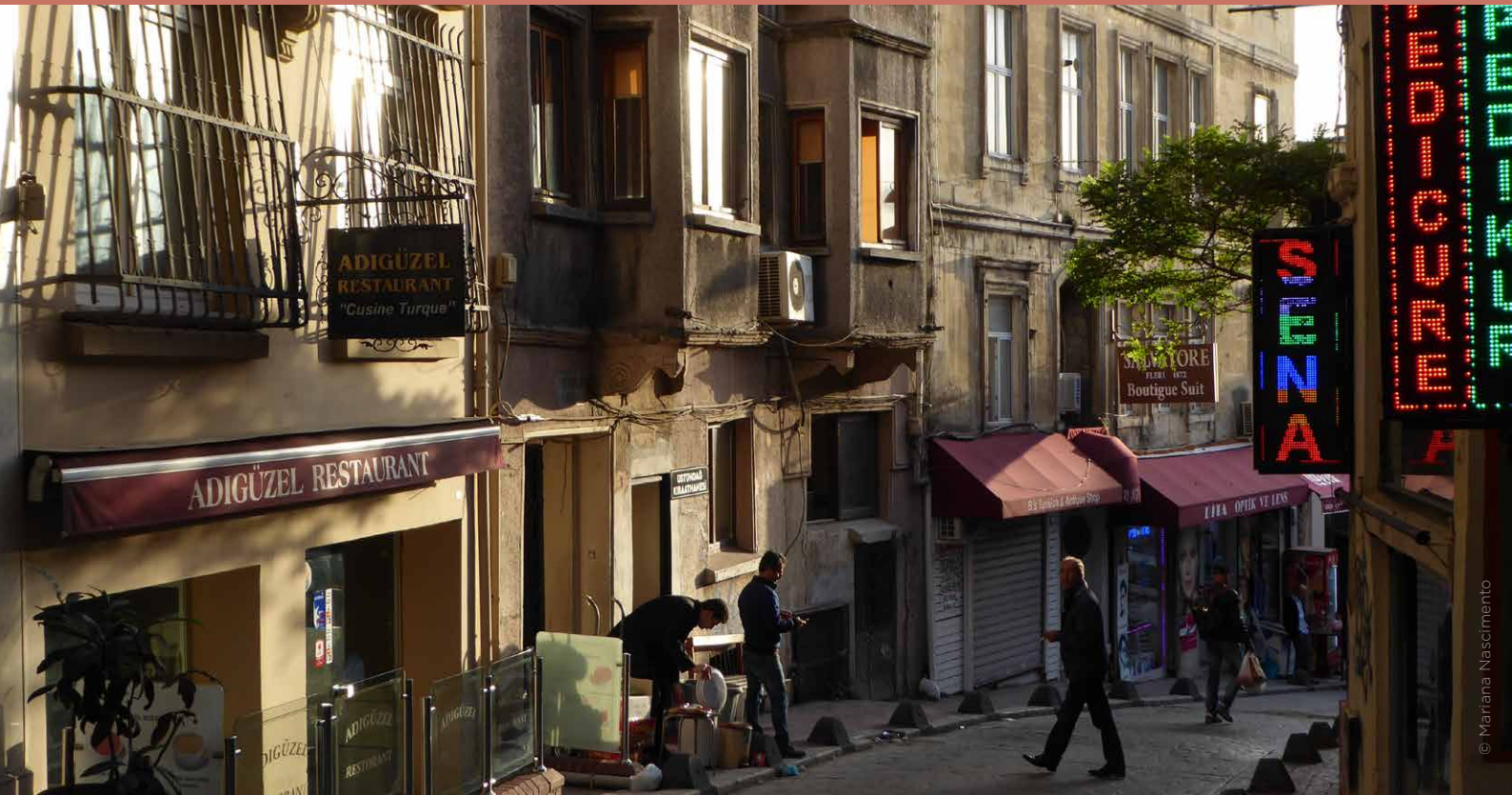
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Local governments around the world have been using ICT to improve management efficiency and service delivery to citizens and businesses for decades. The rapid evolution of ICT with the advent of SMART technologies (smartphones, Internet of Things, big data, analytics, SMART cloud, etc.) have provided renewed opportunities for the optimization of municipal management. Not only technology has changed but also the approach that local governments have towards it, evolving from digitization, to e-government and, more recently, towards digital governments. While the first two aimed mainly at improving productivity in administrative services, the digital government approach is more focused on the use of SMART technologies to reflect the user demands.

The digital government employs innovative changes in service design, management and delivery; providing greater openness, transparency, engagement and interaction between the citizen and the administration and between services within the municipality. It also achieves increased efficiency and productivity gains¹, as using SMART technologies reduces the cost of government operations and contributes to increased municipal revenues. We are presenting here a few ways in which local governments can apply SMART technologies to optimize the municipal administration, encourage smarter payment systems and improve tax revenue.

1 See here for more information about the evolution between digitization, e-government and digital government: <http://www.oecd.org/gov/digital-government/Digital-Government-Strategies-Welfare-Service.pdf>

1.1 MUNICIPAL MANAGEMENT OPTIMIZATION



SMART technologies offer opportunities for local governments to optimize management in two aspects: in the services they provide to their citizen and in the workflows within the administration and in between services.

1.1.A

SEAMLESS ONLINE SERVICES

The most visible impact of the use of SMART technologies in municipal management has been the “channel shift” of moving transactional services’ delivery from telephone and face-to-face interactions to online platforms. The kind of transactions that municipalities typically digitize include: paying taxes, fines and bills, registering businesses, requesting building permits, drivers’ licenses, applying for passport, enrolling in education institutions, etc.

Challenges of digitizing municipal services and processes. Even though municipalities around the world have made considerable progress in moving transactional services online, there is still a long way to reach seamless online services’ systems. In fact, we often observe that cities, rather than providing a single website for the entire institution, have different websites for each department, and each department has its own IT support team. This often results in high expense; it is confusing for citizens as they get lost amongst the numerous websites and the huge quantity of information.

A good management is also a source of revenue.

VINCENT NCHO, VICE-GOVERNOR, DISTRICT OF ABIDJAN, IVORY COAST.

In addition, even if citizens can process transactions online, many city departments remain unable to share data easily or are still reliant on manual processes to make sense of digital transactions. Another challenge that municipalities face when digitizing processes is that they have to adapt to different population expectations and profiles. On one side, cities need to take into account residents with low level of literacy, digital literacy or limited internet access, in order to avoid exclusion. On another side, cities have to adapt to the increased use of mobiles to access websites and services, and constant adaptation is needed as websites become obsolete due to lack of mobile accessibility.

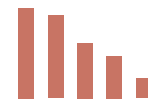
SMART solutions. To meet the rapidly evolving needs and expectations of residents, local governments can use SMART technologies to further simplify services by moving all transactions in one centralized online platform and fully automating back offices. To do so, local governments should aim at building one-stop city services digital platform that gathers information and enables transactional services from all city departments. To go further, two-dimensional city websites could be transformed into interactive digital platforms that connect users with third-party apps and services, and stream personalised content on local public services, jobs, local events and news, etc. and provide a space for feedback and communication between the administration and the citizen. Besides, having a single online platform for citizens to proceed with their transactions, local governments must make sure to fully digitize their back office, which means both automating individual processes and digitizing the organization and workflow. This means breaking down silos, ensure data sharing, integration and interoperability between services,

Potential benefits. By offering a single platform that integrates previously siloed information from multiple departments, and by automating records and management processes, municipalities increase efficiency both for city staff and for constituents. Shifting towards online transactions improves the quality of service delivery by improving access to information and transparency, and increasing convenience by allowing for quicker processes. Digitization also generates significant savings for municipalities. According to a Nesta research¹, municipalities could save up to 13 % of their budget if they implemented simple digitisation programmes, compared to the status quo. For ambitious cities willing to transform everything they do with digital technologies (from procurement to how they organise), the potential savings could be much greater, up to 40%.

The example of Valencia. The city of Valencia, Spain, is a successful example of both offering online services to citizens and digitizing the back office. In 2007, the City Council adopted an e-government action plan which, among other actions, planned the digitalization of all processes and records. After seven years of preparation, training, mapping, digitalization, the City launched in 2014, the Comprehensive Electronic Management Platform (PIAE – Plataforma Integrada de Administración Electrónica) and the Electronic Office. The PIAE is the internal management software that allows the municipality to process records electronically throughout



Digitisation can generate significant savings for municipalities up to 13 % of their budget with simple digitisation programmes, and up to 40% for ambitious ones (from procurement to city's organisation).



Valencia's digitalisation programme has reduced operational costs by 170 million € in its first operational year, and the expectation is to save up to 10 million € per year.

1 http://www.nesta.org.uk/sites/default/files/connected_councils_report.pdf

the entire administrative circuit. The Electronic Office is the online platform that enables citizens to perform all administrative procedures electronically. An electronical management of all procedures and records increased efficiency and transparency for the municipality, and simplified administrative procedures for citizens. According to the city council, the initiative has generated huge savings for the municipality: after one year operational, the PIAE had reduced operational costs by 170 million euros, and the expectation is to save up to 10 million € per year.

When you start using SMART technologies in municipal administration, there usually is a strong reticence to change, mainly from long-time employees. To ensure the success of any SMART project, it is of utmost importance that employees are involved in the whole modernization process since the beginning, to ensure greater acceptance and endorsement.

EDUARDO JIMÉNEZ GONZÁLEZ, ICT DIRECTOR, MUNICIPALITY OF CARTAGO, COSTA RICA.

MANAGEMENT OF ONLINE PROCEDURES

MEXICO CITY, MEXICO

ABOUT MEXICO CITY

Mexico City (Federal District) has a population of 8,851,080 inhabitants (2010) connected to a metropolitan area of 20 million inhabitants. Every day, the capital receives an influx transit of around 4 million people who come to the city for their daily activities. The annual budget of Mexico City is approximately 9 billion USD. Mexico City was an administrative bureau of the national government until 1997, when, for the first time, citizens were able to elect their mayor and the heads of sixteen “political bureaus” (Delegaciones Políticas) which depend administratively but not politically on the local government. At the end of 2015, the National Congress approved a constitutional reform creating the 32nd state of the Federation, called “Ciudad de México”, which has now its own local powers (legislative, executive and judiciary).

ABOUT THE GCAM AND THE PROCEDURES

The General Coordination of Administrative Modernization (GCAM) of Mexico City¹ is responsible for designing, managing and coordinating strategies for innovation, government modernization and performance, and legal framework improvement. It was created in 1990 to answer to the urgent need to improve public management, but it only became a strategic actor in 2013 when it expanded its competence to the entire local government and the sixteen “political bureaus”. Both the State Government and the Political Bureaus are responsible for delivering transactional services to citizens. However, until 2012, procedures and services were registered manually in a paper book that gathered 290 of them. As a result, the procedures management system was characterized by a lack of standardization, the duplication of information, the lack of updated schemes and the complexity and bureaucracy, which resulted in distrust and uncertainty among citizens regarding governmental services.

¹ General Coordination of Administrative Modernization
Website: <http://www.cgma.df.gob.mx/index.jsp>



THE ELECTRONIC REGISTER SYSTEM AND THE PROCEDURES WEBSITE

In 2013, the GCAM launched an initiative to digitize procedures and services' registration. All procedures performed both by the State Government and the political bureaus were collected and registered in an electronic system to simplify and to remove duplicated procedures with no added value for the public. To do so, it created an Electronic register system (Registro CDMX) and the Procedures website (Trámites CDMX)¹. The project benefited from a \$25,000 USD contribution by the British government to the association, "PIDES - Innovación Social"², who developed the website and effected the training of local officials. The GCAM set up a team to map all the existing procedures and services conducted by the 91 different local government bodies. The team identified 2.385 procedures. Each one was thoroughly revised, simplified and electronically registered. The web platform was launched in March 2015, and now provides accurate, reliable and updated information to the citizen regarding all the procedures and services registered in the Registro CDMX system.

FEATURES OF TRÁMITES CDMX

The website offers a variety of services to citizens. It provides information about procedures and services, which are classified by topics and geo-referenced, being easily accessed from computers or mobile devices. The system allows citizens

to submit formal complains reporting any act of corruption or unlawful behaviour by the city officials. It contains an Electronic repository for laws, regulations, decrees, and other legal documents was created to facilitate access to information. In the future, the portal will automate certain procedures to allow citizens to get electronic documents, communicate with the appropriate service, get a birth certificate, start a business, deal with construction permits, register property, etc. As Mexico City residents are increasingly choosing online payment mechanisms to pay their bills and taxes (23,4% in 2015), the Trámites CDMX website will soon offer the possibility for citizens to pay taxes and other fees through it, this modality will also be possible through a mobile application "Treasury CDMX" is being tested since January 2016.

Results – By September 2016, out of the 2.385 existing procedures, the GCAM team had reviewed 982 procedures (519 from the Local Government and 463 from the political bureaus) and had reduced them to 758 procedures registered in Registro CDMX and published in Trámites CDMX, corresponding to a reduction of 23%. The implementation of a unique registration system and information portal helps the local government to improve the quality of services thanks to standardized and detailed information regarding procedures and services. It also offers legal certainty to the population and business sector. The initiative should also reduce management expenses and help fight corruption in public services.

- 1 Trámites CDMX Website : www.tramites.cdmx.gob.mx
- 2 More information : <http://www.pidesinnovacion.org/Iniciativas/tramites-cdmx/>



Screenshot of the Trámites CDMX website

1.1.B

MANAGEMENT PLATFORMS

Big Data. In a technology-driven world, cities are dealing with ever-increasing amount of information. Data is produced from different sources such as Internet of Things (IoT), networked sensors and devices, cameras, smartphones, social media, and diverse interactions and transactions across networked systems. And a diverse range of public and private bodies collect and process such data about citizens and cities including utility companies, transport providers, mobile phone operators and government institutions. Big urban data provides actionable information to municipalities to help understand city dynamics and citizen needs, formulate actionable policies, and even interpret trends and patterns and predict possible future scenarios.

City dashboards. To manage this enormous quantity of data, local governments are implementing sophisticated software management systems that aggregate, process, store and analyse the raw data streams from different sectoral systems. The data is then transformed into structured and understandable information that can be visualized through interactive maps and graphs in central control rooms, online city dashboards and open data portals. Operation centres allow city managers to monitor services in real-time and make better informed decisions based on reliable and objective information. City dashboards enable cities to measure progress toward stated goals against a set of key performance indicators (KPIs) which allow city managers to continually monitor and improve their strategies. While dashboards are typically meant for municipal officials, they are increasingly made publicly available to citizen and local businesses, usually through open data portals. Examples of cities that have adopted data management platforms include Rio de Janeiro with its Intelligent Operations Centre¹ developed in partnership with IBM, the city of Boston with its “Boston About Results” (BAR)² program that tracks city performance, the Dublin city dashboard³, or the Valencia Smart City Platform⁴.

Efficiency benefits. Besides allowing for increased visibility of operations and knowledge-driven decision-making processes as well as service-delivery, a citywide data management platform improves management efficiency by eliminating unnecessary duplication and allowing city managers to share data and work across administrative boundaries and organizational silos. Distinct departments can see where activities can be mutually supportive and adopt a collaborative approach, to operate from a common view of the city as a holistic system. As such, SMART technologies can contribute in radically transforming the way municipalities work, including how they are internally organised and manage resources, towards more transparent, inclusive, innovative and collaborative organisations.

When using SMART technologies, local governments must make sure to adapt the SMART solution to each category of people; and to find a way to communicate differently with each one of them. It is also very important to make available a variety of solutions in order for people to choose the option that suits them best, keeping the choice between traditional or SMART.

FRANK BATUNGWE
TIMISINE, KAMPALA
CAPITAL CITY
AUTHORITY, UGANDA

1 <http://policytransfer.metropolis.org/case-studies/rio-operations-center>

2 <http://www.cityofboston.gov/BAR/>

3 <http://www.dublindashboard.ie/pages/index>

4 <http://www.uraia.org/case/valencia-smart-city-platform>

Remaining challenges. Although SMART management platforms and big data analytics are seen as a fundamental part of a “SMART city” structure, only a few cities have implemented them (less than 20% of European cities according to the EU). In fact, due to lack of a standards-framework, these SMART tools are often proprietary and rarely interoperable with other platforms, applications and services. The fear of lock-in, coupled with the high capital and operational costs prevent local governments from undertaking such initiatives. As international standards are being defined and more vendors propose new generation of less-expensive, cloud-based tools such as the Software as a Service (SaaS) model, the number of cities implementing data management platforms will rapidly increase. While this may be true for big cities in developed and emerging economies, smaller cities and low-income cities still have a long way until they sort out the necessary underlying digital infrastructure to deploy such sophisticated platforms.

We, municipalities, have a long-term job to do on adapting mind-sets and human resources, because we cannot speak of SMART cities without speaking of SMART administration. It is key to start training and adapting the municipalities’ themselves before starting to use SMART tools, and this seems to be particularly true in the case of African cities.

OUAFA MONIATI,
FINANCIAL DIRECTOR,
URBAN COMMUNITY OF
MARRAKECH, MOROCCO

E-GOVERNMENT FOR IMPROVED MUNICIPAL FINANCE

WORLD E-GOVERNMENTS ORGANIZATION OF CITIES AND LOCAL GOVERNMENTS (WEGO)

ABOUT WEGO¹:

The World e-Governments Organization of Cities and Local Governments (WeGO) is an international organization of 101 cities and local governments that pursue sustainable urban development based on e-Government and ICT. WeGO helps its member cities pursue Smart and Sustainable Solutions through Digital Capacity Building Programs, IT Consultation & Pilot Projects, Knowledge Sharing & Networking, and International e-Government Competition (WeGO Awards).

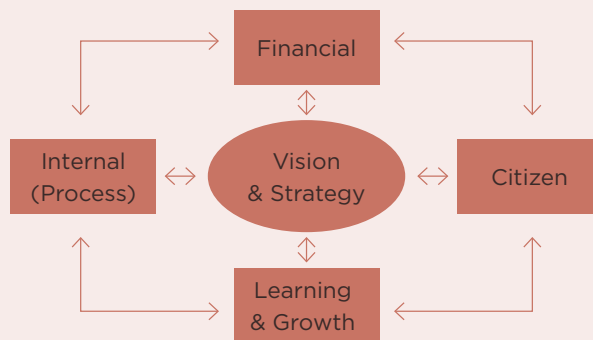
E-GOVERNMENT AND MUNICIPAL BUDGETS²

E-Government programs have a wide range of effects on municipal budgets, ranging from immediate and direct effects to long-term and less-visible effects. While the ultimate objective is, of course, delivering the best services to citizens at the lowest cost, not every program needs to have such a direct linkage to impact the municipal budget. While a policy that cuts paper consumption or reduces process time for productivity has quite obvious and traceable impact, harnessing citizen input through social media or analysing big data may lead to more agile, better-focused policies that in turn create efficiency and cost savings down the road. Seoul, for example, has utilized Big Data based on late-night mobile phone call volumes collected by a telecom company as well as taxis called late at night to create efficient routes for the popular Seoul Night Bus, also known as “Owl Bus” system. In Barcelona, Big Data is being utilized at the city’s largest annual festival, La Mercé. Weather, GPS, social media, traffic, parking data, and many others are providing the Barcelona City Council with insights into providing safer, more enjoyable events for its citizens.

A holistic framework for e-Government should therefore employ a balanced approach that facilitates citizen participation, learn from that feedback towards better policies, improve internal business processes, and eventually reap the revenue increases and cost savings of these better programs. With this improved budget, the citizens ultimately benefit from better-funded programs.

BALANCED SCORECARD FRAMEWORK

The following Balanced Scorecard Framework applies a business model to municipal e-Government. On one half of the framework, the more intangible perspectives of e-Government, citizens and learning and growth are represented. Satisfaction and participation both make up the citizen perspective. Learning and growth aim at quality improvement and capability building. The other two elements present more concrete perspectives: internal (i.e. more efficient process cycles and faster turnaround times) and financial (revenue increase and cost savings). The output of the four perspectives, when they are successful, is that the municipal government achieves its vision for the city, which may vary across contexts.



1 www.we-gov.org

2 The Focus Box was elaborated by WeGO, with special thanks to Ms. Mijung Kim of Yong Consulting for assistance in the research for this Focus Box and for the valuable contributions of WeGO featured member cities.

EXAMPLES

In practice, no municipal policy framework will ever perfectly execute each aspect of this model. Here at WeGO, our directive leads us to learn from the obstacles our members have faced and apply the lessons learnt and best practices towards having the most successful future programs. Here is a more detailed look at some of examples from our valued member cities:

Frankfurt, has overcome fractionalization problems by creating a one-stop portal for civic participation. With a population of 724,486, Frankfurt is the fifth largest city in Germany and among the richest in all of Europe (GDP per capita of \$95,491 USD), with a government's operating budget of over \$3.7 billion USD, which allows them freedom to pursue more advanced ICT programs. One such program is their civic participation portal, "Frankfurt Asks Me", which acts as a clearinghouse for all citizen participation, distributing the input to whichever department is relevant, as well as a multi-client tool. With an annual operating cost of \$11,000, it is a cost-effective resource that aims to facilitate citizens having an active role in their civic system. The time-efficiency of centralizing the various participation mediums and also the reduction of paper-waste have both benefited the city's budget. From a long-term point of view, the data collected from this tool may even lead to more cost-efficient allocation of municipal resources. The city initially experienced some obstacles due to various departments' reluctance to share information. However, over time, and with sufficient training, the departments gained familiarity with the program and participated more enthusiastically.

Moscow has updated its infrastructure and educated employees in order to streamline its medical system online. The most populous mega city in Europe with 16,800,000 residents in its urban agglomeration, suffered a near crisis in its health care system in the wake of the collapse of the Soviet Union. Inefficiency not only had an impact upon the cost of running health care, but chronically-long waiting times for health services, and lack of doctors and facilities led to decreased life expectancies. Burdensome amounts of paperwork consumed the time of employees, patients, and doctors. However, these conditions have been overhauled immensely. While ICT was only part of many reforms that ameliorated conditions in Moscow, the innovative Unified Medical Information Analytical System (EMIAS) has reduced costs and improved medical service in numerous ways. E-prescriptions have saved time and allowed doctors to dedicate more time to their medical work. Online booking has drastically reduced the queues

for patients, and live data and centralized information in the EMIAS Monitoring Centre have allowed the Department of Healthcare to operate more efficiently and make more informed decisions. While the indirect savings are impossible to calculate, labour hours saved from increased efficiency amount to over \$9.8 million USD annually, and reduced document printing saves the government over \$290,000 USD per year. Moscow overcame many standard obstacles to implementation, such as the need to enact legislation for electronic documentation, the need to educate employees, and the lack of existing infrastructure. To overcome these difficulties, and legislation was passed, continuous education programs to train employees carried out, new infrastructure was phased in by stages. Adding to infrastructural difficulties, no suitable software for such a project existed, and so Moscow took the bold approach of developing their own software for EMIAS, which it successfully accomplished.

Addis Ababa is currently exploring how to work around legislative and budgetary challenges to implement an e-Office system aimed at increasing administrative efficiency. With its ICT still developing, its e-Government programs are focusing upon the digitization of documents and processes with plans to expand into further programs in the future. WeGO conducted a 2013 feasibility study for an e-Office program, the intended output of which would lead to less paper consumption, faster processing cycles, and fewer lost documents (lost documents often lead to a costly complaint process). Challenges presented by such a context however, included a lack of legislative framework to allow for such a system, budgeting for implementation, and stakeholder buy-in from government staff who may initially feel inconvenienced by training and changes to their routine. WeGO is committed to providing knowledge-based solutions learnt from other members that have overcome similar challenges.



INTERVIEW WITH VIJAY JAGANNATHAN, SECRETARY GENERAL CITYNET

About CityNet¹: Established in 1987, CityNet is an association of urban stakeholders that gathers 135 municipalities, NGOs, private companies and research centres. CityNet’s mission is to connect urban actors to exchange knowledge and build commitment to more sustainable and resilient cities across the Asia Pacific region. Through capacity building, city-to-city cooperation and tangible projects, CityNet helps its members respond to Climate Change, Disaster, the Sustainable Development Goals and rising Infrastructure demands.

ACCORDING TO YOU, WHAT ARE KEY CHARACTERISTICS OF THE ASIAN CONTEXT REGARDING SMART TECHNOLOGIES? AND HOW HAVE ASIAN CITIES BEEN USING SMART TECHNOLOGIES TO POSITIVELY IMPACT MUNICIPAL FINANCES?

The first characteristic of Asia is the rapid spread of smartphones: the number of smartphone users in the region is expected to reach nearly 1.5 billion by 2019, and to grow further at a faster pace than the rest of the world. The second characteristic is the familiarity of young residents with software apps. They have become a digital tech-savvy generation, from mobile learning to social media and games. Most of the time spent on mobile devices is for usage of the apps. And third, games greatly enhance the potential of applying ICT to improve governance and accountability. An interesting example is the “Block by Block” initiative led by UN-Habitat in partnership with Mojang that uses Minecraft (digital lego) to design public spaces by engaging community for participatory public space design, enabling the youth to identify and visualize their needs. Block by Block reaches groups such as urban poor and children who are often not included in the decision-making processes. Asian cities have begun to appreciate the power of big data analytics and cloud computing to improve urban management. We are seeing cities as diverse as Kathmandu (Nepal), Makassar and Sidoarjo (Indonesia)



run hackathons to encourage young people to suggest innovative apps to enhance city management.

IN YOUR OPINION, WHAT ARE THE MAIN CHALLENGES THAT LOCAL GOVERNMENTS IN THE REGION FACE WHEN DEVELOPING SMART PROJECTS?

Technology is an instrument to enhance transparency, accountability and participation and not an end in itself. There are two key challenges in optimizing the use of technology: first is to develop cost effective solutions without creating significant burden to the public purse; second is to be wise in dealing with various vendors or providers in order to avoid irrelevant services. City government has to prioritise citizens first and ensure their satisfaction with government services.

1 <http://citynet-ap.org/>

BASED ON YOUR EXPERIENCE, WHAT ADVICE AND RECOMMENDATIONS WOULD YOU GIVE TO CITIES WISHING TO ENGAGE IN SMART PROJECTS TO IMPROVE MUNICIPAL FINANCES?

I would suggest three main points to cities that would like to engage in ICT projects: Review options, check with peers and do not sign on with vendors offering magic solutions. Before a city makes any decision, they need to review the available options thoroughly by elaborating both the advantages and risks that might occur in short, mid and long-term. Organisational synergy among relevant departments need to be developed in order to make the right and informed decision. City governments also need to realise that there are no ICT vendors that can offer a quick and magic solutions to improve municipal finances, they need to combine all the necessary components for the citizen's interest and it is a process. We believe that peer to peer learning among cities is the way to go.

PLEASE MENTION EXAMPLES OF CITYNET ACTIVITIES REGARDING THE USE OF SMART TECHNOLOGIES IN ASIAN CITIES.

CityNet has partnered with Microsoft and developed two main initiatives.

Since 2014, CityNet and Microsoft have held CityApp, an innovative series of events designed to create web and mobile applications to help citizens, businesses and governments better address urban challenges. It is a method to employ technology in ways that are citizen-centred, responsive and efficient. Tapping into the talent, creativity and commitment of start-ups, local NGOs, government officials and hundreds of

young software developers, CityApp seeks to catalyse technological and social transformation through web and mobile applications. In Sidoarjo, for example, the local government launched the winning app, M-Bonk, for public use. It enables citizens to report poor road conditions to the local governments for prompt actions, using their smartphone's GPS. Improved road infrastructure means faster and more reliable travel times which eventually bring benefits to the city.

Another initiative was the production of a White Paper that included a survey on the benefits of cloud computing and its applicability to cities. The advantages of cloud adoption were found to be relatively well-known amongst senior city officials. Over 80% of those surveyed acknowledged that cloud computing can deliver a variety of benefits for Asian cities. It debunks some of the common misconceptions around cloud, such as high security risks and costs. In order to address Asian cities urban challenges (providing reliable and equitable services, ensuring equitable access to services, ensuring environmental sustainability, etc.), you need a common platform that can integrate the various performance indicators and start measuring performance. In order to do this, cities need a proper infrastructure and ICT has proven to improve municipal governance and finance in many cities in the region.



CITYNET

1.2 SMART PAYMENT



Payments for services are at the heart of a city's economic activities. Money flows both in two ways, from citizen and businesses to the local government, and from the administration to citizens and vendors. The first flow includes transactions such as taxes (property taxes, sales' taxes, etc.) and fees (parking fees, business licenses, building permits, fines, etc.), while the second flow includes payment of salaries to city employees, procurement of goods and services from suppliers and disbursement of benefits to citizens. This makes payment systems an important target for modernization. By digitalizing both disbursements and collections, a city can increase both revenue collections and generate savings due to increased operational efficiency.

1.2.A

PAYMENT FROM CITIZENS TO LOCAL GOVERNMENTS

Facilitating payment of taxes and public fees can help municipalities increase their revenue: if citizens and businesses find it easier to pay taxes, they might be more willing to comply. This is particularly important in low-income countries where informality is high, and where obstacles to pay taxes (long queues in municipal halls and in banks, etc.) are one of the reasons for the poor local revenue collection system. Tools for smarter payment may include:

- **Electronic payment (e-payment).** An increasing number of local governments around the world are creating web interfaces that centralize information about all public processes and allow for online revenue collection and payment of taxes, fines and other fees. These electronic forms and auto fill features can save money and time both for the citizen and for the administration, while reducing errors. According to the Smart Cities Council, electronic payment platforms can contribute to an increase of revenue by 5%¹.
- **SMART cards and digital wallets.** Hundreds of cities already use SMART cards to facilitate payment for public services, and especially for transportation services. Increasingly, SMART cards are becoming digital, where smartphones combined with NFC technology (Near Field Communication), are used as a single interface to allow for payment of a variety of services, both private and public (loyalty programs, transportation tokens, movie tickets, etc.). While digital wallets are particularly suitable in developed cities, where a significant size of the population has smartphones and access to bank accounts and credit cards, local governments in the developing world are developing solutions adapted to local context to facilitate payment through simple mobile phones and without the need for bank accounts (Mobile Money being the most famous and successful example).



Electronic payment platforms for taxes and fees can contribute to an increase of municipal revenue by 5%.

In cities with an important informal economy, it is difficult for local governments to finance urban projects. SMART technologies, such as mobile payments, can represent a big opportunity to recover this lost revenue. However, to ensure the success of such initiatives, it is essential to deploy sensitization campaigns for the taxpayer to familiarize himself with the new system.

We need to combine the use of technology with both punitive and incentive policies to facilitate the transition towards new payment systems. An interesting way to convince informal traders to pay their taxes is to negotiate with the heads of each sector; and to offer them concrete services to improve their working conditions in exchange for paying taxes.

DENISE FAMPOU TCHAPTCHET, MAYOR OF DOUALA II, CAMEROON

¹ Source: The Readiness Smart Cities Guide: <http://SMARTcitiescouncil.com/resources/SMART-cities-readiness-guide>

THE LOCAL GOVERNMENT ECONOMIC SERVICES COMPANY AND THE PANGO PARKING PAYMENT SYSTEM

UNION OF LOCAL AUTHORITIES OF ISRAEL (ULAI)

ABOUT ULAI AND ITS SUBSIDIARY COMPANIES

Israel has a population of 8.5 million (2016), 92% of which lives in urban areas. The Union of Local Authorities in Israel (ULAI)¹ is a non-profit organization established in 1938 gathering more than 250 local councils and municipalities. ULAI is an umbrella organization that represents the common interests of Israeli local councils and municipalities before the Israeli parliament, central government and other official public institutions in municipal matters. ULAI also offers professional advice and provides training programs for municipal employees about education, welfare, economy, water, security, gender issues, labour relations and legislation. The Union of Local Authorities of Israel counts with several subsidiary companies, including:

- **The Israeli Bank of Local Authorities**, created in 1953 to provide financial services to local councils and municipalities, including the transfer of central government funds, access to low interest credit

for, infrastructure and urban development projects. Although ULAI only owns small shares in the bank's budget, ULAI holds 17% of the voting rights in the bank's general assembly.

- **The Automation Technologies Group (ATG)**², established in 1967 offers support to the development and operation of information and technology systems. It provides computer processing services to municipalities and related bodies. With more than 400 employees, the company works with 200 Israeli local governments, municipal companies, schools, and other local public organizations. The company offers Management Information Systems solutions in areas such as financial systems, payroll and human resources, engineering and geographic information systems (GIS), water and sewage services, social welfare, etc. It offers support to implement systems for improved communication with residents (local authorities' websites, online services to facilitate tax payments, school registration, development of mobile applications, making payments secure,

1 Union of local authorities of Israel (ULAI): <http://www.masham.org.il/English/Pages/AboutUS.aspx>

2 The Automation Technologies Group (ATG): <http://www.ladpc.co.il/about/Pages/eng.aspx>



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etc.). Assistance with information systems for the management of municipal income and billing and debt collection services (automatic and operator answering services, call service centre for payments, parking fines, municipal taxes, management and operation of water consumption, levies, educational fees, construction fees, welfare services, etc.).

- **The Local Government Economic Services Ltd (LGES)**¹. Established in 1974, the LGES assists municipalities to streamline public projects in a wide range of municipal activities. LGES had an annual turn-over of 1.2 billion euros in 2015. The company's goal is not to make profit but to serve local governments. Every year, 2/3 of the annual profits are redistributed to the municipalities according to the amount of transactions the municipality had that year with LGES, while the rest covers operational costs. The independence of the company is ensured by a board composed by mayors, city directors, professionals and politicians. One of the main services is the development of a system for collective procurement, where the LGES acts as purchasing agent for a consortium of local governments and offers assistance to municipalities to conduct tender processes to purchase goods and services and to provide assistance with service contracting.

ABOUT THE PARKING PAYMENT SYSTEMS IN ISRAEL

Parking payment systems are important both for urban spatial planning and to ensure a fixed source of revenue to local authorities. Although parking fees may not represent an important part of municipal income (usually, less than 5% of own source revenues of Israeli cities) and it concerns mainly medium and big cities, it is useful that local governments build favourable conditions to collect and enforce parking payment, as collecting local taxes and service fees effectively and using them efficiently allows a local authority to offer better public services to its population. In Israel, drivers can either pay in cash in parking vending machines, for a specific time duration. They can also opt for prepaid parking devices such as the EasyPark, a national electronic parking card that can be bought at post offices and gas stations. Once activated, the driver sets the device for a specified amount of time or either for an indefinite time until returning to the vehicle. Finally, they can also use pay-by-phone technology with the apps Cell-o-Park or Pango, which can be used both for parking spots on the street and for parking lots.

THE PANGO APPLICATION

Pango² is an app created in 2006 by an Israeli start-up offering a cashless pay-by-phone payment system for curbside parking in urban centres. Pango is an easy-to-use application adapted both to Smartphones and simple mobiles. Drivers can pay parking either through SMS, calls or via the app. After dialling a

¹ Company of Public services: <http://www.mashcal.co.il/MashkalEnglish/Pages/default.aspx>

² About Pango in Israel: <http://en.pango.co.il/> About Pango worldwide solution: <http://pango-parking.com/> and <http://www.mcp-parking.com/how-it-works>

simple access code, the driver is connected to a call centre that identifies the car's location and authorizes parking. When leaving the parking spot, the driver again contacts the centre (through SMS, call or App) to end the parking period. The driver receives a reminder on his phone when the parking time is about to expire and it is possible to extend the time remotely. If the driver is early, he can use the "un-park" option to be billed only for the time he has parked the vehicle. The Pango application was created to facilitate parking payment, but ten years later, the application also offers services such as payments for car washing, gas stations; information about local rates and regulations to avoid parking fines and a feature to help drivers locating their cars in a map. In July 2016, a navigation map to identify available parking spots was developed in partnership with other Israeli start-ups Parko and Anagog¹. Because a vast majority of car owners in Israel use Pango, the company has collected valuable data on parking habits and this allows the application to use crowdsourcing and GPS to give drivers the most accurate info about parking availability and steer them to spots about to become available. Pango combined with Parko is a complete urban mobility app that helps with traffic, parking identification and cashless mobile SMART payment, all in one.

IMPLEMENTATION

The parking payment system was developed by the start-up Pango and a partnership was established with LGES and ULAI to scale-up the use of the system by Israeli local governments. The fees are collected from the parking payment through mobile payment by Pango and transferred to the LGES that reverses it to the municipality where the fee has been paid. Both Pango and the LGES keep 1 or 2% of the transaction to cover operational costs. In 2016, 50 Israeli cities were part of the agreement.

RESULTS

According to Pango, the project has allowed for an important transfer of payments from traditional means (prepaid cards, meters, on-car devices) to mobile payment: the percentage of cellular payment compared to other payment methods jumped from 10 to 70%. Currently, nearly 85% of Israeli drivers use the Pango App (1.5 million subscriptions for 3.09 million motor vehicles in 2015) and has more than 500 private garages

and parking lots. Pango is the 4th most downloaded app in Israel (after Facebook, WhatsApp and Waze) and is expanding to other countries, having already signed agreements with 60 cities around the world. From the municipalities' point of view, the Pango parking payment system allows municipalities to improve management efficiency by:

- Increasing transparency. For example, Pango produces monthly automatic reports which inform where and for how long each vehicle has been parked.
- Facilitating enforcement and control. Since the App is connected to the municipal parking database, enforcement agents know exactly which vehicles are illegally parked.
- Enabling municipalities to better plan their expenditures as the system guarantees a regular and immediate municipal income.
- Improving compliance for parking payment. The system brings benefits for the drivers who gain from a centralized, nationwide, efficient, simple and convenient solution. An easy-to-use payment method enhances residents' positive perception of the municipality and increases the driver's willingness to pay for parking services.
- Reducing operational costs thanks to a reduction in bureaucracy. The Pango payment system avoids the need for a costly infrastructure by providing a risk-free solution with no upfront costs. It can work in parallel to the existing conventional parking payment methods.
- Increasing municipal revenues. Pango estimates that municipal revenue increases by 25% in 5 years². In addition, the income from parking collected by the LGES in 2016 was \$ 66 million USD (250 million shekels), redistributed to 50 cities.

1 More info: <http://www.israel21c.org/parking-your-car-just-got-easier-thanks-to-israeli-tech/>

2 Source : <http://www.mcp-parking.com/component/content/article/2/22-case-study>

1.2.B


GOVERNMENT PAYMENTS TO THE CITIZENS AND VENDORS

Digitalized processes of disbursements from governments to citizens, employees and vendors help local governments reduce expenditure and improve operational efficiency. Examples of how SMART technologies can be used in disbursement processes include:

Disbursements to citizen. This includes payment of social benefits, tax reimbursements, public servants' salaries, and financial support to small businesses, among others.

Payment of salaries and social benefits with prepaid debit cards. According to the Smart Cities Council, electronic payment of salaries and other benefits can reduce operational costs by 60%¹, and contribute to fight corruption (particularly important in low-income countries). In Egypt, the Ministry of Finance implemented in 2013 a program with Microsoft to pay employees' salaries with prepaid debit cards². In August 2016, the Government of Jakarta, Indonesia, launched a pilot project to disburse social service benefits to low-income households by electronic payment via the SMART Prosperous Family Card, in order to track down the payments and ensure it reaches the intended beneficiary³. Similarly, the City of Ontario, in Canada, created in 2013 the "City Services Benefit Card"⁴ which allows the city to disburse assistance to the population that does not have bank accounts. Other cities, for example in the United States such as Oakland and Richmond have created municipal ID programs⁵ that contain a prepaid debit component. The goal of such programs is to provide undocumented residents (immigrants, homeless people, etc.) with a recognition as citizens, to increase their security and facilitate access to local public services and open bank accounts. As the basic cardholder information is stored in a central database, this facilitates the transfer of social benefits from various city administration departments.

Financial support to local businesses. An interesting example has been reported in UK where local councils are using a FinTech platform to channel funding to local businesses to stimulate local economic growth and employment. The council of Lambeth announced in August 2015, the launch of a "Local Business Lending Partnership", which is a pioneering new scheme where the council will lend money directly to businesses based in Lambeth using the Funding Circle's peer-to-peer platform. Launched in



Electronic payment of salaries and other benefits can reduce operational costs by 60%, and help to fight corruption.

1 Source: Readiness Smart Cities Guide: <http://SMARTcitiescouncil.com/resources/SMART-cities-readiness-guide>

2 <http://SMARTcitiescouncil.com/resources/egypt-ministry-finance-prepaid-payroll-card>

3 [https://govinsider.asia/innovation/jakarta-pilots-electronic-social-service-payments/?ct=t\(GI_WSub194.1\)&mc_cid=f6cfc0c98b&mc_eid=7962beb331](https://govinsider.asia/innovation/jakarta-pilots-electronic-social-service-payments/?ct=t(GI_WSub194.1)&mc_cid=f6cfc0c98b&mc_eid=7962beb331)

4 <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=95baa81204bc0410VgnVCM1000071d60f89RCRD&vgnnextchannel=36b2d08099380410VgnVCM10000071d60f89RCRD>

5 <http://www.secureidnews.com/news-item/cities-start-issuing-municipal-id-cards/>

August 2010, Funding Circle¹ is an online marketplace where investors, big and small, can directly lend to small businesses. Until 2015, more than £750 million of loans had been lent to over 9,000 small businesses across the UK.

Payment to suppliers for goods and services. Both national and local governments have been using SMART technologies such as e-procurement to increase efficiency and generate savings in procurement processes. In these systems, the entire procurement process is integrated in an electronic platform and all public tenders and contracts are published online. Such a tool enables cities to get real-time access to a database of suppliers to make price comparisons and make sure to get a fair price, and thus, increase competition. By replacing printed purchase orders with electronic ones, administrative burdens are reduced and procurement procedure deadlines are shortened, thus lowering operating costs. Estimates from the Smart Cities Council² indicate that cities could save up to 30% of operational costs with e-procurement. In addition to efficiency, e-procurement systems can provide integrity benefits, help in the fight against corruption by limiting direct interactions between officials and potential suppliers, and ensure that officials have access to relevant and useful data regarding prior vendor performance, bribery condemnations and other integrity breaches, which can be listed in public debarment databases. In fact, it was found that 57% of cases presented at the OECD anti-bribery convention between 1999 and 2014, involved bribes to obtain public procurement contracts³.

One of the most advanced and successful examples is the Korean On-line E-Procurement System (KONEPS)⁴, a fully integrated, end-to-end system that covers the entire procurement cycle electronically (including registration, bid notice, tendering, contracts, inspection and payment). All related documents are exchanged online, including automatic collection of bidder's qualification data, delivery report, e-invoicing and e-payment, and information is provided on a real-time basis. As all public organizations are mandated to publish tenders through KONEPS, by 2012, 45,000 public entities interacted with 244,000 registered suppliers and over 62.7% of Korea's total public procurement was conducted through the system⁵. The system has boosted efficiency in procurement, and significantly reduced transaction costs. The system has also increased participation in public tenders and considerably improved transparency, eliminating instances of corruption by preventing illegal practices and collusive acts. It is estimated to have delivered \$48 billion USD in savings alone in 2010. E-procurement platforms are not necessarily initiated by governments: in Ukraine for example, Transparency International partnered with a hundred entities in the private sector, the civil society and government institutions to create the

Technologies might help municipalities to build a tax culture. But dialogue with all parties involved and political leadership are key to ensure the success of any SMART project. A strong communication campaign about the advantages of using technological options is often necessary to bring people close to use the SMART services instead of the traditional ones.

ENOCK ARINDA, EXPERT ON DECENTRALIZATION AND FISCALIZATION, RWANDAN ASSOCIATION OF LOCAL GOVERNMENTS (RALGA)

1 <https://www.fundingcircle.com/blog/press-release/lambeth-council-to-finance-local-business-growth-through-funding-circle/>

2 Source: Readiness Smart Cities Guide: <http://SMARTcitiescouncil.com/resources/SMART-cities-readiness-guide>

3 <http://www.ethicalsystems.org/sites/default/files/files/OECD%20Foreign%20Bribery%20Report.pdf>

4 <https://www.pps.go.kr/eng/jsp/koneps/overview.eng>

5 [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=GOV/PGC/ETH\(2014\)2/REV1&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=GOV/PGC/ETH(2014)2/REV1&docLanguage=En)

portal ProZorro¹ in 2015. In less than one year since its creation, the portal has already resulted in 12% savings. Typically, it is recommended that local governments complement electronic disbursement systems with didactic transparency portals to ensure that citizens can “follow the money”. The Slovakian example is particularly interesting as it has created a tool useful not only to government agencies in improving procurement processes, but also to citizens in increasing social control. In fact, the country’s online portal was visited 480,000 times between 2011 and 2015, which corresponds to 11% of the Slovakian adult population².

Besides increasing the revenue of the municipality, electronic systems of payment make transactions more convenient for the citizen, increasing satisfaction with services provided. However, people are still reticent towards using new technologies. Fear of change is still very strong amongst the municipal officials and population. It is important that the municipality offers as much information as possible about how the system works

NIKOLAS ESTAFHIOU, DIRECTOR OF INNOVATION, MUNICIPALITY OF NICOSIA, CYPRUS



**Cities could
save up
to 30%
of operational
costs with
e-procurement.**

1 <http://bi.prozorro.org/> and <https://www.one.org/international/follow-the-money/case-studies/public-procurement-transparency-generates-12-savings-of-public-funds/>

2 <http://www.transparency.org.uk/who-knew-contracts-could-be-so-interesting/>

E-PROCUREMENT

INDONESIA

CONTEXT

Corruption is one of the most serious problems facing public institutions in many developing countries, including Indonesia. According to Transparency International, in the year 2015, Indonesia was ranked 107th out of 175 countries comparing how corrupt countries' public sectors are perceived to be. Many cases of corruption in public institutions in Indonesia take place in the procurement processes of goods and services. An example is collusion between contractors and public officials, resulting in poorly qualified contractors getting contracts, and therefore overpriced contracts and projects of poor quality.

CHARACTERISTICS OF INDONESIA'S NATIONAL E-PROCUREMENT POLICY

The national policies on e-Government and e-procurement, called INAPROC¹, were initiated in 2008 with the aim of reducing bureaucracy and improving cost effectiveness and efficiency in public sector spending, as well as increasing transparency and accountability in the fight against corruption. Indonesian's e-procurement regulations oblige all government institutions to procure goods and services electronically: while central government offices must use 75% of the allocated budget, local government offices must use 40% of their budget. The National Procurement Agency (LKPP) is in charge of formulating and improving the procurement policy; regulating the system to ensure that e-procurement processes are efficient, effective, transparent, competitive, fair, and accountable; and providing mainframe websites for all Indonesian government institutions. All government institution (Ministries, State-Owned Enterprises and local governments) has a Procurement Service Unit (ULP) which is in charge of leading the goods and services purchase digital processes. The web platforms allow local governments to centrally post requests for proposals on all of the projects it plans. Contractors



can then bid on multiple projects and check who has won which ones, how much they bid, and the technical details of their proposal. The e-procurement system enables agencies across ministries, provinces and cities to track their expenses, share financial data, compare costs and prices and renegotiate where they find that others have gotten better deals.

RESULTS

Gains in efficiency in government agencies – Since the initiative begun in 2008, an increasing number of tendering processes in government institutions has been carried out through e-procurement, increasing from 33 to 98,272 tenders in 2008 and 2013 respectively. A total of 222,280 tendering processes were conducted over the period, all together totalling to \$21 trillion USD (IDR 275,587 trillion). Digital procurement processes create greater transparency and accountability between government, industry and citizen along the entire

1 Most information of this case study comes from the following reports: https://www.researchgate.net/publication/259467756_What_Is_the_Status_of_Indonesian_E-Procurement and <http://www.emeraldinsight.com/doi/pdfplus/10.1108/IJPSM-03-2015-0035> and <http://www.davidpublishing.org/Public/uploads/Contribute/556541de5ac26.pdf>

contracting process. By improving market access and increasing competition between contractors, digital procurement processes enable government agencies to get lower prices, while also increasing time efficiency on the procurement process and generating cost savings by eliminating office stationery, and cutting expenses of transportation, accommodation, consolidation, and printing. The e-procurement system has had important financial impacts to national and local governments altogether. LKPP reported that from 2008 to 2013, the Indonesian government institutions have saved \$26 billion USD (IDR 33.9 trillion), corresponding to 10.89%, of which \$10 billion USD (IDR 13.5 trillion) worth of national financial efficiency were saved in 2013 only. In the City of Surabaya, for example, the adoption of an e-procurement system in 2008 has led to a budget saving of \$ 107 million USD (IDR 1.392 billion) until September 2012, corresponding to 26.96% of its budget.

Disparities in implementation – Despite the important increase in the use of e-procurement system, as of 2012, only 10.26 % of the central government institutions procurement budget and 10 % of the local governments procurement budget went through the e-procurement system, with wide variations among cities. In fact, although local governments use the system more than national governmental institutions, disparities are still important and depend from the capacity and the size of the administration. Local governments only use e-procurement to procure a small portion of their total budget: for instance, the purchase of goods and services

through e-procurement of Provincial governments corresponded to 36.58 % of their budget in 2011, and increased sharply to 62.31 % in 2012. However, the regency and city government procurement in 2008-2013 only reached an average of 8.84 % of their budget. Although the national target is 40 %, it is reported that only 18 local governments are using e-procurement to procure more than 20% of their procurement budgets. Estimates indicate that, if all government agencies were using e-procurement, the government could save up to 30% of its total budget¹. Disparities are mainly due to the lack of telecommunication infrastructure at the level of the local government, resulting from Indonesia’s archipelagic geography (urban areas on the most-populous islands of Java and Bali have much better information access compared to other areas).

CHALLENGES AND RECOMMENDATIONS

Key issues that ensured the success of e-procurement policies at local level in Indonesia include: a strong political will to fight against corruption; the adoption of basic regulations at local level and having the influential support from legislators and guidance from central government; investing in the necessary resources, mainly human (training and change in management) and infrastructure (systems, bandwidth and electricity); ensuring the autonomy of the municipal procurement service unit, to avoid risks of corruption.

1 Source regarding potential savings: <https://govinsider.asia/innovation/three-indonesian-e-government-projects-to-watch/>



Screenshot of the Indonesian e-procurement system

1.2.C

MOBILE MONEY

Mobile Money is an electronic wallet service that allows users to store, send and receive, cash-in and cash-out money, and make payments using their mobile phones, both SMART and basic feature phones. At the end of 2015, there were 411 million user accounts (a 31% growth compared to 2014) in 93 countries (mainly Africa and Asia) from 271 service providers¹. It was initially created in Kenya in 2007 with the goal to allow small rural producers to realize personal payments, and that way, foster financial inclusion as Mobile Money appears to be an alternative to bank accounts. While most of Mobile Money payment systems have been initiated by private telecommunications companies in Asian and African countries, it has opened the door to innovation in public services and is increasingly adopted by national and local governments and used for public purposes. For example, local governments can use Mobile Money services to:

- **Enable payment of taxes.** An increasing number of countries and cities, mainly in Africa and Asia, are enabling citizens to pay their taxes through Mobile Money. Some examples include: Kenya, Mauritius, Rwanda, Tanzania, Uganda, Philippines. It is important to note that in these countries, tax payment via Mobile Money is not marginal, as in 2012, in Tanzania, more than 15% of the tax base used mobile money to pay taxes. Allowing for tax payment with Mobile Money in low-income cities brings several benefits both to citizen and local governments. It offers increased convenience to citizens by facilitating payment, reducing distances travelled and loss of time in queues at tax offices and banks. As such, Mobile Money systems remove barriers to compliance and decreases tax avoidance. In particular, it enables expansion of taxpayers' base by reaching citizens that live in informal settlements (people do not need to have an address to have a Mobile Money account or to have a smartphone) and bringing citizens that do not have a history of paying taxes, typically, people and businesses from the informal to the formal sector. In addition, it reduces paperwork and check processing, leading to savings in operational costs. By eliminating cash payment and intermediary agents and increasing transparency, traceability and real-time control, Mobile Money helps local governments fight fraud and corruption. All this contribute to significantly increasing municipal revenue and strengthening municipalities' financial capacity to provide quality services.
- **Facilitate payment of bills.** An increasing number of utilities for services such as electricity and water in developing cities are allowing payment via Mobile Money. Despite an increase in accepting payment for public services with Mobile Money, it is estimated that bill payment only represents 9% of all mobile money transactions on a global scale². In Nairobi for example, the Water and Sewerage Company, in partnership

SMART technologies can bring fundamental changes in municipal management and thus improve performance and reduce costs. But to ensure the success of an online revenue management system, political leadership, communication to citizens, a capacitated municipal team and strong partnerships are the key.

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1 http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/04/SOTIR_2015.pdf

2 Source : <https://www.theguardian.com/global-development-professionals-network/2015/apr/29/12-ways-mobile-money-can-go-further-development-financial-inclusion>

with the World Bank, launched in 2015 the Jisomee Mita programme (“Read Your Meter” in Swahili)¹, in order to improve access to water in slums. The project allows residents to pay for water bills using M-Pesa, the Kenyan Mobile Money service. Every house is equipped with a SMART meter, and users are required to read their own meters, send readings through SMS to the water utility, and the bill is then texted back for payment. Since its adoption, approximately 100,000 residents of the Kayole slum are using it. The system has had such a success because it increases convenience (residents avoid long queues at banks and frequent service interruption), but also because it is easier for customers to afford the start-up cost associated with connecting to the water system (approximately \$100), which can be paid in increments over the course of a couple of years. Besides increasing the number of households connected to water service, the project has contributed to exponentially increase revenue collection by the water utility and the system has minimized operations and transaction costs associated with meter reading, billing and payments.

- **Improve disbursements.** Among others, local governments can use Mobile Money to provide payment of salaries of public employees, social benefits to low-income population, micro-credits to local small entrepreneurs, or transfer aid and reach faster victims of natural disaster. The city of Quezon², in the Philippines, has been authorizing tax payment with Mobile Money since 2013 and realizing disbursements for public school’s teachers’ salaries and students’ scholarships in Mobile Money.
- **Foster local economic development.** Thanks to Mobile Money, the unbanked portion of the population (2 billion worldwide) can easily cash-in and out money, and have access to financial services such as micro-credits, which will increase investment opportunities for small entrepreneurs, and boost local economic growth. Digital payments are particularly important in low-income countries where digital financial services lower the cost and increase the security of sending, paying and receiving money, and where the resulting increase in financial inclusion is also vital to women’s empowerment and gender parity³.

The example of Ecuador. An interesting example that displays how governments can use Mobile Money is the case of Ecuador, which created in 2014 the “Dinero Electrónico”⁴, an electronic payment application program. It is the first country to create a state-run national platform that allows for citizens to make money transfers, payments to local businesses, cash in and out money, and pay taxes and services through digital money, and even realize international transfers since June 2016. Run by the Internal Tax Service within the Central Bank of Ecuador, it has a unified mobile platform that overcomes the interoperability issue, and has established itself as the sole e-money issuer in the country. Users can cash in and

1 <http://www.newsweek.com/2016/09/30/mobile-banking-kenya-nairobi-501350.html>

2 <http://quezoncity.gov.ph/index.php/recent-news/1170-mobile-money-initiative-in-qc>

3 <http://www.worldbank.org/en/news/press-release/2014/08/28/world-bank-report-digital-payments-economic-growth>

4 <https://efectivo.ec/> and <http://www.sri.gob.ec/web/guest/dinero-electronico>

out money in specific authorized institutions (financial, cooperatives, mutuelles, pharmacies, restaurants) and in ATMs. Since April 2016, in order to encourage citizen to use Dinero Electrónico to pay their taxes, the Central Bank offers tax incentives and tax money is returned to citizens through the Dinero Electrónico. Up to October 2016, the application attracted more than 72,000 users, and half a million people are eligible for the service; 17,500 centres are able to realize transactions with Dinero Electrónico; and the total transactions made with Dinero Electrónico accounted for USD 792,000. To finance the service, the Central Bank levies 0.05 cents in each transaction. Besides increasing tax income to national and local governments, the platform should also foster financial inclusion for 60% of the population that is unbanked and economically active. The project will evolve to offer, not just money transfers, but also access to credits, insurance and other financial instruments.

When a municipality implements a mobile payment initiative, it is useful to combine it with a data analysis programme. This would allow to follow-up fluxes to know better the dynamics of territory and to adapt public decisions accordingly. Orange is currently working with the District of Abidjan, in Ivory Coast, to deploy a project that will enable cab drivers to pay their taxes via mobile payment, while at the same time provide local governments with travel flux data to take better informed decisions.

ERWAN LEQUENTREC, ORANGE LABS

E-CITIE: ONLINE REVENUE MANAGEMENT SYSTEM

KAMPALA, UGANDA

BACKGROUND

With 1.9 million inhabitants in 2015¹ and an average annual growth of population of 4%, the capital city of Uganda faces many challenges: 39% of the population lives under the poverty line, 43% of the Kampalese work in the informal sector, and almost 60% of the Kampala population lives in informal settlements. A National Parliament act in 2010 made obsolete the Kampala City Council (KCC) and instituted the Kampala Capital City Authority (KCCA)² instead. The KCCA is led by an Executive Director appointed directly by the President and by a Lord Mayor elected by residents.

MUNICIPAL FINANCES IN KAMPALA

As for many African cities, Kampala's revenue still depends strongly from central government's transfers (70% of the city's revenue). As Kampala experiences rapid growth and increased responsibilities, there is a need to strengthen financial autonomy by increasing the share of own source revenue in its total income. Local revenue sources administered by KCCA include a dozen tax and fee revenues, five of which provide for over 80% of the total (property tax, road user fees, trading licenses, local service tax, ground rent) and the others provide a few substantial revenues (taxi operation fees, street parking fees, outdoor advertising, land fees, local hotels tax, market, building fees, vaccines fees, passport fees, marriage certificates, penalties and fines, etc.). When the KCCA initiated its activities in 2011, it encountered important challenges in the revenue collection and administration system. Amongst them: bureaucratic manual system which led to frequent mistakes and high operational costs; absence of a functional city revenue registry which prevented the municipality to track taxpayers and know who had paid or not; delays in collection, reconciliation payments, issuing licenses and receipts; long queues at banks; a system prone to misuse and corruption because of cash collection. In addition, the municipality used more than 151 different bank accounts operating, some without official authorization. All this, led the municipality to have little knowledge on

how much money was effectively collected or lost, and to be unable to provide adequate service delivery due to weak revenue mobilization.

REFORMS IN REVENUE MANAGEMENT

Since 2011, KCCA has engaged in a five-year strategic plan intended to steer the authority towards self-sustainability by reforming fiscal structure and modernizing the revenue collection and administration system. One of KCCA main successes has been the automation of revenue administration with the introduction of the eCite³ programme. Launched in 2014, eCite is a unified management information system, that allows for online registration, declaration and payment of local taxes and fees. It offers taxpayers a variety of payment methods options, including payment over the counter, at point of sales, bank payments, mobile payments (mobile money and mobile banking). With the new system, each person or business are provided with a personal identification number, and the information is stocked in a centralized municipal taxpayers' registry. The online revenue management system also facilitates reporting (both users and managers can consult reports online or via mobile); improves debt collection and refunds, and facilitates enforcement thanks to the use of mobile technologies (SMS reminder of notices and acknowledgement of payments). The project started in the transportation sector (mainly road user fees and taxi operation fees) and is being adapted to other revenue streams such as hotel fees, business licenses and property rates. For fiscal year 2015/2016, total collection by Mobile Money reached approximately UGX 10,9 BN (US\$ 3 million) making a fraction of 12.8% of the total non-tax revenue collections as per eCite.

RESULTS

The financial reforms initiated by the KCCA in 2011 have yield positive results in a very short time frame:

- **Increase in revenue collection.** KCCA own revenue went from 30 billion Ugandan shillings UGX (US\$8.9

1 Source: <http://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/TP52010.pdf>

2 <http://www.kcca.go.ug/>

3 <https://ecitie.kcca.go.ug/portal/>



million) in 2011 to 110 billion shillings (US\$32.5 million) collected in 2016, which corresponds to a rise of 266% over the period. Besides the sharp rise in the amount collected, the share of own sources revenue in total municipal revenue has also increased, going from 36% in fiscal year 2010 to approximately 46% in fiscal year 2016. The growth was mainly due to an expansion of taxpayers' base as; 110,000 new informal business were included in the tax net¹, and an increased compliance level of 70% resulting from easier payment method and improved enforcement. In addition, central government transfers and donor funds have also increased over the period, which is also a reflection of the improved performance of KCCA, which has given the National Treasury and other funders confidence that grant monies are being used appropriately. Transfers from central government went from 52BN UGX in fiscal year 2010 (US\$14 million) to 126BN UGX (US\$35 million) in fiscal year 2016, which means a growth of 242% in 6 years.

- **Increased operating cost-efficiency in revenue administration.** The cost of collection has increased nine-fold between 2011 and 2014. The initial situation had very limited administration capacity, there was a need to establish systems and capacities, including investments such as procuring assets and hiring consulting services. The Directorate for Revenue Collection (DRC) recovered all initial investments in only one year. In the longer term, the cost efficiency of

regular operations is expected to improve substantially and to reach 5%.²

- **Reduced corruption and fraud.** Thanks to the reduction of manual processes and bureaucracy, the elimination of cash collection, an increased control through processes automation and real-time update of customer registers and money entry. The reduction of KCCA bank accounts from 151 to 16 in 2015 allowed to increase traceability and to reduce risk of misuse.
- **Improved management of funds.** More knowledge about taxpayers and how much revenue is collected resulting from the new automated system, enabled the municipality to improve projections, cash flow planning, budget management and plan the roll out of new services and infrastructure. KCCA has now a full team dedicated to revenue analysis and projections and a city fiscal policy to guide the allocation of funds.
- **Increased expenditure in public services.** The amount spent on repairs and maintenance of services has more than doubled from 2012 to 2014. Reflecting KCCA's efforts to rehabilitate much of the city's infrastructure. KCCA has formulated a five-year capital investment plan that includes slum upgrading, street naming, road reconstruction, an integrated public transport system, storm drainage, disaster management, upgrading the city's healthcare schools and recreation facilities, as well as various economic development initiatives.³

1 Source : <https://nextcity.org/features/view/kampala-africa-urban-development>

2 Source : <http://www.theigc.org/wp-content/uploads/2016/01/Kopanyi-2015-Working-paper.pdf>

3 Source : <http://www.kcca.go.ug/uDocs/KCCA%20credit%20rating%20report.pdf>

- **KCCA received its first credit rating¹** in Uganda's history as a result of its sound financial management. In May 2015, Kampala was rated 'long-term A' and 'short-term A-' by Global Credit Ratings, a South African rating agency. This has allowed KCCA to access funding from international institutions such as the World Bank, and it will also open the perspectives for KCCA borrowing or issuing bonds.

- **From the citizen point of view**, the eCitie project has increased quality of services by reducing delays in delivery and reducing mistakes. It has also increased convenience by offering the option to pay in instalments and greater capillarity of sales point of Mobile Money than traditional banks and tax collection offices, avoiding long queues and travelled distances. The reform contributed to increase client awareness about how the system works (websites, information library, etc.), deadlines and amount to be paid (automated reminders and notifications through SMS and other channels).

CHALLENGES AND RECOMMENDATIONS

According to Mr. Batungwa Frank Tumusiime, Manager of business processes at the KCCA, the key elements that have ensured the success of the project include:

- **A strong and clear political support** from KCCA leadership, and particularly from the Executive Director, that ensured that actions were taken rapidly.
- **A strong institutional capacity:** KCCA established in 2011 the Directorate for Revenue Collection, which strengthened in-house capacities by hiring experienced staff, offering regular training, improving wage to increase motivation and stability, and buying modern equipment. The DRC includes a Research and Business Analysis unit which played a particularly important role in completing critical studies, drafting operation procedures, projecting revenues, and proposing reform measures.
- **Make thorough studies beforehand** in order to identify the challenges that prevent seamless revenue collection and adequate actions to improve tax collection and management, instead of just raising tax rates.
- **Partnerships** with a variety of institutions and strong dialogue with all stakeholders, particularly banks and



telecom companies, to ensure that citizens would be able to make payments at any bank or with any operator. The negotiation with banks was crucial as the eCitie programme enables people without a bank account to effect payments with Mobile Money. Collaboration with national agencies, such as the Uganda Revenue Authority, the Uganda Registration Service Bureau and the National Social Security Fund, were key to share information in order to verify and update databases and registers but also to ensure that the eCitie programme was compatible with other existing systems. A strong dialogue with trade and business associations was important to ensure success of the initiative.

- **Communication:** Although compliance has increased, there is still a strong lack of voluntary tax payment culture. KCCA has been also facing difficulties to ensure enforcement during the election period. Communication and sensitization campaigns are still needed to make sure the citizen understands its obligations and rights. The local government must also create communication channels to receive the citizens' enquiries and feedback. Related communication campaigns showing how funds are being used are crucial to make sure that extra revenue is reinvested in public services and that the citizen knows it.
- **Combine traditional and innovative solutions.** The administration encountered resistance from the citizens who still fear to use technology or do not have the capabilities to do so; so it has to offer alternatives adapted to different category of people (elderly, illiterate, rural population, etc.). As such, the eCitie payment through Mobile Money is compatible both with smartphones and simple phones without internet. And citizen can choose to pay through the traditional way (at bank) and the innovative way (mobile money). KCCA also maintains a Revenue Service Centre at the authority's headquarters for customers that still prefer going into an office to pay their taxes and fees.

¹ Source : <http://www.kcca.go.ug/uDocs/KCCA%20credit%20rating%20report.pdf>

INTERVIEW WITH JEAN PIERRE ELONG MBASSY, DIRECTOR

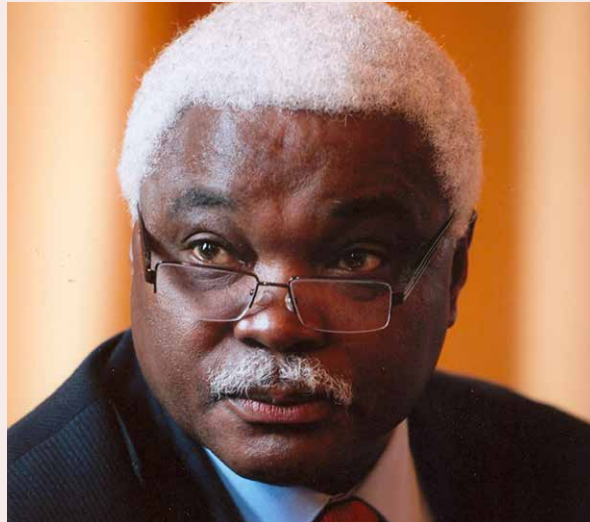
UNITED CITIES AND LOCAL GOVERNMENTS (UCLG) AFRICA

About UCLG: United Cities and Local Governments is the main global network of cities and local, metropolitan and regional governments. Its mission is to represent their interest on the world stage and promote the goals of democratic, local self-government through cooperation between local and regional governments and with the wider international community. It has 7 regional sections, including UCLG Africa.

HOW HAVE AFRICAN CITIES BEEN USING SMART TECHNOLOGIES TO POSITIVELY IMPACT MUNICIPAL FINANCES?

African cities have been integrating SMART technologies in their management at different scales, including:

- By developing projects based on the use of tools such as Google Maps, GSM or more complex Geographic Information Systems (GIS), that enable cities to gather data and better visualize the dynamics of their territories.
- By deploying SMART applications that aim at increasing citizens' participation in services management, mainly composed of tools to report incidences or corruption (for example Kigali, Rwanda)
- By deploying SMART systems that enable municipalities to remotely control their street lighting systems which make it easier to achieve important cost savings (for example Salé, Morocco).
- By deploying SMART tools to improve tax and fees collection such as Mobile Money. Many African cities have followed the example of Nairobi, Kenya that uses the Mpesa mobile money system to collect tax revenues or tariff bills for services such as electricity or water, which is particularly interesting for people working in the informal economy in that they save precious time that otherwise would have been spent in lining up in front of billing offices at the municipality or the service provider premises. The use of these technologies has drastically improved revenue collection in African cities, thus contributing to widening their financial autonomy vis-à-vis the national governments.



IN YOUR OPINION, WHAT ARE THE MAIN RISKS, DIFFICULTIES AND CHALLENGES THAT LOCAL GOVERNMENTS IN THE REGION FACE WHEN DEVELOPING SMART PROJECTS TO IMPROVE MUNICIPAL FINANCES?

Municipal finance in the African is still a challenging topic as in several countries decentralization is still incomplete. This is particularly true in francophone countries where the Ministries of Finance usually have the responsibility to collect taxes and redistribute them to local governments. Besides a lack of autonomy, African cities often lack technical (institutional and human resources) and financial capacities to lead reforms to improve municipal finance management. For instance, several secondary African cities still lack electricity which is the necessary basis for any ICT infrastructure, and even in those cities with electricity, bandwidth is not sufficient to support SMART projects based on big data for example. Which means that, if local governments want to improve tax collection with ICT, they need to make an arrangement with the Ministry of Finances, which may represent at the same time an opportunity to strengthen their capacity and a challenge in additional bureaucracy. The city of Cotonou, Benin has implemented such arrangements. Although SMART projects are mostly led at national government level, it is important to empower local governments and avoid having all decisions taken at national level thus disempowering local administration.

BASED ON YOUR EXPERIENCE, WHAT ADVICE AND RECOMMENDATIONS WOULD YOU GIVE TO AFRICAN CITIES WISHING TO ENGAGE IN SMART PROJECTS TO IMPROVE MUNICIPAL FINANCES?

Besides all the positive impact SMART technologies and the increased access to information that comes with it can have in municipal administration, they must be used wisely and cities must be prepared:

- African cities, which often lack the capacity to carry on complex technological projects, generally turn to the private sector that offers a wide variety of SMART solutions. However, big multinational companies tend to offer cities ready-to-use solutions considered to be applicable in any context. However, disparities amongst African cities are huge and a tool that may be suitable for Dakar or Johannesburg may not be adaptable to Bangui or Douala. As such, it is important that when partnering with private sector companies, local governments make sure to choose a solution that is adaptable to their needs in financial and technical capacities, as well as ensure that contracts benefit both parties, and include local companies to ensure the contracts contribute to local economic development.
- Local governments must complement technological tools with other elements to improve revenue collection. In particular, they must create a culture of paying taxes, and this can be done by showing to citizens the return on their investment. This could include, among others, campaigns to show why residents have to pay their taxes and how tax proceeds are being used; create opportunities for citizens to participate in decision making processes.
- Cities should start with building their internal capacities before launching any SMART projects. This means investing in IT infrastructure, and starting with small projects instead of betting on highly complex technological projects. But it also means investing in human skills by offering training to municipal employees in order to ensure appropriate usage of technical equipment. Local governments should also think about other ways of motivating public officials and encourage a mindset change towards greater endorsement of innovation in municipal management.
- Cities must use SMART tools following the principles of transparency and integrity and show how resources are being used for the collective good.

- Local governments can see in SMART technologies an opportunity to increase the democratic debate, to increase citizen participation. However, it is important that SMART tools do not substitute public deliberation as technologies will not be able to solve conflicts of interest. In addition, they must be careful in the relationship they build with residents; these must not be seen as mere users of products, and SMART technologies should not be a tool for local governments to control their citizen.

WHAT ARE THE MAIN ACTIVITIES OF UCLG IN AFRICA REGARDING THE USE OF SMART TECHNOLOGIES TO IMPROVE MUNICIPAL REVENUE AND REDUCE EXPENSES?

In 2013, UCLG Africa started a cooperation with Microsoft, with the goal to contribute to the development of African cities and to strengthen the governance and municipal management with the usage of ICT. The partnership projected to implement the CityNext initiative in pilot African cities to improve citizen engagement in local management and to better answer citizens' expectations. CityNext combines Cloud and Smartphone technologies with big data and social media analytics, and offer to municipalities an ecosystem of solutions to connect and fluidize data circulation between city services. A pilot-project was implemented in Kigali, Rwanda, where an application was created to allow municipal employees and citizens to report incidents and problems in services and infrastructures by taking pictures geotagged in a digitized map. This represents a big advantage to municipalities who can better know the state of municipal assets, and plan quicker interventions and repairs, which will in turn, reduce management costs while improving services' quality. However, African cities still face important obstacles to implement this type of project, as they do not always have the capacities to answer to all incidents reported, which can generate frustrations for the citizen or the municipal employee. As a consequence, it is important to demystify the usage of technologies as a miracle solution for urban management. If ICT can help governments to better know the dynamics of their territory and encourage citizen participation, they are not enough per se, and municipalities must make sure to have financial and technical means before initiating any SMART project.



1.3 INCREASING TAX REVENUE



Collecting taxes from large numbers of businesses and citizens is an ongoing challenge for any local government, especially in developing economies. There is constant pressure to collect more revenue with fewer resources and reduced budgets (do more with less), even more so during a period of global economic downturn. Local governments also face citizen demands for better and more transparent services with improved value for money. To address these challenges and with recent advances in ICT, there has been a strong drive to use SMART technologies to increase tax revenue, either by improving efficiency in tax collection and administration, or by encouraging local economic development. This has concerned both developed and developing economies, although at different levels. While cities in developed countries are betting on SMART technologies to fight tax fraud and evasion, cities in low-income countries still face challenges to build a tax culture, and have updated databases.

1.3.A TAX COLLECTION AND ADMINISTRATION

Examples of how local governments can apply SMART technologies to improve tax collection and administration include:


Technologies are of great support for cities, they can identify who taxpayers are and to improve control over income, but they can also allow to create additional communication channels between the municipality and the citizen.

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MUNICIPALITY OF
CARTAGO, COSTA RICA

Online payments. Local governments are increasingly offering citizens the possibility to pay their taxes via web platforms or mobile phone. With e-tax systems, the process of filing returns and paying taxes becomes simpler, faster and easier to understand for taxpayers. It is important for local governments to promote these benefits to taxpayers to increase compliance, especially as the complexity and bureaucracy of filing and paying taxes are often given as reasons why taxpayers delay, do not file or not pay. Automating tax filing and payment processes also increases transparency, reduces the risks of mistakes and corruption, which in turn strengthen the trust between citizen and administration, and contributes to build a tax payment culture, which is particularly important in low-income cities, where informality is important. For local governments, e-tax systems allow for faster processing of information and data, enable to compile and update a database to identify and address non-compliant taxpayers, reduces fraud and corruption, and requires fewer resources, reducing the cost of collection for revenue authorities. Both cities in developing and developed countries have been allowing for tax payment via SMART technologies, and mobile payment have been particularly popular. Seoul, for example, recently created a smartphone application to further simplify tax payment, and already has 7,3% of taxes currently being paid without any form of paper, neither in billing or payment. In African cities, tax payment via Mobile Money has significantly improved tax recovery and many cities, such as Douala II in Cameroon, Kinondoni in Tanzania, have reported an increase higher than 50% after a few years implemented.

Central management. To optimize tax administration, local governments could aim at centralizing all disparate tax payment mechanisms in one single integrated system linked to one city department, instead of having a fractioned system where different departments are responsible for different taxes (and other fees) collection, with different databases and registers. SMART technologies can help centralize tax recovery in one department, with one general database, and this should provide greater efficiency and better oversight, transparency and accountability.

Mapping tools. SMART technologies can help local governments streamline collection and management of taxpayer data. Software and applications allow to establish an accurate inventory and analysis of individual, corporate and residential tax payers, and have automatically updated databases and registers about taxpayers and taxable goods. While most cities in developed countries have been using advanced mapping tools for years, in low-income cities, mapping tax payers and taxable goods is still an important challenge. For instance, several cities, are still proceeding with street addressing. This is particularly the case in Africa and Asia where demographic growth is important and informal settlements account for an important part of the urban territory. The city of Kampala in Uganda for example, started a street addressing process recently mid-2016, to locate residents, houses and businesses in order to operate urban services and better enforce collection for user-pay services and local taxes. In municipalities where street addressing has been implemented, a 25 to 30% increase in local revenues has been achieved just by reconciling the street index with



Most African cities that have reformed their tax collection and administration system with ICT and Mobile Money, have experienced an increase of more than 50% in revenue in only a few years.

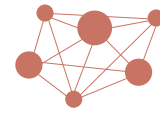
The use of SMART technologies in tax recovery systems brings benefits to the municipality: by improving management traceability, reducing corruption, enhancing taxpayers' knowledge and increasing revenue. But also directly benefits the citizen, with access to an easy-to-use and better quality service.

VINCENT NCHO, VICE-GOVERNOR, DISTRICT OF ABIDJAN, IVORY COAST.

the fiscal registers¹. Other local governments have created smartphone applications that municipal field agents can use to map businesses. In Indonesia for example, the Ministry of Finances created an app that allow public agents to check if businesses have registered and paid their taxes².

Geographic Information Systems (GIS) is certainly one of the favourite mapping tools used by local governments to improve tax recovery and administration. The GIS is an ensemble of computer tools (hardware and software) that allow for the capture, storing, analysis and display of big quantity of data with a spatial reference in real time. A GIS system enables users to visualize data in graphic map formats or satellite pictures, analyse spatial and temporal information, and formulate future scenarios to predict trends. It supports municipal management and planning by enabling a more efficient decision-making, resulting from a better knowledge and understanding of territorial dynamics. When it comes to tax recovery, GIS help local governments to establish an accurate inventory of individuals, activities and properties, and facilitates the update of databases and fiscal cadastre and registries. GIS is particularly useful to maximize property tax collection by allowing to track, store and manage critical information about land registration and analysis of land value and associated improvements of private and commercial real property. This is particularly important for local governments in developing countries where property tax is not only the main revenue source under their responsibility but also a prime urban planning and development tool, but where its recovery is still very low. In some developing cities, for instance, more than 50 per cent of urban populations live on land where title is disputed or unknown. With GIS system information, planners have access to rich information on natural resources (wetlands, vegetation types and geological formations, including potential hazard zones) and human activity (illegal settlements, construction, and encroachment). When digitized land registration systems are combined with frequently updated data from Geographical Information Systems, disparities in land title, zoning and land uses can be better understood, reconciled and updated. Planners can then ultimately act based on more current and accurate information, for all policies, but also for tax collection.

Big data analytics to fight tax evasion and fraud. Fraud and corruption in tax management are one of the main challenges encountered by local governments around the world as they represent huge shortfalls for the public administration. In a technology-driven world, fraudsters are getting more organized and sophisticated, using advanced analytical techniques and taking advantage of the lack of communication between government agencies. To face this challenge, local governments are looking for innovative ways to prevent, detect and recover losses from fraud. In particular, they are increasingly using data-tracking and predictive analytics systems to cross-check data from a variety of datasets and records across city departments, government bodies of different levels and private institutions, to verify and validate transactions in administrative procedures, or to spot anomalous patterns of behaviour and uncover potential and actual fraud. “Intelligent data mining” and Big Data analytics software can possibly lead



The use of Big Data to fight tax fraud has brought to the Seongnam municipality an increase of 10,9% in revenue in only one year.

In my country, where fiscal decentralization is still incomplete, the central government is in charge of redistributing taxes amongst local governments. But there is no traceability to know if the amount redistributed actually corresponds to the amount due. Technological tools can reassure central governmental that local governments are capable of managing their own revenue; and able of autonomously define a fair and adequate planning.

VINCENT NCHO, VICE-GOVERNOR, DISTRICT OF ABIDJAN, IVORY COAST.

1 http://www.europeanhabitat.com/wp-content/uploads/2016/03/7_Municipal-Finance.pdf

2 <https://govinsider.asia/digital-gov/indonesia-to-hunt-tax-evading-businesses-with-an-app/>

to predicting where anomalies may happen again. Predicting, preventing and thus discouraging fraud, boosts tax revenue and avoid raising taxes on law-abiding citizens to compensate for uncollected revenue. Analytics do not replace tax inspectors, but it does make them more effective by directing them to areas of likely fraud. As an example, multisource data analysis software has helped the city of New York to uncover more benefit abuse with less effort. In 2014, agency staff members completed nearly 30,000 investigations and identified about \$46.5 million in fraud compared with nearly 48,000 investigations and about \$29 million in fraud in 2009, before the agency began systematic data analysis of recipients¹. Another example is the Birmingham City Council, in the UK, deployed in 2011 an internal data matching process across multiple systems for preventing and detecting fraud and error. The data matching has proven to be very successful and has resulted in around 20,000 instances of fraud or error being identified and has saved £25 million in five years².

Improved compliance and enforcement. Local governments can use SMART technologies in different ways to improve compliance and enforcement for tax payment. This typically includes a better communication with the population. With updated registries about taxpayers' information, it is easier for municipalities to keep track on who has paid and who has not, and to send reminders and notices, not only by mail, but also e-mails and mobile phones. Some cities such as Kampala in Uganda, have adopted the simple strategy to send SMS to remind taxpayers of deadlines, which contributes to increase compliance. Local governments can also use online platforms to display to citizen how tax money is being used to finance for better public services. Another way to encourage local businesses to pay taxes is e-invoicing systems which forces buyers and sellers to register invoices with the tax authorities electronically when a transaction takes place. This is a strategy particularly used by state authorities in Latin American countries such as Chile, Brazil and Mexico³ which aim at both reducing tax evasion, and operating costs. The Ministry of Finances in Taiwan has created incentives that combine paperless transactions with gamification. It started in 1951 with incentivizing customers to request for receipt for their purchases to push businesses out of the black economy. In exchange, customers would automatically compete to win lottery prizes. The scheme led to a 75% increase in tax revenue. More recently, in 2013, the Ministry updated the system and put in place a program to encourage paperless transactions, with a special prize pool for those who request electronic invoices to be received in mobile phones⁴.

One of the best ways to reduce fiscal evasion is to facilitate payment conditions for the population.

EDUARDO JIMÉNEZ GONZÁLEZ, ICT DIRECTOR, MUNICIPALITY OF CARTAGO, COSTA RICA

1 http://www.nytimes.com/2015/02/22/technology/bringing-big-data-to-the-fight-against-benefits-fraud.html?_r=0

2 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/118508/strategy-document.pdf

3 <http://www.economist.com/news/finance-and-economics/21602274-reduce-tax-fraud-governments-encourage-automated-accounts-electronic>

4 <http://www.bbc.com/news/business-23057852>

GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REVENUE INCREASE

CARTAGO, COSTA RICA

CONTEXT

With a population of 157,000 inhabitants, Cartago is one of the biggest cities of Costa Rica. It has a positive Social Development Index, which grew of 10,8% between 2007 and 2015. Cartago holds the third position at the Municipal Management Index which measures local governments' efficiency. Since 2008, the municipality has innovated management by using SMART technologies, launching the Cartago Digital¹ initiative and the Municipal Digital Agenda, which constitutes a roadmap to build Cartago as a SMART city. Priority actions will cover issues such as: ensure access to internet infrastructures to citizens; modernize the technological infrastructure of the municipality; deliver online services to citizens; strengthen citizen engagement with SMART technologies; improve, social, economic and urban development and environmental sustainability with SMART applications; create a surveillance system; etc.

IMPLEMENTATION AND STRUCTURE OF THE GIS IN CARTAGO

One of the tools at the core of the construction of Cartago Digital, is the creation of a robust Geographic Information System (GIS). The implementation of GIS in Cartago started in 2007. In the first version of the system, each municipal department was responsible for acquiring their own licenses and structuring their own model. In 2010, the municipality transformed the GIS in a structure that centralized data in a single server and created a unique consultation tool to be used by all municipal services. More recently, in 2013, the GIS was updated towards a modern platform that combines mobile applications, web interface, cloud-based software and makes the information available to citizen².

FUNCTIONALITIES OF THE GIS

Cartago's GIS has more than 300 information layers related to a variety of topics and includes mapping of properties, addresses, districts; visualization of the city Master Plan; fiscal cadastres, building permits, businesses' licenses, concessions and authorizations; mapping of polluting activities; maintenance and monitoring of infrastructures; potable water and sewage networks; street maintenance; information about touristic sites and activities, etc.

PARKING AND TRANSIT FINES

Among other benefits, the new GIS has helped Cartago to improve tax and fees collection. An interesting example is the automation of parking and transit fines created in 2014. The solution combines a mobile application with a management software that allows levying the fine on the place where the infraction occurs, stocking information, printing the ticket and automatically uploading the data in the central database of the municipality.

This system improves the monitoring of fines' payment because municipal agents and citizens can follow-up the process online, know if the fine has been paid, send automatic notifications and accelerate payment. The system also allows an increase in transparency, which reduces the risks of fraud by the offender and of corruption from the agent. It also minimizes the number of appeals as the system allows to follow-up the registry with pictures that prove the infraction (the number of appeals between March 2014 and March 2015 went down from 72 to 18). The project also resulted in greater efficiency in reducing the operating costs and increasing revenue. The productivity of inspection agents increased by 45% between 2014 and 2015, passing from an average

1 Más información: <http://www.cartagohistoricodigital.com>

2 <http://municartago.maps.arcgis.com/home/index.html>

of 25 infractions per day in 2014 to 45 infractions per day in 2015. The revenue from infractions went from 15,9 million colones (\$28 800 USD) in January 2014 to 34,7 million colones (\$62 930 USD) in March 2015. A more efficient fine system also brings improvements to the city's road traffic by leading to changes in drivers' behaviour.

Thanks to the integration with the GIS, the municipality can immediately visualize in maps the fines reported by municipal agents. This offers relevant information to the municipality and allows to: identify critical traffic zones, expand parking zones delimitation, better distribute traffic regulation officers in specific sectors of the city, and in general, improve the transit regulations.

GIS AND MUNICIPAL FINANCES

The GIS is a tool particularly useful to improve taxes and fees collection and administration processes, by allowing the municipality to: update fiscal cadastres and properties' databases, improve the inspection of business' licenses, building permits and real property, etc. It provides the municipality with a better knowledge of its taxpayers and a bigger control over who has paid and who hasn't, and the possibility to generate targeted campaigns in districts that owe the most. The GIS also supports the municipality in identifying frauds and data manipulation in tax property declarations. The GIS allows to confirm in real time the information provided by the taxpayer and adjust the amount of taxes and licenses, even if taxpayers didn't declare the business activity or the real size of the property. In addition, the GIS also brings benefits to citizen: taxpayers can know the state of their finances through the web and mobile applications, and process quicker transactions online such as exonerations, building permits, land use permits, property and license declaration, reports, inspections, etc. This also contributes to improve the institutional image, creating better credibility in municipal services. More specifically, in Cartago, the GIS program has allowed to increase the budget allocation from 5.5 billion colones (\$9,9 million USD) in 2006 to 23 billion colones (\$41,6 million USD) in 2015, corresponding to an increase of 315% for the period and 12% between 2014 and 2015. Considering that the GIS project costed \$600,000 USD, spread over several years, the return on investment was very quick.



CHALLENGES AND RECOMMENDATIONS

According to Eduardo Jiménez González, ICT Director of Cartago, one of the main difficulties encountered during the implementation of the GIS was to ensure transversal collaboration between all departments and overcome the resistance to change within each service. The lack of experience of municipal officials in using technological tools was also a challenge. To overcome these difficulties, an important element was to involve municipal officials to create an ownership feeling, which leads to real endorsement and use. Other key elements were to hire a local private company to provide training to municipal officers in different departments, and to have the leadership of the Mayor and his Cabinet to ensure the participation of all departments. Other elements that ensured the success of the project included:

- To define clear goals, benchmark existing tools and identify solutions adapted to local needs and the municipality's capacity.
- Have a team fully dedicated to continuously update the GIS system working in close collaboration with the ICT department.
- Sensitize taxpayers about the GIS in order for them to understand that it is not only an instrument to control and increase recovery, but also to improve transparency and create communication channels between the citizen and the administration.
- Find a balance between the need for transparency and the importance to protect citizens' privacy. (for example, a citizen who wants to buy a property can find information about possible debts of the owner, but cannot know the exact amount of the debt).

BIG DATA AGAINST TAX FRAUD

SEONGNAM, KOREA

ABOUT SEONGNAM

Located in the Gyeonggi Province of South Korea, the City of Seongnam has a population of 994,271 and a population density of 7,032 per square kilometre. Its main export commodities include electronics and technology, and alone from these two areas, it exports goods worth not less than US\$ 571 million annually. Other significant sectors of the economy are textile manufacturing and petrochemical industrial processing.

SEONGNAM SOURCES OF REVENUE AND MAIN EXPENDITURES

Seongnam's 2016 revenue, thus far, is comprised of about 32.2% local taxes, 12.5% non-tax revenue such as parking tickets and fines, 16% matching funds for specific projects from the central government, and 9.4% subsidies from the provincial government. Additionally, 29.2% of the revenue is miscellaneous carry-over from the previous year such as late tax payments or projects that came in under budget. The city of Seongnam provides ambitious social programs including pre- and post-natal care centres, as well as stipulation-free basic income for youth. In fact, social welfare programs account for 25% of the city's budget, with education and culture, environmental protection, and land and infrastructure development making up 36.3%, 13.8%, and 24.9% respectively.

THE CHALLENGE OF LOST TAX REVENUE

Previously in Seongnam, separate databases existed for each department regarding collection of payments such as standard local taxes, standard non-tax revenues, traffic and parking fines. A dedicated team was typically charged with collecting taxes and fees specific to its department. This entailed coordinating 87 departments. The fragmented system led to unpaid taxes slipping through the cracks and ultimately resulted in loss of revenue. Furthermore, it was difficult to establish and evaluate bigger picture trends and patterns emerging across departments.

RECOVERING REVENUE THROUGH DATA AND STREAMLINING

To improve its revenue collection and help fund priority social programs, the municipality has targeted three key areas: corruption, budget waste, and tax evasion. The last area, tax evasion, when effectively controlled, has the ability to increase revenue for city budgets. As such, Seongnam has taken an innovative approach in utilizing ICT to engage its inhabitants and encourage the payment of uncollected taxes and fees.

In May 2015 Seongnam embarked on a journey to streamline the revenue collection process through the utilization of big data and personalization. Towards this end, the "Comprehensive Digitized Outstanding Tax Collection System" was developed and implemented. A step-by-step big data system is now in use and is being continuously improved to analyse methods to increase the payment of overdue fees. Seongnam undertook the project, funded entirely by its own municipal budget without additional assistance from provincial government, central government, or public-private partnerships. The program cost was US \$ 823,563USD, whereas the annual operating costs are expected to average \$ 30,872 USD¹.

Centralization was the most essential aspect as the improved efficiency simply made it more difficult for delinquent taxpayers to escape notice. By streamlining the previously fragmented departments' collection, Seongnam was able to recognize repeat offenders across a variety of types of taxes. Furthermore, 79% of these delinquents (13,996 people), were found to be well within the financial means to be able to pay these taxes. For those who were unable to easily afford payments, deadlines could be extended, and the government had more data to effectively target these individuals for social welfare programs.

Several methods have been deployed to collect the outstanding payments, from simple text message reminders to phone calls. The most effective method has been dispatching personnel to pay visits and reason-out with citizens to encourage payments. These employees offered assistance to failing taxpayers on how to make

¹ All KRW to USD figures are given based upon July 22, 2016 exchange rates.



payments more convenient, through the available apps and educate them on doing it online. In mid-2016, the final project stage commenced and aims to use Big Data to further track and analyse trends in outstanding payments.

RESULTS AND OUTPUTS

After being operational for one year, the municipality was able to pursue 17,587 cases through the new system and found a 468% return on investment. In one year, the revenue increase through the programme amounted to \$3,840,000 USD, and taxes collected in 2015 increased by 10,9% compared to 2014, before the programme implementation.

LIMITATIONS AND DIFFICULTIES

As the Seongnam City government possesses the broad legislative backing to collect taxes, no additional laws were needed. The biggest obstacle was in restructuring the tax departments. The tax department swelled from 16 to 148 employees as it absorbed those who had been in charge of taxes in other departments. Not all of the employees may be excited by the prospect of changing their role, nor will they initially excel at their new duties, particularly if they feel unprepared to use the new technology. In addition, a project like this one should not be rushed. Rather, each department's tax policies must be thoroughly analysed, and employees should be pre-emptively educated on their new roles prior to moving which will in turn ease their transition and leave them less frustrated by the change. Extensive training on the new IT tools is also advisable to make the process smoother. Finally, the new methods of payment

may initially annoy citizens who are not used to them, but a public campaign to raise awareness can ameliorate this as well. In Seongnam's case, citizens were able to view the remaining balance of their taxes in real time, and received text message updates.

KEY ELEMENTS OF SUCCESS

The municipal employees should explain to the citizenry what programs the taxes collected have been used for, and further, the citizens should experience the benefits of these social programs in order to establish a greater culture of social trust and cooperation associated with tax payment. Though the end result may appear to be low-tech, it was the use of ICT and data that made it possible. While the face-to-face aspect of the campaign was key to the success, it was also supported by an advertising campaign to educate citizens on the nature of their taxes and that the programs that they rely upon in their daily lives depend on the timely payment of such taxes. The combination of these two educational methods is recommended.

1.3.B

LOCAL ECONOMIC DEVELOPMENT

To increase revenue, besides improving tax collection and administration performance, local governments can tap into SMART technologies to foster local economic development and create more wealth to be taxed. In fact, if local governments fail to attract new businesses or help existing businesses to grow, it could lead to funding shortfalls for vital services. Local governments can complement traditional local approaches to economic growth such as measures involving tax incentives or business support, with initiatives revolving around SMART technologies. Examples include:

- **Reform procurement processes.** By directing public procurement spend towards high-growth local businesses, local governments can stimulate innovation and actively support their local economies. However, small businesses have typically struggled to access public contracts. As such, SMART technologies provide a means of opening up procurement processes. Promising trends include ensuring there is a single, easily accessible digital procurement portal that promotes contract opportunities, using smaller contracts, or using challenge or problem based procurements. For instance, Barcelona uses challenge-based procurements, which invites local entrepreneurs to develop innovative solutions to local challenges. Winners are given accelerator support to implement their ideas. The city promotes these processes widely online, including on social media, to broaden the audience. Through challenge-based procurements. Combining these processes with financial support brings new providers into the local government space and helps them scale.
- **Provide information, networking and matchmaking business opportunities to local companies through online platforms.** Cities can create online hubs dedicated to the start-up ecosystem, that provides information about local companies, investor, event, job, incubator, accelerator and resources. In Israel, for example, Tel Aviv created ILVenture, an open platform for start-ups, investors, accelerators and others in the city interested in innovation, to post jobs, services and programmes, and search for investors and potential hires.¹
- **Data to support business.** Local governments can provide open data to encourage local entrepreneurs to use public data to create new services and business opportunities to solve city problems. To encourage data usage, governments can organize Hackathons.
- **Applications to promote local businesses.** Local governments can create Smartphone apps to boost local economy by strengthening the link between potential consumers and local businesses. The city of Santander in Spain, for example, created in 2012 the “SMART Santander RA” app

SMART technologies can help the municipality to increase communication towards its own citizens; but can also develop a branding strategy to attract visitors, businesses and investments from elsewhere. The city of Lehavim, for example, is known to be one of the greenest city in Israel thanks to the communication about its water reuse system. Although it is not easy to quantify, this attracts people and investment and thus increases revenue for the city in the long run.

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¹ <http://www.forbes.com/sites/federicoguerrini/2015/08/07/5-key-traits-of-startup-and-innovation-friendly-cities/#19a3172042e9>

based on augmented reality technology and 2600 NFC and QR tags that were deployed in the centre of the city. The app provides information to tourists and residents about touristic attractions, cultural agenda, commercial offers of local businesses, opening hours of museums and other public services, among others.

- **Territorial marketing.** To boost local economy, local governments can create an enabling environment and “brand” their city to attract investment and businesses. Barcelona for example, has been known to be the world’s smartest city, and consequently has attracted businesses in the sector and developed a strong innovation start-up ecosystem.

ICT TO IMPROVE REVENUE COLLECTION

RWANDA ASSOCIATION OF LOCAL GOVERNMENT AUTHORITIES (RALGA)

DECENTRALIZATION AND MUNICIPAL FINANCES IN RWANDA

Rwanda is one of Africa's most densely populated countries with 12.5 million people living in 26,000 km². Its economy is mostly rural, with at least two thirds of the national workforce engaged in agricultural activities. In 2015, 28.8% of the Rwandese population lived in urban areas, out of which 53.2% lived in slum areas. In 2001, the national government launched its decentralization policy by establishing democratically elected structures at the local level and creating territorial administrations. The country has been divided into 4 provinces plus the city of Kigali, 30 Districts, 416 Sectors, 2150 Cells and 14,953 villages. The 2006 government's Fiscal and financial decentralization policy accorded local governments a greater role for service delivery across all sectors. It also transferred the responsibility to collect an assortment of local revenue sources, including taxes (fixed asset tax, rental income tax and trading license tax, property tax) and fees (public cleaning services, market fees, land lease fees, parking fees, etc.). Despite this progress, local governments are still struggling to build institutional and financial autonomy. For instance, districts are very dependent from the central government as transfers averaged 71% of their revenue sources in 2015, while endogenous sources of revenue are averaging 11%. The other 18% include grants from donors and, in a small degree, borrowings.

AN INEFFICIENT REVENUE MANAGEMENT SYSTEM

Revenue collection and administration in the Districts was manual until recently. This prevented the administration from having an updated taxpayers' database; municipal officials lacked the training and knowledge about the taxation regulatory framework, among other difficulties. The lack of capacity to engage in substantial broad-based revenue mobilization resulted in a low level of enforcement of tax legislation. Some fees were not even collected as the cost of the collection was higher than the revenue collected. From the citizen's point of view, besides the lack of culture of paying revenue, long distances between district offices and banks and long queues at counters discouraged people from paying their taxes.

THE RRA POLICY OF AUTOMATING TAX REVENUES FOR LOCAL GOVERNMENT

The Rwanda Revenue Authority (RRA) is well known for its advancements in using IT to improve tax collection: among other initiatives, it adopted, in 2011 an Electronic Billing Machine system and in 2012 a system to improve financial reporting by automating accounting for local governments. In 2013, the RRA signed an agreement with local governments to transfer the mandate to collect taxes on their behalf. As such, the RRA was tasked with the responsibility of collecting all necessary taxes and duties for districts and undertaking key functions in the revenue management process, such as registration of taxpayers and properties, declaration, audit, enforcement, tax appeals and arrears management. With the goal of automating and improving the decentralized tax collection and administration system, the Ministry of Finance and the RRA launched the Rwanda Automated Local Government Revenue Management System (RALGRMS) in 2015, an automated software system composed of two main measures to ensure regular and stable tax revenue for local governments:

- The e-tax project created in 2013, allows taxpayers to register, declare and pay online, enabling the administration to build an electronic database of taxpayers.
- The m-declaration initiative launched in 2014, enables taxpayers to use mobile phones (not necessarily a Smartphone) to register, declare and pay taxes and fees. Payment can be done with Mobile Money, Mobile Banking or over the counter. Besides facilitating payments, the system also allows users to request trading licenses, registration of properties, market fees, driving licenses, visa applications, marriage and birth certificates, etc. Furthermore, the system facilitates the communication between the tax administration and taxpayers through internet based platforms.

While the e-tax is particularly important for large taxpayers (330 large firms with an annual turnover of over \$1million USD contribute to 70% of all domestic tax revenues), the m-declaration project is customized for small entrepreneurs and informal businesses (estimated to be around 90,000 in the country).



ABOUT RALGA

The Rwanda Association of Local Government Authorities (RALGA)¹ is a non-governmental organization established in 2003 that brings together all the 30 Districts of the country and the city of Kigali. RALGA's mandate is to represent, advocate for and build the capacity of local governments addressing the current issues they face and particularly regarding effective implementation of the decentralization policy, increasing revenue, encouraging local economic development and social development. In 2016 RALGA launched the Local Governance Institute (LGI)² in collaboration with the Commonwealth Local Government Forum and the UK's Local Government Information Unit, to offer capacity building activities to local officers and elected representatives to help improve financial management capacity and provide policy guidance and support for local economic development.

THE ROLE OF RALGA IN BUILDING LOCAL GOVERNMENTS AND CITIZENS' CAPACITY TO USE ICT IN REVENUE MANAGEMENT AND COLLECTION

RALGA has had a very important role in the process of improving decentralized revenue management with ICT: it has led strong advocacy alongside the RRA for automation of revenue processes in Rwandan local governments; it has negotiated and signed the

Memorandum of Understanding that gave the RRA the mandate to collect revenue on behalf of local governments; and it is part of a Steering Committee alongside concerned ministries that ensures the smooth implementation of the Rwanda Automated Local Government Revenue Management System. In addition, it has led sensitization campaigns and organizing training sessions to local governments' officials to promote the use of ICT in revenue management. RALGA also worked closely with public officials to explain to the population how the new tax system relates to improved service delivery. Local governments have capitalized on traditional collective actions to sensitize the population. Examples of meetings include: Ubudehe (to engage community to solve common problems); Umuganda (a monthly mandatory community service); and Imihigo (an annual activity to engage the community in planning, accountability and monitoring of local governments' activities). In addition, the government has also created a "tax week campaign" and "the annual budget and accountability day", where local leaders present to the community what they have achieved compared to what was planned.

RESULTS

From the citizen point of view, implementing the e-tax and the m-declaration system allows tax payment from anywhere at any time, increasing customer compliance. It has also contributed to increase financial inclusion:

1 <http://www.ralgarwanda.org/>

2 <http://www.lgi.rw/>

THE DEADLINE FOR DECLARATION AND PAYMENT FOR LAND LEASE FEES IS DECEMBER 31st, 2016



Use your mobile phone by dialing *800# and follow prompts

You can pay your land lease fees via Mobile Money by dialing *182# and follow instructions

3004 @rinfo www.rra.gov.rw



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the number of Rwandan citizens having a bank account rose from 21 % in 2012 to 42 % in 2015. From the local government point of view, the automation of tax revenue and administration has increased transparency and accountability; reduced corruption and tax fraud; improved enforcement; strengthened capacity to forecast revenue and expenses; it has also increased tax base and reduced informality. The digitalization of tax processes led to a reduction of transaction cost thanks to reduced office paper and the need to deploy less staff to support tax collection in all districts (reduced from 900 to 173 staff). An increase of 55,5% in revenue has occurred: according to the RRA, the total revenue collected for local governments nationally increased from \$28 million USD in 2011 to \$68million USD in 2015.

CHALLENGES AND RECOMMENDATIONS

According to Enock Arinda Bwatete, Finance and Administration Unit Manager at RALGA, the following elements were key to ensure the success of the automation process of decentralized revenue and administration:

- To secure sustainable funding for the deployment of the software and for the training of stakeholders and beneficiaries. RALGRMS was developed thanks to a grant of \$600,000 USD from the African Development Bank.

- To identify one unique software to manage and report the revenue collection that fits the capacities of all 30 districts, given that none of them had a revenue collection system in place in the past.
- To align the software with the existing legal framework and reporting requirements; and to make sure it is compatible with the existing software used by the RRA and the banks.
- To develop strong sensitization and awareness campaigns for all stakeholders, including the districts, banks, telecommunications companies and taxpayers.
- To ensure enforcement by combining penalties and incentives.
- To establish strong partnerships. The fact that the project was led by the central government through the RRA ensured that all banks and all telecommunications companies were integrated the system. Partnership with banks was key to improve taxpayers' identification: for example, every time a new business was created and an account opened, the bank would notify the district to be included in the taxpayers' database.
- To show taxpayers how taxes are being used in improving services' and quality of life.
- To ensure that SMART payment methods and management systems are completed by other tools that allow the administration to estimate correctly the amount of taxes paid by each business and individual. RALGA, together with other stakeholders are currently working on a property valuation tool to assist local governments in determining the value of properties and define the correct amount of taxes to be paid.
- Having the central government lead the automation process in partnership with RALGA was key to ensure that all districts could equally improve their revenue collection and administration capacity.

1.4 LESSONS LEARNED ABOUT DIGITAL GOVERNMENT



As we have seen, SMART technologies represent great opportunities to improve service delivery and the relation between citizen and administration, workflow and processes' efficiency within city administration, payment flows, tax recovery and administration, and also encourage local economic development. All this contributes to generate savings and increase municipal revenue. City managers frequently highlight a few elements they must pay attention to, in order to ensure the success of SMART projects, including:

- **Make sure to have the necessary IT infrastructure and connectivity to develop SMART projects.** This is particularly important in developing economies that face challenges such as frequent power cuts, slower network speeds or system failures. The SMART tools chosen by the municipality must be adapted to the local infrastructure capacity. For example, African cities should not engage in sophisticated projects that require strong IT infrastructure, but instead could opt for solutions based on mobile technology given the prevalent mobile phone and network usage and availability.
- **Build capacity of the municipal team.** Prior to implementing SMART projects, it is key that local governments address organisational efficiencies and ensure to have well-trained and motivated staff. Besides capacity building, change management is important and requires thoughtful planning and sensitive implementation to ensure that employees are willing and able to use the systems. To do so, key elements include providing: effective communication about the change and benefits it will deliver, training to build awareness and employee confidence in using new systems, associating employees to the project design and implementation to avoid reticence and ensure endorsement.
- **Define strong regulatory frameworks to ensure data privacy and cybersecurity.** As more data is shared among government agencies and with third parties, there is a need for greater public consultation and adequate regulation on the use of personal data. Local and national governments have to find a balance between sharing enough data to ensure transparency while protecting data privacy.
- **Dialogue with stakeholders.** Local governments should lead strong dialogue with all parties involved in SMART projects from the beginning

of the project, in order to make sure that all interests are satisfied and to avoid resistance.

- **Avoid implementing isolated SMART initiatives.** Local governments must make sure that every SMART initiative is integrated and interoperable with the system. For instance, a web interface for paying taxes is useless if all the background procedures are still manual.
- **Political leadership.** Support and commitment from high government levels are key to ensure the sustainability of the project, to overcome divergences among city departments, to ensure all stakeholders are on board and to define appropriate legal and regulatory frameworks.
- **Ensure services adapted to all and combine traditional and online methods.** Local governments must ensure that the SMART initiatives are inclusive and accessible to all segments of the population, even those with low level of literacy, digital proficiency or limited internet access, in order to avoid risks of exclusion. To uncover blockages in user pathways and ensure the needs of different groups are being met, local authorities can adapt information in online platforms to people with language and literacy difficulties, ensure that people have access to in-person navigation support, telephone call centres and provide assisted digital services, including computer and internet access in libraries and community centres for example. In addition, local governments should make sure to combine both online and offline solutions in order to let the citizen chose the option that he prefers.
- **Conduct strong communication campaigns.** In order to ensure acceptance, understanding and usage of SMART tools, local governments should use different communications means to sensitize the citizen, both traditional (radio, television, outdoors, mail) and digital (mobile technology, social media, online platforms, cars with speakerphones to reach remote areas, etc.). This is particularly important in the case of projects to improve tax recovery, to explain to residents why they have to pay taxes and how the money will be used.
- **Greater integration between city departments.** SMART projects and particularly those related to revenue collection and administration require increased data sharing between city departments and government agencies from different levels to increase efficiency and give citizens a more convenient, seamless experience. For example, instead of requiring citizens to create different accounts for tasks like paying parking tickets, taxes or trash pickup fees, city government could require one single identification in one single web platform to simplify transactional processes.
- **Collaborate with national governments and association of cities.** Both have a key role to play to ensure that cities of all sizes have the capacities to implement SMART projects that will improve municipal management and revenue collection and administration. For example, national governments could offer support to structure cities websites with SaaS structure models, saving cities hosting and maintenance costs.

INTERVIEW WITH ERWAN LEQUENTREC

ORANGE LABS, FRANCE

About Orange and Orange Labs – Orange is a French telecommunications company with 250 million customers worldwide in 2016. The group is either leader or the second operator in 75% of European countries and in 80% of African and Middle East countries where it operates. Orange Labs¹ is the research and development division of the group focusing on SMART cities, mobile payments, content aggregation, mobile connections, services and applications, and SMART grids. Orange Labs network has more than 5000 employees in 18 centres.

IN YOUR OPINION, HOW CAN LOCAL GOVERNMENTS USE SMART TECHNOLOGIES TO INCREASE MUNICIPAL REVENUE OR DECREASE EXPENSES?

Among others, local governments can use SMART technology to reduce the level of informality (and increase taxpayers' base) and for the analysis of data (Big Data).

Reducing informality and tax evasion through SMART technologies – In some countries, and particularly in Africa, informal activities can represent between one quarter and one third of GDP and contribute up to over 60% of employment. This constitutes a significant shortfall in tax revenue for local governments. To make the 'formal' attractive and thus reduce the informal, local governments can use technologies to:

- Digitize certain processes by focusing on simple mobile technologies (the only terminal widely distributed in Africa). In Tunisia, for example, Orange has launched a project to reduce electrical consumption, billing errors or fraud risks.
- Facilitate the means of payment (Mobile Banking) and access to credit. In Ivory Coast, Orange is working with the Abidjan District to set up a digitization pilot project of collecting business taxes. The project includes three lines of development: 1) to propose to taxi drivers of the District to pay for their professional fees via mobile phone (Mobile Banking); 2) to provide a simplified method of communication
- with the District to facilitate exchanges and to trace requirements through the M-Tew platform; 3) to provide feedback on the movement of taxis in Abidjan (attendance lines, traffic jams, parking areas, etc.). The expected outcomes of the project are: to avoid the waste of time and money of taxi drivers trip to the municipal treasury; to ensure a secured and transparent circulation of financial flows; to reduce corruption by eliminating the use of cash; to improve tax collection for the District; to improve exchanges between the District and local economic operators on the development needs of infrastructures used by taxis. The project should bring benefits for citizens, taxi drivers and the municipality. Rising incomes and reducing shortfalls will improve public services such as road infrastructures.
- Establish programs to increase the competence and productivity of small businesses and entrepreneurs, to expand their activity and leave the informal sector. In Ivory Coast, Orange created an application called "My Business with Orange" that enables informal sellers of fruits and vegetables, or other products, to facilitate inventory management, orders from wholesalers or product sales, and customer relations with payment



1 More info: <http://laborange.fr/>



via Orange Money. Another Orange project aims to strengthen the actions of the French Group Bel cheese among street sellers to improve and retain their skills by offering them training via mobile phone and social incentives.

Data analysis for an optimal decision making – Local governments in partnership with telecom operators can use the massive data from mobile phones and / or deploy connected objects to generate data that allow optimizations¹. In this sense, in 2012, Orange organized the competition “Data 4 Development.”². During challenges organized in Senegal and Ivory Coast researchers identified that Big Data can complement or facilitate heavy censuses, surveys or polls to measure indicators (e.g. of poverty, illiteracy, urban mobility, energy access, crisis management, floods, etc.). The analysis of these data allows public authorities to make informed and appropriate decisions. For example, in the field of urban mobility, the collection of data from mobile phones allows public authorities to carry out investigations of origin and destination, to identify areas of high density, to know where to act to better regulate the flow traffic, etc. Big Data can also establish probabilities of the percentage of illiterate population and the location of this population (e.g. based on the number of SMS sent) and better adjust communications campaign. The communication channel and the message can be customized according to the characteristics of the target populations. A research “OPAL” for Open Algorithm, is currently being developed with the

French Development Agency to find ways national statistical institutes and local governments could use such indicators.

HOW CAN THE PRIVATE SECTOR WORK WITH LOCAL GOVERNMENTS TO IMPROVE MUNICIPAL REVENUE AND DECREASE EXPENSES THANKS TO THE USE OF SMART TECHNOLOGIES?

When it comes to SMART projects, public sector bodies are often cautious and have strong financial constraints. The implementation of public-private partnerships to test solutions that mobilize new products or services based on digital technologies to increase tax revenues or reducing expenses may be interesting. Especially before scaling up projects, thus allowing to proceed by demonstration effect in order to reduce risks and provide evidence-based advocacy. Telecom operators are the main actors with access to bulk data and innovation in business model could help local governments reduce investment costs. A new economic model based on Big Data context is the “Outcome economy” where companies do not sell services or products, but results directly quantifiable. In Los Angeles, the start-up “Streetline” partnered with the municipality to implement over 7000 sensors on urban roads allowing to know, in real time, parking availability. Los Angeles observed an increase of 2% in revenue generated by parking fees despite a decline in parking costs.

¹ More info here: <http://www.orange-business.com/fr/big-data-analytics>

² More info here: <http://www.d4d.orange.com/en/national-statistics> and http://www.ffue.org/wp-content/uploads/2015/09/FU-US_150927_Blondel_LaRecherche_BigData.pdf

IN YOUR OPINION, WHAT ARE THE MAIN OBSTACLES AND CHALLENGES ENCOUNTERED BY LOCAL GOVERNMENTS TO USE SMART TECHNOLOGIES TO IMPROVE MUNICIPAL FINANCES?

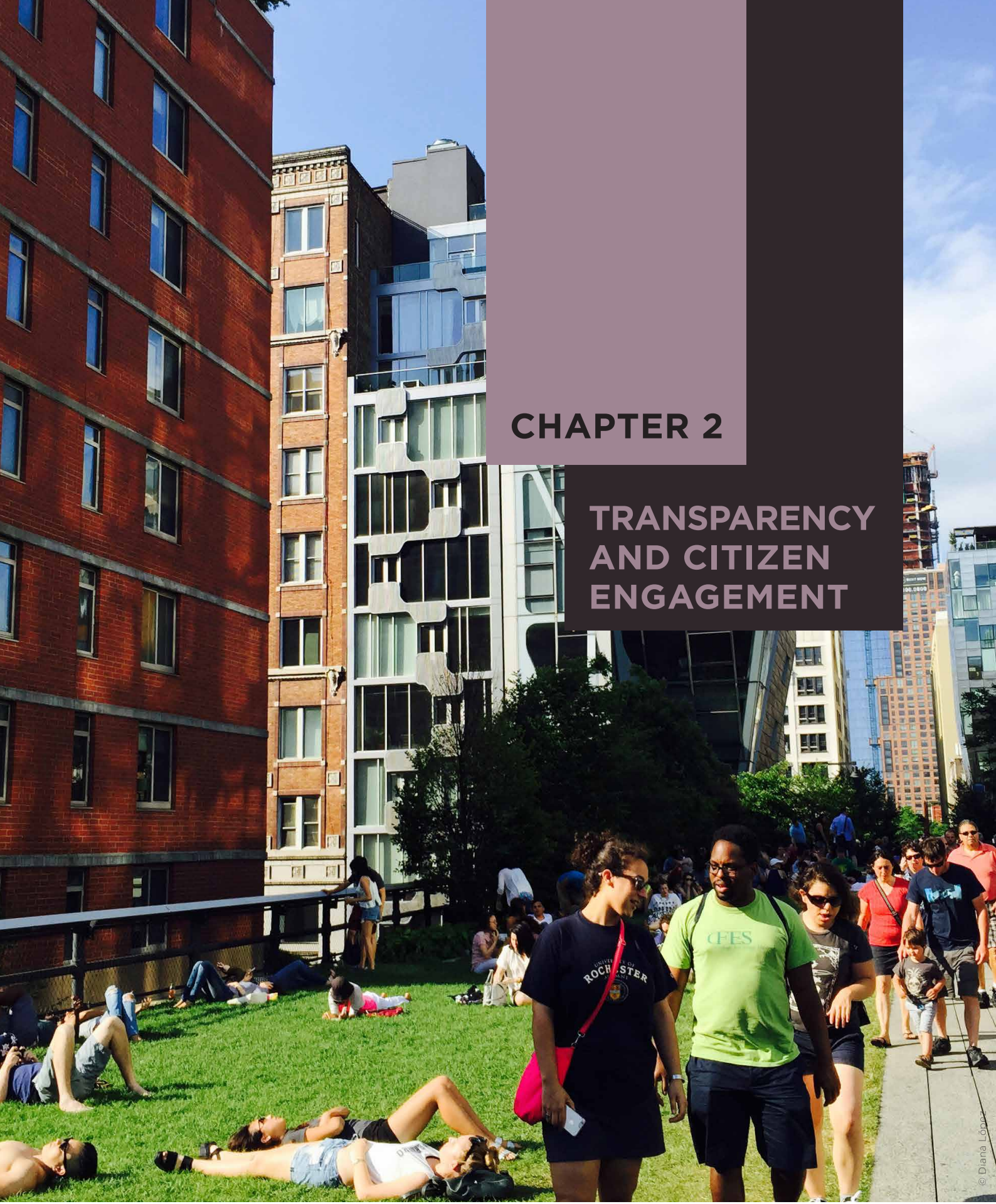
The illiteracy rate and Internet access inequalities are still high, especially in the cities of developing countries. Consequently, local governments should provide adapted services to the entire population, which means there should be alternatives to the solutions based on new technologies, and cities should also implement initiatives to reduce the digital divide and to educate people in their use. For example, in the case of tax payment projects via mobile phone, it is important that messages are understood by everyone (replace SMS by voice mail messages or interfaces with intuitive icons). From this perspective, the fact of having informed and updated databases on the profile of taxpayers in order to ensure that tailored messages are sent and conduct appropriate targeting policies is key.

The legislation does not always give autonomy to local governments to raise their taxes. It is therefore useful to plan extensive phases of negotiation with all stakeholders and to identify issues at stake for each actor involved (trade unions, local government, private sector, involved ministries, etc.). It may also be useful to start with a pilot phase, completed by a detailed impact assessment. This would serve to model and demonstrate the effectiveness of the project and defend it to citizens and decision-makers from central governments and guarantee a return on investment.

WHAT RECOMMENDATIONS WOULD YOU GIVE TO LOCAL GOVERNMENTS THAT WISH TO USE SMART TECHNOLOGIES TO POSITIVELY IMPACT MUNICIPAL REVENUE?

When implementing SMART projects, local governments should pay attention to the following elements:

- Implement incentives to facilitate the transition to a system that uses the technology. For example: tax reduction, delay extension; in case of partnership with a telecom operator, offer tariff discounts on communication; etc. In the specific case of the project of the District of Abidjan, Orange has established a partnership with Total fuel distributor in order to offer gas coupons to taxis when they fill up at a gas station and print there the stickers-receipts confirming the payment of the tax.
- Ensure data protection of users by ensuring the anonymity of the collected information.
- Ensure transparency of actions, conduct sensitization and awareness campaigns. Show the results of a “SMART” policy by presenting in a systematic, personalized and geo-localized way the investments made through income increases.
- Within the municipality, in order to avoid resistance, staff training and change management by including employees in the project elaboration and implementation since the beginning is essential.



CHAPTER 2

TRANSPARENCY AND CITIZEN ENGAGEMENT

A document elaborated by

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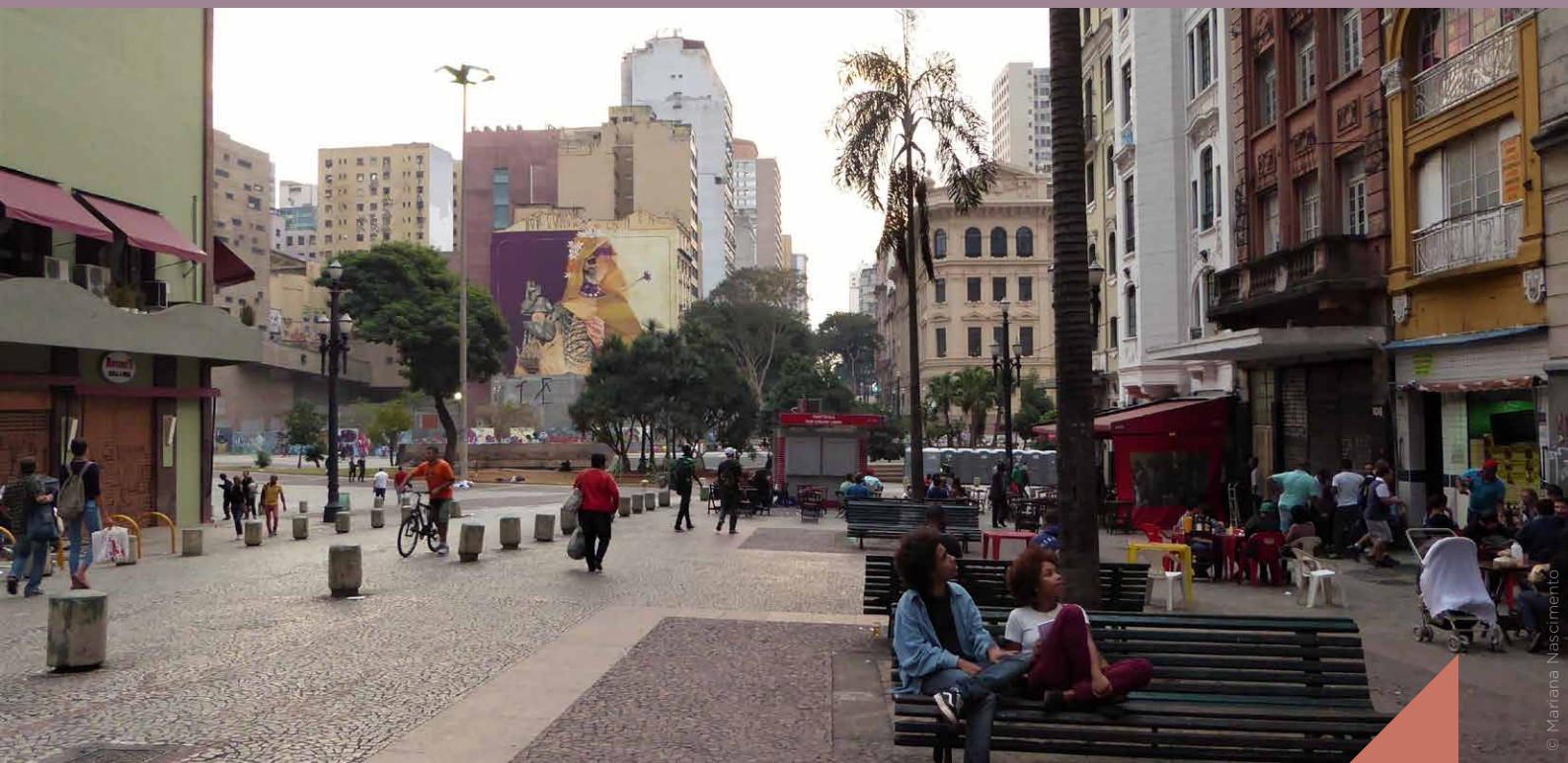
For the past two decades, digital technologies and particularly social media, have been changing the citizens' expectations and demands towards public service delivery and the way public resources are being used. Novel technologies are increasingly seen as a new space for citizens to express dissatisfaction regarding government's performance. This kind of aspiration would not have been possible (or tolerated) in more traditional means of communication. Citizens are particularly demanding towards municipalities, being the place where citizens and the public sector interact most regularly and directly.

This context of new "digital governance" raises challenges and risks for which governments must prepare, but it also offers new possibilities to improve the relation between citizen and administration.

SMART technologies can contribute to empower citizens by improving their access to information, enhancing their capacity of organization and advocacy, facilitating the monitoring of governments' activities and political processes. **It may also lead to government transparency and accountability** as there is an increase in the quantity, quality, and reliability of information. **SMART tools can also contribute to increasing trust between citizen and administration** thanks to a greater exchange of information, communication and participation for a greater number of people from a variety of backgrounds and profiles. Information is no longer a privilege for a few. This is particularly applicable to youth, who are often marginalized from decision-making processes. This leads to more collaborative and participatory relationships, where the citizen is not a passive or a simple user anymore, but actively contributes to shape political priorities, collaborate in the design of public services and participate in delivery. SMART technologies can contribute to transform the way politics are practiced towards a more effective and democratic governance. By bringing governments closer to the citizens' demands, SMART technologies can enhance the efficiency of municipal management and improve the quality of services. In turn, enhanced transparency and participation resulting from the use of digital tools can increase residents' knowledge about municipal issues and functioning, which may lead to increased support from the population to the municipality's projects, while improving satisfaction in public services and perception of well-being within the community.

Although less highlighted, increased transparency, accountability and citizen participation can produce a positive impact on municipal finances. First, by increasing participation in budgetary decisions and by increasing transparency on the way money is collected, managed and spent. This may contribute to strengthen the trust of citizens in the local government, and thus on the long run, leading to an increase in revenues. It is believed that citizens are more willing to pay taxes when they perceive that their opinions are taken into account by public institutions. Secondly, SMART technologies can also help cities to fight against corruption and fraud and reduce financial losses due to misuse. Finally, increased transparency and participation may help local governments to improve creditworthiness, facilitating access to international standards and certifications to access to external funding sources: transfers from central governments, national and international credit markets, loans and grants from international development, financial institutions, etc.

2.1 BUILDING TRUST BETWEEN THE CITIZEN AND THE ADMINISTRATION



2.1.A

TOOLS TO INCREASE TRANSPARENCY ABOUT CITIES' ACTIONS AND FINANCES

INCREASED ACCESS TO INFORMATION FOR BETTER MONITORING

SMART solutions offer local governments the possibility to improve transparency and accountability by making publicly available information regarding how financial resources are being used. Some examples are:

- **Online transparency portals.** Where local governments can publish all information concerning their activities and finances. Although this is an already common practice among local governments, it is often not frequently offered in a structured way. It is important to avoid “dumping” all public information and to let the viewer make sense of raw data; as this may discourage citizens or lead to misinterpretations. Local governments may adopt strategic transparency policies by creating user-friendly interfaces, where only the most relevant information is published in an accessible and easy-to-understand way. Reporting software systems can process the data and generate didactic reports in city public dashboards

Local governments must show that taxes are not punitive but that they are the means to offer better public services to citizens.

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allowing users to quickly find the information they are looking for. An interesting visualization method can be for governments to show how the municipality is executing its strategic plan and help citizen understand how it is performing according to the targets initially set. This enables the municipality to present targets, actions and highlight challenges and how they are being solved. While an increasing number of countries are adopting national legislations that require all local governments to create transparency portals, not all of them, and particularly in small municipalities, have the financial and technical capacities to design and maintain such tools. Thus, it is key that national governments and national local governments' associations assist these smaller municipalities in complying with existing legislation.

- **Tools to monitor budgets and map money flows, showing how tax money is being used.** To increase fiscal transparency, local governments can provide easily accessible public data about infrastructure and services provision and link those expenditures with increased taxes and fees collection to proof that public funds are efficiently used. The city of Bordeaux, in France, for example, created a tool¹ that allows residents to calculate where local tax money is being invested. It also maps activities that need investment, explaining why certain activities have been shut down. The goal of the tool is to raise interest in budgetary issues, to explain how political choices are made and to be more transparent about past actions and what needs to be done.
- **Tools to monitor political life.** In order to increase interest and social control of citizens in government's activities, SMART tools can help monitor political party financing or keep track on parliament activities at national level and city council activities at local level. These tools enable citizens to find out in an easy way the issues that are being discussed, to know how councillors are voting, to position themselves on a topic, to deliberate with other users, and to eventually to put pressure on specific topics.
- **Smartphone applications to facilitate access to information** about municipal activities and services and to encourage two-ways communication. The city of Tel Aviv, in Israel, created the DigiTel app² that offers a variety of services to the citizen. From the possibility to pay their bills and taxes; to locate services such as bike lanes, parking lots or restaurants; to receive alerts about incidents in the city; to access information about cultural activities; to report incidents and hazards. This "all-in-one" application has a huge success, and about 40% of the population currently use it.

It is key to remind the population about why they pay taxes and how the money is going to be used. New communication tools can help local governments to raise awareness in a systematic and geo-localized way.

ERWAN LEQUENTREC,
ORANGE LABS

1 More information about the tool here: <http://bordeauxpourtous.fr/>

2 Source : <http://citiscopes.org/story/2015/tel-aviv-digital-e-government-app-and-smart-card-all-one>

OPEN GOVERNMENT DATA

Open data is a policy where governments (at all levels) make public data available for anyone to access, use or share. Typically, governments create a web platform where they publish datasets with all sorts of information: budget, transportation, crime statistics, health, etc. These sets are published in an open source format; and regularly updated in order to be easily used by businesses, developers, researchers, who can create services based on that information. Examples of services that use open data may include transport applications, car navigation systems, weather forecasts, financial services, etc. Benefits of open data include:

- **Creating fresh forms of governance and policy-making.** Open data policies provide new ways of conducting government business by promoting public participation and social engagement in public life, policy-making and service design and delivery. They are also instrumental for the co-development and co-production of services where users are not only passive consumers of content and services, but also active contributors and designers.
- **Improving government transparency** by enhancing the quality of interactions between the governments and the users, strengthening accountability and resulting in increased government legitimacy.
- **Improving citizens' quality of life.** Governments empower citizens by enabling more informed decision-making.
- **Improving the efficiency of government operations.** Open data allows governments to re-engineer and to simplify internal procedures; automating processes, increasing integration between city services, optimizing task distributions, reducing workload and paperwork, and producing lower transitional costs.
- **Generating economic activities.** Although it is not easily measurable, open data is increasingly considered to have an economic value¹. According to a 2013 McKinsey report, open data's economic potential is estimated at more than \$3 trillion USD a year in the global economy. Analyses show that when information is provided to the public; individuals, developers and private enterprises are more likely to create added-value products for the market based on that information. This can increase the volume of private sector activities, which can stimulate economic growth, open up new sectors, create jobs, foster innovation and boost entrepreneurship. This in turn may generate financial benefits for local governments by providing revenue in the form of taxes. In Spain, for example, the Aporta project encourages the re-use of public sector information by providing access to over 650 government datasets in reusable formats. Spain estimates that there are over 150 companies that work solely on the "info-mediary sector" employing around 4,000 people and generating 330-550 million euros annually that can be directly attributed to open data re-use².

1 Source : <http://www.governing.com/columns/tech-talk/gov-open-data-hidden-value.html>

2 Source : <http://www.oecd-ilibrary.org/docserver/download/5k46bj4f03s7.pdf?expires=1474214824&id=id&accname=guest&checksum=5D071CF08C319B347674C458224F61A8>

- **Increase municipal revenue.** Local governments can generate income by commercializing government data. While it is usually argued that public data should be made available for free; an increasing number of local governments are considering to sell their data sets. According to a 2013 Capgemini study¹, allowing non-commercial reuse at zero cost and reducing the charges for commercial usage can significantly contribute to increase the number of re-users of the data, leading to a potential increase in revenues.

Although benefits emerging from open data initiatives are evident², local governments still faces barriers to deploy open data initiatives; some of them refuse to implement them altogether while others start the process but do not achieve implementation (known as “open washing”). Usually, this is due to lack of internal capacity to take on such projects, and sometimes to a lack of political will, when the city leadership do not believe the effort it takes to adopt open data analytics program is worth the cost. In addition, new threats such as privacy and data security issues arise; danger of data misuse, poor quality of data, etc.

In order to ensure that open data actually creates value, governments must identify relevant, high-value data for the public; ensure data quality in terms of accuracy, consistency and timeliness; and create simple, reliable and publicly accessible open data infrastructure. Most importantly, in order to maximize open data benefits and ensure re-use, local governments must encourage public participation and entrepreneurship by organizing challenges, dedicated events or offering technical and financial support. A good example are hackathons, which are time-limited events that gather programmers with the aim of developing software applications. The most innovative solutions created during these events receive a reward. Cities encourage this type of activity to create apps to generate content or provide services that citizens may find useful. Increasingly, local governments are organizing civic hackathons that gather software developers; but also other profiles of participants such as interested citizens and municipal employees, in a collaborative environment to address issues of shared civic importance.

Besides an important lack of tax payment culture, one of the reasons why the citizen does not pay taxes is because they don't see the result. And if local governments cannot increase taxes because it is bad for politics, they can try to improve tax collection performance. SMART technologies can help map actors and particularly businesses, but it can also help local governments increase transparency. And this is often a more efficient option for municipalities than enforce taxpayers to pay their due, as they see how the money is being used.

ENOCK ARINDA, EXPERT ON DECENTRALIZATION AND FISCALIZATION,
RWANDAN ASSOCIATION OF LOCAL GOVERNMENTS (RALGA)

1 Source:https://www.capgemini.com/resource-file-access/resource/pdf/the_open_data_economy_unlocking_economic_value_by_opening_government_and_public_data.pdf

2 See maps of open data initiatives around the world here: <http://opendatainception.io/> and <http://index.okfn.org/>

INTERVIEW WITH HUASCAR EGUINO, LEAD SPECIALIST IN FISCAL AND MUNICIPAL MANAGEMENT INTER-AMERICAN DEVELOPMENT BANK (IADB)

WHAT ARE THE KEY CHARACTERISTICS OF THE USE OF DIGITAL TECHNOLOGIES IN THE MANAGEMENT OF MUNICIPAL FINANCES IN LATIN AMERICA AND THE CARIBBEAN (LAC)?

There are three main characteristics that emerge from the introduction of digital technologies in the management of municipal finances: first, there is an increasing demand for online services, particularly for improving tax administration and access to municipal services; secondly, there are new citizen participation channels in both the planning processes of local development and in monitoring of municipal public services; and thirdly, there is a closer interaction between citizens and local governments, which leads to a better knowledge of the activities carried out by the administration and, therefore, fosters a greater transparency in the use of public resources.

Furthermore, we observe that municipal governments have been shifting from e-government strategies (focused on the use of ICTs as a tool to deliver better services) to Digital Government Strategies, that embrace ICTs as the backbone of governmental modernization and public value creation for a multitude of local actors such as the entrepreneurial sector, non-governmental organisations, citizens' associations, academic and research centres and different segments of the local population. In this context, the new practices of "open government" and "open-data" gain importance, given that they are mechanisms that enable local actors to influence the municipal public offer.

HOW DO LAC MUNICIPAL GOVERNMENTS EMPLOY DIGITAL TECHNOLOGIES IN ORDER TO TRIGGER A POSITIVE IMPACT IN THEIR FINANCES?

In my opinion, the main impacts of the use of ICTs in municipal finances are related to: (i) simplify tax and services' fees collection; (ii) achieve a better resource allocation; (iii) enable the monitoring of plans, projects and the performance of municipal services; and (iv)

accomplish a better and more efficient social control of the municipal initiatives.

An example of the use of ICTs to improve tax collection was carried out by the Municipality of Cali, Colombia. The city launched in 2013 the programme "Online Taxes" (Impuestos en Línea), which allows citizens to pay their property and betterment tax, while also providing taxpayers with assistance services, including: invoices issuance, electronic self-reporting, request a payment certification, among others. Another interesting example is the "payment of vehicular circulation licenses" in Peñalolén, Chile. The application allows individuals, to pay the license fee online and to show their current license directly in their mobile device.

Another area where cities have been using ICT are the citizen attention programmes. These applications allow local governments to establish a unique registry of municipal programmes' beneficiaries, facilitating both the control of resources allocation and the focus on the most vulnerable sectors of the population. An example of this application is the programme "en todo estás vos" of the city of Buenos Aires, Argentina. This network is an information system that allow for an integrated management of beneficiaries' databases from more than 20 social programmes and municipal subsidies.

ICTs can also be applied to investment planning and management. One example is the application: "Sigamos Medellín" which enables citizens to monitor in real time all municipal public works. In addition, the application allows to know the investments' price and report complaints or observations for those projects, leading to a greater transparency in the use of public resources.

IN YOUR OPINION, WHAT ARE THE MAIN CHALLENGES AND RISKS THAT MUNICIPAL GOVERNMENTS FACE WHEN DEPLOYING PROJECTS THAT INCORPORATE DIGITAL TECHNOLOGIES?

First, there is a risk of addressing the projects from a strictly technological perspective, without considering the inherent challenges entailed by municipal

management modernization projects. For this reason, any project where ICTs are used to improve municipal management, must be carried out jointly between city employees from functional areas directly involved in the project and specialists in information systems.

A second risk might be initiating projects without having good knowledge of the existing solutions in the market or without a good analysis of international best practices. This aspect is particularly important, provided that municipalities have a strong potential to learn from one another and share successful solutions already implemented elsewhere.

Finally, a third risk would be to implement ICT-intensive projects in an isolated way without being part of a global municipal digital strategy. The importance of this factor lies in the fact that ICT have the capacity of changing the way in which the population access municipal services, regardless of whether those services are under the responsibility of the area of education, health, public works, finance or any other. In addition, an integral approach towards digital services provided by the municipal government, can lead in important economies of scale and promote a better communication with citizens.

WHAT ADVICE AND RECOMMENDATIONS WOULD YOU GIVE TO CITIES OF THE REGION WISHING TO ENGAGE IN PROJECTS BASED ON DIGITAL TECHNOLOGIES TO IMPROVE MUNICIPAL FINANCES?

Considering the heterogeneity of local governments in the region, recommendations about the use of ICTs in fiscal municipal management should be done only on a case to case basis. In spite of this, it is still possible to identify some general recommendations. When implementing projects to improve municipal finances management based on ICTs, municipalities must make sure to: have the necessary connectivity infrastructure; include the ICTs projects within a Digital Government Strategy oriented to improve municipal services in an integrated manner; participate in municipal governments' networks to exchange best practices and information with their peers; build on the local capacity to innovation by establishing the necessary tools to make municipal data available to the public. Additionally, it is important that these projects are supported and encouraged by high-level authorities of the municipalities as this will determine the success of institutional efforts coordination and the use of the new applications in their launching phase.



WHAT ARE THE MAIN ACTIVITIES OF THE IADB IN LATIN AMERICA REGARDING THE USE OF ICT TO INCREASE MUNICIPAL REVENUE OR REDUCE EXPENSES?

The IADB has a wide experience in supporting financial management modernization both at a national and subnational level. Most of the programmes led by the IADB integrate the use of ICTs in critical processes and areas related to the management of subnational finances. Particularly, the Bank supports the following lines of actions: (i) the definition of a research agenda to identify and disseminate good practices concerning the use of ICTs in financial management. A good example is an ongoing research about “Digital Government and municipal management” in which we analyse the development degree of the digital government at a municipal level and we identify a set of good practices with the potential to be replicated; (ii) the development and implementation of technical cooperation initiatives with a regional scope that allow us to support the work of local governments' associations, and to exchange experiences, best practices and information about problems and solutions of common interest; and (iii) the financing of programmes to strengthen local governments' finances, where we provide funding to improve systems of: financial management, cadastral and tax administration, planning and project management, and open government solutions. All these programs aim at integrating the technical needs in fiscal management with potentialities offered by ICTs.

2.1.B

TOOLS TO INCREASE PARTICIPATION IN CITY MANAGEMENT AND FINANCES

We have identified three main ways for local governments to encourage citizen participation in public decision-making with SMART tools: digital participatory budgeting, gamification and crowdsourcing.


PARTICIPATORY BUDGETING

Participatory budgeting¹ are processes where citizens participate in the decision-making process of budget allocation and investment priorities and in the monitoring of public spending at the local government level. This model combines two key elements: on one side, it improves information flows between administration and citizens, leaving the former better informed regarding the services deemed as priorities by citizens; and on the other side, it strengthens accountability as it stimulates frequent checks on public actions. **Originating in 1989 at the Brazilian city of Porto Alegre, up to 2.500 local governments around the world have actually implemented Participatory Budgeting (PB) initiatives.** Typically, citizens are invited to propose projects for the city's improvement; they take part to meetings where they can discuss and vote for the projects of their preference. In average, cities dedicate between 2% to 10% of their investments to participatory budgeting processes.

By creating a channel for citizens to give voice to their priorities, local governments can better identify needs and adapt investments accordingly. **PB can make the allocation of public resources more inclusive and equitable.** For instance, a 2008 World Bank report demonstrated that PB has a significant impact on social indicators. It shifts policies' priorities towards expenditures that directly benefit the poor, and is particularly strongly associated with improvements in poverty rates, access to water services, and reduction in infant mortality. PB processes also increase transparency in fiscal policy and public budget management, and promote public access to revenue and expenditure information. Moreover, as the citizen become more aware of the city's budgetary restrictions and see how the resources are being used to projects that matter to them, PB may increase citizen satisfaction with city services, enhancing the government's credibility and the citizen's trust. **Evidence demonstrates that citizen participation in budgetary decisions may increase tax revenue** and may be even more effective at curbing tax evasion than traditional and commonly adopted deterrence measures, such as fines and controls. According to a 2004

Besides reducing expenditures and increasing revenue, SMART technologies bring the municipality nearer to the population and help to strengthen the trust in between them.

ERASMO LÁZARO
BENDEZÚ ORÉ, DEPUTY
MAYOR OF ATE, PERU



Tax revenue collection increase is **78% higher** in communities with participatory budgeting initiatives than those with no participatory process.

¹ Source: <https://democracyspot.net/2015/10/09/ask-citizens-where-public-money-should-go-the-results-might-surprise-you/> and <http://www.participatorybudgeting.org/wp-content/uploads/2013/11/citylevelpbmemo1.pdf>

study, that compares 25 municipalities in Latin America and Europe¹, we can observe a significant reduction in levels of tax delinquency and an increase in tax revenues after the adoption of participatory budgeting. The research shows how in Porto Alegre, property tax delinquency dropped from 20 % to 15 % and, in less than ten years, property taxes grew from 6 % to almost 12 % in several of the other municipalities studied in the report. A 2014 IADB study² found evidence that citizen that take part in participatory budgeting processes tend to be more willing to pay their taxes than those that do not. Their experience showed that annual local tax revenue collection per capita increased 78% more for the city that implemented PB compared to the control group that did not.

However, PB experiences usually reach a very low level of participation, in between 0.5 and 2% of the city's population³. **Cities around the world are increasingly applying SMART technologies to improve mobilization and participation, but also to give more visibility to government action.** Digitalizing PB means using ICT to: improve communication and mobilization (mobile technologies to raise awareness); allow for remote participation and online voting; facilitate monitoring and oversight of budget execution; enable residents to send proposals to be discussed in assemblies; enable online live stream of assemblies; display proposals in a web-based platform; allow for interaction and deliberation between residents; etc.

The example of the South Kivu Province. Regarding the effect of Digital PB processes in municipal revenue, an interesting case is the South Kivu Province, in the Democratic Republic of Congo, where a PB was implemented in 2012⁴. The experience combined offline in-presence meeting and mobile technologies to send SMS to mobilize residents to participate in assemblies and to inform them about project selection. In its first year of implementation, the initiative translated into demonstrated and measurable results on better services and more public funds in services for the poor. Concretely, it allowed to repair schools, to build a bridge, to create a health centre, to repair a sewage system, to build a water fountain, to construct toilets in local markets, among others. The PB yielded quick results as tax collection increased up to sixteen fold when citizens saw projects starting to be implemented. After the pilot, the provincial government decided to start transferring money to local areas only for cities using PB. Quickly, the transfer of funds to local governments increased up to fourfold resulting from a more legitimate process to elaborate the budget. The project shows that technology can help build more inclusive decision-making processes even in fragile and low-tech environments.



Municipalities in South Kivu' (Democratic Republic of the Congo) saw their tax collection increase 16-fold. Transfers from the provincial government increased 4 times after the implementation of participatory budgeting.

1 <http://eau.sagepub.com/content/16/1/27.full.pdf>

2 <https://publications.iadb.org/bitstream/handle/11319/6699/Does-Participatory-Budgeting-Improve-Decentralized-Public-Service-Delivery.pdf?sequence>

3 Source:http://skl.se/download/18.9f425ef147b396d4676d0a7/1408368331886/Whitepaper%2526Slideshow_Tiago_Peixoto.pdf

4 <http://radar.oreilly.com/2012/07/mobile-participatory-budgeting-helps-raise-tax-revenues-in-congo.html> and <http://blogs.worldbank.org/ic4d/mobile-enhanced-participatory-budgeting-in-the-drc>

CHANGE TOMORROW, PARTICIPARE PLATFORM: DIGITAL PARTICIPATORY BUDGETING OVAR, PORTUGAL

CHANGE TOMORROW AND PARTICIPARE¹

Change Tomorrow is a Portuguese start-up created in 2013 dedicated to the development of solutions based on novel technologies for active citizen participation in municipal administration. The main service of Change Tomorrow is Participare, a cloud-based participatory budgeting (PB) solution for municipalities.

Participare was born from the following observation: although an increasing number of local governments around the world are implementing participatory processes, these are not always successful. Many PB processes fail for lack of participation resulting from a lack of trust in the process. With the goal to improve these processes, Change Tomorrow created Participare, a platform designed to manage the entire participatory PB process for cities. It does so by guaranteeing a credible, reliable and transparent process, ensuring proper participants' identification, maximizing engagement, and integrating offline and online participation. The platform offers a complete service and centralizes all the different steps of a PB: promotion, registration and identification of citizen, submissions and visualization of proposals, monitoring of project's implementation, etc.

Participare combines a software solution and technical assistance from the Change Tomorrow team. Structured as a SaaS platform, Participare is an easy to use, fast to set-up and low-cost solution which only needs customization instead of development, and where cities pay for what they use and no hosting is needed. It is flexible to adapt to local specificities, multilingual, and costs approximately 300 - 400 USD per month, with prices depending on the number of registered participants. Participare has been adopted by more than 50 municipalities across Europe.

IMPLEMENTATION OF THE PROJECT IN OVAR, PORTUGAL²

Ovar, a Portuguese city of 55,000 inhabitants, implemented a participatory budgeting initiative in 2015, using the Participare solution. For the 2015 and 2016 editions, the budget allocated to the process was 100 000 euros, which corresponds to approximately 1% of investment budget, 38% of indirect taxes collected. By implementing a PB, the goal of the municipality was to increase citizen participation and interest in local public policies, bring citizens closer and increase trust in the local administration. The total cost of the project was €10.000 euros, including the monthly subscription for the platform, the communication and marketing material expenses. The participatory budgeting was implemented in five phases:

- **Preparation and definition of PB rules.** The city of Ovar decided that voting was open to anyone that had a connexion with the municipality and was over 16 (either a formal resident or not). The proposals could relate to any subject as long as the proponent was an individual citizen and the proposals would not benefit someone or a specific institution.
- **Collection of suggestions.** Once the rules were set and the platform created, the city communicated via local press, social media and in-person sessions. 16 meetings were organized in the eight parishes of the city. Project proposals could be submitted online and discussed during in-person meetings. Only the 5 top ideas voted in each parish were selected to go to the final vote. 38 projects were collected city-wide.
- **Technical evaluation of suggestions.** After each parish voted for their favourite projects, the municipality worked with city officials to ensure that the projects are feasible and complied with local regulations. Projects' proponents were involved in this phase. After this technical assessment, 16 projects were approved to go to final voting.

¹ To know more about Change Tomorrow and Participare: www.participare.io and www.changetomorrow.io and www.changetomorrowblog.wordpress.com

² To know more about the participatory budgeting in Ovar: www.op.cm-ovar.pt



- **Voting.** The proposals were published in a web platform for a period of 1 to 2 months, during which citizens could vote. Each citizen had three votes in order to encourage them to think about their parish but also at a city-level. People had two options to vote: either online or by using home-delivered paper ballots. Results were presented in the online platform for people to know in real time, which projects were winning. At the end of the process, the municipality organized an award session where diplomas were given to proponents to reinforce their recognition.
- **Monitoring of the projects' implementation.** One final proposal was selected for implementation and the execution of the project can be followed via the online platform.

RESULTS

The 16 meetings brought together over 1,000 citizens, 38 proposals were submitted, 13,598 votes, were casted, corresponding to 25% of the city's population. The Mayor of Ovar, Salvador Malheiro, believes that the initiative contributed to reducing mistrust from citizens and to improve community engagement.

LESSONS LEARNED

According to the municipality, the following elements were key to ensure the success of the participatory budgeting:

- Active involvement of proponents. The city engaged them to promote their projects: they had to mobilize their fellow citizens to support their initiative. In addition, meetings were organized with the proponents and the municipal technicians responsible for their areas to ensure the feasibility project and that

the project was kept unchanged from the initial idea.

- To deploy means of participation adapted to all types of public. Typically, it is challenging for the elder to use digital tools. It was key that the municipality offered off-line means of participation by organizing in-presence meetings and sending paper bulletin to each household of the city.
- Communications campaign combining traditional media (radio, television, local newspapers...) and social media to ensure citizens' involvement.
- Gamification of the process was key to attract citizen engagement. For example: the municipality promoted a little competition between the different parishes, to see which would manage to have more citizens voting and participate.
- Political leadership from the Mayor was a key element to ensure that municipal employees and citizens were on board.
- Transparency about the process and disclosing the votes in real-time in the online platform was key to increase trust of the population in the process and to encourage participation.
- Having a central platform to improve organization and monitoring of the initiative, to allow cross-referencing the different participation channels and increasing visibility of the process.

GAMIFICATION

Definition. Gamification¹ refers to the application of game elements and principles to non-game contexts. Typically, a gameful experience is proposed to people in a specific institution either to improve user engagement, increase organizational productivity or to reach a specific goal. Gamification strategies may include competition to engage players or rewards for players who accomplish desired tasks. Making the rewards for accomplishing tasks visible to other players or providing leader-boards are also ways of encouraging people to play along.

Game strategies in public policies. Governments around the world have been using game strategies to encourage participation and enforcement of specific programmes for long. Lotteries are among the main strategies used to change behaviour. The Sweden Government created an initiative to reduce road speed. Besides punishing faster drivers with fines, the system would also reward those who respected the speed limit. Drivers below speed limit entered in a lottery, with prizes paid by the fines collected from those who exceed. Results appeared quickly as after a three-day experiment in Stockholm in 2010, the average speed was reduced by 22%.² Other governments have also applied a similar logic to tax recovery. The Taiwan Government, for example, has been implementing such strategy since the 1950's by using receipts and invoice numbers in a lottery to prevent business tax evasion. This motivated consumers to shop at stores that legally report sales taxes, demanding official receipts so that merchant transactions are kept on the books. After a year of implementation, the finance ministry saw a reported increase of 75% in tax revenue. Cities in Peru also implemented a system where citizens who paid their local taxes on time would compete to win lottery prizes.

Digital tools, gamification and citizen engagement. More recently, local governments have been combining digital tools with gamification techniques to increase civic engagement and interest in local public policies. In particular, digital games can increase citizen participation in budgetary decisions. The city of Salem Town, USA, launched a video game in 2013 to gather feedback from its citizen. The municipality opted for a game to mobilize low-income Latino neighbourhoods and to overcome language barriers. Called "What's The Point", the game invites players to complete challenges and missions, answer trivia questions and collect coins to pledge to local causes. Along the way, players interact and post messages and ideas for their neighbourhood. In the end, causes and organizations that get the most coins through the game could earn real-life donations. Based on the data collected from the game, the city was able to identify investment priorities for specific neighbourhoods³. New Orleans launched in 2016 the Big Easy Budget Game, which aims at encouraging people to have better knowledge of the city's budget and to gather data on people's priorities. The online game uses open data from the city to allow players to create

It is crucial that, besides making public finances information public, is also easily understandable by all. It is not transparency if the citizen is not able to understand the meaning of the data made available.

LIDIA COBAS,
COORDINATOR, UCLG
DIGITAL AND KNOWLEDGE
CITIES COMMITTEE

1 About gamification and citizen participation :<http://citizenlab.co/blog/civic-engagement/gamification-in-citizen-participation/>

2 Source : <http://www.megamification.com/when-governments-become-game-masters/>

3 Source:<https://www.communityplanit.org/how-to-play/>

their own version of an operating budget. The city plans to compile the data from each player into a crowdsourced meta-budget called “the people’s budget” and to use it to decide on the investment priorities of the city.¹

CROWDSOURCING

Crowdsourcing is the process of obtaining ideas and information by soliciting contributions from a large group of people. Crowdsourcing processes applied to an urban context are able to generate new models for local governance that gather and mobilise heterogeneous social actors around issues of common concern. Cities around the world are using crowdsourcing combined with SMART tools to gather input from residents and to make improvements in communities. Local governments can either use tools from grassroots initiatives, tools developed by the private sector, or take the initiative to create their own apps bringing local residents into the ideation and decision-making processes. While such initiatives may increase civic engagement and improve public services which will be more adapted to local issues and citizens’ needs, it also provides city managers with more accurate information for better decision-making, it can also generate savings for municipalities resulting from efficient management. Concrete examples of SMART crowdsourcing tools applied to local governments may include solutions:

- **To report incidents.** Applications that enable residents to report issues and hazards in the community (potholes, off street lamps). Location-based information helps the municipality identify the issues, reducing telephone calls and unstructured emails. They can repair hazards faster if the request is sent directly to the workers who can fix them (cf. focus boxes about Seberang Perai, Malaysia and Kit Urbano in Argentina). Local governments can also create such tools specific for municipal employees and community leaders. The city of Makassar, in Indonesia, has distributed 6,000 SMART phones to newly elected community leaders who use an app to submit data on the social response of the community to services, reporting on cleanliness, tax collection, greenery and crime².
- **To map security issues.** An example is the CityCop³ app that enables citizens to report crimes through GPS tagging. This allows citizens to choose the most secure route and municipalities to establish heat maps to identify the areas more prone to crime, taking measures accordingly. Another example is the Ushahidi app⁴, which uses mobiles and texts to gather and distribute information to report violence. Born during the 2007 Kenyan election context, the app presents geo-located maps of violence hotspots.

1 Source: <https://nextcity.org/daily/entry/new-orleans-open-data-budget-game>

2 Source: [https://govinsider.asia/innovation/makassars-data-revolution/?ct=t\(GI_WSub192.1\)&mc_cid=4a6d85d853&mc_eid=7962beeb331](https://govinsider.asia/innovation/makassars-data-revolution/?ct=t(GI_WSub192.1)&mc_cid=4a6d85d853&mc_eid=7962beeb331)

3 Source : <http://citycop.org/>

4 <https://www.ushahidi.com/>

- **To map transit routes** in order to better adapt transportation services. The city of Toronto, Canada, created an app to track cyclists' rides with GPS; collecting information about their trip purpose, route, date and time. Data is analysed to assist city planners to know cycling patterns and to improve cycling infrastructure and plan for future cycling investment¹.
- **To facilitate urban planning processes.** An interesting example are SMART tools aiming to map informal settlements in developing countries. Open Reblock², created by Slum Dwellers International, is an example of open-source platform designed to simplify the process of reorganizing slum communities in order to provide an access path to urban infrastructures and services. The tool combines an algorithm that suggest reblocking solutions in a minimally disruptive way and using knowledge from the slum dwellers.
- **To gather ideas on specific projects.** Cities can create platforms to launch challenges and competitions to solve a specific issue. The city of Santander, Spain created a web-based platform called "Santander City Brain" where residents can make suggestions on how to improve services and the quality of life in the city, and where the Mayor can create "challenges" asking residents to make proposals to solve a specific issue. The best ideas win a prize and the resident responsible for the suggestion is involved in the implementation of the project.
- **To collect funds for urban projects**³. The city of Rotterdam, Netherlands, for example, financed in 2013 the construction of a bridge through crowdfunding.

Crowdsourcing only works if many people use it. The key of success for these projects is when the city defines clearly its needs and engages an important part of the population through awareness communications campaigns.

Technology can contribute to generate and strengthen the trust between the citizen and the local administration by facilitating a direct dialogue where the citizen participates in an active and positive way, while the government adopt an active listening attitude. By putting the citizen at the centre, the SMART participation tools allow to involve the citizen in public management and improve its perception in municipal management.

LAURA LÓPEZ, KIT URBANO, ARGENTINA

1 Source:<http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=5c555cb1e7506410VgnVCM10000071d60f89RCRD&vgnextchannel=6f65970aa08c1410VgnVCM10000071d60f89RCRD&appInstanceName=default>

2 Source:<http://www.citylab.com/cityfixer/2016/02/high-tech-map-urban-slums-open-reblock/470910/>

3 To discover other crowdfunding initiatives led by municipalities: <https://www.theguardian.com/cities/gallery/2014/apr/28/crowdfunding-we-built-this-city-the-SMARTest-urban-projects-in-pictures>

SMART MONITORING SYSTEM

SEBERANG PERAI, MALAYSIA

BACKGROUND

Seberang Perai is a Malaysian city covering an area of 738 sq. km with a population of 897,600 inhabitants. The municipal Council of Seberang Perai or Majlis Perbandaran Seberang Perai (MPSP) has competences over urban planning, licensing, town beautification, health services, cleanliness, controlling contagious diseases, construction and regulating road system, managing traffic system, regulating drainage system, and providing and maintaining public amenities. Local revenue comes from rates, licensing fees and various municipal charges and compounds. Local tax revenues represented 72% of MPSP's total revenue in 2015.

THE PROJECT

Originally, MPSP received citizen complaints through a myriad of system such letters, emails, phone calls but also meetings, mass media and the internet. With these conventional methods, response and feedback were slow and communication unilateral. To improve communication with residents and the governments' responsiveness MPSP developed in 2013 the "SMART Monitoring System" (SMS). The SMS facilitates two-way communication between the public and the municipality. The two main functions of the SMS are i) to manage

citizens' complaints and enhance communication with MPSP to provide feedback on issues related to urban services; ii) to monitor progress of development project on sites and to ensure that the developers comply with the approved plans. Main topics addressed by the SMART tool related to floods; urban planning enforcement; illegal waste dumping and environmental issues.

HOW IT WORKS

The SMS integrates data and information from social networks (MPSP Watch Facebook) and the "Citizen Action Technology" (CAT) application¹. To submit a complaint, users take pictures with their mobile phones and describe the problem. In the application, complaints are registered according to categories and location. A reference number is automatically given to ensure that the report is received by MPSP and addressed quickly. A team dedicated to the follow-up makes sure that the complaints in the Smart Monitoring System are channelled to relevant departments for action. The response time is 1 to 3 days. Feedback is visible on the websites. This system also allows the Municipal President to monitor the progress of the work carried out to rectify the problems. According to Dato' Maimunah Mohd Sharif, President of MPSP "the community becomes

1 <http://www.cat.betterpg.com> and www.facebook.com/mpspwatch



the eyes and ears of MPSP and anyone among them are welcomed to transmit information directly through the use of these applications.”

RESULTS AND BENEFITS

Since the launching of the application, 11,456 complaints have been received, with 100% of the complaints solved. The user-friendly app has 14,103 followers. It brings the following benefits to Seberang Perai’s management team and citizens:

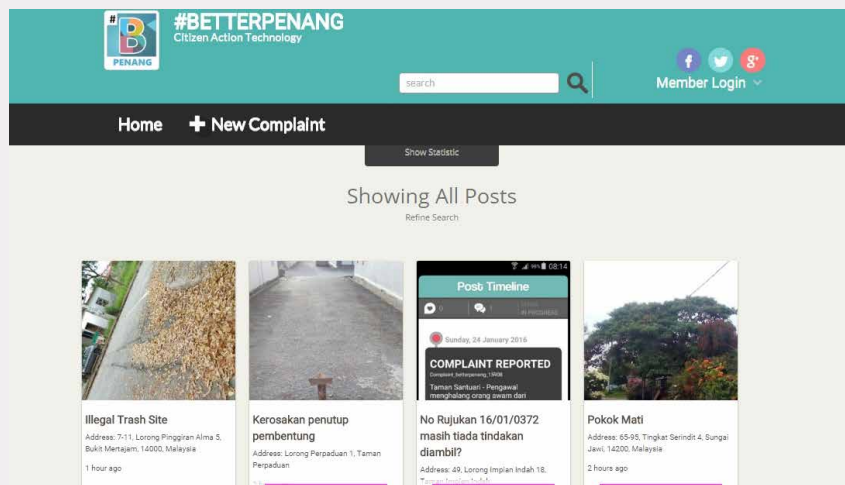
- **Improved service delivery and transparency on compliance with approved urban plans.** The SMS enables MPSP to deal with complaints quickly and execute more comprehensive and systematic procedures, making more accurate conclusions.
- **Costs savings (labour).** The SMS helps covering the whole area of Seberang Perai with the existing human resources. One of the most significant and important contribution of the SMS is saving time, money and energy for workers.
- **Communication and participation.** Engaging the public to monitor urban services is part of a deliberate public empowerment strategy. MPSP uses this system as a platform to deliver information to its citizens and to provide a platform for social engagement. It takes a practical approach to help communities to deal with MPSP on various issues regarding urban services, particularly in cleanliness.
- **Building trust and accountability.** This is a new way for stakeholders to interact with the government. The implementation of the SMS has had a positive impact for the MPSP administration, whereby it is able to provide faster and more transparent services, which will eventually lead to a cleaner, greener and healthier

Seberang Perai. This system helps to improve the quality, the effectiveness and the efficiencies of MPSP services on the ground and reinforces the citizens’ confidence in public action.

CHALLENGES AND LESSONS LEARNED

According to the MPSP, there are key issues that local governments must pay attention to when implementing similar initiatives, including:

- **Build the tool with internal capacities.** The SMS is an in-house operation financed by MPSP that can be replicated by other local governments inexpensively. The overall cost to establish the system was MYR 50,000 (USD 12,500).
- **Strengthen staff capacity and motivation.** Local staff needs to feel involved.
- **Regularly improving the tool.** In 2016, the SMS tool was improved to include supervision from municipal officers. Feedbacks and monitoring are now carried out more efficiently and effectively thanks to the use of the SmartEye mobile application. This app provides a platform for any officers to submit a report during a site visit. They have immediate access to all complaints, feedbacks and visual images and can go to the site to investigate and submit immediate feedbacks and provide the status of the case on the spot through SmartEye. This allows MPSP to monitor the 303 urban projects currently under construction.
- **Increase citizen awareness with communication campaigns.** Raising awareness among citizens is essential to make sure the app is widely used and trusted.



Screenshot of the Seberang Perai Smart Monitoring System website

BARRIOS ACTIVOS, KIT URBANO: REPORTING PLATFORM SAN LUIS, ARGENTINA

KIT URBANO AND BARRIOS ACTIVOS¹

Kit Urbano is an Argentinean startup created in 2013 and specialized in creating innovative technological solutions improving the link between the citizen and the public administration. One of its main SMART tools is Barrios Activos (“active neighbourhood”), a collaborative intelligence application that allow citizens to report hazards related to the city’s maintenance (e.g. transportation, cleanliness, security, public services, etc.) in a platform that aggregates and centralizes the information. It enables the administration to visualize the main areas of conflict, and provide feedback to the citizen regarding the resolution of reported incidents.

EXPECTED BENEFITS

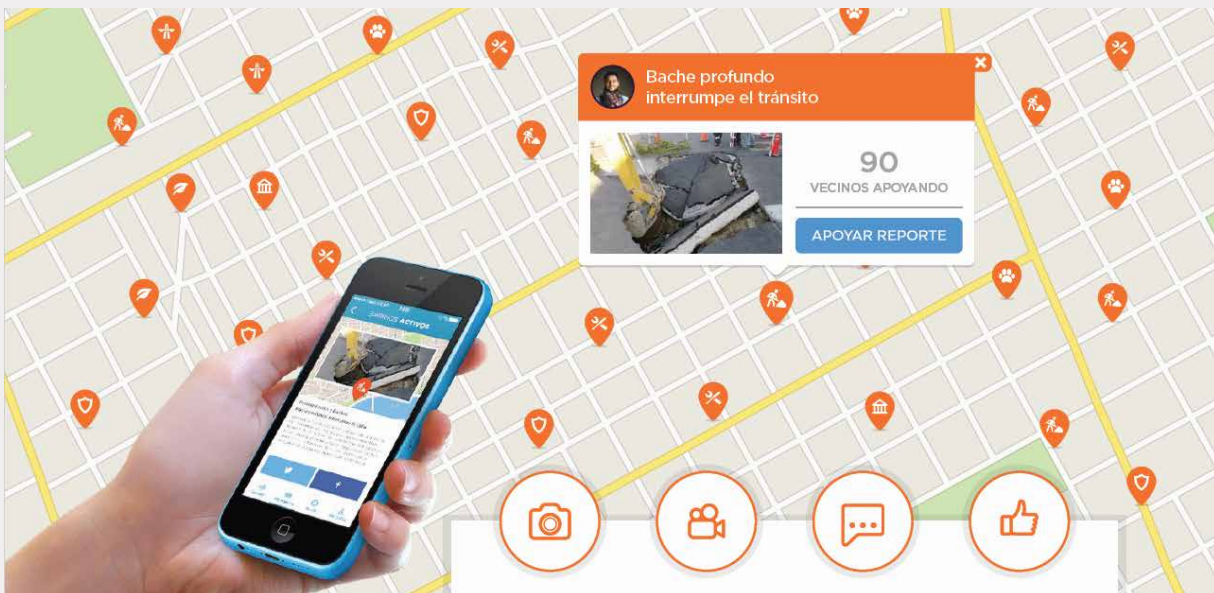
The Barrios Activos platform offers a new and direct communication channel between the citizen and the local government; promoting civic engagement and active listening from the administration. It also allows the municipality to increase the transparency and efficiency of municipal management and improve the quality of the services thanks to a better resources management. In fact, the municipality may reduce public expenses

dedicated to services audit as it creates “Observer citizens” who help the municipality to quickly identify and solve problems. Barrios Activos also contributes to improved decision-making as it generates concrete and reliable information such as real-time statistics, demographic data, citizen satisfaction analysis per topic and geographic location. It allows the local government to adapt its policies and to look for solutions that correspond to citizens’ real needs.

THE TECHNOLOGICAL SOLUTION

The Barrios Activos solution combines a mobile application for citizens to report hazards and a private Management Dashboard. The latter allows the municipality to establish a direct link with the citizen and monitor the issues reported. Barrios Activos is offered as a SaaS (Software as a Service) cloud based system, a low-cost, easy-to use solution that can be quickly implemented by municipalities; as they only pay for the service and not for the design and maintenance of the infrastructure. The cost of Barrios Activos varies according to the size of the municipality, ranging from 1,000€ per month for cities of less than 20,000 inhabitants, to 6,000€ per month for cities with

¹ For more information about Kit Urbano: <https://kiturbano.com/> and Barrios Activos: <https://barriosactivos.com/>



1 million inhabitants and above. According to Kit Urbano, the solution is 14 times less expensive than traditional management techniques and 8 times less than a call centre. Kit Urbano offers technical training for the municipality to deploy the tool, toolkits on how to use the platform, support to adapt the visual identity to the city’s image, online and offline kits of communications tool to raise awareness about the platform, technological support services (domain, hosting, technical support, software update, etc.)

IMPLEMENTATION IN SAN LUIS, ARGENTINA¹

Since its creation in 2014, Barrios Activos has been implemented in 9 countries, connecting more than 8,500 municipalities in Latin America and has more than 15.000 active residents reporting incidents. One of the most successful experiences is the city of San Luis, Argentina, with a population of 169,000. The municipality deployed the Barrios Activos solution in 2015. After 20 days for the deployment of the tool including personalizing the tools to the city’s visual identity and training the municipal team, San Luis launched a 2-month communications campaign to ensure citizen endorsement and participation. It combined online tools (social media, website) and offline (flyers in public sites, and letters sent to the 60,000 households of the city). The initiative was a success as more than 10,000 residents regularly use the platform, corresponding to 2% of the city population. In addition, the municipality observed that there was no increase in the total quantity of reports received, but response time were improved as 90% of the incidents were answered (not necessarily solved, but feedback

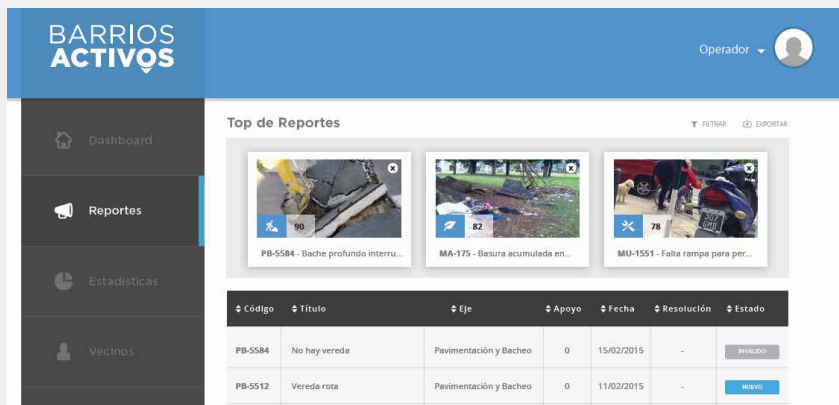
provided) and management cost of reports reduced 63% compared to the previous call centre system.

CHALLENGES AND RECOMMENDATIONS

Key issues to overcome initial challenges and ensure the success of the platform include:

- Political leadership from the Mayor, to ensure that both citizens and municipal employees are on board.
- Communication is critical to ensure that residents use the tool. Besides combining online and offline tools, local governments can also encourage participation regarding specific topics that are priority for the administration, who planned to resolve them at short or long term, which would ensure that incidents are more quickly solved.
- Local governments are often alarmed that a SMART solution such as Barrios Activos will increase the number of reports and that they will not have the capacity to answer to all complaints and solve all issues. To face these risks, local governments can:
 - Restrain the number of participants varying the intensity of communication tools.
 - Answer reports in a strategic manner, choosing priorities to respond.
 - Create a dedicated team within the department of modernization and communication: depending on the size of the city, this means 2 city managers that will ensure the follow-up of the reporting and one supervisor who will have a global vision of the system.

1 About Barrios Activos in San Luis: <http://sanluisactiva.com/> and <http://ciudaddesanluis.gov.ar/barrios-activos-nueva-plataforma-virtual-para-recibir-reclamos-de-los-vecinos/>



Screenshot of the management software of the Barrios Activos application

2.2 FIGHTING CORRUPTION AND FRAUD



© Fabienne Perucca

Corruption is a huge problem across the globe. In Africa, it is estimated that one-quarter of the continent's GDP is lost to corruption each year. In Latin America, the Inter-American Development Bank believes that corruption may cost 10% of GDP every year. The World Bank puts the total direct cost of corruption at \$1 trillion annually¹.

A common assumption is that absence of data in the public domain and lack of visibility regarding resource utilization can lead to misallocations and create space for corrupt-behaviour such as absenteeism, bribe-taking and resource theft. Corruption, even on a small scale, is a major drag on economic and societal growth, and has a direct impact on local government's revenue. Besides losing money, corruption results in citizens' dissatisfaction, as they perceive that tax money is being misused and not invested in public interest, breaking the fragile link of trust between the citizen and the government. Corruption is difficult to detect, hard to police, and even harder to eradicate once a culture of bribery has taken hold on society.

SMART technologies are often seen as efficient tools to address these issues by promoting transparency and accountability, facilitating rapid collection, analysis and flow of information between government institutions and citizens. They permit a new level of public scrutiny. Local governments around the world have been using SMART tools to prevent, detect and deter corruption with two objectives: as a means to empower citizens by raising

Increased transparency from public administrations and civil servants allow for greater accountability and social control from the citizen, helping to reduce corruption and increase citizen satisfaction.

ENOCK ARINDA, EXPERT ON DECENTRALIZATION AND FISCALIZATION, RWANDAN ASSOCIATION OF LOCAL GOVERNMENTS (RALGA)

¹ Source: https://www.weforum.org/agenda/2016/04/this-could-save-governments-millions-of-dollars-and-tackle-corruption/?utm_content=buffer9694b&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

awareness and offering tools to monitor, identify and report corruption; and to reduce public official corruption through simplifying bureaucratic processes and introducing transparency and accountability in government management.

It is important to note that petty corruption and grand corruption require completely different approaches and solutions. Petty corruption (which refers to everyday abuse of entrusted power by low and mid-level public officials in their interactions with citizens), can be stemmed using simpler techniques and tools such as exposure and whistleblowing, and can be tackled at local governments' level. Grand corruption consists of acts committed at a high level of government by the distortion of policies enabling leaders to benefit at the expenses of the public good (including kickbacks in procurement contracts, tax avoidance by using opaque financial centres, money laundering, etc.). Grand corruption requires a more complex set of tools such as advanced data analytics to closing tax haven loopholes, tracing illicit asset flows, etc. and it requires national or international level action¹.

The automation of tax recovery processes allows local governments to fight against corruption by taking away the power of intermediary agents and increasing the transparency of transactions.

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MAYOR, MUNICIPALITY
OF ATE, PERU.

TOOLS TO EMPOWER THE CITIZEN

Tools to monitor and report corruption. Technology can provide effective channels to report administrative abuses and briberies. Online platforms, hotlines or SMART phone applications can facilitate the aggregation and lodging of complaints and dissemination of information about reported cases of corruption. This may help governments to take concrete actions to prevent and to punish violations; it can also serve as a deterrent leading to change of behaviour, thanks to increase visibility and the end of impunity. These crowdsourcing whistle-blowing systems can take various forms, including the following examples:

- Web-based platform where a citizen can anonymously report corruption in public service delivery allowing to localize where corruption is concentrated. One of the most famous examples is the platform “I Paid a Bribe”² created by an Indian civil society organization in 2010, which allow users to report bribery, but also publish stories of people refusing to pay a bribe, and reports about “honest officers”. This data can be visualized in a map, presenting a snapshot of where corruption happens. Although the tool was not initiated by the local government, it had such a success that Indian local governments have used the information raised by the tool to adopt reforms to reduce corruption within government agencies (it has already received more than 100.000 reports in 1.000 Indian cities). For example, the transport Commission of the state of Karnataja offer driver’s licenses services exclusively online today, eliminating potential bribes.

1 See The Guardian discussion about using technologies to fight corruption : <https://www.theguardian.com/global-development-professionals-network/2015/may/19/crowdsourcing-anti-corruption-bribery-kenya-india>

2 Source : <http://www.ipaidabribe.com/#gsc.tab=0>

- Robocall systems to ask for feedback. The Pakistani government created a Citizen Feedback Model¹, which uses a simple method of enhancing government accountability. Whenever a citizen deals with a government agency (police, health or administrative services such as registering property), they receive a follow-up robocall and text messaging asking if they experienced any corruption during their visit. With more than 1,3 million people signed up in the program, more than 30,000 robocalls are being made each day, enabling the government to collect targeted information about where corruption lies.
- Tools to monitor elections and report electoral fraud. Uganda watch 2011 is an independent hotline that allows citizens to report problems, fraud and irregularities during the electoral process. The organisations involved analyse the information and publish reports covering issues such as voter registration issues, money in politics, as well as violence and intimidations.

Tools to raise awareness and educate both citizens and public officials.

SMART technologies can help local governments promote ethical attitudes and raise awareness to empower the public by informing it about its right and methods to resist petty corruption. The national Indonesian government created an application² featuring a virtual “theme park” where animated graphics teach people how to avoid bribes. Such tools are interesting not only to educate the citizen on how to avoid corruption, but also to coach public officials about what constitutes corruption.

Tools to support campaigns to mobilize people against corruption.

SMART technologies can be used to raise awareness and mobilize citizens to pressure governments on specific issues. Digital technologies such as emails, social media, SMS and mobile applications can amplify the citizen collective voice. An interesting example is the Brazilian NGO, “Meu Rio” (My Rio) a mobilization platform for civic engagement and people-powered political action, which wants to improve city life and urge local institutions to be more responsive. Meu Rio leverages the collaborative power of technology to pool citizens’ ideas and facilitate coordinated actions to pressure decision makers. Using technology allow to create communities of interest for specific causes, which can be activated easily and regularly according to campaigns. Technology also helps activism become more organized and inclusive, allowing for a range of diverse voices to mobilize for causes. Since its creation in 2011, Meu Rio has mobilized more than 160.000 residents and changed over 50 public policies in the city. It has helped passing legal amendments and solving neighbourhood problems. As an example, it resulted in forbidding people prosecuted for corruption from being nominated to positions in public administration. More recently, the organization created the “DefeZap app”, which allows citizens to upload videos reporting violence and abuse of power by police forces, by uploading videos to the platform. Then, videos are disseminated to relevant bodies responsible for investigating and responding to violations of power by

For local governments, SMART technologies are once in a lifetime opportunity to improve city management. Mobile phones have become an instrument of citizenship. A wonderful way to connect with citizens.

DIANA LÓPEZ
CARAMAZANA,
UN-HABITAT

1 Source : http://www.economist.com/news/technology-quarterly/21578520-technology-and-government-how-clever-use-mobile-phones-helping-improve?fsrc=scn/tw_ec/zapping_mosquitoes_and_corruption

2 Source: <https://www.theguardian.com/global-development/2014/oct/03/indonesia-corruption-eradication-commission-app>

public agents. The goal is to underlie institutional problems in an effort to drive broader reform of police security.¹

TOOLS TO INCREASE GOVERNMENT ACCOUNTABILITY

E-government initiatives. Local governments can use SMART technologies to fight corruption by automating tax payments, enabling online service delivery, and ensuring transparency in public procurement and contracts. Opportunities for corruption are reduced with eliminating red tape and bureaucratic processes and cutting out intermediaries with automation.

Data analytics. Local governments can use data analytics software based on open datasets to detect anomalies, underperformance and find corruption among government agencies and fight tax fraud.

Increased transparency in budget allocation and public assets registries. Technologies can assist local governments in making financial information public and facilitating citizens' access to official information. One possibility is to create online asset registries for public officials. Asset declaration regimes aim at preventing conflicts of interest among public officials and members of the government and avoiding illicit enrichment by monitoring variations in the wealth of senior public officials and civil servants over time. Typically, an independent government agency is responsible for receiving, archiving and reviewing the submissions, verifying and investigating possible wrongdoing and answering to public requests of information. Technologies can help increase these processes efficiently and dedicated software can ensure the available information is digestible.

LESSONS LEARNED

Initiatives to combat corruption are often initiated by civil society organizations or national governments, but local governments can adopt such tools to increase accountability and reduce resource misuse at their scale. It is important to note that, while SMART technologies make it easier to track corrupt practices technology is an enabler, but it is not the solution. The success of any SMART tool to combat corruption depends both on whether it is used or not by citizens and on how public institutions ensure follow-up. Thus, a series of factors must be taken into account when deploying initiatives to tackle corruption²:

- Communication campaigns to make citizens more aware about their rights and responsibilities to reduce their vulnerability to corrupt practices and to share mechanisms to report and avert corruption.



SMART technologies make it easier to track corrupt practices technology. Technology is an enabler, but it is not the solution.

¹ About Meu Rio & Defezap: <https://www.defezap.org.br/> and <http://www.meurio.org.br/>

² Source: http://www.transparency.org/files/content/corruptionqas/376_technological_innovations_to_identify_and_reduce_corruption.pdf

- Combine SMART tools with other non-IT tools to ensure participation of people with diverse backgrounds. SMART tools must be user-friendly and adapted to the local capacities.
- An enabling political environment that promotes and protects free speech, plus strong political willingness.
- Collaboration between governmental institutions and civil society organizations.
- Ensure law enforcement by adopting regulatory frameworks to ensure responsiveness from the public authorities, including investigation and prosecution; defining sanctions to end impunity of corrupt behaviour; and policy adjustments to prevent corruption. It is key that local governments recognize the value of the tools created by external stakeholders such as crowdsourcing anticorruption platforms, and integrate them into the existing criminal justice system. As such, the public may be reassured that telling their stories will have some impact, and will be encouraged to use the tools.
- Security and confidentiality. There are significant security challenges associated with the use of mobile phones for reporting corruption, as in some cases the whistle-blower risks being identified or the message intercepted. It is key to find ways to secure confidentiality when sensitive information is being communicated and to build trust of citizens in using the tools: anonymity of reports and protection of whistle-blowers must be ensured.

Corruption and tax evasion represent a considerable cost for municipalities. Taxes not recovered prevent the municipality to generate the expected benefits and, as a consequence, to carry out the projects planned. SMART technologies may help local governments to reduce corruption, to be more transparent towards tax payers and to offer better services to citizens.

LAMINE KOITA, LEGAL AND LITIGATION AFFAIRS DIRECTOR, DISTRICT OF ABIDJAN, IVORY COAST.

INTERVIEW WITH VALENTINA RIGAMONTI, REGIONAL COORDINATOR FOR WESTERN EUROPE

TRANSPARENCY INTERNATIONAL

About Transparency International (TI): Created in 1993, TI is a non-governmental organization which goal is to stop corruption and to promote transparency, accountability and integrity at all levels and across all sectors of society. Based in Berlin, it has more than 100 representations around the world.

ACCORDING TO YOU, WHAT ARE THE LINKS BETWEEN TRANSPARENCY, FIGHT AGAINST CORRUPTION, MUNICIPAL FINANCES AND SMART TECHNOLOGIES?

We can identify two main dynamics. First, we observe that if the citizen knows how tax money is being spent, they will be more willing to pay their taxes. To achieve this, local governments can increase transparency, citizen engagement and accountability, which will in turn improve the trust of the citizen in the administration and, in the long-run, it may raise compliance in paying taxes. Secondly, we observe that local governments lose a lot of potential revenue due to tax evasion and fraud. If the administration fights corruption, it might increase its revenue rapidly and significantly. The main way to fight corruption and increase trust of citizens in the administration is to implement transparency and participation initiatives, and SMART technologies offer great opportunities to do so. Such initiatives may reduce citizen passiveness, increase city revenues and reinforce municipalities' investment capacity and ability to offer services of better quality to citizen.

WHAT WORK TRANSPARENCY INTERNATIONAL IS DOING TO FIGHT CORRUPTION IN LOCAL GOVERNMENTS WITH THE SUPPORT OF SMART TECHNOLOGIES?

Anti-corruption initiatives often focus on abuses and illegal practices at the national level. Yet significant



power is increasingly vested in local government that are responsible to deliver public services to their citizens. This proximity to the people and the discretion that local officials have in exercising their functions can make local governments highly vulnerable to corruption. In parallel, we observe that technology and web and mobile-based initiatives are more and more seen as democratic tools that can reshape the interaction between citizen and government and also change the fight against corruption. Thus, TI develops several actions related to local governments and technology, including the following examples¹:

Tools to monitor local government performance

- Online monitoring systems that engage the population in the oversight of services, such as creating a Smartphone application where citizens can flag problems and the information is sent directly to the public administration. TI has implemented such initiatives in a variety of countries.
- Tools reporting corruption include: physical offices such as the Advocacy and Legal Advisors Centres (ALAC) that exist in 50 countries, telephone hotlines, or online complaint mechanisms. Among other examples, TI has developed complaint mechanisms in Honduras in 2013 for increased transparency in the

¹ For more information about TI activities to strengthen integrity in local governments: https://www.transparency.org/whatwedo/activity/strengthening_local_government_integrity about tools to support transparency in local governance: https://www.transparency.org/whatwedo/tools/tools_to_support_transparency_in_local_governance/3/

procurement of medical material; and in Morocco in 2012 where it created a website that allows citizen to report bribery.

- **Rankings and indices** of local governments transparency, integrity and accountability are effective advocacy tools to foster upward competition between governments. TI National Chapters develop Municipal Transparency Index to assess and rank a selected number of municipalities within a country. Municipal Indexes have been implemented in Spain, Portugal and Slovakia¹.

Tools to prevent local corruption

Integrity Pacts² (IP) are a tool developed by TI in the 1990s for preventing corruption in public contracting, both at the national and local level. They are an agreement between the government agency offering a contract and the companies bidding for it that they will abstain from bribery, collusion and other corrupt practices for the extent of the contract. To ensure accountability, Integrity Pacts also include an independent monitoring system (the social witness) typically led by civil society groups, which are often TI's national chapters. When one of the parties violates these terms it is liable to sanctions, which could include blacklisting, contract revocation or forfeiture of bid bonds. The transparency agreement covers the whole cycle of the project, from the preparation of tender documents until the last phase of implementation. Integrity Pacts have been applied in more than 15 countries and 300 separate situations. Among other benefits, Integrity Pacts discourage corruption and lead to more efficient outcomes by reducing purchase prices and project costs by 30 to 60%; clean operations on the part of contractors and public officials during the execution of a project; ensure that infrastructure projects and other public works are delivered efficiently, and stave off avenues for illicit gain; increase the level of transparency in public procurement and contracting processes. This, in turn, leads to greater confidence and trust in public decision-making and public decisions, reduces litigation over procurement processes, enhances competition in the business sector by having more bidders competing for contracts. Integrity pacts can also encourage institutional changes, such as the increased

use of e-procurement systems, simplified administrative procedures and improved regulatory action. The cost of implementing an IP may vary depending on the implementation arrangements, the activities included in the process and the complexity of bidding procedures, but experience has shown that they remain a very small percentage of the project costs and can be covered by different sources: the authority's own resources; contributions from donors or project financiers; bidders' fees, or a combination of these.

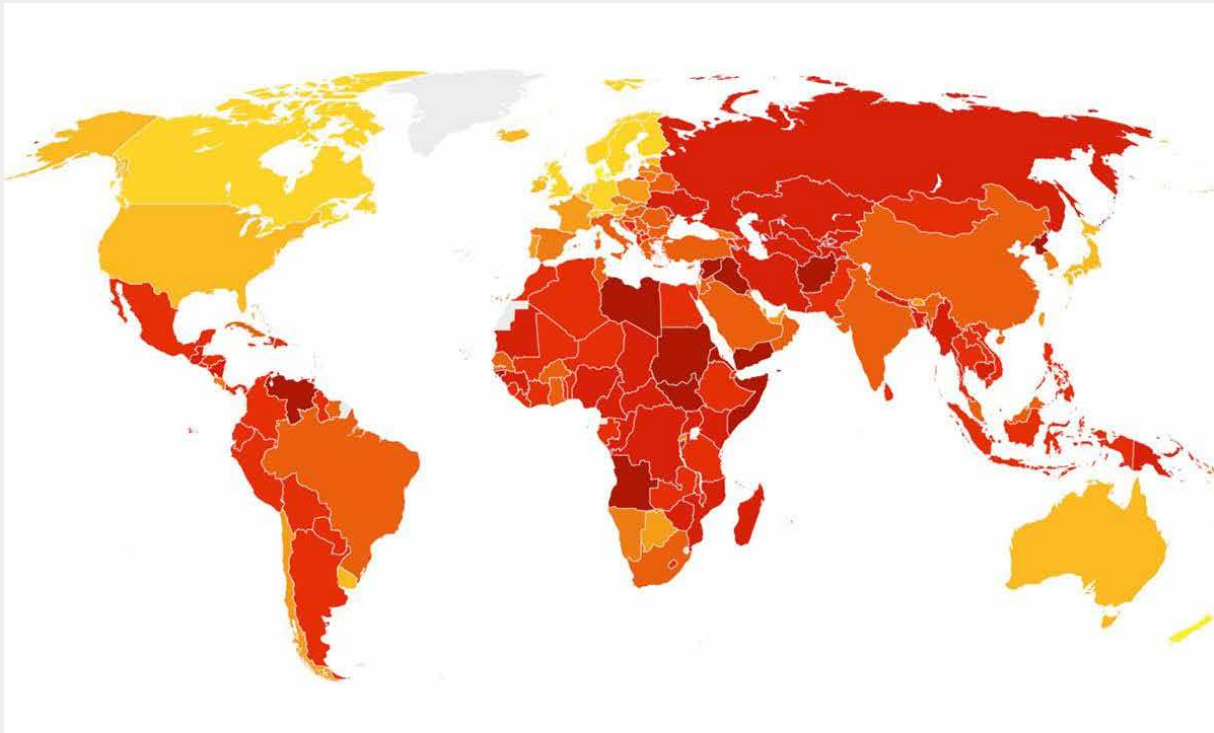
A recent example is the implementation of Integrity Pacts in four local districts in Rwanda in 2012. Initially on a pilot basis, the IP tool monitored two projects related to infrastructure and water supply contracts in each district. Integrity pacts were signed between the local governments and the bidders under the supervision of an independent monitor. As of 2016, 22 types of infrastructure projects including roads, water, electricity facilities and buildings were monitored. All monitored projects have a total a value of 21.6 billion RW. This corresponds to 55% of the 4 selected districts' development budgets. As TI-Rwanda advocated for the active inclusion of concerned citizens, a new web-based tool called Civil Society Procurement Monitoring (CSPM) was created to enhance the process of procurement oversight by representatives from communities in their districts. CSPM is inbuilt in all the phases of the tendering process namely, planning, bidding, evaluating, implementation and monitoring. Through CSPM tool, citizens got involved in anonymous reporting to complain about theft and mismanagement in the project. Districts complied with procurement guidelines and no bribery was detected during the project implementation. National stakeholders involved in the procurement oversight, managing of local government and public financial management discussed issues linked to improving public procurement.

Tools to assess local corruption risks: The Local Integrity System (LIS)³ tool assesses the effectiveness of procedures and mechanisms to promote transparency, accountability and integrity in order to fight corruption at the local level, provides recommendations on areas for reform, and develops a follow-up action plan for strengthening local integrity in collaboration with

1 On municipal indexes: TI Spain (<http://transparencia.org.es/en/index-of-municipalities-ita/>), TI Portugal (<https://transparencia.pt/indice-de-transparencia-municipal/>) and TI Slovakia (<http://zupy2015.transparency.sk/sk/sets/zupy-2011/rank>).

2 About the integrity pacts: https://www.transparency.org/whatwedo/tools/integrity_pacts/4/

3 About the local integrity system assessment: http://www.transparency.org/whatwedo/publication/local_integrity_system_assessment_toolkit



Corruption perceptions index 2016

key local stakeholders. The LIS Assessment Toolkit is designed to conduct an in-depth assessment of a small number of local government units in a given country based on a series of indicators that allow to identify strength and weaknesses of local system. TI National Chapter approaches the municipality to understand if they are interested in doing a LIS and if it is the most appropriate tool. The LIS is paid through the project money and not by the municipality. The implementation usually takes between 6 months and one year. Since its launch in 2014, the tool has been implemented in the cities of 5 countries: Argentina, Kenya (Kisumu and Kwale), Palestine (Ramallah), Portugal (Lisbon and Braga) and Senegal (Guediawaye).

Activities to strengthen local governments' capacity:

A TI National Chapter may organize training activities for municipal officials based on the needs and projects, and anti-corruption schools addressed not only to public servants but also students and civil society organizations, such as training for trainers; anti-corruption schools¹, etc.

Activities to foster creation of innovative tools that use SMART technologies to fight corruption:

In 2012, TI organised a series of Hackathons around the world to bring together anti-corruption and technology experts to create innovative ICT solutions to corruption problems. TI is now supporting its chapters to put their

ideas on mobilising people through web- and mobile-based technologies into practice.

Actions to spread knowledge and facilitate the exchange of experiences:

TI and its chapters regularly organize anti-corruption seminars, publish reports with case studies and recommendations to improve local governance (for ex. series of case studies on how governments can use open data to fight corruption), organize webinars on specific topics (ex. use of technology in political financing in election periods).

WHAT ARE THE MAIN OBSTACLES THAT LOCAL GOVERNMENTS MAY FIND WHEN USING SMART TOOLS TO INCREASE TRANSPARENCY AND FIGHT AGAINST CORRUPTION? HOW THIS CAN BE OVERCOME?

One of the main difficulties we encounter is that often the legislation exists but it stays on paper, either because local governments do not want to apply it either because they cannot. There are two key elements here: dialogue with public authorities in order for them to understand the benefits of fighting corruption; and training so they know how and have the capacity to comply with national regulation.

¹ About transparency school on anti corruption: <http://transparencyschool.org/>

WHAT ARE THE KEY ELEMENTS THAT ENSURE THE SUCCESS OF A PROJECT TO IMPROVE TRANSPARENCY AND FIGHT AGAINST CORRUPTION? WHAT ADVICES WOULD YOU GIVE TO LOCAL GOVERNMENTS WISHING TO IMPLEMENT SUCH PROJECTS?

TI has established a few principles and standards that, if followed by local governments, should ensure good governance and greater trust between citizen and administration. Principles include: transparency (e.g. access to information); accountability (e.g. elections; media independence; people's participation); and integrity (e.g. rule of law; ethical conduct). Standards identify concrete measures that local governments should take to make sure that these principles are realised. Although it is important to know that contexts vary a lot and thus adaptation to local context is key, when we talk about SMART technologies and municipal finances, a few examples of standards and recommendations are:

- Rules and regulations for revenue collection must be clear, transparent and simple.
- Citizens should be able to access information on taxes and administrative procedures.
- All information about taxpayers and subscribers to services must be managed in electronic databases.
- Tax appeals mechanism should exist and be functioning.
- Provide fully transparent and comprehensive information to the public about how the money is collected, how much is collected and how it is spent.
- Reporting should be facilitated through a complain mechanism, and victims and witnesses of corruption must be anonymous and protected.

Other issues that are key to ensure the success of projects using SMART technologies to fight against corruption and reinforce transparency in city management include:

- A strong political will from the local government to work closely with TI.
- A lot of dialogue to make sure all parties are on board and understand why the project is needed.
- Establishing a feedback loop to make sure there is

a follow-up after complains and corruption reports. When citizens report corruption cases, they expect at least a reaction, if not a solution to their problem. This is one of the most difficult challenges to tackle when building a reporting tool.

- E-government policies help but real clear codes of conducts are also very important. A simple example is to show how much public servants earn.
- Training and capacity building of the municipal team is very important to ensure the success of any SMART project. National governments can play an important role in this matter, particularly to assist local administrations in developing necessary skills and be prepared to adapting and complying with new national legislations regarding transparency, accountability and fight against corruption.
- To work with a third neutral party in initiatives to fight corruption: the citizen may trust more an independent institution as it ensures protection of witnesses, transparency of denunciation, and follow-up in justice. TI for example often play the intermediary between the citizen and the local administration when it comes to complaining mechanisms.
- SMART projects have costs that must not be underestimated. This includes the cost of technical development but also human resources. It may be important that the local government have a dedicated team to manage transparency and anti-corruption SMART projects.
- Local governments must remember that technology is a tool to empower citizens, raise awareness, show areas needing improvement and pressure authorities. But it is not a solution that will ensure the end of corruption. SMART technology is not enough to change cultures or amend laws ... only people can do so. It is imperative to remember that online tools should be part of a broader strategy of engagement and participation.



2.3 IMPROVING CREDITWORTHINESS AND INVESTMENT ATTRACTION



Studies have found that fight against corruption may increase governments creditworthiness, as measured by credit ratings. Predictions indicate that a one standard deviation decrease in corruption improves sovereign credit ratings by almost a full rating category. The rating agency Moody for example, considers corruption in its assessment of sovereign risk. It uses the World Bank's Worldwide Governance Indicators "control of corruption" composite measure as 25% of its overall measure on the quality of a country's institutional framework, complemented by the "rule of law" (25%) and "government effectiveness" (50%) indices¹. While this data corresponds to national level, it could also be applied at local governments' scale.

Cities that increase transparency and accountability with the help of SMART technologies may help local governments gain recognition for sound municipal management, which will improve creditworthiness and contribute to attract investments such as transfers from central government, funds from international donors, or issuing municipal bonds. The city of Kampala, Uganda, for example, has led important efforts to improve its municipal finances, in part using SMART technologies to improve processes and increase transparency and accountability. As a result, it received A+ from a rating agency, enabling access to World Bank grants and opening the path for issuing its first municipal bond.

Transparency is crucial to build trust with citizens; but it also allows local governments to access funding from donors, banks and other agencies.

FRANK BATUNGWE
TIMISINE, KAMPALA
CAPITAL CITY
AUTHORITY, UGANDA

¹ Source: <http://blogs.iadb.org/gobernarte/2016/09/19/los-beneficios-fiscales-de-la-transparencia/>

ISO 37120: CERTIFIED CITY DATA TO PROMOTE INVESTMENT

THE WORLD COUNCIL ON CITY DATA (WCCD)

The World Council on City Data (WCCD) hosts a network of innovative cities committed to improving services and quality of life with open city data and provides a consistent and comprehensive platform for standardized urban metrics. Comparable city data is critical for building smarter, more sustainable, resilient, prosperous and inclusive cities. WCCD is implementing the international standard ISO 37120 Sustainable Development of Communities: Indicators for City Services and Quality of Life. ISO 37120 defines a comprehensive set of 100 standardized indicators that enables any city, of any size, to assess their performance and measure progress over time and also draw comparative lessons from other cities. The WCCD is also developing new indicators on SMART cities that will become part of the new ISO standard on SMART City Indicators. WCCD publishes the list of cities that are certified against ISO 37120 by a team of independent verifiers in an Open City Data Portal¹, which enables city managers, citizens, industry leaders and researchers, to compare and benchmark cities performance across the 100 indicators in the ISO 37120 standard, allowing over 1 million potential visualisation combinations. Numerous cities from all continents have already been certified by the standard, including: Amman, Amsterdam, Barcelona, Boston, Bogota, Buenos Aires, Dubai, Guadalajara, Haiphong, Helsinki, Johannesburg, London, Los Angeles, Makkah, Makati, Minna, Melbourne, Rotterdam, Shanghai, and Toronto.

The application of ISO 37120 delivers real benefits to cities by enabling them to:

- Monitor the efficiency of city service delivery and effectiveness of SMART city solutions, policies and programs;
- Build frameworks for SMART city planning together with sustainability and resilience planning;
- Set data driven targets and data informed priorities for SMART infrastructure investment;
- Monitor and evaluate the impacts of infrastructure investments on the overall performance of a city;

- Undertake local and international benchmarking; and draw on comparative lessons and share experiences with other cities; and
- Leverage funding and demonstrate responsible management practices to attract private investment, both domestic and foreign direct investment, and improve creditworthiness.

LINKAGES FOR INVESTMENT

The investment related applications of ISO 37120 are of great interest to the growing network of WCCD certified cities and other stakeholders such as national governments. The ISO 37120 indicators inform a number of mechanisms that can facilitate and enable investment in cities:

- **Investment attractiveness.** The ISO 37120 indicators cover a number of key aspects of investment attractiveness – including infrastructure performance and reliability and quality of life indicators which are important for attracting mobile, high-skilled workers. The City of Toronto uses its leading performance on higher education degrees (47,000 per 100,000 inhabitants) as a key point in attracting high-value technology companies to locate and invest in the city.
- **Good governance.** Open data on city performance sends a clear message of openness and accountability from city government. Quality of municipal governance is often a key factor for investors when evaluating the risk associated with local investment, particularly for infrastructure.
- **Leverage funds from national governments.** Investing in urban infrastructure is a key priority for national economic and social development. The Canadian Government for example is currently implementing a \$125 billion dollar, ten-year infrastructure investment program with a focus on cities. The Government of India has made urban development a central part of its policy agenda, and is funding multi-billion-dollar

* This box was elaborated by Patricia L. McCarney, President & CEO of the WCCD.

1 www.dataforcities.org



investment in infrastructure through its SMART Cities Mission and AMRUT programs. Cities and national governments are now working with the WCCD to use comparable ISO 37120 certified city data to make the case for investments (e.g. through identifying gaps in infrastructure services) and for tracking and evaluating the economic, social and environmental benefits and impacts of investment.

IMPROVING CITY CREDITWORTHINESS

A further avenue for cities to access finance are local and international capital markets. Municipal bond markets are well-established in some parts of the world, but in many countries these markets are in their infancy and cities need to take substantial action to build sufficient creditworthiness to enter the market. Recent estimates by the World Bank show that less than 20% of the largest 500 cities in developing countries are deemed creditworthy locally (and only 4% in the international context), severely constricting their capacity to finance investments in public infrastructure. The WCCD database includes a range of indicators to inform credit assessment and, more broadly, the perceptions of investors regarding the city:

- **Municipal finances.** The ISO 37120 indicators certified under the WCCD Audit Protocol, include a number of key performance indicators of the health of a

municipal government’s finances, including: debt service ratio; capital spending as a percentage of total expenditures; own-source revenue as a percentage of total revenues; and tax collected as percentage of taxes billed.

- **Current & future economic performance.** The ISO 37120 indicators include overall measures of the city’s current economic performance (e.g. city product per capita; city unemployment rate; youth unemployment rate; number of businesses per 100 000 inhabitants). Combined with the indicators relating to investment attractiveness the WCCD helps to inform perspectives on future economic prospects for the city and the ability of the municipality to collect net revenues and repay debt obligations.

The WCCD is currently exploring, in collaboration with cities and credit ratings agencies, how ISO 37120 certification can support or enhance creditworthiness for cities worldwide, as well as identifying priority indicators related to creditworthiness that could be included in the forthcoming revision of ISO 37120 in the near future.



2.4 CHALLENGES AND RECOMMENDATIONS



Despite numerous examples of local governments applying SMART technologies to increase transparency and participation around the world, there are still barriers to its full deployment. Hereafter we present a few elements to which local governments must pay attention to when implementing such initiatives.

A RESOURCE-COSTLY DEPLOYMENT: PLANNING AND PREPARATION NEEDED

Developing and maintaining SMART technology projects can be costly both financially and in terms of human resources, as it requires strong technical skills. In addition, it can be difficult to predict the reaction of the population regarding its use. Thus, to ensure the success of the project, it is key that local governments make sure:

- **To develop a long-term strategic plan.** Participatory and transparency processes take a long time to yield results. Thus, a strategic development plan needs to be defined in coordination with all city departments and broadly supported by the top level of municipal government and civil society organizations. It should establish specific targets and specific actions to be taken on the long-term, and it is important that the goals correspond to the municipality's priorities and residents' needs.
- **To define a clear legal and regulatory framework.** Most legal frameworks for citizen participation are several decades old. They overlook the

opportunities presented by SMART technologies and do not reflect recent innovations, sometimes even not taking into account key issues such as privacy. Sometimes local governments may even be reluctant to use digital tools because they believe the laws on participation do not allow them. It is key to adapt legislation to ensure flexibility and room for innovation.

- **To strengthen institutional capacity.** It is important that citizen engagement and transparency initiatives correspond to the city's management capacity. As such, it is preferable to start with small initiatives and pilots that can be scaled-up if successful. In addition, SMART tools tend to generate huge amounts of data, and it is key that the government is prepared to process it and has the required staff. In particular, this is the case for crowdsourcing tools such as those applications that allow residents to report hazards or bribery. If the administration does not have the capacity to provide feedback and ensure follow-up, it may create frustration and lead to a loss of interest in the tool and increase distrust in the government. Local governments may find useful to establish a team dedicated to citizen engagement initiatives, with a dedicated budget. One of the team's responsibilities would be to ensure the sustainability of the tool, making sure data is regularly updated and feedback provided.

LOW PARTICIPATION: IMPORTANT MOBILIZATION NEEDED

While SMART technologies can be very useful in generating new opportunities for transparency and citizen participation, local governments often face difficulties to recruit enough participants to ensure the success of the initiatives. This may be due to: difficult access to SMART technologies combined with cultural and literacy barriers for marginalized population; highly educated people may not be familiar or comfortable with the latest technologies and may refuse to participate; or sometimes, most of the population may lack of time and interest to participate in such activities. To maximize citizen participation in the initiatives, local governments should:

- **Develop on-going awareness communication campaigns.** It often happens that despite the many tools that are available for citizen engagement, they remain unknown to the public due to lack of promotion. Hence, local governments must promote SMART engagement tools and show the advantages and risks; explain how the initiative works, the implementation steps, difficulties, etc.
- **Collaborate with local leaders.** It is recommended that local governments map the network of people they want to engage. Community leaders, and particularly in low-income countries, can be of great help to municipal governments to gain comprehensive understanding of the concerns of residents.
- **Pair both traditional and SMART solutions.** Technology is an enabler but it is not sufficient by itself. Local governments should combine both

To ensure the success of SMART municipal projects, it is essential to offer training to public officials, but also to ensure that they are motivated. To do so, technology must be friendly and intuitive; and municipal employees must be involved in the entire deployment and implementation process, in order for them to belong to the process, to understand that the technology is there to help his work and not complicate it.

SILVIA FAICAL,
MUNICIPALITY OF
MONTEVIDEO

online and offline events to ensure participation of people with various backgrounds. As such, it is key to develop engagement strategies that are customized to the concrete needs and capacities of those who will use it. Local governments must choose a mix of technologies, channels and languages mindful of the literacy, income, gender and linguistic dynamics in the community concerned. In low-income countries, for instance, it is important not to rely on too sophisticated technologies that might prevent an important portion of the population to participate. For example, the government may prefer initiatives adapted to traditional mobiles and not only Smartphones; opt for low bandwidth web portals in order for the internet network to support it; or in cities where the population speaks several languages and face high illiteracy rates, IVR (Interactive Voice Response) tools may be more adapted than SMS based systems.

- **Use pre-existing platforms.** Municipal governments may find easier to gain buy-in for residents' participation if they opt for tools that were already being used by the population, instead of creating completely new and sophisticated tools. Sometimes using Facebook may not be as innovative, but it is often far more effective.
- **Ensure data protection.** Citizens' mistrust in government and participatory initiatives is often very high. A key element to reassure citizens and increase their participation is to guarantee privacy protection. This is a particularly challenging topic for smaller cities that might not have the capacity to protect data.
- **Ensure data is accessible and easy to understand.** Transparency and participation initiatives must be easy to access and understand for all citizens. It may be important to have one single central tool that concentrates all the information instead of having several apps that may confuse the citizen and split their attention and participation.

CHAPTER 3

ENERGY EFFICIENCY OF MUNICIPAL ASSETS

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Energy1 is a basic service crucial to the well-being of population as well as for the country's economic development. Nevertheless, an important portion of the world's population still does not have access to electricity. The International Energy Agency (IEA) estimates that 1.2 billion people around the world did not have access to electricity in 2013, amounting to 17% of the world's population, and characterized by a strong inequality between regions. More than 95% of the population without access to electricity is located in Sub-Saharan Africa and Asian countries; the gap is also significant between rural and urban areas, with 80% of the global figure located in rural areas. Since 2000, progress in providing electricity to urban areas has been twice faster than in rural areas, with important disparities in cities around the world. As an example, in many major African cities, less than 60% of households have access to electricity, and those that do, struggle with frequent interruptions².

The accelerated pace of urbanization, accompanied by the ill-managed concentration of economic activities, households, industries and infrastructures in urban areas has led to several challenges, including the exponential growth in energy consumption. **According to the IEA, cities are the biggest consumer of electric energy, being accountable for two thirds of the world consumption.** Energy generation and use is primarily due to the consumption of fossil fuels for energy supply for heat and lighting of the industry, services, households and transportation. Cities are responsible for 75% of the world's energy consumption and production of 80% of the world's greenhouse gas (GHG) emissions. Global energy consumption is projected to increase by 40% between 2015 and 2030; and by 2050, two thirds of the growth in energy demand will come from cities in emerging and developing economies, according to the IEA.

In this context, **local governments have to juggle between the need to provide a growing population with universal access to energy services, and the urgency to reduce energy consumption to protect the environment.** This is not an easy task for local governments who lack the technical and financial capacity to adopt the necessary measures and investments. From the financial point of view, energy management takes an important share of the municipalities' budget: the energy bill comes often second after payroll, and estimates indicate that it can reach up to 40% of cities' budget. Typically, the municipal energy bill is split between street lighting, public buildings, water and waste facilities. Energy management is particularly challenging for cities in the developing world, where there is a need to plan for the sustainability of the investment and the maintenance cost of future services. Given that the price of energy tends to be higher and volatile, it makes it even more difficult for cities to manage the supply for households and industry, while investing in repairing the worn-out utility infrastructure.

Cities around the world are looking for innovative solutions to reduce energy consumption and the energy bill, while improving service quality and access to an increased part of the population and protecting the environment. SMART technologies represent huge opportunities for cities to improve



17% of the world's population do not have electricity. 95% of those, are located in Sub-Saharan African and Asian countries, and 80% in rural areas.

1 Main source of the data mentioned in this chapter: <https://www.iea.org/>

2 Source: UN Habitat World Cities Report 2016

energy management and to increase efficiency by reducing expenditure. Although energy management is not always a responsibility of the local government, they can work in cooperation with other levels of government and with energy utilities at different stages of the energy value-chain such production, distribution and consumption.

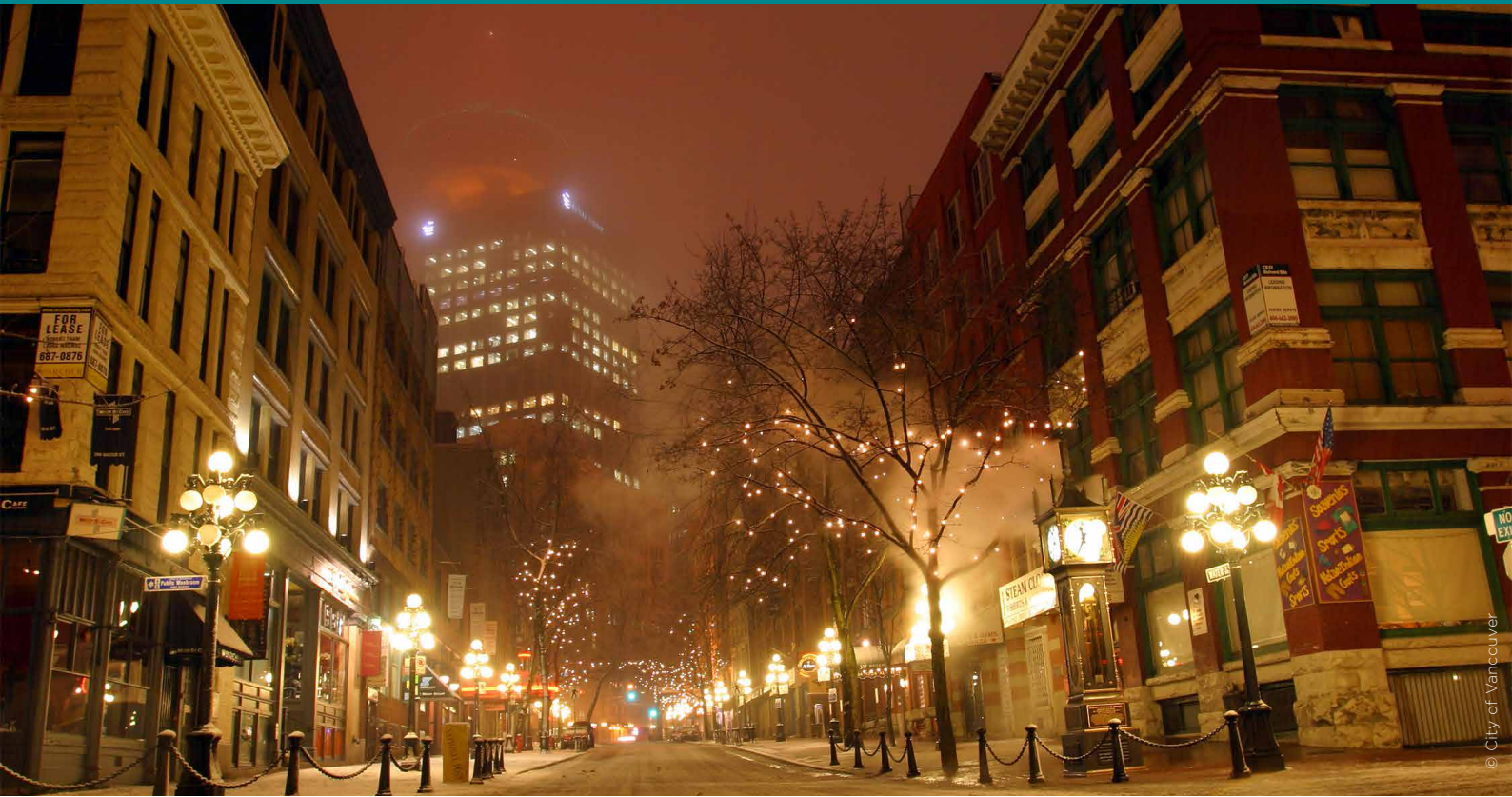
- **At the energy production level**, local governments can foster the generation of renewable energies thanks to the use of solar panels, wind turbines, waste-to-energy plants, etc. The COP21 held in Paris in December 2015, set the ambitious goal of having two-thirds of electricity generated by renewables by 2050. According to the IEA, renewable energy currently provides around 23% of the global energy consumption.
- **At the supply and distribution level**, local governments can tap on SMART technologies such as SMART meters and sensor networks to build SMART grids. Such technologies are based on ICT tools that allow for more efficient management, thanks to data analytics.
- **At the energy consumption level**. Local governments can aim at reducing consumption with the help of SMART technologies in municipal assets (street lighting, municipal buildings, transportation, waste and water utilities, etc.) and at household and industry level by raising awareness to change energy consumption patterns (apps to provide information and demand-response programmes).

In this chapter, we will focus mainly on the distribution and consumption levels, where local governments have more leverage to use SMART technologies to reduce their expenditure + reduce GHG emissions + increase access and quality of the services. We will focus particularly on three topics: street lightning, municipal buildings and SMART grids.



Cities are responsible for 75% of the world's energy consumption and 80% of GHG emissions worldwide.

3.1 STREET LIGHTING



3.1.A

BACKGROUND AND SMART SOLUTION

According to the IEA, public lighting services represent 19% of the world's total energy consumption, most of which happens in urban areas. Energy costs for public lighting is usually the most expensive item of the municipalities' energy bill, approaching to 40%. Energy efficiency projects in public lighting sector can therefore play an important role for cities to reduce consumption and costs, among other benefits.

For the past years, lamps using Light Emitting Diodes (LED) technology have emerged as a great option for investments in energy efficiency in the public lighting sector. In fact, LEDs lamps are 40% to 60% more efficient in terms of energy consumption than the current technologies installed in cities around the world. Longevity of LED lights is four times higher than traditional streetlights (20 years against 5 years), which can significantly reduce maintenance costs.

SMART technologies for street lightning also offer the capacity to integrate SMART monitoring systems. Concretely, this means equipping street lamps with sensors to give electric utilities the ability to monitor and remotely adjusting light intensity according to the environmental lighting and traffic needs. For example, the system will provide extra light when a cyclist approaches to an intersection or when an accident has happened. Networked



Street lighting is responsible for 40% of the cities' energy bill.

systems can also instantly pinpoint burned-out lights and send automatic streetlight failure notifications, eliminating the need for monitoring patrols and ensuring a quick identification and repair. Turning on and off lamps or dimming the lights only when needed, facilitates additional savings in energy consumption and maintenance costs.

The implementation of a sensor network control system offers the possibility of integrating street lighting with multiple other intelligent systems (traffic light controls, security cameras, electric vehicle charging stations, environmental sensors and digital signage), allowing cities to create the backbone infrastructure for further SMART projects. Linking the sensors incorporated in street poles to a communications network enables city operators to collect huge amount of data (on weather, pollution, noise, movement of traffic and people, etc.) in order to make better real-time informed decisions and to enable a broad array of applications and services in areas such as public safety, parking, etc. Switching to a LED technology combined with sensors network systems gives cities the opportunity to turn streetlights from a “dead asset” with intensive resource consumption into a “live asset” actively collecting data.

It is difficult for municipalities to find a balance between the law that requires open data, the institutional and administrative capacities of municipalities and the data privacy.

EDUARDO JIMÉNEZ GONZÁLEZ, ICT DIRECTOR, MUNICIPALITY OF CARTAGO, COSTA RICA

3.1.B

LESSONS LEARNED

BENEFITS

Hundreds of cities around the world have been implementing SMART street lights initiatives, although very recent, several benefits have already been identified:

- **A reduced energy consumption and cost:** estimates indicate that LED lighting alone can produce energy savings by 50%. When combined with SMART control systems, it can provide an additional 30% reduction of energy consumption.
- **Reduced costs of maintenance:** the extended life of LED street lamps can significantly reduce maintenance budgets, as they only need to be replaced every 15 to 20 years; additionally, networked systems can improve knowledge about the state of the infrastructure.
- **Lower greenhouse gas emissions,** by reducing the streetlights consumption.
- **Socioeconomic benefits** such as: improvement in lighting quality, reducing criminality, increasing the citizens' perception of safety, reduced traffic accidents, increased local economy activity, etc. The city of Los Angeles, for example, was one of the first cities to replace 80% of its 215.000

streetlights with LED technology in 2009. With an investment of \$57 million USD, it managed to reduce 65% of its energy consumption, saving \$ 9 million USD per year, it also contributed to crime reduction, which decreased by 20% in the same period.¹

- **Quick return on investment:** the pay-off for SMART street lighting programs is usually very quick. The city of Boston started to convert its 64,000 street lights to LED technology in 2010, and has experienced a return on investment in only 1,5 years (Boston benefited from a national subsidy but even without it, the project would have paid for itself in less than 3 years).²

CHALLENGES

Despite the numerous proven benefits of SMART street light systems, only 10% of the world's existing streetlights use LED technologies, while only a 1% have installed control systems³. The main reason for this low percentage lies in the fact that a citywide streetlight conversion represents few complexities.

Although SMART lighting systems are more energy efficient and bring cost savings on the long run they are still more expensive than existing technologies (roughly 4 times as much as high pressure sodium lights). LEDs' luminaires prices are falling fast (approximately 10% per year), but the high costs of replacing the whole existing light system may prevent small and medium cities to reform their public light systems. While Public-Private Partnerships may appear as a solution to carry out light retrofit projects, these are mainly suitable for emerging and big cities who have the technical and financial capacity to carry on such complex contracts. Thus, business and financing models must be identified to ensure that cities of all sizes are able to implement SMART lighting projects.

While the benefits of replacing streetlights with LED technology are widely acknowledged, cities are still sceptical about the adoption of networked control systems. Most of existing projects are still on a pilot phase mostly because payback periods are not as good as they are for LED street lights. In addition, a lack of standardization and the large number of diverse players competing in this space makes difficult for local governments to choose the best-networked control systems and to make sure that the product they will chose will not be outdated too fast and will be compatible with other future initiatives.⁴



LED lighting technology combined with SMART control systems can cut up to 80% of street lighting bill for municipalities.

1 Source: <http://bsl.lacity.org/led.html> and <http://www.techrepublic.com/article/how-la-is-now-saving-9m-a-year-with-led-streetlights-and-converting-them-into-ev-charging-stations/>

2 Source : <http://SMARTcitiescouncil.com/article/led-streetlights-1-more-cities-find-switch-quickly-pays-itself>

3 Source : <https://www.weforum.org/agenda/2016/01/the-surprisingly-simple-solution-to-climate-change/>

4 Source : <https://www.navigantresearch.com/research/SMART-street-lighting>

RECOMMENDATIONS

There are a few key elements that local governments must pay attention to when implementing SMART streetlights projects, including:

- **Transparency** is key to ensure the population endorsement. Local governments need to communicate on cost and benefits and reassure their citizens about data privacy protection, explaining clearly that the data collected with the streetlight sensors control system is only “meta data” and not personal information.
- **Carry out the necessary studies prior to establishing a PPP contract:** identifying the latest offer of options for street lighting before contacting private companies. It may be useful for cities to talk to each other and to exchange experiences to ensure good price negotiation and contract conditions.
- **National policies and actors** play an important role in helping cities shift towards a SMART lighting system. They can offer support by putting in place financing mechanisms, legal and regulatory frameworks, offering technical assistance to the elaboration of feasibility studies, or defining standards to enable interoperability between systems to ensure vendors offer compatible services.

A smart territory is a territory that uses SMART technologies to collect, to process and to analyse information. It allows public administration to make decisions based on objective criteria adapted to the territory needs and not according to the perception of politicians or providers.

SANDRA TORRES, PUBLIC POLICIES ADVISOR,
COLOMBIAN FEDERATION OF MUNICIPALITIES

SMART CLOUD: SOLUTIONS FOR SMART CITY MANAGEMENT

COLOMBIAN FEDERATION OF MUNICIPALITIES (FCM)

ABOUT THE FCM¹

The Colombian Federation of Municipalities (FCM in Spanish) is the association representing Colombia local governments in the formulation and evaluation of public policies, with the objective of defending and promoting decentralization and local governance. FCM brings together efforts at international, national, sub-national and public-private level to reinforce municipal management in an integrate manner. Amongst other activities, the FCM: represents the interest of municipalities vis-à-vis the Congress of Colombia and the national government; offers legal advice and technical assistance for municipalities' projects; provides support to project design and identification of financial resources.

ABOUT SMART CLOUD²

One of FCM mission is to encourage the use of technology into the Colombian local public administration to build intelligent and sustainable cities. In March 2016, FCM created the company "SMART Cloud" with the objective of technically support Colombian municipalities to manage services in a more efficient, effective and

transparent manner, thanks to better access to data to facilitate accurate decision-making. SMART Cloud has two main characteristics. On one side, it constitutes a technological platform able to provide cloud based services supported by a physical data centre (TIER IV) composed of communications, servers and data storing and processing equipment. The centre contains a portfolio of tested online apps offered to municipalities covering all aspects of municipal responsibilities and administration of public resources. Those resources include water management, hospital management, financial planning, transport and mobility, e-government, digital certification, security, etc. SMART Cloud combines cloud computing, IoT (Internet of Things), big data analysis, Infrastructure as Service (IaaS) and Software as Service (SaaS). On the other side, SMART Cloud offers technical assistance and professional support for municipalities, thanks to the possibility to access a team of specialist consulting on the start-up of projects, monitoring, developing, etc. SMART Cloud facilitates the following:

- To transfer from a model of buying technology to a model of service delivery, where local governments can access a complete service without having to

1 More info: <https://www.fcm.org.co/>

2 More info: <http://www.SMART-cloud.co/>



invest in technological infrastructure, using the one owned by SMART Cloud. The services are accessible to municipalities by subscribing a monthly fee that varies depending on the type of services and the size of the municipality.

- To shorten the contracting times, facilitating quick implementation of projects by offering flexibility thanks to the use of inter-administrative agreements.
- To provide services in a consistent and uniformed way, creating economies of scale. The solutions developed by SMART Cloud can easily been adopted by small municipalities who would not have the financial capacity to invest in such technological developments.

One of the services offered by SMART Cloud is the initiative “Cloud services from end to end applied to the public lighting system”

CONTEXT: MUNICIPALITIES AND PUBLIC LIGHTING ¹

Colombia has 48 million inhabitants, 2/3 of them living in urban areas. The country has 1.101 municipalities and districts, and 90% of them have less than 100.000 inhabitants. In Colombia, 30% of the CO2 emissions come from the energy sector. In order to fulfil the commitment signed at COP21, the national government has identified priority actions to produce savings in the energy sector; one of them is the upgrading and technological transformation of public lighting, actually consuming up to 3% of the total energy of the country. Additionally, public lighting management represents a heavy burden to Colombian municipalities as the service delivery corresponds to an average of 5% of their income.

SMART CLOUD AND PUBLIC LIGHTING RENOVATION

To support municipalities in renovating their public lighting system towards greater efficiency, SMART Cloud offers two services: in a first phase, it offers support to modernize street lighting with LED technology and in a second phase it offers a tele-management and tele-measurement systems. To implement the solution, the municipalities must first conduct an audit about the energy solution more convenient for the municipality’s need, than sign an agreement between the municipality and SMART Cloud including the services provided,



Smart Cloud data centre

the duration, the costs, etc. and finally implement the solution.

SMART Cloud is currently being implemented in six municipalities of Valle del Cauca. There is still no quantitative assessment of the initiative due to the short period since its inception in March 2016, but it is estimated that the average savings that will result from the initiatives will amount to 60%, thanks to the use of LED combined with tele-management and tele-measurement. The city of Bucaramanga² in particular estimates a 59% of energy savings, amounting to approximately \$ 2 million USD, with additional \$ 1.8 USD million savings in maintenance costs.

RECOMMENDATIONS

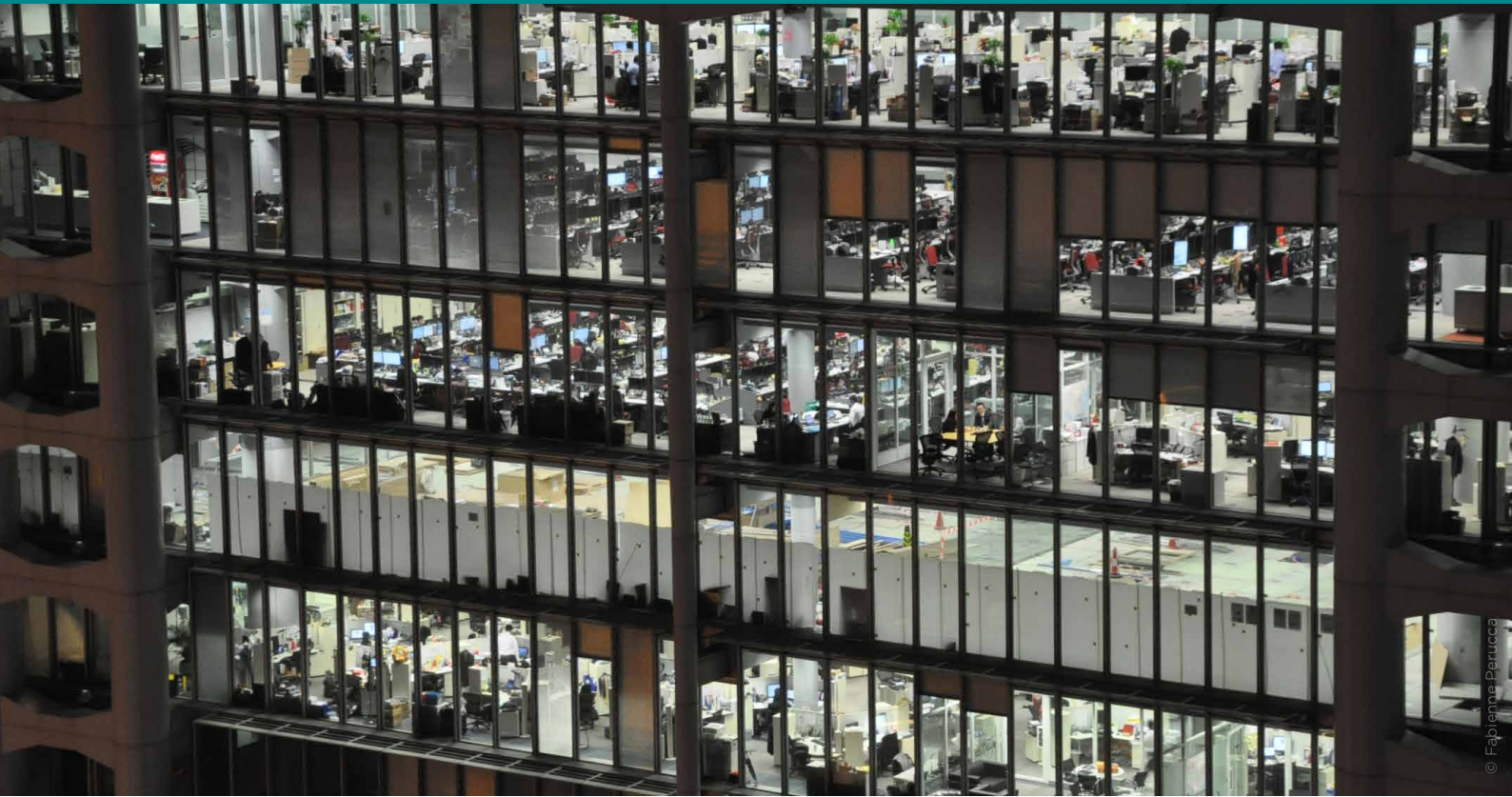
According to Sandra Castro Torres, FCM’s public policy advisor, the following actions are recommended to guarantee the success of this kind of projects:

- To adapt the institutional framework to technology, ensuring that the municipality has the necessary capacity to manage the project.
- To integrate the technological solutions into the overall management of the local government.
- To take the necessary time to dialogue with all the institutions involved.

1 Source : http://www.upme.gov.co/Docs/PEN/PEN_IdearioEnergetico2050.pdf

2 Source : <http://alubrado.bucaramanga.gov.co/files/documentos/InformeEficienciaEnergetica.pdf>

3.2 MUNICIPAL BUILDINGS



3.2.A BACKGROUND¹

UN-Habitat projections estimate that an area equal to 60 % of the world's current total building stock are to be built in urban areas by 2030, mostly in developing or emerging countries. Buildings are resource-intensive consumers: globally, they are responsible for nearly 32% of energy use (including 60% of electricity use), 12% of water use, 40% of waste generated by volume, 40% of material resource use, and buildings are accountable for 40% of the world's GHG emissions, which are expected to double or triple by 2050 without appropriate action. In cities, around 70% of energy consumption in residential, commercial and industrial buildings is related to heating, ventilation and air conditioning (HVAC) as well as in lighting systems. Management of public buildings such as hospitals, schools, libraries, museums and government offices typically falls under the responsibility of local governments, and it represents an important financial burden as it accounts for 40% of their energy bill as an average.


Despite this context, energy efficient policies to reduce energy waste in buildings are still not dined a priority in many contexts; and it constitutes

¹ Source of data in this paragraph are: WRI Building Efficiency report: <http://publications.wri.org/buildingefficiency/>
And http://ar5-syr.ipcc.ch/resources/htmlpdf/ipcc_wg3_ar5_chapter9/
And <http://thecityfix.com/blog/buildings-national-commitments-global-climate-change-conference-cop21-shannon-hilsey-jennifer-layke-eric-mackres/>



Buildings are responsible for 32% of the global energy use and accountable for 40% of the worlds' GHG emissions.

an overlooked opportunity to build sustainable cities, advance both human development and achieving climate goals at the same time. For instance, among the countries that have submitted their Intended Nationally Determined Contributions at COP 21, only 25% have explicitly identified buildings as a means to reducing emissions and only 10% have given details of concrete actions in the sector. Hence, there is a need for a shift in the approach to energy management in cities, the building sector deserve a particular attention as it represents both a risk and an opportunity for local governments to improve energy consumption, produce financial savings while improving people's comfort and quality of life and reducing environmental impacts. This opportunity is even greater in developing countries that will produce the majority of the new built environment in the next years. By taking preventive initiatives, they may avoid "locking in" decades of inefficiency and costly renovations in the future.



Municipal buildings represent up to 40% of a city's energy bill.

3.2.B

SMART TOOLS AND SOLUTIONS

Policies on sustainable buildings include several aspects to be taken into account: ranging from land-use decisions at the planning stage, selection of materials during design and construction, the use of energy and water over the building's life, and the management of the waste produced in the building. In this section, we will focus on how local governments can use SMART technologies either to improve energy efficiency in buildings they own, lease or manage; either to encourage initiatives from private building owners. Although public building retrofit programmes are still rare in cities around the world, municipalities have a vast array of choices when it comes to technical solutions. These can be summed up in three categories:

GREEN BUILDING TECHNOLOGIES

Some of the solutions include: high-performance building shells, efficient heating and cooling technology, thermal insulation, sun control, shading and passive solar heating, SMART windows that lighten or darken depending on the sunlight intensity, high efficiency boilers, destination dispatch controls for elevators, efficient lighting and increased day lighting, better windows and building material. Quick results can be assessed: estimates indicate that SMART windows can bring between 19-26% of savings on cooling and 48-67% on lighting. Similarly, lighting control systems such as movement and occupancy detectors can generate up to 30% savings. Building owners can apply these technologies both to existing construction through retrofits and energy efficiency renovation, and to new buildings that will apply low-energy building design since their conception.¹

¹ Source : <http://www.buildings.com/article-details/articleid/19537/title/how-smart-buildings-save-energy.aspx>

LOCAL ENERGY GENERATION AND STORAGE SYSTEMS

Buildings provide useful space to self-generate the electricity they consume. Technologies include rooftop solar or thermal energy storage systems. According to the IEA, urban rooftop solar could meet a third of cities' electricity demand by 2050. Energy generated in excess in the building's micro grids can be stored to count with extra electricity supply during peak hour, and exchanged between buildings at neighbourhood level or fed into the grids at district or municipal level.

MONITORING SYSTEMS¹

A Building Energy Management System (BEMS) uses SMART technologies to manage, control and monitor the technical services and equipment of buildings (heating, cooling, ventilation, lighting, insulation and appliances, power systems, fire systems, and security systems). They provide the information and tools that building managers need to understand energy usage and improve the building's energy performance. They usually combine:

- A Wireless Sensor and Actuator Networks (WSANs) that allow to: detect movement and room occupancy, measure light fluxes, internal solar radiations, indoor and outdoor conditions such as temperature, humidity, CO₂, air quality, determine the state of windows, blinds and doors, collect data from heating, cooling, ventilation systems, etc.
- A centralized management platform, which is a data analytics software tool that aggregate and process the raw data, collected from different devices and transforms it into intelligible, real-time and actionable information about the energy performance of the building systems and facilities and serve as support for decision-making.

Among others, benefits of BEMS include: detection of equipment failures, performance anomalies, malfunctions and early warnings that maintenance is needed; increased visibility and transparency; better budget management and planning of capital expenditures. It also generates energy and costs savings: advanced BEMS packages on their own can save between 13 and 66% on energy². In addition, BEMS are scalable and can help building owners gain visibility into system performance at level of one building or several buildings at a time, allowing for example local governments to assess energy performance in all public buildings.

When it comes to SMART solutions, partnerships with the private sector are often essential. However, international companies should work with local businesses to make sure the project benefits local development.

JEAN FRANÇOIS
HABEAU, EXECUTIVE
DIRECTOR, FMDV

1 Source : http://blog.rmi.org/blog_2016_02_24_intelligent_buildings_energy_savings_from_SMART_controls

2 Source : <http://www.buildings.com/article-details/articleid/19537/title/how-SMART-buildings-save-energy.aspx>

Q.RAD: COMPUTER HEATERS*

PARIS, FRANCE

BACKGROUND

Data centres consume 3% of the world's electricity, and it tends to double every five years. High-performance computing (HPC) data centres generate a lot of heat, and equipment installed to cool down these powerful computers are costly, need heavy equipment and are very energy-hungry. Half of the energy consumed by data centres is used to cool servers. Usually, it is very difficult to recycle or harness the heat generated by data centres, as they tend to be remotely located from potential users of the heat. Besides having a significant environmental impact, it also represents a lot of wasted energy as estimates say that the heat produced by data centres around the world could heat half of Europe's buildings.

Q.RAD AND Q.WARE

In this context, Qarnot, a French start-up created in 2010 and specialized in energy efficient high-performance computer services, has created the Q.ware and Q.rad SMART solutions. Q.ware is a software platform that uses cloud computing to help companies cool down their high-performance computing datacentres by distributing the heat generated by workload processing into a distributed infrastructure. As such, computing power is no longer deployed in concentrated data centres, but split throughout the city in form of Q.rads, which are small "digital heater" units located in homes, public buildings or offices. Q.rad uses embedded processors as a heat source to provide free and efficient heating where they are installed. Q.rads are completed by sensors placed around the home, and provides functionalities such as Wi-Fi, air quality control, SMART alarm systems. Q.rad can be implemented both in existing constructions and included in the initial design of new buildings. The only technical requirement for its implementation is that the building is equipped with fibre optics. Qarnot works with more than 500 private clients (mainly major banks, 3D animation studios and research labs) to compute remotely with Q.ware and with two local governments (Paris and Bordeaux) to

heat social housing buildings, and the Q.rad solution has been implemented in more than 100 households and offices in France.

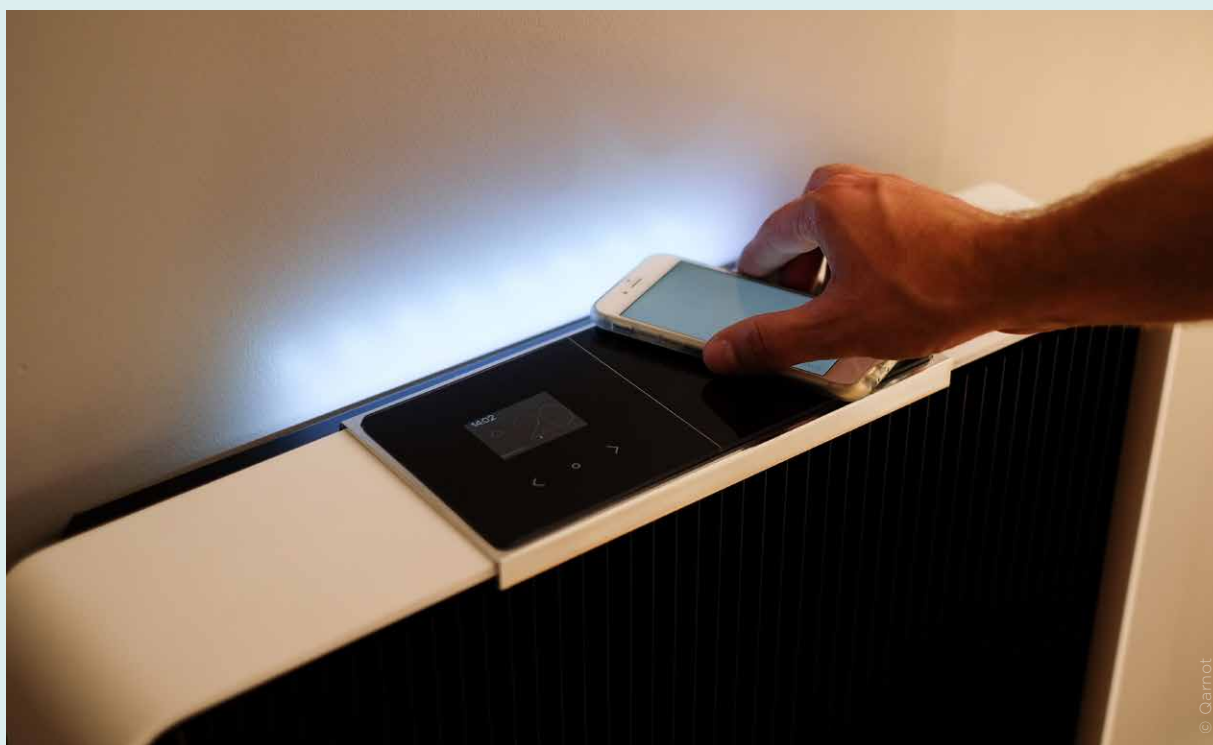
THE PARIS EXPERIENCE

In 2014, Qarnot worked with the city of Paris and RIVP (Régie Immobilière de la Ville de Paris – a social housing landlord where the city of Paris holds the majority of shares) to implement Q.rad digital heaters in one social housing building. The goal of this pilot project was to provide social and financial benefits to inhabitants through free heating, and more energy efficiency to the city. The first step was the conduction of a thorough energy audit to evaluate the number of Q.rads needed (which depends on volumes, insulation, outside temperatures, etc.) and a technical audit to assess the network and needs in terms of cables and fibre optic. The studies served as a basis to draft the contract with the stakeholders, and identified the need for 300 Q.rads. Implementation took six months after the signature of the contract. It included the infrastructure installation (fibre optics in the building, cables and Q.rads in each apartment) and dialogue with the residents of the building (organization of meetings, distribution of leaflets, etc.). The project was included in the Paris' Climate Plan and is part of a renovation process of social housing engaged by the RIVP. The total cost of the Q.rad project was 1 million euros (the price for a Q.rad ranges from 2.5 to 3.5k€ per Q.rad), consisting only of upfront investment cost, as no operating costs are foreseen afterwards because Qarnot provides the free maintenance and replacement of the machines every 3 to 5 years.

RESULTS

The solution has benefits for the companies that pay for the cloud computing service as it reduces their expenses for data centre management, for the house and offices that get free heat, for the research centres to whom the excess energy is redistributed, and for the local government that sees its energy consumption

* All information in this box was provided by Qarnot. For more information: <http://www.qarnot-computing.com/>



reduced. Q.rad has a high social impact: besides solving the problem of waste heat, the system is a mean to enable poorer households to heat their homes free. In fact, in average, in France, 50% of the household electricity bill is dedicated to heating; and one in five households can be considered “fuel-poor”. By providing free heating, Q.rad can reduce the burden on the low income households’ already tight budget. Q.rad SMART solution also has a positive environmental impact as the building is now considered as energy-neutral, it recycles waste energy from computer data centres, and reduces the carbon footprint from computations by 60 to 78%. For the local government, although the system supposes a strong initial financial investment, it generates energy and financial savings on the long term. In addition, it also sends a strong message that the local government takes measures to fight energy poverty and the digital gap, while increasing building energy efficiency.

CHALLENGES AND RECOMMENDATIONS

No major technical difficulties were observed during the project’s implementation, however, the project leaders had to tackle regulatory issues to have the device taken into account by the French thermal regulation schemes. In addition, implementing the system in an occupied building was proven difficult, due to the need to install access to fibre optics and to organize several meetings with tenants. Qarnot identifies the following elements as key to ensure the success of the project:

- Identify a concrete and compatible project based on energetic and technical audits.
- Involve all stakeholders in the process, including local communities and end-users.
- Communication with tenants and end-users about the concept, its benefits and usage of the system. This allows to increase endorsement and comprehension. One important element in this stage was to offer the option to the tenants to refuse the installation of Q.rads, to show it was not mandatory.
- Communication with general public to include the project in the frame of the local government’s agenda for sustainable development and SMART city.

As more and more cities move to SMART city schemes based on intensive use of technologies, which increases data centres size and activities, Q.rad may appear as a solution for cities wishing to combine re-use of heat generated from workload processing and heating social housing buildings. It may help the city reduce energy consumption from data centres and generate substantive financial savings.

3.2.C

LESSONS LEARNED

BENEFITS

Efficient buildings initiatives at the city scale are vital to achieving sustainable development as they create triple bottom line benefits aligning economic, social, and environmental opportunities, as presented hereafter.

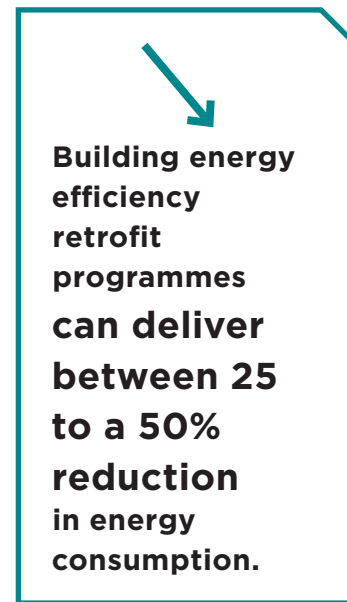
Economic benefits:

Financial savings to municipalities¹ Estimates from Sustainable Energy for all (se4all) indicate that energy efficiency policies in buildings can deliver between 25 to 50% reductions in energy consumption both for new and existing buildings. Lower energy consumption resulting from improving energy efficiency in municipal buildings represents reduced requirements for energy infrastructure and fuel purchasing; thus directly saving money for the municipality and freeing up funds for other issues. Unlike other emissions-saving investments in relatively expensive sectors such as agriculture or transport, efficiency improvements in buildings have often low associated costs, and deliver positive financial returns in the form of energy cost savings within relatively short payback (less than one year). According to the World Resources Institute (WRI), building efficiency measures at city-level has the potential to slow down the growth of energy demand in developing countries by more than half by 2020. Each additional \$1 spent on energy efficiency avoids more than \$2, on average, spent on energy supply investments.²

Employment opportunities. The construction sector represents 10 % of world GDP, 10 % of the workforce, and, in emerging markets, will likely make up 16.7 % of GDP by 2025. Buildings are good and long-term investments, especially because buildings last 40 years or more and construction creates more jobs than other sectorial investments. Municipal building efficiency projects create new temporary and permanent green jobs and further supports employment through offering training opportunities in the retrofit and in the renovation process.³

Environmental benefits:

Reduction of energy consumption. This in turn contributes to reduction of GHG emissions and air pollution, it also leads to greater resource efficiency and to increased climate change mitigation. According to the IEA, if implemented globally, energy efficiency measures in the building



1 Source :http://www.se4all.org/sites/default/files/l/2014/09/Accelerator_Buildings-1015.pdf

2 Source : <http://www.wri.org/blog/2016/05/4-surprising-ways-energy-efficient-buildings-benefit-cities>

3 Source :<http://www.wri.org/blog/2016/05/4-surprising-ways-energy-efficient-buildings-benefit-cities>

sector could deliver CO2 emissions savings as high as 5.8 billion tonnes by 2050, lowering GHG emissions by 83 percent below the business-as-usual scenario¹.

Social benefits:

Reduction of illness and death related to air pollution. According to World Health Organization (WHO)² around 7 million people died in 2012 (one in eight of total global deaths) as a result of air pollution exposure; including 4.3 million deaths from indoor air pollution (in households cooking over coal, wood and biomass stoves) and 3.7 million deaths from outdoor air pollution worldwide. The highest rates of exposure are in developing cities, and regions such as China and India have the highest air pollution-related mortality rates in the world. The largest contributors to these deaths are residential and commercial buildings energy use. Consequently, improved municipal building energy efficiency curbs outdoor pollution by reducing the fossil fuel pollution created by power generation and leads to healthier spaces in office buildings, venues or social housing, helping reducing the level of indoor pollutants. This saves not only lives, but also contributes to reduce the financial and social costs of medical treatment and the loss of productivity.

Support to disadvantaged households - Higher energy efficiency in municipally owned residential buildings supports better and more affordable energy access for disadvantaged households. Improvements in efficiency are particularly important for the lowest income urban residents, who pay a larger portion of their income on energy and are least able to afford higher energy prices or cope with unexpected fluctuations in energy costs.

RECOMMENDATIONS³

Local governments that wish to implement SMART buildings energy efficiency initiatives must pay attention to a few issues, including:

- **Select the technology according to context needs and capabilities, and strengthen institutional capacities.** Key technical challenges encountered by local governments (mainly in developing cities) may include: (i) a lack of affordable and readily available technologies suitable to local conditions which might constrain utilities to import technology; (ii) a lack of experience which may difficult access to investments; and (iii) a limited institutional capacity (mainly lack qualified team), which will make it difficult to elaborate necessary studies and ensure future maintenance. Thus, it is important that local governments strengthen their institutional and technical capacities prior to launching building efficiency initiatives. They can work with the private sector to elaborate feasibility studies and to train municipal staff.

When a municipality wishes to implement a SMART project, a pilot-phase is often useful to understand major issues and challenges. This, added to an extensive impact evaluation, should allow the municipality to communicate and convince national and international decision makers to support the project's scale-up.

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1 quoted in the building efficiency WRI report: <http://publications.wri.org/buildingefficiency/>

2 Source :<http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>

3 Recommendations outlined here were mainly extracted from C40 and WRI reports: <http://publications.wri.org/buildingefficiency/> and http://c40-production-images.s3.amazonaws.com/good_practice_briefings/images/8_C40_GPG_MBE.original.pdf?1456789018

- **Ensure coordination among multiple stakeholders.** Buildings' energy efficiency improvement projects often require multiple stakeholders and providers such as construction companies, energy service companies, energy utilities, local and national governments. Strong political support, leadership and governance capacity are required from local governments, and dialogue, incentives and the incorporation of stakeholders in the policy design processes are strongly recommended. Cities must particularly increase the level of partnership and better coordinate efforts with energy utilities to ensure data sharing.
- **Definition and enforcing of building codes and appliance standards.** Governments can define regulatory tools such as standards and codes that establish a minimum level of energy efficiency in the design, construction and operation of new or existing, public or private buildings. However, definition of building codes is typically outside the jurisdiction of local governments, and it may make difficult the efficiency of municipal building programs.

The city of Johannesburg, in South Africa, introduced in February 2015 a set of basic requirements for energy-efficient building development. The plan establishes that every new building development in the city must incorporate passive design features to reduce energy use, in particular the use of natural heating provided in winter through north-facing buildings; and eaves installed on the north, east, and west façades to facilitate shade in summer and sun penetration in winter. Other measures that are strongly encouraged include solar water heating, roof insulation, energy-efficient light fittings, and motion or timer sensors.

- **Definition of improvement targets.** It is recommended that city governments include building efficiency initiatives in broader low-emission development planning strategies and define specific building energy reduction goals, setting a timeline for actions to be taken. These can be set either at the citywide community level, or applied to its own publicly owned or rented building stock.

The city of Vancouver, Canada has defined clear targets for green building, in its strategy to become the Greenest City by 2020. It requires all buildings constructed from 2020 onwards to be carbon neutral in their operations, and to reduce energy use and GHG emissions in existing buildings by 20% taking into consideration the 2007 levels. The city is also constantly monitoring and disclosing the results on its web page¹.

- **Performance information and certification policies.** These policies may include requiring: energy audits, retro-commissioning, disclosure of energy performance and regular reports on energy use and assessments. Better information regarding current energy use in buildings, the establishment of baselines and monitoring building efficiency is key to successful policies, certification, and ratings enabling building owners to track and evaluate the performance of their buildings, while outlining opportunities



Each additional \$1 spent on energy efficiency avoids more than \$2 spent on energy supply investments.

¹ For more information about the experience of Vancouver: <http://vancouver.ca/green-vancouver/green-buildings.aspx>

for improvements. Transparent and updated information allows decision-makers to measure and track performance against targets, and helps cities to prioritise the policies and initiatives that will maximise energy use reductions from buildings. It sets ambitious but realistic targets, and builds a robust strategy outlining how goals can be met.

In 2008, the environmental protection agency of the city of Buenos Aires¹ launched the Program of Energy Efficiency in Public Buildings (PEEP) with the goal of optimizing energy consumption in public buildings and reducing GHG emissions. The objective was to reduce overall emissions of 30 percent below 2008 levels by 2030, with the specific goal to achieve minimum savings of 20 percent in energy consumption in municipal buildings by 2015. To do so it analysed and monitored energy consumption patterns from public buildings by requiring energy audits, energy management tools and improvements to building operation and maintenance procedures. By 2015, approximately 20 buildings had undergone an energy audit and were implementing efficiency improvements. The program gave the local government the data and clarity required to develop energy reduction policies in public buildings and the information gathered from it was used by policymakers to draft the Energy Efficiency law, which was approved by the city council in 2009. The law has established guidelines for energy efficiency and now mandates the adoption of energy efficiency measures in all public buildings. The law also requires that at least 50 % of the savings generated from improved efficiency will be used to fund educational programs on energy efficiency.

- **Establish financial and non-financial incentives.** Identifying funds to pay for the up-front costs of building efficiency improvements has historically been a significant barrier to action, particularly in developing countries. Local governments can encourage buildings energy efficiency projects from private owners by offering incentives such as: grants and rebates, energy-efficient bond and mortgage financing, tax incentives, priority processing for building permits, revolving loans, dedicated credit lines, risk-sharing facilities, and density bonuses, which allow developers a higher level of density (floor area ratio) in exchange for a higher level of energy efficiency performance.
- **Government leadership by example.** Local governments can encourage initiatives by undertaking projects in public buildings that will serve as an example to create greater demand and acceptance for efficient buildings in the market. Showcasing energy efficiency through demonstration projects in municipal buildings is an important catalysing tool that is available to cities to build political and citizen will. This approach can take the form of improving the public building stock, private-public partnership pilot projects, encouraging or mandating procurement of efficient products and services, and stimulating the energy service company market through municipal energy performance contracting tenders. Successful delivery of municipal building efficiency demonstration projects can also help lower perceived risks among private investors.

¹ For more information about the Buenos Aires project: http://www.iclei.org/fileadmin/PUBLICATIONS/Case_Studies/ICLEI_cs_123_Buenos_Aires_English_2011.pdf and http://www.worldgbc.org/files/3014/0982/5868/Buenos_Aires_-_City_Market_Brief_Final.pdf

Nevertheless, for local governments to implement demonstration projects in public buildings, investments needed are huge. For example, the city of Kiev in Ukraine, launched in 2006 a city-scale building efficiency initiative that retrofitted 1.270 public buildings, including healthcare, educational and cultural facilities. Results were positive as it saved 26% in energy consumption, but the project costed US\$27.4 million and had to be financed through the combination of a World Bank loan, a Swedish Government grant, and municipal funds.¹

- **Information and awareness campaigns to promote behavioural change.** It is estimated that up to 30% of energy demand is due to human behaviour; including energy-use habits and the purchase of energy using technology. Thus, finding an effective way to engage people is essential for the success of any energy management programme. Cities have been designing various strategies to engage their staff and larger public, including specialised training and various awareness raising programs, including competitions and awards. The awareness campaign can be addressed to population, city officials, or private building owners.

When the public administrations work with the private sector in SMART projects, it is key that they have the technical capacities and the institutional framework to ensure a transparent relation; to guarantee that profits are not only in favour of a private party but that benefit the whole society.

SANDRA TORRES, PUBLIC POLICIES ADVISOR, COLOMBIAN FEDERATION OF MUNICIPALITIES.

¹ For more information about Kiev's program: http://www.esmap.org/sites/esmap.org/files/2122010124551_Kiev_Case_Study_020210edited.pdf

BUILDING RETROFIT PROGRAM

SEOUL, KOREA*

BACKGROUND

Buildings account for more than half (56%) of Seoul's total energy consumption and for 87% of the city's electricity consumption. Building energy use reduction through efficiency and other measures is a priority for the Seoul Metropolitan Government (SMG). The Building Retrofit Program (BRP) began in 2008, and expanded in 2012 as part of the SMG's "One Less Nuclear Power Plant" initiative. It was an ambition plan to reduce the city's GHG emissions by 40 per cent by 2030 and to prevent the construction of another nuclear plant. The programme aims at improving energy efficiency in buildings from both the private and the public sector by installing new, or retrofitting existing equipment, and by improving wall and windows insulation, heating and cooling, and illumination.

ENERGY RETROFIT IN PUBLIC BUILDINGS AND REINVESTMENT OF SAVINGS IN SOCIAL WELFARE PROGRAMMES

The program targets buildings owned by Seoul's government such as the City Hall, the SMG's affiliated offices and municipal corporations and social welfare facilities.

The money saved by reducing energy consumption from retrofits in public buildings is reinvested in citizen welfare programs. In order to institutionalize the support for the energy-vulnerable and to lay the foundation for universal energy welfare for all citizens as their basic rights, SMG created the Energy Welfare Fund thanks to citizens' donations and by the profits from the production and conservation of energy in relation to the solar power business, LED, BRP, and Eco-Mileage. The raising of funds as well as management and distribution is handled by the Citizen Council composed of 100 citizens -in collaboration with civil society and professional organizations such as the Seoul Council on Social Welfare and Community Chest of Korea, it is expected that 100.000 citizens will be involved by 2018. The fund will be used to help the energy-poor

improve their homes energy efficiency and reduce their energy bill. Seoul has set the following goal: by 2018 it will enhance insulation in a total of 150 senior citizen and community welfare centres; it will replace the lighting system of 750 social welfare facilities and 120,000 households entitled to National Basic Living Security benefits; finally, it will replace balcony windows, elevators, security lights, and boilers with most energy-efficient products of 115,000 public rental housing units (23,000 unit per year).

More recently, Seoul has implemented energy retrofitting initiatives in the city's basic urban infrastructure. These focus mainly on introducing intelligent electricity load management systems in water purification centres, and in improving the energy efficiency in sewage treatment utilities by replacing old motors with high-efficiency ones, and converting into heat source the digestion gas generated in the sewage treatment process.

ENERGY EFFICIENCY RENOVATION IN PRIVATE BUILDINGS

To encourage participation from the private sector in the building retrofit program, the Seoul Metropolitan Government has:

- Facilitated access to loans for BRP projects. For instance, in 2013, SMG lowered the interest rate of BRP loans from 2.5% to 1.75% per year, while current market interest rate was hovering over 3.8%. SGM also included tenants and contractors in the category of those who are eligible for the preferential BRP loan benefit, and increased the maximum loan amount from 80% to 100% of the applicable facility costs.
- Partnered with building owners, contractors, energy service companies and various businesses and civic organizations. For instance, since the beginning of the programme, SMG has established public-private partnerships to retrofit 59 social welfare facilities and 116 schools. In addition, in 2014, thanks to private sector investment, the city installed an Energy Eco-house where citizens can experience BRP technologies.

* About the Seoul's experience : http://energy.seoul.go.kr/e_news/e_Seoul_Sustainable_Energy_Action_Plan.pdf and http://carbons.org/index.php?id=312&tx_datareport_pi1%5Buid%5D=232 and http://www.c40.org/case_studies/seoul-s-building-retrofit-program



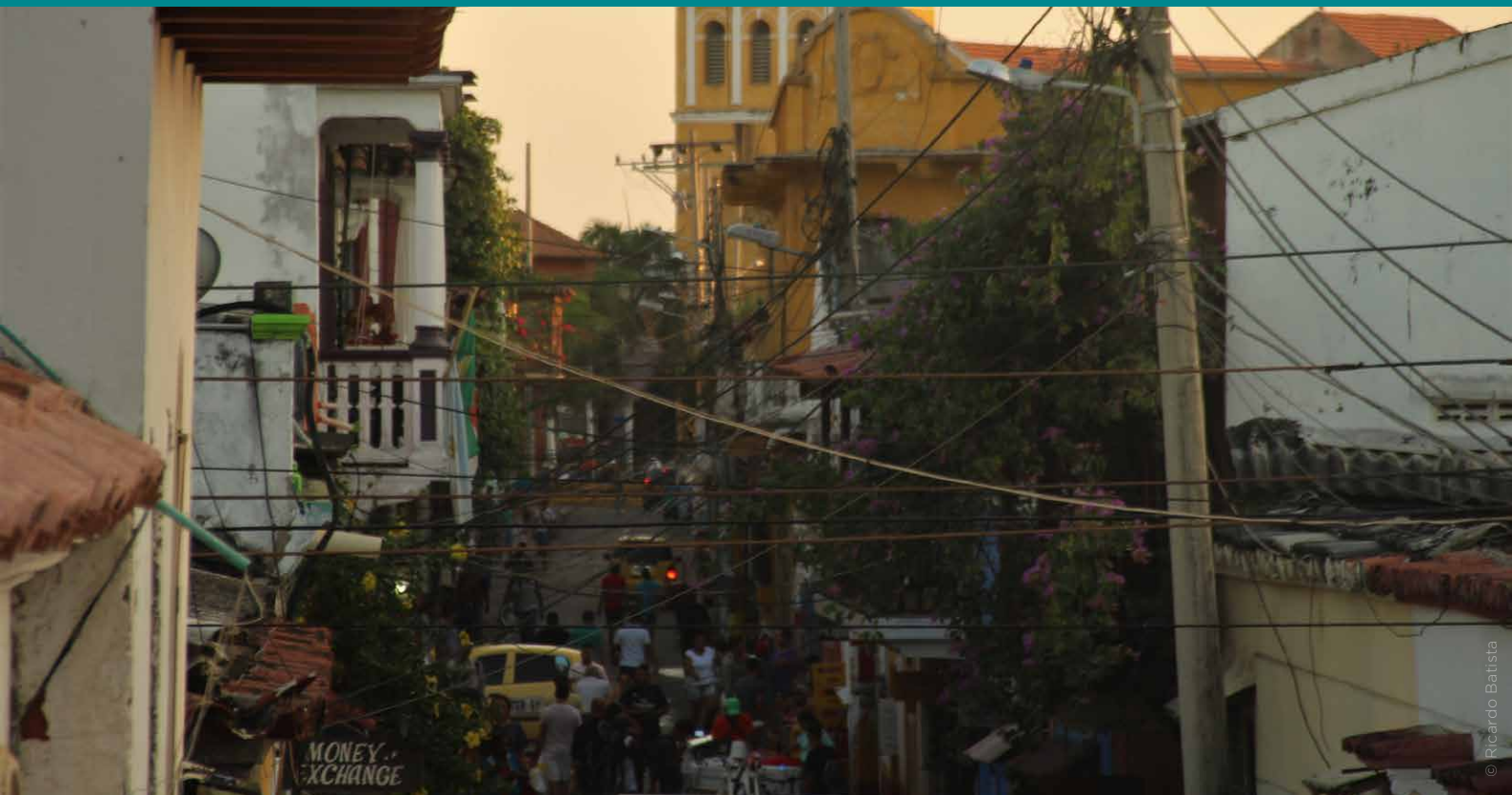
- Disclosed efficiency building retrofit initiatives from the private sector. In 2014, SMG analysed the energy consumption patterns and disclosed the positive BRP efforts to the public, of 424 facilities consuming huge amounts of energy, in an attempt to motivate them to make continuous energy efficient improvements.
- Improved regulation regarding building standards and codes. Particularly working on the regulations on environmental impact assessment, energy consumption certificates for existing buildings, green building design criteria for new buildings, and a definition of higher energy standards.
- Offered assistance for the elaboration of energy diagnosis and audits. SMG has established a strong dialogue with the Korean central government to aim at the delegation of authority of the Minister of Trade, Industry, and Energy to request local governments to compulsory submit energy diagnosis reports for high-energy-consuming buildings.
- Established financial incentives. SMG reduced by up to 15% the property tax for new buildings with green building certificates or building efficiency grades. The same benefits are planned to be extended to old buildings that have successfully completed BRP procedures.

RESULTS AND BENEFITS

By mid-2016, 20,000 buildings have been upgraded and their energy performance data made publicly available. Earlier information show that in 2014, the BRP had completed energy efficiency renovation in 1,221 high-energy consuming buildings; 10,000 individual houses; 82,962 public rental apartments; 59 city-built social welfare facilities; 30 universities' campuses; and 640 low-income households.

The main benefit of building retrofit programs is a considerable reduction in energy consumption, which leads to saving significant amounts of money, both for the local government and the private building owners and tenants. In 2013, Seoul had already cut city GHG emissions by 230,000 tCO₂, and the city government expects to reduce energy consumption by 1 million TOE/year; reaching total reductions of 3.15 million tCO₂ by 2017. Other benefits from efficiency programs in Seoul included a reduction of construction waste, more funds available for citizen welfare programs, and an increased civic cooperation and participation.

3.3 SMART GRIDS



3.3.A

BACKGROUND

Demand for energy in urban centres will exponentially grow in the next decades (it will duplicate by 2030 compared to 2015). Local governments are at a crossroads where they must ensure energy security and access, while reducing GHG. This happens at a time where existing energy infrastructures are ageing and accumulating inefficiencies. In the USA alone, two-thirds of existing power stations are expected to be close by 2030 as they have reached their working times. Moreover, important amounts of electricity are lost in transmission and distribution by grid systems. In industrialised countries electricity loss is low (below 5 % in the USA or Japan), but it can reach up to 30% in developing and emerging economies. Losses are usually linked to technical reasons such as infrastructure failure due to overstrained equipment with increasing demand, but also to the own structure of current grid systems, which are based on long-distance energy transmission from centralized power plants to end-users. Losses can also be related to non-technical issues, such as energy theft, which typically occurs through illegal connections. In India, electricity lost from technical reasons amounts to 26%, but if we add the non-technical losses, it can reach as high as 50%¹. In addition, current power grids are not fit to support the increasing demand. Cities and system operators find difficulties in balancing supply and demand



Electricity losses in transmission and distribution systems can reach up to 30% in low-income countries.

¹ Source : https://www.worldenergy.org/wp-content/uploads/2012/10/PUB_SMART_grids_best_practice_fundamentals_for_a_modern_energy_system_2012_WEC.pdf

during peak times, often resulting in frequent outages and blackouts. This can have a huge economic impact in terms of loss of productivity: according to the Electric Research Power Institute (EPRI), blackouts and outages cost the US economy around \$180 billion USD a year.¹

Local governments and energy utilities face important budget constraints, making it very difficult to replace the whole energy system. This can be both a challenge and an opportunity to change the way energy is generated, distributed and consumed; pushing towards low-carbon, efficient, flexible and secure energy infrastructures. In order to face the rising demand, to increase efficiency, reduce levels of losses and improve services' quality and security, government and private institutions are increasingly turning towards SMART technologies to improve their energy network management.

3.3.B

SMART TOOLS AND SOLUTIONS

Traditional electricity grids. Typically, energy is generated by a central power station, most of the times by a thermal power station fired by fossil fuel sources (like oil, coal and gas, which produce a large amount of CO₂) or perhaps by renewable sources (wind power, photovoltaic power station, hydro, biomass...). Afterwards, energy is stepped up in voltage by a transformer before going into the power lines (higher voltages are more efficient to transport). Power is then carried out through transmission lines over long distances (which can be at the scale of a continent), and at this level, large grids put together many sources of generation. Closer to its destination, power travels through the distribution system, which involves substations and further transformers lowering the voltage again to a suitable level for use. Power goes through a meter when it enters the customer's premises such as industries (electricity intensive industries, manufacturing sector); commerce (wholesale, retail and service sectors), households and transportation (electric cars, buses and trains). In the traditional power grid, energy cannot be stored in large quantities, which means it has to be used at the same instant it is generated. For utilities, this means they must take "load balancing" measures to match the generation of electricity nearly instantaneously with demand. When demand outpaces supply, blackout occurs. Typically, this is solved with spinning reserves, which are backup power plants that pump electricity into the system at a moment's notice, however these represent an important financial burden for utilities and governments. The current energy system is one-directional, where energy flows always in the same direction, with a centralised power generation to homes, offices and industries.

Systems modernization always encounters strong resistance, both in private and public institutions. Change management is a key element to ensure the success of any project based on the use of technologies. Offering capacity building activities and working closely with all stakeholders from the beginning helps to reduce resistance.

ERWAN LEQUENTREC,
ORANGE LABS


¹ Source : <https://www.weforum.org/agenda/2015/04/how-the-internet-of-things-will-change-your-life/>

SMART Grids¹. To increase energy management efficiency, minimize costs and environmental impacts while maximizing system reliability, resilience and stability, governments at all levels and energy utilities are building SMART grids. These are advanced electricity networks that combine the traditional power grid, new ICT and SMART electricity management solutions, bringing changes to the whole energy supply chain, from generation, distribution to consumption. SMART grids involve different elements working together such as:

- **Distributed generation:** power generation is decentralized and energy is produced at the scale of a neighbourhood, building or household, with small-scale power generations, such as rooftop solar panels or micro-turbines, avoiding costly transportation infrastructure for utilities and reducing electricity losses.
- **Distributed storage:** electricity is stored when demand is low and discharged when demand is high. The surplus of energy produced is stored in devices such as big dams, small batteries, or electric vehicles, enabling utilities to better balance energy generation and consumption. Distributed storage also helps to reduce variations and outages in the network, and in particular mitigate solar and wind intermittency. Distance travelled by electricity is also reduced, meaning less losses and lighter distribution frameworks.
- **Renewable sources.** The SMART grid model provides the adequate structure to integrate more intermittent renewables such as wind and solar and distributed energy resources such as rooftop solar and electric vehicles. Besides reducing cities' carbon footprint, it also increases efficiency and reduces expenses for utilities, making cities less dependent on imports from gas and oil from abroad.

The county of Yolo, in the USA, was pioneer in integrating renewable energy to its power grid. In 2010, it initiated a program that installed solar panels in every public building, on government roofs and government-owned ground. By 2014, it had managed to zero its own power expenditures and generate about 50% more electricity than it uses. In addition to reducing the electricity bill by \$2,7 million USD, the Yolo County approach is unique as it includes net metering where customers who generate their own power can sell it back to utilities for as much as they buy it for. As a result, the local government is making money by selling electricity to the state utility, generating revenue in excess of 600,000 USD a year.²

- **Microgrids** are energy networks at a smaller-scale, at the neighbourhood or building level that can operate connected to the centralized power system or islanded and, eventually, switched between the two. This is a particularly interesting model in developing countries where community-led energy projects increase electricity accessibility and security to a majority of urban populations.



Distributed generation and storage systems could reduce the electricity bills of utilities by up to 25%.

1 interactive tool European Union to better understand the difference between traditional grid and future grid: <http://ses.jrc.ec.europa.eu/SMART-grid-interactive-tool>

2 Source : http://www.govtech.com/fs/Three-Ways-Local-Governments-Can-Use-Solar-Power-for-Themselves-Part-1-Yolo-County.html?utm_content=bufferaaddf&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

- **Prosumers.** End-users are not only passive energy consumers, they play a more active role in energy management by being directly involved through small scale distributed generation and storage systems, for example. In fact, prosumers are a new type of player in the energy market who can simultaneously consume and produce electricity. SMART buildings or electric vehicles are for example prosumers, as they can take energy from the grid (charge process of electric vehicle) and release energy (car parked, plugged in and charge). In a SMART grid, consumers can feed the power they produce into the grid, and it is adjusted against the total consumption from the principal grid, leaving the consumers to pay only for the balance that they have consumed (or get paid if they have fed the grid more than they have consumed).
- **SMART meters** are advanced metering infrastructures (AMI), installed in consumers' premises to measure the electric flux and provide reliable real-time data to a control centre about energy consumption in the network. SMART meters improve utility-consumer interaction with a two-ways communication structure: consumers can monitor their electric consumption in real-time and adjust their behaviour and reduce consumption to positively impact their energy bill. For utilities, it reduces management costs by eliminating the need for manual metering, increases revenue by improving billing, and enhances reliability of information collected. For local governments and utilities, this results in better visibility in energy demand at city-wide scale which enables them to define adapted policies to reduce peak load and costs, such as pricing schemes where energy price rises or lowers according to the demand. SMART meters are increasingly deployed in urban and rural areas around the world. The UE has set the target to equip 80% of consumers with SMART meters by 2022, and emerging countries such as Brazil, Mexico, South Africa or China are also implementing SMART meters to improve electricity management.
- **Demand response programmes** are incentives established by electric system planners and operators to change consumer behaviours by encouraging them to reduce their consumption during peak periods. The main method of engaging customers in demand-response efforts consists in establishing variable prices according to demand. Another strategy is direct load control programs, which provide the ability for power companies to cycle equipment (air conditioners, water heaters, lights or dryers) on and off during periods of peak demand. In exchange, electricity customers receive a rebate in their electric bills (the "negawatts"). SMART technologies can considerably help utilities to improve demand-response programs by automating them. For example, sensors can perceive peak load problems and utilize automatic switching to divert or reduce power consumption in strategic areas, reducing the chance of overload and the resulting power failure. These programs have the potential to help electricity providers save money through reductions in peak demand. This lowers the cost of electricity in wholesale markets, and in turn, leads to lower retail rates. In addition, demand response programs have the ability to defer construction of new power plants and power delivery systems, needed to supply energy during peak times and without which, outages and blackouts would be more frequent.

The city of Johannesburg and other South African cities face regular power shortages. To limit the impact of this situation, Eskom, South Africa's national energy company, launched a 'load shedding' initiative, which consist in planned outages whereby citizens and companies are left without electricity for up to several hours at a time. However, frequent load shedding strongly impacts the country's economy. In April 2015, City Power, Johannesburg's energy utility implemented a "load-limiting" initiative with the aim of curtailing electricity consumption during peak hours. Interventions include remote disconnection of households using excessive electricity during peak pressure, use of SMART meters to request (via SMS) households to use less electricity, and the development of apps allowing residents to be aware of load limiting schedules. In 2016, 150,000 SMART meters had already been deployed by City Power throughout Johannesburg.¹

Management platforms. The SMART grid model is typically built on the Internet of Things (IoT). SMART devices (sensors, SMART meters, etc.) collect huge amounts of data about the grid performance. These interconnected components are linked to integrated communications networks and an operations management platform, which is a cloud-based software that aggregates, stores, processes, and analyses the collected data. It generates energy analytics that can be visualized in dashboards and reports, to provide predictive information and recommendations to utility operators on how to improve energy management, including:

- To have a better knowledge of the grid system: monitor energy consumption and demand; see energy in terms of cost or emissions; map out the quantity, quality and location of the various energy sources; improve management processes such as billing and environmental reporting, among others.
- To enable predictive maintenance. Analytics can reduce utilities' overall maintenance costs and improves network uptime and reliability, through efficient identification of power failures and restoration of outages by remotely rerouting power flow to quickly reconnect customers; automatic detection of leaks in gas pipelines and high-voltage electric wires, in order to reduce losses quantity and prevent expensive leaks; monitoring equipment health and condition to facilitate maintenance, etc.
- To improve the utility - consumer relation: analytics can help utilities gain visibility on individual customers' responses to programs such as price signals. If crossed with external data sources, it can provide valuable insights to inform the creation of new targeted services or communications' campaigns; and to create notification systems to alert users of unusual or unexpected energy consumption.

Collaboration between sectors is key. We need to find innovative models of partnership between the public administration, the private sector and the population to spread ICT technologies, particularly to rural areas and small cities.

ERWAN LEQUENTREC,
ORANGE LABS

¹ Source : <http://businesstech.co.za/news/energy/93809/how-power-load-limiting-works/> and http://www.joburg.org.za/index.php?option=com_content&view=article&id=9703 and <https://www.citypower.co.za/customers/Pages/Load-Limiting.aspx>

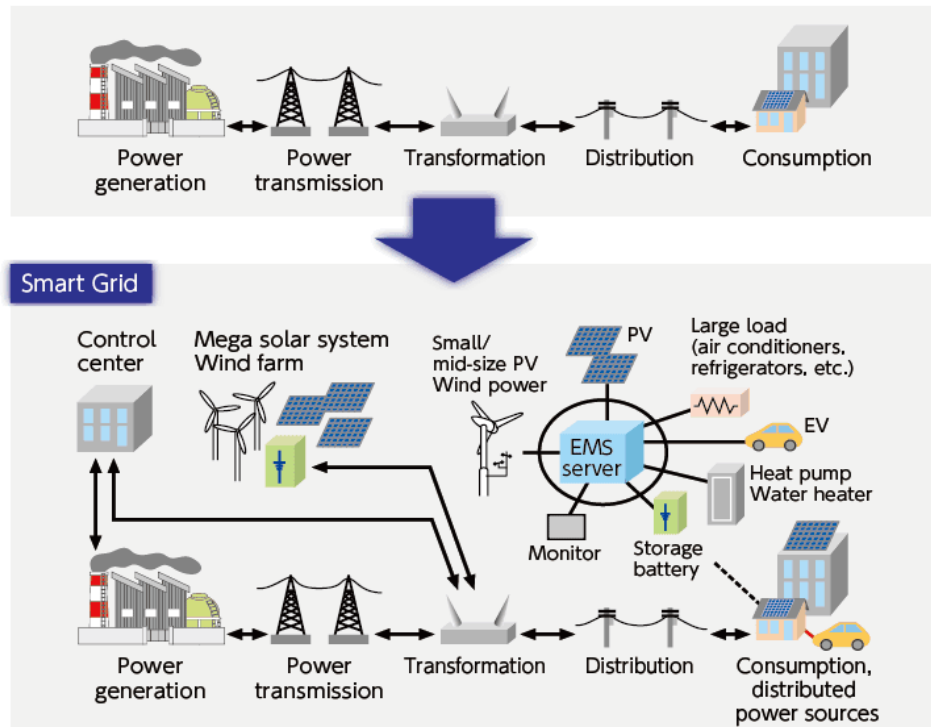
Estimates indicate that intelligent energy management platforms can deliver savings to utilities of approximately 15%.¹ Local governments and utilities are increasingly using Virtual Power Plant (VPP)² as SMART management software platform. Usually, these platforms are cloud-based software-as-a-service (SaaS) solutions, provided by start-ups that make the connection between various energy suppliers, grid operators and end-consumers. The software tool aggregates the different components of the grid and ensures seamless integration of distributed generation sources, storage devices and demand response programs in order to balance energy supply and demand, avoiding disruptions in the grid. In addition, the ‘aggregator’ identifies pockets of spare capacity among the clients (surplus energy from generation sources and storage devices, or “negawatts”) and pools them to create a virtual power market where utilities pay the platform for the service. SMART devices transmit data to the central software platform to track energy reductions at each individual site, but analytics also offer a city-wide visibility where utilities can reduce area-wide energy demand when power is suddenly needed during peak hours to avoid outages and blackouts.



Energy management platforms can produce savings up to 15%.

Conceptual Diagram of Smart Grid

From grid to smart grid: Optimize power generation and consumption with IT-based efficient control



Source of image:
<http://global-sei.com/csr/feature/2011/images/table011.gif>

1 Source : https://www.capgemini.com/resource-file-access/resource/pdf/capgemini_ibm_iem_white_paper-13-12-18.pdf

2 Source : <https://www.theguardian.com/environment/2016/aug/02/the-new-green-grid-utilities-deploy-virtual-power-plants>

3.3.C

LESSONS LEARNED

BENEFITS

SMART grids have massive transformation potential in the way we generate, deliver and consume energy. They contribute to achieve energy security, affordable energy and climate change mitigation. SMART grids bring benefits to all actors involved, from consumers to electric utilities, local governments, the environment and the society in general. They allow:

- **To improve the service quality** safety and reliability by reducing interruptions, and improving customer satisfaction via increased transparency, tariff flexibility and communication with the utility.
- **To improve energy management**, as data collected are more accurate, reliable, and in real-time. This increases visibility in the performance of operations for system managers, allowing the grid to be operated with tighter margins of error and thus more cost-efficiently. Operational costs are reduced (preventive maintenance and automatic measurements and adjustments) and revenues are increased (reduction in energy technical losses and theft, and smarter billing).
- **To reduce energy consumption and, correspondingly, to generate financial savings** for utilities, local governments and consumers. This results from a reduction in levels of electricity losses and behaviour changes. Estimates say that distributed generation and storage systems could reduce electricity bills to utilities by up to 25%¹. From the consumers' point of view, studies have found that when people are made aware of how much power they are using, they reduce usage by about 7%. With additional incentives, they can further curtail use during peak times by 15% or more.² Juniper Research expects that SMART grids will deliver \$18.8 billion in cost savings by 2021.³ According to the UK National Infrastructure Commission, investment in SMART power could save consumers up to £8 billion a year by 2030, and to help the UK meet its 2050 carbon targets, securing the UK's energy supply for generations.⁴ Estimates say it is generally two to three times less expensive to save a kWh of electricity than to generate one.⁵

1 Source : <https://www.weforum.org/agenda/2016/02/4-ways-SMART-cities-will-make-our-lives-better/>

2 Source : <https://www.weforum.org/agenda/2016/07/it-has-the-potential-to-change-millions-of-lives-so-what-is-the-digital-grid>

3 Source : <https://SMARTcitiesworld.net/special-reports/special-reports/getting-SMART-with-energy>

4 Source : <https://www.gov.uk/government/news/a-SMART-power-revolution-could-save-consumers-8-billion-a-year-adonis>

5 Source : <https://www.weforum.org/agenda/2016/03/perspective-distributed-digital-and-demand-side-energy-technology-implications-for-energy-security>

- **To foster economic development:** deployment of SMART grid systems opens up new markets for the business community and creates new jobs.
- **To diminish environmental impact:** SMART grids increase the shares of variable renewable energy sources in power grid and reduce the need for traditional power plants, reducing carbon emissions. According to the Climate Group, SMART grids have the potential to avert the generation of 3.71 gig tons of CO2 global emissions by 2020, delivering some \$464 billion in global energy cost savings to our society¹.

SMART technologies can help cities to be more efficient but not all cities have the capacities to apply SMART solutions. In order to create a better environment to facilitate SMART projects, local authorities must work together to adapt to national contexts and frameworks. National associations of local governments have a key role to play and can balance differences among cities, making sure that innovation and technology arrive to all kinds of cities.

AVI RABINOVITCH, ADVISOR, UNION OF LOCAL GOVERNMENTS OF ISRAEL

¹ Source : <https://www.weforum.org/agenda/2016/07/it-has-the-potential-to-change-millions-of-lives-so-what-is-the-digital-grid>

SMART GRID PILOT

PUDUCHERRY, INDIA

BACKGROUND

A medium-scale town of 1,2 million inhabitants, the city of Puducherry is suffering from rapid urban population growth (almost 3% per year between 2001 and 2011). Puducherry faces increasing difficulties to provide electricity to its population and ensure reliability of the network. Although the electrification process of Puducherry is well above India's national average (78,7% of India's population have access to electricity), 31% of the electricity is lost in transmission and distribution lines. The electricity provision system is inefficient due to ageing and overloaded infrastructures. This results in unreliable delivery and regular power shortfalls in many areas; frequent metering errors due to manual reading of old metering systems and inefficiencies in energy accounting and billing, resulting in revenue losses.

FUNCTIONALITIES

In 2013, the Electricity Department of Puducherry, in partnership with the Power Grid Corporation of India Ltd (PGCIL) and a consortium of 50 energy and IT companies, implemented a SMART grid pilot project to showcase the feasibility of digital grids, to later on scale-

it up city-wide¹. It aimed at implementing all features of digital grids, including:

- System of Advanced Metering Infrastructure. To measure consumption of end-users which are predominantly domestic households, but also commercial, agriculture, street lighting, industrial, etc. 1,400 SMART meters were installed in the first phase of the pilot, sending real-time data to a central control room. The scale-up phase of the project started in July 2016, and 34,000 domestic and 1,640 industrial additional SMART meters should be installed by the beginning of 2017.
- Peak load management solution. To assist consumers to reduce their overall electric demand, helping them decide when to use their electricity; avoiding high peaks and associated high tariffs. Pending on the regulator's approval, it is foreseen that consumers will be informed of their bill thanks to messages to their mobile phone, so they can decide to switch off non-essential equipment.
- Power quality management system to ensure stability and balance.
- Outage management system is a preventive maintenance solution that enables utilities to have

1 To know more about the project : http://www.kalkitech.com/wp-content/files/CS_%20Enabling%20the%20SMART%20Grid%20in%20India-Puducherry%20Pilot%20Project.pdf and <http://www.metering.com/india-puducherry-SMART-grid-pilot-to-be-expanded-to-87000-meters/> and <https://apps.powergridindia.com/SMARTgrid/Default.aspx>





visibility in the health of distribution infrastructure; to alert the control room of a malfunction; to manage scheduled and unscheduled outages; and to inform consumers.

- Distribution management system to monitor consumption in real-time.
- Integration of renewable energy and distributed power generation. The pilot tested a grid-interactive rooftop solar photovoltaic systems.
- Energy storage systems to ensure stability of the grid during contingencies.
- Automation of street lighting systems.
- Electrical vehicles.

RESULTS AND BENEFITS

Although the Puducherry pilot project was implemented at a small scale, and results will be visible once the project is scaled-up, the city power utility expects several benefits, including: increased management efficiency (possibility to remotely proceed with power connections and disconnections); enhanced reliability of the electricity network (less interruptions and quicker restoration) and consumers are better informed about their consumption. In addition, the Puducherry Electricity Department envisages an important reduction in distribution losses from 31 percent to 10%¹, as well as increased revenue and reduced expenses with a tariff collection efficiency improvement from 90 percent to

98 percent. The resultant benefit is estimated at \$ 2.5 million USD annually.²

CHALLENGES AND LESSONS LEARNED

The utility and government wishing to implement a successful SMART grid project must be sure:

- **To choose a solution adapted to the local context.** In the Puducherry pilot for instance, a functionality for electric vehicles was foreseen, however the project was quickly abandoned as it did not correspond to the local needs and capabilities.
- **To choose a sustainable business model and financing model.** In the Puducherry context, a MoU was signed between the Electricity Department of Puducherry and the Power Grid Corporation of India Ltd (PGCIL), where each institution was responsible for the financing of 50% of the project. Initially, the project planned to be implemented in 1,400 households and then scaled-up to 87,000 households. However, the national utility, gave up on the scale-up phase in 2013, and only in July 2016 did the government of Puducherry find another investor, the Chinese company Dong Fang Electronics Corporation, to scale-up the initial pilot project at 34,000 households.³

1 Source : <http://www.thehindu.com/news/cities/puducherry/ped-grapples-with-ageing-cables-everincreasing-power-load/article8684857.ece>

2 Source : <https://www.metering.com/mou-signed-for-smart-grid-pilot-in-india/>

3 <http://www.thehindu.com/news/cities/puducherry/SMART-grid-project-back-on-track/article8036407.ece>

CHALLENGES AND RECOMMENDATIONS

Although SMART grid investment has been booming for the past decade (mainly in Europe and the USA), local governments are still reluctant in implementing such transformative technologies. In order to encourage and ensure the success of SMART grid deployment, there are key issues to which local governments and power utilities must pay special attention, including:

- **To start with pilot projects in small areas** to demonstrate the success of the technology. In France for instance, a law for the Energetic Transition was adopted in 2012, and since then, the national government has fostered innovation in the area. A pilot project was implemented in the city of Lyon at full scale to experiment on SMART grid technologies. More than 200,000 SMART meters were installed. The pilot assisted 400 voluntary consumers to use peak load management. Four years later, the GreenLys pilot project has had positive results and has set an example; the SMART meters are expected to be rapidly implemented nation-wide.¹
- **To find innovative financial and business models.** The main reason preventing local governments to opt for SMART grids is that large amounts of funding are needed throughout the lifecycle of infrastructure and technologies deployment. According to World Energy, in the USA alone, realizing a fully functioning SMART grid could have a cost of USD 476 billion, spread over 20 years (the equivalent to an annual cost of USD 24 billion per year²). Innovative mechanisms to finance these investments are therefore absolute necessary. Historically, the energy industry was vertically integrated from generation to billing. Today, the SMART grids redefine the way electricity is operated, corresponding to a more horizontal, transversal and integrated management. Generation, transmission and consumption can be managed by different companies; new actors appear (the figure of the “aggregator”, for example). Local governments, private sector and utilities companies must find adapted business models to fund and operate SMART power networks.
- **To define a roadmap.** The evolution towards SMART grids requires several conditions to be met. This includes the system structure, the local legislation, regulation, market organization, technological advancement, customer involvement, technical skills development, etc. SMART grid systems take several years to be deployed and need to go beyond political cycles. It is key that local and national governments establish a roadmap that takes into consideration the local specificities in terms of energy policy, market structure, network conditions, institutional and financial capacities, and establishes targets, priority actions, and a clear timeline.
- **To strengthen utilities’ institutional capacities,** before initiating SMART grid projects and particularly in developing countries. For instance, they need to have their building blocks finished, which involve more basic IT

1 For more information about the Lyon pilot project: <http://greenlys.fr/wp-content/uploads/2016/07/Dossier-de-presse-BD.pdf>

2 Source : https://www.worldenergy.org/wp-content/uploads/2012/10/PUB_SMART_grids_best_practice_fundamentals_for_a_modern_energy_system_2012_WEC.pdf

systems like computerized databases for consumers, billing, assets, etc. Many of these steps are underway, and usually benefit from programs supported by central governments, but need to be achieved before engaging in SMART grid programs.

- **To establish dedicated energy savings, reinvestment plans and funds,** to ensure that future energy efficiency projects are internally self-funded from savings from a previous project.
- **To ensure strong involvement and collaboration between all stakeholders.** SMART grids are long term projects that bind capital over many years and need cross-sectoral efforts. It is important that policymakers, industry (including energy and IT companies), network operators and research centres work closely together. Besides ensuring cooperation with other stakeholders, local governments must take a holistic and integrated approach amongst their own departments; ensuring consistent communication and data sharing in-between services, support from senior managers and the necessary political will.
- **To involve the consumers and to educate the population.** One of the main challenges encountered by local governments and utilities is having voluntary participation of consumers in demand response programs. It is strongly recommended that operators involve the end-user in the whole SMART grid implementation process. For example, establishing awareness programs about the benefits of SMART grids and indicate possibilities of participation to avoid energy wastage are necessary to increase acceptance and participation.
- **To ensure data privacy and cyber security.** Consumers may be reluctant to use SMART devices such as SMART meters due to privacy concerns. Thus, it is key that local governments and energy utilities carefully address data ownership issues. Besides taking the necessary regulatory measures, governments must also work closely with users to address fears and build trust. In addition, managers should guarantee cyber security of the SMART Grid ICT infrastructure, including protecting assets from any type of hazards such as deliberate cyber security attacks, equipment failures, information theft and natural disasters.
- **To establish interoperable standards for technological solutions.** Utilities and cities usually encounter difficulties to select among the various SMART solutions proposed from vendors. The standardisation of solutions and interoperability of technologies can unlock the benefits of choice and innovation for cities and utilities, reducing deployment costs.
- **To define regulatory and policy frameworks to foster the deployment of SMART grid technologies.** In the energy sector, responsibilities may overlap between national and local governments, complicating technical and investment-related decisions. Cooperation between different levels is important to ensure coherent legislation and policies. For example, regulations could establish mechanisms to allow consumers to produce (as well as to consume) energy, and sell it back to the grid.

- **To create financial incentives to foster innovation in the energy sector.**

Governments and utilities may also be reluctant to move towards SMART power networks because SMART grids are often considered as solutions still in a testing phase. In fact, most of the SMART grids implemented in cities around the world are still pilot-projects at a small scale. Very few business cases exist for scaling-up locally tested SMART grid solutions to wider cities or regions, consequently, results and impacts are still to be proven at a large scale and the long term. To face this uncertainty, it is important that international, national and local governments encourage experimentation and innovation, both from public and private bodies. At regional level, the European Union has been piloting hundreds of SMART grid projects across European cities, offering financial and technical support for more than €3 billion¹. At national level, governments can create dedicated funds or co-fund pilot-projects to demonstrate the applicability of SMART grid technologies, reducing the level of risk investment. For example, the UK has implemented a Low Carbon Network government fund with £500 million to test out ideas. South Korea has launched the Jeju Island test bed, a project backed by the government and private sector to produce SMART grid innovations that able to roll out to the rest of the country.

¹ Source : <https://ec.europa.eu/jrc/en/news/more-than-3-billion-euros-invested-european-smart-grids-projects>

INTERVIEW WITH VICTOR GANCEL, PROGRAMME MANAGER CLIMATE KIC - LOW CARBON CITY LAB

TELL US ABOUT CLIMATE KIC AND THE LOW CARBON CITY LAB PROJECT.¹

The Climate-KIC is one of three Knowledge and Innovation Communities (KICs) created in 2010 by the European Institute of Innovation and Technology (EIT); a European Union body whose mission is to create sustainable growth. Climate-KIC addresses climate change mitigation and adaptation. The Low Carbon City Lab (LoCaL) is a Climate-KIC programme that aims to bridge the climate-funding gap for cities by providing cities and investors with training, project preparation, investment mechanisms and impact assessment tools. Since 2015, LoCaL has built a portfolio of 13 projects and created a collaborative ecosystem of more than 30 Climate-KIC partners, cities and international initiatives.

FROM YOUR POINT OF VIEW, HOW FIGHTING CLIMATE CHANGE CAN HAVE POSITIVE IMPACTS ON THE ENVIRONMENT AND ON LOCAL GOVERNMENTS' FINANCES?

Climate innovation offers many paths to positively impact municipal finances. One straightforward and obvious way of fighting climate is to reduce energy consumption with efficiency measures, which will reduce the city's energy bill. At a different level, designing high-quality environmental projects also enable cities to access new sources of funding, the so-called "climate finance". Several schemes and frameworks are being developed and piloted at a global scale: city green bonds, city voluntary carbon markets and project preparation facilities, among others. This expands and diversifies cities' sources of funding while providing a framework to design, develop and operate climate solutions. In addition, these projects can contribute to strengthening cities' profile and attractiveness globally.



HOW CAN LOCAL GOVERNMENTS USE SMART TECHNOLOGIES TO IMPLEMENT POLICIES THAT WILL FIGHT CLIMATE CHANGE AND REDUCE MUNICIPAL EXPENSES?

By their nature, SMART technologies help mainstreaming data collection, analysis and generate information that can be used in a climate context in order to help cities make better and more cost-efficient decisions, leading to increased revenues in the long term.

COULD YOU MENTION A FEW ACTIVITIES OF UNDER THE LOW CARBON CITY LAB PROGRAMME ON THESE TOPICS?

We have a full set of activities using SMART technologies in a climate change context. For instance, the use of mobile phone signals for cheaper and more accurate traffic monitoring; open-source GHG sensors' networks to produce cheaper and more accurate emission

¹ For more information about LoCaL and Climate Kic: www.local.climate-kic.org

inventories; 3D city models with GHG fluxes information; online decision making tools for low carbon investments within cities, etc. All these activities are piloted and designed in collaboration with cities. Sometimes cities can also be the technology developer. It is the role of the Climate-KIC and LoCaL to help them designing and scaling the solution.

Knowing the quality and energy performance of residential housing is crucial for city planners and real-estate investors. However, this information is costly and hard to generate. One of our projects, the “3D GPC” is developing an application that automatically extracts building energy performance from online real-estate platforms. Making such performance assessment known prior to any transaction becomes the norm in an increasing number of countries across the world. By collecting this information automatically, we enable cities to update their databases frequently at a lower cost, with greater accuracy, report automatically to a various set of emission standards and finally make better informed decisions. A pilot project has been implemented in Potsdam, Germany, and is on its way to be implemented in other European cities.

Municipal GHG emission data repositories are expensive and time-consuming to build, maintain, validate and evaluate. However, they are key to cities since the absence of detailed cost/benefit measurements make difficult to understand results of mitigation strategies. The Carbon Track and Trace (CTT) project aims to develop an automated system for GHG emissions monitoring in real-time. The system will enable a municipality to automatically log and analyse calibrated measurements of their direct GHG emissions. This data will allow municipalities to develop evidence-based policy for mitigation strategies, linking specific actions and strategies to real data on reductions. This GHG software system is composed of an Internet of Things (IoT) sensor network that collect real time measurements about GHG levels, which are then relayed by gateways communication technologies to an open cloud platform allowing for easy integration with other applications. Afterwards, tailored data analysis integrates the sensor measurements with other open data sources to generate new insights and city-level emission overviews. The results of the analysis are visualized to different stakeholders

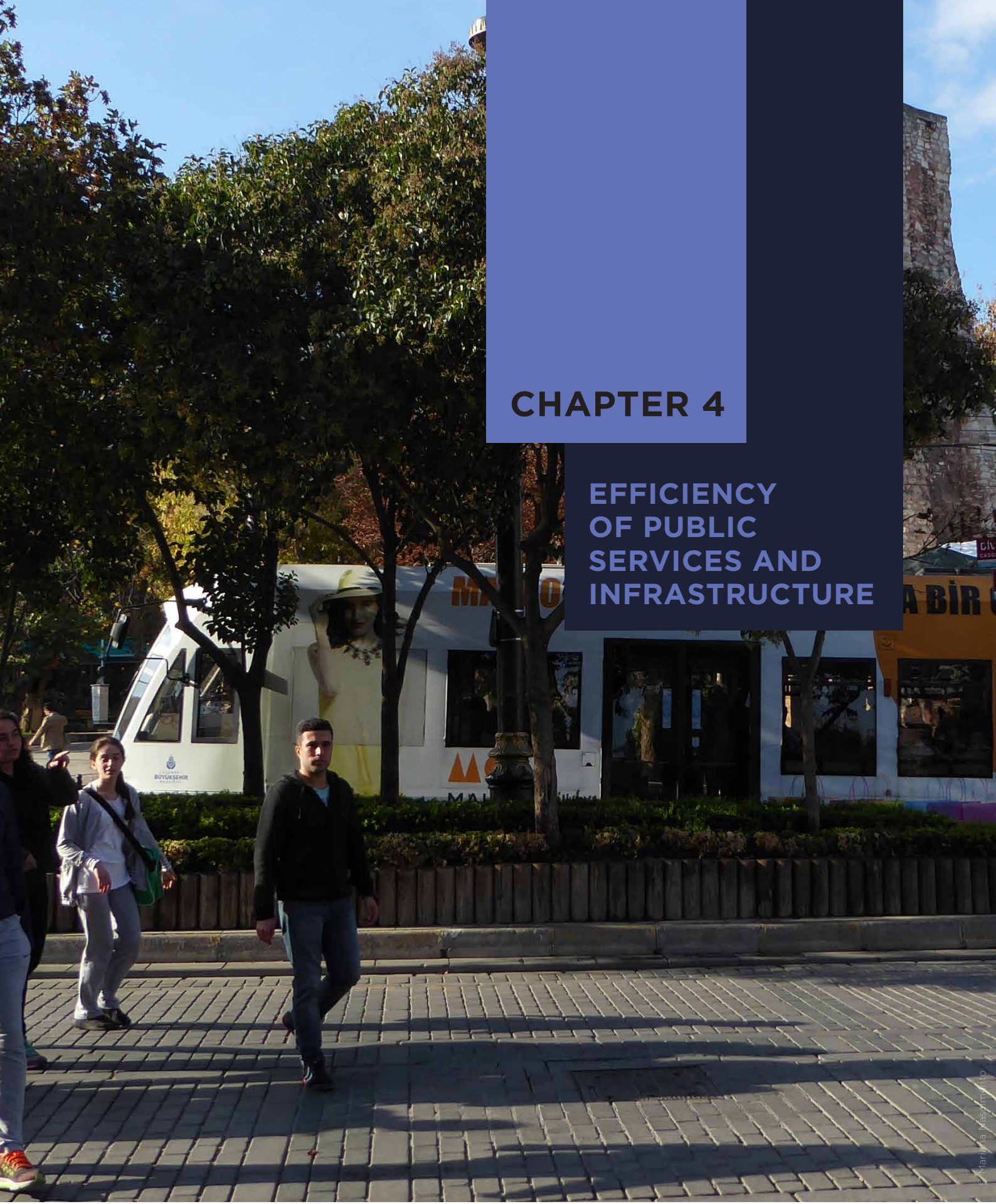
IN YOUR OPINION, WHAT ARE THE MAIN OBSTACLES AND CHALLENGES ENCOUNTERED BY LOCAL GOVERNMENTS TO USE SMART TECHNOLOGIES TO FIGHT CLIMATE CHANGE?

Beyond the (often prohibitive) upfront investments needed, cities lack the internal capacity or knowledge to integrate SMART technologies into their workflows. Cities often operate in tailor-made or unique IT and process environments, with long time frame between each purchasing cycle. These factors, coupled to a perceived lack of mandate from the electorate to act against climate change can hinder the adoption rate of SMART green technologies within cities.

WHAT RECOMMENDATIONS WOULD YOU GIVE TO LOCAL GOVERNMENTS? WHAT ARE THE KEY ELEMENTS THAT ENSURE THE SUCCESS OF SUCH PROJECTS?

Cities sometimes feel a bit “bullied” by innovative solution providers knocking on their door. There is a cultural push towards adopting new SMART technologies. On top of their usual selection criteria (improvements compared to the existing solution, value for money, operational costs...) cities should really assess to what extent the solution can be integrated into their operations. Moreover, cities should be cautious about the viability of the technology provider. Many SMART technologies today are relying on unique competences, reducing the chance for cities to find other providers to maintain their SMART systems if the original developer disappears. If cities feel that they do not have the proper capabilities to assess the performance of the technologies they are being proposed, they should not hesitate to contact national/international schemes related to technology transfer. As an example, Climate-KIC can accelerate both developers’ solutions uptake while helping the city to integrate it.





CHAPTER 4

EFFICIENCY OF PUBLIC SERVICES AND INFRASTRUCTURE

A document elaborated by

Thanks to the support of



Maria Pia Nassimato

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According to UCLG¹, basic services can be organized into three categories: (i) Basic infrastructure services: water and sanitation, waste collection and management, transport, energy. (ii) Social services: education, health, housing, and elderly and child care. (iii) Quality of life services: public safety, urban planning, culture and entertainment, sport, public spaces. Basic services are fundamental to guarantee good living standards in urban centres. In general, local governments have the responsibility for their provision. There are significant differences in the extent to which the responsibilities for providing basic services are allocated between levels of government, but in most instances, local governments play at least some role in these services, whether in urban infrastructure planning, land use management, revenue raising, service provision or oversight.

In this chapter, we will focus on how SMART technologies can improve cost-efficiency in the management of three main municipal services: transportation, waste and water. Although the equation between SMART technologies - efficiency improvement - impact on municipal budget is not easily quantifiable, the impacts are concrete and verifiable.

1 Source UCLG Gold III report : <https://www.uclg.org/en/issues/access-basic-services-gold-iii-report>

4.1 SMART TRANSPORTATION MANAGEMENT



© Mariana Nascimento

4.1.A BACKGROUND

Transportation networks in most cities struggle with serious problems, the first of them being traffic congestion, which produces a huge economic impact, environmental damage and social related costs. It is estimated that traffic congestion accounts for more than 1% of the GDP across the European Union and cost the U.S. economy more than \$115 billion USD each year¹. Without significant actions to alleviate congestion, this cost is expected to increase by 50% by 2030². Climate change is heavily exacerbated by transport-related habits in cities: the transportation sector is the third-biggest source of greenhouse gases worldwide (approximately 26%), with personal mobility responsible for 15 % of those emissions³; this places urban areas in breach of air pollution limits. The World Health Organization estimates that over one million deaths per year worldwide can be attributed to outdoor air pollution, in large part caused by road traffic. As a consequence, cities around the world face important pressure to provide citizens with efficient and sustainable transportation, which is at the core of liveable cities.

1 Source : <http://www.sustainablecitiescollective.com/hdia/1049321/SMART-future-urban-mobility>

2 Source : <http://SMARTcitiescouncil.com/resources/SMART-cities-readiness-guide>

3 Source : <https://www3.epa.gov/climatechange/ghgemissions/global.html>



Transportation is responsible for 26% of worldwide greenhouse gas emissions.

The emergence of SMART technologies such as sensors and actuators networks, big data, digital platforms and automated technology, represent a huge potential to create a more connected and cleaner mobility system while reducing traffic, pollution and accidents. Connectivity is also likely to bring to local governments more efficiency in management, increased municipal revenues and cost savings. According to Navigant Research, the global SMART urban mobility infrastructure and services market is expected to grow from \$5.1 billion USD in 2015 to \$25.1 USD billion in 2024¹. A Pike research² states that, from all worldwide SMART city infrastructure investment, 1/4 will be destined to digital systems and infrastructure for SMART transport solutions between 2012 and 2020. Hereafter, we have highlighted a few selected SMART solutions currently being developed and implemented by local governments around the world that have a potential to positively impact municipal finances, either by increasing revenue or by reducing expenses.

4.1.B

SMART TOOLS AND SOLUTIONS

DATA ANALYTICS

Intelligent Transport Systems (ITS) use SMART technologies to integrate in an efficient manner the whole array of multimodal transport options in a city, including both individual mobility and mass transit options. Usually this includes devices disposed all over the city such as: network of sensors (roadway sensors and SMART streetlights that provide a global picture of traffic), connected cars and GPS tracked municipal fleet (that allow city managers to know their exact locations), dynamic traffic lights, passenger information panels, CCTV systems, signalling systems, among others. Most importantly, ITS have the capability to integrate live data from most of these sources to provide real-time information about traffic situations. These devices are connected with a citywide multi-services communications system that channels the data towards corresponding services to be properly analysed and acted upon. The vast amount of raw data can be analysed through a cloud-based software system. Cities can also develop open innovation platforms that make data publicly available and offer the opportunity for developers to create apps to improve transportation services efficiency. Data collection and analytics provide transportation managers with a complete operating picture, which increases the reliability and resiliency of the infrastructure, and allow for the quickest possible incident response time. A few concrete examples on how data analytics can improve mobility include:

**Traffic
congestion
accounts for
more than
1%
of European
Union GDP.**

1 Source : <http://SMARTcitiescouncil.com/resources/SMART-cities-readiness-guide>

2 Source : https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249423/bis-13-1217-SMART-city-market-opportunities-uk.pdf

- Smartphone apps that synchronize the schedule of different transportations mode;
- Traffic lights can be synchronized and adjusted according to congested routes and incidents;
- Information from cameras and vehicles can be analysed to detect traffic incidents;
- Notification systems and Smartphone apps can be created to alert drivers about roadway hazards, accidents and congestion and to suggest alternative routes in real-time;
- Maintenance of transportation infrastructure can be improved by using analytics to predict when elements are close to deterioration, avoiding replacing the whole infrastructure, and thus reducing maintenance costs.

ICT can make cities more sustainable. A city must be SMART with its citizen, its economy, its environment and in managing its services.

LIDIA COBAS,
COORDINATOR, UCLG
DIGITAL AND KNOWLEDGE
CITIES COMMITTEE

SMART CARDS AND DIGITAL WALLETS

Fare management schemes of public transportation in urban centres is often complicated as governance usually follows a siloed approach where each transport mode is owned, operated or maintained by a range of different actors from public and private sector. To encourage people to use the public transportation system, local governments can implement digitized fare management schemes that use contactless payment technologies such as Near Field Communication (NFC) payments (usually SMART card and Smartphone-based). SMART digital payment methods allow users to pay for all city transportation services (bus, subway, bike, tramway ...) with a single account enabled through multiple channels such as integrated fare cards, cell phones, websites, and on-vehicle transponders. Transit SMART cards or digital wallets replace old paper tickets and can effectively tear down interoperability barriers and facilitate fare collection and management.

The use of a single card across several modes of transport is meant to improve public transportation experience by making multi-modal travel easier for commuters. It will also allow for quicker boarding thanks to quicker payment, which means that buses will move faster, which in turn will decrease road congestion and reduce delays. Digital payment methods can also contribute to reduce corruption resulting from the elimination of cash reception and facilitate travel data collection, which helps in planning future investments or route changes to adapt to actual demand. A convenient transportation network is also more attractive and fosters mass use; more riders mean more rider fares, which results in increased revenue for the municipality and operator. It also boosts efficiency, as fare collection and redistribution between the local government and operators is simplified and operational costs reduced. In London for instance, the operator Transport for London (TfL) estimates that after the introduction of the Oyster card in 2003, expenditures on fare collection have dropped from 14% to 9%, the distance travelled by private vehicles dropped by 6.7%, while the distance travelled by public transport grew by 45%¹.

¹ Source about London data: London example: <http://www.citylab.com/cityfixer/2014/06/5-lessons-us-transit-systems-should-learn-from-london/373667/>

Hundreds of cities around the world have already adopted SMART cards in urban public transportation systems, mainly in developed countries and increasingly in developing countries. Digital wallets are still rare and implemented only in pilot phases, mainly in European cities¹. The city of Kigali, Rwanda, is one of the most recent examples of a developing city to have started switching to a card-only system earlier this year. Kigali Bus Services operator is working closely with the AC Group, a Rwandese private company, to include technology innovation in the public transportation system. It has implemented the SMART card system in buses and mini vans, and also plans to integrate GPS in buses to allow operators to better manage their fleet and to offer information about routes and times to passengers. It is expected that it will not only improve efficiency on Kigali's public transport but also help operators recover the money lost through traditional cash payments. According to Kigali municipality, loss of revenue in the transportation system, mainly due to corruption, may reach up to 50% of fares collection².

SMART PARKING

Evidence says that drivers searching for parking spots in cities are responsible for around 30 % of inner-city congestions. To face this issue, local governments around the world have been developing SMART parking projects that identify available parking spaces and relay the information to drivers. Parking spots can be identified either with sensors installed underground in each parking spot, cameras installed in strategic locations, or predictive algorithms and software based on data analytics from crowd-sourced data from mobile phones³. Information can be relayed to drivers either through electronic street panels or mobile applications that allow them to reserve parking in advance or very accurately predict where they will be likely to find a spot. SMART parking can also include dynamic pricing, with prices that increase during peak hours, which could increase turnover as higher costs would encourage people to park for a shorter time. Benefits of SMART parking include: cutting congestion and pollution, reducing stress among drivers and boosting economic activity and productivity. Besides providing a better service for drivers, SMART parking has a potential to significantly generate higher revenue for local governments from parking fees and tax on sales, resulting both from an increase in parking fares and sales of local businesses.

Cities like San Francisco, Los Angeles, Moscow, Copenhagen or Santander have implemented SMART parking projects in the last years and claim very positive results. San Francisco estimates that SMART parking have cut the time drivers spend searching for a space by 43%, reduced greenhouse



1 Source about MobiWallet: http://www.mobiwallet-project.eu/index.php?option=com_content&view=article&id=20&Itemid=117
2 Source about Kigali experience: <http://www.bbc.com/news/world-africa-36016064>
3 Source about Israeli app for SMART parking: <http://nocamels.com/2015/05/israeli-mobile-parking-apps/>

gas emissions by 25% and city revenue increased by \$1.9 million USD¹. Los Angeles saw a return on its investment in SMART parking within three months; occupancy increased by 15% in underutilized areas; and while the average price per parking spot went down, total revenue went up².

However, local governments encounter some obstacles for the implementation of SMART parking projects, particularly for those projects based on the installation of sensors:

- Facilities require high upfront costs which means a significant government support is usually needed to ensure that projects get off the ground.
- A strong uncertainty surrounds return on investment, as SMART parking projects typically involve revenue that is either saved or created through decreased congestion, which is often difficult to quantify.
- Sensors that have been used in the first SMART parking projects have showed some limitations both in terms of accuracy and lifespan, which may increase maintenance costs.
- The fragmentation of public and private parking operators makes it more difficult to have a citywide solution. Consequently, individual SMART parking efforts may be locally successful but uncoordinated.

In face of these difficulties, some cities have had to discontinue their SMART parking projects. Nice, in France bet in SMART parking in 2013 with an initial investment of 10 million euros, to install sensors in 8,500 on-street spaces and 19 multi-storey car parks. In the first year, authorities reported a 30 % saving in operational costs and a 10 % reduction in pollution and congestion. However, in May of 2016 the initiative was shut down³.

SHARED MOBILITY SERVICES

Advancements in SMART technologies such as social networking, location-based services, along with mobile technologies and software applications have contributed to developing the sharing economy phenomenon. In the transportation sector, shared-mobility enables users to obtain short-term access to transportation as needed, rather than requiring ownership. Shared-mobility services are quite old practices but the use of disruptive technologies have recently increased its potential to improve mobility in urban centres. Modalities of shared-mobility services based on the use of SMART technologies include, among others: carpooling, car-sharing, on-demand ride hailing services, bike sharing, and alternative transit services such as micro-transit. Hereafter, we focus on two main solutions:

Car sharing is a mobility service in which an operator provides access to

Before launching any project that is technologically disruptive, local governments must conduct a dialogue with all stakeholders involved, from the private sector, the appropriate ministries, municipal services, taxpayers, intermediary agents, etc. This will allow to define the project and avoid conflict.

LAMINE KOITA, LEGAL AND LITIGATION AFFAIRS DIRECTOR, DISTRICT OF ABIDJAN, IVORY COAST

1 Source about San Francisco experience: <http://scienceline.org/2016/02/can-we-park-smarter/> And <http://www.citylab.com/cityfixer/2014/06/does-san-franciscos-smart-parking-system-reduce-cruising-for-a-space/373351/>

2 Source : <http://cities-today.com/study-reveals-savings-from-smart-parking/>

3 Source : <http://transports.blog.lemonde.fr/2016/05/05/le-stationnement-intelligent-etait-une-idee-bete/>

a fleet of vehicles deployed in lots located in multiple pickup and drop off points for the users. It is an on-demand, self-service, pay-per-use and short-term basis use service. Users are linked to a Smartphone app that allows locating and reserving a car. Car sharing provides the benefits of motorized individual mobility without the costs and responsibilities of owning a private vehicle. Operators of car sharing programs are usually private companies (the Car2Go program for example is powered by German automaker Daimler AG), but an increasing number of local governments are implementing their own programs, typically in partnership with the private sector. To encourage car-sharing initiatives, local governments can create incentives, including: offering public parking spaces; financial support; tax incentives; raise awareness; support to improve ride-matching platform's customer experiences; offer road traffic privileges such as free parking or city tolls exemptions, in exchange for guarantee that the service will operate within public interest (fair fares, equal territorial distribution, facilitate disabled access, etc.). Some European cities such as Bremen, Germany, London, UK and Paris, France, have adopted comprehensive development strategies to support car-sharing services, usually opting for the Public-Private Partnership business model. Autolib in Paris received extensive financial support from the city government (EUR 35 million) as well as the city districts (up to EUR 50 000 per car sharing station), and the provision of public parking spaces to set up the stations¹.

On-demand ride-hailing services are mobile and GPS enabled services that allow passengers to hail rides from a pool of drivers that use their personal vehicles. Main ride-hailing services are Lyft and Uber (present in more than 400 cities around the world). The use of Smartphone technology makes the process of reaching the passenger much easier, facilitates booking and electronic payment, by providing e-billing and enabling quicker and cashless transactions. On-demand services are adaptable to local context and demand. In several cities around the world, it offers ride-splitting services in which customers can choose to split a ride and fare in a vehicle such as Uberpool. In African cities such as Nairobi, Kenya, Uber and competition offer SMART payment methods such as Mobile Money². It offers a variety of transportation modes: Uber offers the option of the “auto-rickshaw” in Indian cities and Grab offers a motorcycle option in Asian cities such as Manila, Philippines. Other private operators, sometimes in partnership with local governments, have undertaken on-demand services initiatives with busses and shuttles, in cities such as Helsinki, Finland and Kansas, USA – although not always successful³. Local governments are also starting to partner with ride-hailing operators to compensate for closed public bus lines (for ex. Pinellas Park, USA) or to share mobility data (for ex. Boston, USA).⁴

1 Source : http://www.sutp.org/files/contents/documents/resources/B_Technical-Documents/GIZ_SUTP_TD12_Carsharing-Services-in-Emerging-Economies_EN.pdf

2 Source : <http://www.businessdailyafrica.com/Corporate-News/Uber-allows-cash--mobile-money-payments-for-Kenya/539550-2840178-guyigs/index.html>

3 About the on-demand bus in Helsinki that failed: <http://citiscopes.org/story/2016/why-helsinkis-innovative-demand-bus-service-failed> about the Kansas City experience : <http://www.theverge.com/2016/2/11/10962182/ford-bridj-kansas-city-on-demand-bus-start-up> <http://www.bridj.com/#how>

4 About partnerships between uber-like services and local governments: <http://www.bloomberg.com/news/articles/2016-08-15/uber-and-lyft-want-to-replace-public-buses>

Although both car sharing and on-demand services are initiatives from the private sector, increasingly people use these solutions, and local governments have had to cope with them. While often they have brought challenges to local governments (mainly in the case of Uber-like services), SMART shared mobility services represent a huge opportunity to improve mobility performance in urban centres but also from a financial point of view by reducing expenses from partnering with car sharing operators to improve management of municipal fleet (cf. Focus Box 1) and increasing revenue through regulation of on-demand services (cf. Focus Box 2).

SMART shared mobility initiatives are expected to reduce vehicle ownership and, consequently, diminish the number of cars in the streets.

A recent research led in 5 North American cities by UC Berkeley, found that, for each car2go vehicles, as many as 11 personal cars were removed from the road¹. Another study elaborated by the International Transport Forum (ITF - OECD), found that scaling up ride sharing has enormous potential to change urban traffic: results of tests based on data from Lisbon show that replacing private cars in a city with shared vehicles provided the same level of mobility, but with 97 % fewer vehicles². From fewer cars in the streets derive numerous benefits, including a reduction in traffic congestion and travel times, a smaller environmental impact and less air pollution. According to the ITF study, this represents over a third less traffic during peak hours and carbon dioxide emissions could fall by about one third. Local governments may also benefit of indirect monetary savings as car sharing may lower the cost of mobility infrastructure and the embodied energy associated with building and maintaining it. According to a 2015 Deloitte report, with car sharing initiatives, US cities would potentially save \$366 million USD in annual deferred road construction costs, \$77 million USD in accident avoidance, and \$36 million USD in savings from almost 1 million metric tons of reduced carbon dioxide emissions³. If more people use car sharing and ride-hailing initiatives, this may end up in more walking, bicycling and increased public transit ridership thanks to increased service accessibility and quality.



**SMART
management
tools
cut operating
costs
of Chicago's
municipal fleet by
15%.**

1 Source : http://www.citylab.com/commute/2016/07/car2go-car-ownership-vmt-ghg/491825/?utm_source=nl__link4_072116

2 Source : [http://www.itf-oecd.org/shared-mobility-innovation-liveable-cities?ct=t\(ITF_Newsletter_July_2016\)&mc_cid=2de965e4de&mc_eid=6998e2da2c](http://www.itf-oecd.org/shared-mobility-innovation-liveable-cities?ct=t(ITF_Newsletter_July_2016)&mc_cid=2de965e4de&mc_eid=6998e2da2c)

3 Source : <http://dupress.com/articles/SMART-mobility-trends/>

REGULATING ON-DEMAND SERVICES FOR INCREASED MUNICIPAL REVENUE: UBER VS. LICENSED TAXIS

While on-demand ride-hailing services may bring benefits to the city as a whole by improving mobility, it can also result in an important loss of revenue for local governments. For instance, as Uber grows, it represents a huge competition to taxi drivers who have lost shares of the market and the taxi industry has been petitioning authorities to ban or suspend ride-hailing, citing passenger safety and insurance concerns. As a consequence, it has caused a decrease in collection of traditional taxi-related revenues. In New York for example, the price of yellow-cab medallions has been undervalued due to competition and has fallen by 30% from an average of \$1million USD in July 2014 to \$690.000 USD one year later, which represents an aggregated cost of \$4 billion USD for the municipality¹. An option for local governments to compensate this loss is to regulate ride-hailing services.

Regulating Uber-like services has been very controversial as it fits in a legal grey area and this disruptive service brings challenges to local governments around the world that have adopted different approaches, some banning the service, others imposing certain conditions, and others even partnering with the company. However, to address the shifts in conventional revenues on transit, cities must adjust local tax policies. If Uber-like services stress the infrastructure paid by public bodies by increasing the usage of roads by independent contractors, and in order to ensure a fair competition to traditional taxi services and car-sharing initiatives who are strongly taxed, local governments should collect local sales' taxes on the web platforms of the service (not the driver nor the user, but the company) or apply a license tax (like taxis pay). Not collecting taxes on the ride-hailing services represent loss of millions of dollars for local governments. For instance, Uber projected to reach 20 billion dollars' ride payments in 2015, which represents \$2billion USD revenue for the firm (it takes 20% of each ride), which means that the potential taxes here if applied by public authorities would be huge². It is important to note that the tax should be collected by local governments who could reinvest the money in



better roads, better public transport services, and not central government (such is the TVA).

A few local governments have already started to regulate and tax ride-hailing services. Mexico City for example, in July 2015 became the first Latin American city to set down regulations: the new law states that a tax of 1,5% of each journey must be paid to the city to help improve transport infrastructure; drivers must be registered and submitted to annual inspections; and there is a ban on cash payments and soliciting passengers from taxi stands. In Australia, a similar regulation has been imposed to ridesharing services completed by a reduction of costs for drivers and owners of taxis, halving the license lease fees in 2016³. Regulation could also be set at national level, and shared-mobility services could be included in existing regulation of e-commerce services.

1 Source : <http://www.economist.com/blogs/graphicdetail/2015/08/taxis-v-uber>

2 More information on Uber tax scheme: <http://fortune.com/2015/10/22/uber-tax-shell/>

3 Source : <http://cities-today.com/how-cities-are-accommodating-ridesharing-services/>

CAR-SHARING AND SMART TECHNOLOGIES TO REDUCE EXPENSES IN MUNICIPAL FLEET MANAGEMENT

ZIPCAR AND THE CITY OF CHICAGO, USA*



Besides offering incentives to private car-sharing initiatives to improve citizen mobility, local governments can also adapt car-sharing programs to their vehicle fleet management program. Traditional government vehicle fleet management plans are often resource-heavy and costly, and prone to misuse and underutilization. To address this difficulty, local governments have been collaborating with car-sharing companies to improve their fleet management services.

ZIPCAR PROGRAMS FOR MUNICIPAL FLEET MANAGEMENT

Zipcar, one of the main car-sharing companies in the USA, offers two programs to improve local governments' fleet management, and have collaborated with a dozen local governments since 2011 to implement its solutions. In the first program, local governments can purchase discounted memberships for their employees to use Zipcar's existing fleet of vehicles at reduced hourly rates. The second program, known as FastFleet, consists in the implementation of a fleet sharing and management system, to the existing government's fleet.

FastFleet combines hardware and software technology components. City vehicles are equipped with GPS devices, on-board telematics control units, card readers, antennae and wiring integration, and city employees are supplied with RFID-based access cards. A management software, city branded and fully hosted, is implemented to administer reservations and track fleet users, among other logistical tasks.

EXPECTED BENEFITS

The implementation of such as program includes benefits such as: a reduction of fleet size and increase in the usage of vehicles; a reduction in greenhouse gas emissions thanks to more fuel efficient cars and fewer vehicles being used; significantly lower capital and operational costs due to an increase in management efficiency; and increased accountability and transparency from departments by avoiding misuse of cars by employees resulting from the tracking system deployed in the vehicle fleet.

* Information in this box is based on an interview with Kevin Campbell, Manager of the Fleet Services of the City of Chicago realized in August 2016. And in this article: <http://www.govexec.com/state-local/2014/07/car-sharing-chicago-zipcar-indianapolis-blueindy/88141/>

CITY OF CHICAGO & ZIPCAR PROGRAM

The City of Chicago, which signed a 5-years contract with Zipcar in 2011, was the first municipality to implement a combination of both the car-sharing program (where the contractor provides the vehicles) and the carpooling approach (where the city uses the online reservation technology tool in their own vehicles). Zipcar made available a web-platform management tool¹ that can be adapted to the city's needs, by allowing the city to register all its owned vehicles, manage reservations, track location, monitor usage and maintenance, and pull up reports.

RESULTS

Currently, Chicago has 120 city-owned vehicles managed through Zipcar's FastFleet carpooling program, out of a 650 vehicle non-emergency, light duty fleet. More than 1.200 city employees have signed up to use the shared fleet and about 400 city employees have signed up for Zipcar memberships, where cars scattered across the city are shared with regular Zipcar members. Chicago has seen its overall fleet decrease in size from 1.000 cars before the program's implementation to about 650 vehicles in 2016, equalling a 35% reduction. The program brought important financial savings for the administration: for each vehicle reduced, \$6.000 USD was saved per year, which means around \$950.000 USD per year. Part of the savings are related to the fact that the program also has reduced the need to pay for parking downtown, which previously cost the city roughly \$200 USD per month per vehicle, the equivalent of approximately \$200.000 USD per month. The Zipcar/FastFleet program is 25 cents per mile cheaper for the city compared to the city-managed fleet. Overall, the reduction of the motor pool through car sharing has yielded roughly \$6.2 million USD in savings since it started, which means a 15% reduction in operating costs every year. Return on investment of the program is impressive as the total expenditure of the city has been \$600.000 over the life of the contract. These expenses covered the hourly Zipcar charges as well as the FastFleet installations.

CHALLENGES AND RECOMMENDATIONS

According to Kevin Campbell, Manager of the City of Chicago Fleet Services, the main difficulty encountered

when implementing the car-sharing and car-pooling project with Zipcar was the resistance from employees and departments, who were accustomed to having vehicles at their disposal. With the FastFleet program, they had to get used to sharing the vehicles with 25 other departments.

To ensure transition to the new system, it was key to create the demand by removing all the non-essential vehicles the employees used before, and only gradually adapt the new system to the actual demand. According to Kevin Campbell, "If you create the new system in parallel of the existing one, employees will keep using the old service and the project will have no impact. What we did was to impose the new system as the only option and wait for employees to say if the new system was adapted to their needs or not. And when, Zipcar car-sharing fleet was not enough, we included the FastFleet car-pooling program." To face employee resistance, the city had to adapt the offer according to the employees' needs: employees with short-term and short-distance vehicle needs are encouraged to use Zipcar, while those who have out-of-town business or need a car for a longer period are pushed in the direction of FastFleet.

To ease the shift to the new system, strong communication towards municipal employees of all departments and training programs were key to ensure the understanding and support to the project. As stated in the contract with the municipality, Zipcar organized regular training sessions addressed to employees that will drive the vehicles and city officials that will administrate the management interface, to help everyone get through orientation and sign up with the program.

Another challenge with the program was that the contract with Zipcar was short-term. Which means that, now that the 5 years' contract is about to expire, the city will need to renew the contract with Zipcar, or consider other companies that offer similar services. However, as the city does not own the infrastructure, changing provider represents a break transition, as the city would have to change hardware from vehicles, change website, membership cards, etc. An option for the municipality could be to develop its own software management system, in order to ensure the sustainability of the project. However, the monthly fee structure of the contract has minimized Chicago's infrastructure investment, and allows for the consideration of other options now that the initial contract is coming to an end.

1 <http://chicago.fastfleet.net/>

4.1.C

LESSONS LEARNED

BENEFITS. SMART mobility initiatives can lead to major improvements in transportation network management efficiency by reducing capital and operating costs and increasing visibility in operations. Reducing traffic congestions and pollution, improving accessibility, reliability of transport services, safety, convenience by an increased ease of travel and access to information, reduced delays and travel time, and improved inter-modality and complementarity of transportation modes. On the long run, it can trigger a virtuous circle: the better the customer experience is, the more willing people are to use public transportation, and the more people use public transport modalities, the more the capability of the local government to improve the quality of the transportation.

LIMITATIONS. SMART technological infrastructure is still expensive and changes quickly, which means projects can quickly be outdated. Cities may face shortage of qualified staff in the area of information and communications with relevant experience and skills. This may be overcome with cooperation with research institutions and support from ICT entities from the private sector. Interoperability between new systems and systems already in place is often an issue, and it may be difficult to gain synergy. Services based on technology are not always accessible to all citizens, due to a persisting digital divide in urban areas.

RECOMMENDATIONS. Local governments that wish to implement SMART mobility initiatives, must take into account a few key issues, including:

- **Ensure data sharing, standardization and protection.** Intelligent Transportation Systems collect huge amounts of data regarding travel habits of citizens such as origin and destination, travel time and trip duration, and such information can be useful to city managers to identify mobility needs and routes. Thus, it is important that local governments develop practices that standardize data to ensure interoperability among platforms and ensure data sharing among operators. It is also important to find a balance between making the data collected available in open source for citizen, entrepreneurs, developers and city services to use it to create services (such as transportation apps), while ensuring data privacy protection with adequate regulation and policies.
- **Guarantee integration and interoperability between SMART public transportation modes.** This can be achieved by facilitating single payment mode (SMART cards or mobile wallets), creating apps that synchronize the schedule of different transportations mode, or make sure that different transportation mode stops are physically close (for ex. that car-sharing stations are set up close to public transport interchanges). In addition, SMART mobility initiatives (including car-sharing and on-demand services) must be incorporated into municipal and regional planning processes such as land use and transportation plans. Include SMART solutions in transportation planning is key to have an integral view and make improvements in all transportation interfaces at once.

SMART technologies allow for extensive data collection and processing via big data, offering cities with better knowledge about their territory, actors and fluxes; allowing for better policy decision-making, adapted to the local context.

ERWAN LEQUENTREC,
ORANGE LABS

- **Offer an enabling environment for the development of private initiatives** that may have a positive impact on urban mobility, while regulating the services through legislation and taxes.
- **Ensure the accessibility and equity of SMART transportation services.** Services such as car-sharing and ride-hailing services are still mainly used by high income population. Although this may not only be related to inequality in access to Smartphone technologies, local governments can develop strategies that address the digital divide, for example by using kiosks and screens to aid in routing and to display travel information to ensure populations without Smartphones still have access to key travel information and services.
- **Include and train city managers.** To facilitate the transition towards the use of SMART technologies in transportation management, municipalities must include their employees in the whole process of project definition and offer training activities.

4.2 SMART WASTE MANAGEMENT



4.2.A BACKGROUND

As more people move into cities, the amount of trash generated in urban areas increases. According to the World Bank, cities currently generate about 1.3 billion tons of solid waste per year and this volume is expected to increase to 2.2 billion tons by 2025. Asia-Pacific and Africa will be responsible for 90% of total waste volume production in the coming years. Waste production and management also have health and environmental impacts (it is estimated that waste management accounts for almost 5% of total global greenhouse gas emissions) and it is source of economic activities (it is estimated to represent 1% to 5% of all urban employment). Globally, solid waste management costs will increase from today's annual \$205.4 billion USD to about \$375.5 billion USD in 2025. Cost increases will be most severe in low income countries (with more than 5-fold increases) and lower-middle income countries (with more than 4-fold increases). Solid waste management is usually the one service that falls completely within the local government's responsibilities, however, they often have insufficient capacity or funds to meet the growing demand for solid-waste management services. In lower income country cities solid waste management is usually the main budgetary item: municipalities spend 20% to 50% of their budgets on this, and yet they only manage to provide services for less than half of their citizens. A range of tools and technologies already exist to assist local governments in waste management, the greatest challenge is a shortfall in



Waste management has important environmental and economic impacts: it accounts for 5% of the world's global GHG emissions and represent 1 to 5% of all urban employment.

the financing of this service.¹

Local governments are increasingly looking towards SMART technologies to increase waste management efficiency and adopting innovative models to drive improvements across the entire waste management chain. From waste collection, to processing, recycling and recovery, municipalities can leverage on emerging Internet of Things and mobile technology to infuse their waste management operations with SMART technologies. According to Navigant Research, the SMART urban waste management market is growing, and it is estimated to help processing more than 40% of all urban waste worldwide². Below, we list some examples of how SMART technologies can help local governments to improve their waste management in order to reduce cost and to address the long-term lack of investment.

4.2.B

SMART TOOLS AND SOLUTIONS³

SMART WASTE COLLECTION

In low-income countries, waste collection makes up the bulk of a municipality's waste management budget, as high as 80 to 90% in many cases; yet, collection rates tend to be much lower, between 41 and 65%. In high income countries, despite collection costs can represent less than 10% of the municipal budget, collection rates are usually higher than 90% on average and collection methods tend to be mechanized, efficient, and frequent⁴. SMART technologies can be useful to local governments wishing to increase waste collection efficiency. We have identified two main SMART tools: SMART applications to locate illegal dumping, and the use of technological devices for SMART routing.

Localizing illegal dumping with mobile technology

An important challenge faced by municipalities when managing waste is fighting illegal dumping that appears in unpredictable amounts and places. While the easiest solution may be to place a greater number of bins around the city, SMART technologies can also help local governments by predicting and therefore preventing waste in public spaces. An example of this could

Technologies can revolutionize the way we manage the city and life of the citizens. However, there are two key elements that ensure the success of any technological project: a good communication towards citizens, and a tightened dialogue with all stakeholders involved.

VINCENT NCHO, VICE-GOVERNOR OF ABIDJAN DISTRICT, IVORY COAST.

1 Sources of data on waste issues: http://www.unep.org/pdf/UNEP_GEAS_oct_2013.pdf and http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf and <http://www.worldbank.org/en/news/feature/2014/10/30/how-to-finance-solid-waste-management>

2 cited in guardian <https://www.theguardian.com/sustainable-business/2016/jun/14/internet-of-bins-SMART-solar-powered-trashcans-in-colombian-cities>

3 About SMART waste management tools: http://www.ibm.com/smarterplanet/global/files/us_en_us_cities_14_navigant_research.pdf

4 Source : http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf

be through surveillance apps that catch people in the act. Some cities have launched Smartphone apps citizens can use to report illegal dumping, as well as other incidents in the city¹. This allows the city to analyse the data to uncover hotspots and concentrate enforcement efforts on them; thus optimizing waste cleaning and collection. Using a different approach, cities can also install motion-activated cameras in strategic areas to localize illegal dumping.

SMART routing

In traditional waste collection, trucks are typically sent to empty the trash bins on a predetermined schedule, with fixed collection points on regular routes, not taking into account, if the trash bins are full or not. SMART technologies can help local governments reducing operational costs with better planning and more efficient and dynamic collection routes. SMART collection attaches wireless sensors to waste containers to measure and forecast their fill-level; the devices send the data to a cloud-based management platform that generates collection plans using the most efficient schedules and routes based on real needs, and delivers the information to truck drivers via mobile application. Other technologies such as radio frequency identification (RFID) tagging and GPS routing can help cities know better waste generation patterns and track the composition of waste streams and the rate of diversion in real-time. Technological devices generate important amounts of data, and give valuable insights and visibility into operational processes to local administrations who can use analytics to spot trends and predict what will need to be collected and when, before trash is even generated.

Companies offering these services estimate that the SMART routing solutions that combine sensors in bins, GPS tracking and software management, can help cut collection costs between 50% to 80%². Besides reducing costs, SMART collection projects significantly reduce emissions, road wear, vehicle wear, noise pollution and working hours.

The number of cities implementing SMART collection initiatives is still low and limited to developed countries. Examples of cities that have already implemented SMART bins projects are: Santander, Rotterdam, Seoul, New York City. In emerging countries, cities such as Bogota, Buenos Aires, Mexico City and Santiago de Chile are already adopting digital tracking of waste collection trucks. More recently, in 2015, the Korean start-up Ecube Labs partnered with Interaseo, a Colombian waste management company, to implement a SMART waste collection pilot in two cities, Santa Marta and Ibague. The goal is to solve the problem of overflowing bins in busy areas where bigger bins couldn't fit, by improving garbage collection to empty the bins on a more frequent basis. To do so, Ecube Labs equipped both cities with SMART waste networks using 130 of its Clean Cubes, SMART bins fitted with compactors and built-in sensors that report when the bin

One of the main difficulties related to the use of SMART technologies in municipal management is the quick evolution of solutions. It makes the adaptation by municipal employees difficult, as they are not prepared for the change and often resist to using the tools because they are not involved in the process of change. Another difficulty is the political inconstancy, as priorities may change as government changes and projects and technological tools may be discontinued.

**JULIO CIAMBELLI, ICT
MANAGER, MONTEVIDEO,
URUGUAY**

1 In Chapter IV of this report, we cite the example of Seberang Perai, Malaysia and Kit Urbano, Argentina, who have implemented mobile platforms where citizen can report incidents, including illegal dumping.

2 Example of companies are: the Finish Enevo <http://www.enevo.com/> and the Korean Ecubelabs <http://ecubelabs.com/>

is ready to be picked up, as well as a Wi-Fi hotspot and an LED ad screen, all powered by solar panels. However, Ecube Labs' technology was too expensive for emerging markets (each SMART bin cost between \$2,000 USD and \$3,000 USD), making the company adapt its offer to a solution that didn't involve replacing a city's entire existing infrastructure. As a consequence, the start-up created the Clean Cap solution, a sensor with a 10-year battery life that can be fastened to a city's existing bins of all sizes. Although it may be too early to tell if the results of the Latin American pilots, Ecube Labs's easy-deployment and low-maintenance approach might be adapted to developing cities' context¹.

Despite the impressive results for SMART bins and SMART routing collection presented by companies, challenges remain. For starters, the infrastructure is still very expensive, and in some cases (such as in the Colombian case), needs to be imported from abroad. This means that, besides increasing investment and maintenance costs, the project can only be applied to a small part of the infrastructure, and thus may not yield the expected results. In developing countries, implementing the SMART bins may not be the best solution but sensors in existing bins can be more realistic. In addition, city managers may encounter resistance from city employees who may find difficulties in adapting to disruptive technologies in waste management, and from collectors who may fear for their jobs or simply refuse to take advice from a faceless app. According to Ecube Labs, it often takes several months of dialogue and communication to convince workers to use the SMART bins solutions effectively. Finally, SMART bins projects may have negative social externalities, particularly in developing countries where informal recyclers work by extracting valuable recyclables straight from the collection bins, and SMART bins could reduce access to the material which is source of revenue for these informal recyclers. As such, it is key that SMART waste collection solutions must be accommodated to the city real needs and capacities. Political leadership and dialogue with municipal employees, collectors and informal workers' associations are key elements to ensure endorsement and successful implementation of waste innovation projects.

SMART WASTE TREATMENT

Besides saving money in collection process, cities can use SMART technologies to improve efficiency in waste recycling, reusing and recovery. To achieve this, local governments must see waste as a resource, as a business opportunity instead of a problem. Hereafter, we showcase two areas where cities can use SMART technology to reduce the quantity of waste going to landfills, thus reducing costs of maintaining the landfills, protecting the environment and bringing economic benefits.



SMART routing technologies can cut waste collection costs between 50 to 80%.

¹ Source : <https://www.theguardian.com/sustainable-business/2016/jun/14/internet-of-bins-smart-solar-powered-trashcans-in-colombian-cities>

SMART processing

The portion of the municipal budget reserved for waste disposal and treatment facilities varies a lot according to countries: while it may be a very small portion in cities from low income countries, most part of budget allocation in municipalities from developed countries is employed in intermediate waste treatment facilities. SMART processing includes advanced recovery facilities, that may use mechanical biological treatments and refuse-derived fuel production systems, and energy recovery facilities focusing on waste as a strategic renewable resource for material and energy generation; this includes facilities like incineration plants, landfill gas capture projects and advanced bio-refineries. SMART energy recovery is one of the more mature sectors in the emerging SMART waste market.

Some countries have approached SMART waste processing as a real business opportunity and have reached impressive goals. Sweden, for example, has managed to reduce to only 1% the amount of garbage sent to its landfills¹. To do so, the government implemented early recycling and reuse regulations in the 1970's and built 32 waste-to-energy plants that incinerate almost 2 million tons of filtered garbage annually; generating steam further used to produce electricity then distributed across the country. The speed of incineration is so fast that the waste produced locally is not enough and the country has planned to start importing 700,000 tons of waste annually to feed its incinerators. Sweden sidesteps the problem of release of heavy metal emissions due to incineration by using an advanced, low-emission process that greatly reduces airborne pollutants. Although the high cost to build low-emissions plants and waste-to-energy facilities are prohibitive for cities from low income countries, some cities like Johannesburg in South Africa, have implemented such facilities with positive results².

Circular economy

Resource recovery is not only environmentally important, but it is also cost effective for local governments as it decreases the amount of waste for disposal and saves space in landfills. In addition, betting on circular economy, where waste is seen as a resource, creates markets for recycling resulting in valuable materials being recovered for reuse; which brings potential for new jobs and new business opportunities. The rise of SMART technologies has a key role to play in helping local governments to improve waste treatment and disposal by fostering recycling, reuse and recovery and creating closed-loop economies.



In lower-income countries, municipalities spend between 20 to 50% of their budgets on waste management.

1 Source : <http://SMARTcitiescouncil.com/article/sweden-and-san-francisco-point-way-zero-waste-future>

2 For more information about the Johannesburg experience in landfill gas-to-energy project, please visit www.uraia.org to download Uraia's 2015 Guidelines.

ASPIRE: A MATCH-MAKING TOOL FOR RESOURCE RE-USE AND ECONOMIC DEVELOPMENT

STATE GOVERNMENT OF VICTORIA, AUSTRALIA

BACKGROUND

The State of Victoria, in Australia, found that waste disposal in landfills for businesses had grown importantly going from \$30 AUD a ton in 2010, to \$58,50 AUD in 2014, and this was reducing the competitiveness of local businesses and particularly small and medium enterprises (SMEs) from the manufacturing sector. To face this challenge, a software tool called ASPIRE (Advisory System for Processing, Innovation & Resource Exchange)¹, was created to help local businesses cut waste disposal costs by matching them with other businesses which can put the waste to good use. ASPIRE is a collaborative project developed in partnership between the State of Victoria who provided a grant to fund the project, CSIRO (Commonwealth Scientific and Industrial Research Organization) who developed the tool, and the City of Kingston who led the project implementation with partner local councils and business associations. It has been active since September 2015 and is freely available to businesses within the partner regions. This match-up system is built as an online marketplace which identifies potential business to business resource exchange in order to allow waste from one company to be used as raw materials for another, by matching businesses with potential purchasers or recyclers of their waste by-products.

THE SMART TOOL²

ASPIRE users are invited to join via their local council or business network. They create a user account and enter details about the type and quantity of their output/input needs. ASPIRE provides automatically the following personalized information according to the profile of the user:

- Information about waste management possibilities for business and local recycling options, potential sources and destinations for the materials.
- A list suggesting business-to-business solutions, with options for aggregation with other local businesses and local recyclers with resource matches.

- Case studies for related resources matches and new processes, and resource information on innovative reuse and recycling initiatives for materials.
- A dynamic overview of information about the manufacturing material flows in their region.
- Access to an internet forum where SMEs can find topical discussions on resource sustainability questions and engage with academic researchers and the industrial sustainability community.

A CONCRETE EXAMPLE

A successful example³ of business match-making by ASPIRE is the partnership created between the companies Viridian, specialized glass manufacturer; and Olympic Polymers, specialized in recycling post-industrial plastic waste. Viridian identified, cleaned and segregated the various grades of usable plastic film and plastic pipe waste, and the plastic was then collected by Olympic Polymers and converted into high quality plastic resin pellets for reuse in industry. Viridian's waste collection bill and landfill costs have been reduced by at least 30% as a result of sorting, baling and then recycling plastic film waste and plastic pipes to Olympic Polymers, which corresponds to \$15,000 AUD to \$20,000 AUD per year of cost savings to the business. This successful exchange has also diverted between 600 –800kg/week or 36,400kg/year of plastic film from landfill. Olympic Polymers have benefited from the additional feedstock delivered by Viridian at no cost.

BENEFITS

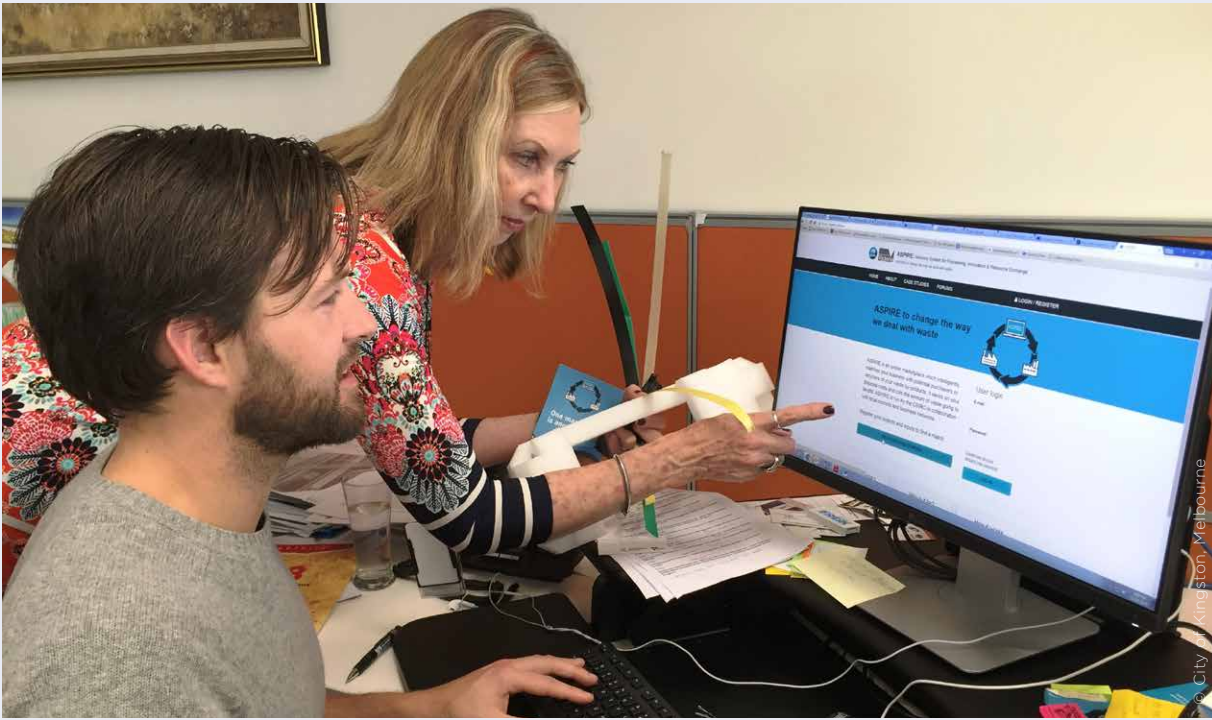
A match-making tool such as ASPIRE may have numerous benefits, including:

- Reduce business operating costs by reducing waste disposal costs, and thus, delivering productivity benefits to SMEs.
- Improve business awareness of waste/resource streams, and increased knowledge about alternatives to resource disposal and resource exchange opportunities.

1 <https://aspire.csiro.au/>

2 <http://www.csiro.au/en/Research/MF/Areas/Innovation/Reducing-waste-through-ASPIRE>

3 https://aspire.csiro.au/sites/default/files/viridian_olympicpolymers_finalapproved.pdf



- Improve business networking, local connection between businesses, create supply chain partnerships and potential new markets.
- Inspire innovation in resource reuse and recycling, driving greater engagement in recycling and alternatives to landfill.
- Create new business opportunities and jobs, and thus improve the economic development outcomes of the region.
- Transform current business practice, by fostering the circular economy, increasing collaboration, changing the way we deal with waste, and generating alternative supply chain pathways for resources, cycling useful materials extracted from waste back in to the supply chain to be used again.
- Increase waste diversion from landfills, thus saving money for the city by reducing landfill operating cost efficiency, and reducing emissions.
- ASPIRE also helps local governments to capture data regarding local businesses to improve decision making.

CHALLENGES & LESSONS LEARNED

Although it is too early to tell the degree of success and challenges face by the project, it is possible that the platform only works if it is widely used and manages to have a strong database with business information. To ensure the success of the project, this clearly means that a strong communication campaign is necessary and that State government of Victoria and CSIRO will need to rely on partnerships with local councils and business associations.

4.2.C

LESSONS LEARNED

BENEFITS. By applying SMART technologies to waste supply chains, from collection to disposal and re-use, cities can derive valuable insights and visibility into operational processes. This can generate substantial benefits, such as optimized collection costs, generate renewable energy, improve the environmental performance of landfills, and foster a sustainable economic development by incentivizing the circular economy.

CHALLENGES. Although solutions for a SMART waste management are increasingly disseminated and used by local governments around the world, capital cost remains the most significant barrier to the advancement in SMART waste practices and infrastructure, particularly in developing cities. In addition, the required infrastructure, even when the financial resources are available, is built much slower than the rapid rate of growth of waste generation, and the current waste management systems are not capable of leap-frogging from open dumps to high-tech systems. These rules of thumb suggest that the diffusion of SMART municipal solid waste solutions will take time, and that the growth of the market is initially expected to take place in the countries and regions where the waste management markets are more mature and ready to use advanced technologies.

Besides important infrastructure costs, local governments may also encounter a challenge in the resistance from municipal employees, collectors and informal waste pickers' associations, particularly in developing countries for the case of SMART bin projects. Cities across Latin America and the Arab region have a quite significant portion of the population deriving their income from waste. In Brazil, for example, it is estimated that waste pickers are responsible for 1/3 of trash recycled, collecting almost 50.000 tons of waste per day¹. Thus, when local governments try to modernize waste management with SMART technologies, it may end up depriving informal workers from their only source of revenue and has called for establishing different strategies to face the needs of this specific group.

RECOMMENDATIONS. In order to ensure the success of SMART waste management projects, we have identified the following recommendations:

- SMART technology is not always enough to ensure a successful waste management. There is a need to elaborate a strong regulation on recycling and reusing to ensure that waste is properly collected and disposed. Communication campaigns towards citizen will also help to produce changes in consumption and waste production patterns.
- Co-operation among a wide range of stakeholders (citizen, private sector, informal workers' associations, industry and business associations, etc.) is key to ensure a SMART waste project is successful.

1 Source : <http://www.iadb.org/en/topics/solid-waste/bringing-informal-recyclers-into-the-formal-system,3837.html>

- Dialogue with all involved parties, is crucial to make sure the project is in the interest of everyone, that the project is understood and endorsed by the population in order for it to be effective.
- It may be interesting for local governments to start with small actions, such as applications to report illegal dumping or to improve recycling, before going to more complex projects such as waste to energy projects or SMART bins. It is key that local governments take the necessary time to make sure to choose a solutions adapted to the local context.

It is very important to use technologies that are adapted to local context: these may differ if the municipality is small or big. Nowadays, there is a lack of adequate technology for small urban centres. Thus, the private sector, which holds the technical tools and capacity, can have an important role to reduce the gap between big urban centres and smaller rural communities.

Associations of local governments can also have an important role in supporting municipalities by offering technological solutions that would be too much expensive for only one to develop.

SANDRA TORRES, PUBLIC POLICY ADVISOR, COLOMBIAN FEDERATION OF MUNICIPALITIES

4.3 SMART WATER MANAGEMENT



4.3.A BACKGROUND¹

According to the United Nations estimations, over 91% of the world population have access to improved drinking water. Despite the progress made in recent years; access to basic water services, including clean drinking water and sanitation, is still unavailable to a large fraction of the world's population. In 2016, an estimated 663 million people lacked access to improved sources of drinking water and there was 2.4 billion people with no access to adequate sanitation. This problem is particularly concentrated in developing countries as it is estimated that 60% of the population lacking access to potable water is located in Sub-Saharan Africa and South Asia. Access to water is higher in urban than rural areas (96% against 81%), however growing urban population also results in increasing urban dwellers that still lack access to water and sanitation services. In 2010, in Latin America and the Caribbean over 20% of the urban population still had no access to improved sanitation, while 6% lacked access to safe water. Limited access to water has huge detrimental impact on human health and on economic productivity. According to the UN, inadequate water, sanitation and hygiene is responsible for 4% of worldwide deaths and



In the world,
663 million
people lack
access to
drinking
water and
2.4 billion
people have
no access
to adequate
sanitation.

¹ Data on water management background is a combination from the following sources: UN Habitat World Cities 2016 Report at <http://wcr.unhabitat.org/> and The United Nations World Water Development Report 2016 at <http://unesdoc.unesco.org/images/0024/002440/244041e.pdf> And 2014 focus groups International Telecommunications Union reports on SMART water management <http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx>

associated with global economic losses of \$260 billion USD every year. A combination of water scarcity accentuated by climate change, and growing water demand for agricultural, industrial and domestic use consumption, generates further stress on the supply and demand of water resources. UN Habitat estimates that by 2030, global demand for water is expected to grow 50% compared to 2015 which corresponds to a projected 40% gap between demand and supply by 2030.

In addition, poor management has also an important impact on access to water. It is estimated that 34% of the world's drinking water supply is lost before getting to the final consumer, and the percentage is even higher in developing countries reaching 40-50%, mainly due to unseen leakages in ageing infrastructure but also to illegal connections within the distribution network, and lack of metering or faulty meters. Besides less water distributed to the population and economic activities, water loss also means that a large portion of revenue is not always claimed from the customers, reducing the administration capacity to finance improvements in the network. Given the tough financial constraints on water utilities, it becomes increasingly important that customers are billed correctly to improve water revenue collection.

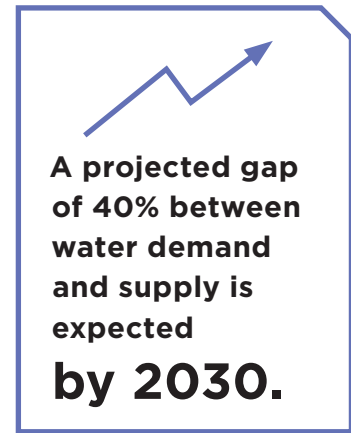
Access to water is essential to build more resilient cities and to reduce the vulnerability of the poor. Local governments usually hold the responsibility to manage water in urban areas, however, they do not always have the human resources, let alone the financial and technical capabilities to keep up with rapid demand, often relying on external sources of funding and establishing a good cooperation with the private sector. The elevated cost of urban water supply in most cities points to the urgent need for more efficient use and conservation of the resource, and the need to optimize the management of the existing system to reduce costs while improving the quality of the service.

4.3.B

SMART TOOLS AND SOLUTIONS

Local governments are increasingly using SMART technologies to improve water management efficiency in many aspects of water security both in urban and rural areas, from consumption reduction, agricultural and irrigation optimization, water reuse, flood and drought prevention and disaster management. Typically, SMART Water Management (SWM) systems integrate ICT solutions to the water system by overlaying a data network to the physical pipe network. It includes a range of intelligent devices connected to communications systems that aim at providing operators with a better knowledge and control over the system in order to make more informed decisions. It is usually built as follows:

- **Tools for data acquisition and integration** allow utilities to more accurately monitor and operate water pipe systems. It is comprised of intelligent



equipment such as: SMART meters (measure water consumption in greater details than traditional meters and automatically transmit the information to service provider); sensor networks (measure parameters of water delivery and distribution such as water flow, pressure, quality, reservoir levels, temperature, acoustic information); and remote-controlled devices (SMART pipes, pumps, valves and pressure-reducers, that enable to control and modify network pattern according to needs).

- **Tools for data dissemination, modelling and analytics enable** data transfer from the sensing layer to the data processing software via internet (and includes technological equipment such as data loggers, radio transmitters, Wi-Fi) and technology that allows data analysis and modelling. (such as Geographic Information System - GIS,) Devices communicate and transmit information amongst them and to a central location.
- **Tools for fusing, processing, storing and analysing data** collected from various intelligent devices are usually web-based software, commonly called Cloud Computing or Software as a Service (SaaS). The resulting information may be displayed to a human operator, passed on to further analysis within the software, or trigger automatic action in the system.
- **Tools for management and visualization** allow to transform raw data collected and stored by intelligent devices in understandable information that can be used by operators as support for decision making. It includes technology such as: supervisory control and data acquisition (SCADA) programs, optimization tools, modern dashboards applications that displays multiple data streams graphically in control interfaces, and control room systems with simple alert rules. These tools can also aggregate data from other operational systems (such as information from workforce and asset management systems) and external sensors (e.g. temperature, humidity) that are blended in with the water network data for integrated decision making. These tools also enable the restitution of data and information to cities' technical services and to the end users through web-based communication and information systems tools, mobile applications for sharing information on water services, etc.

Local governments and operators implementing SWM systems can use SMART technologies in order to:

- **Identify anomalies and take preventive action.** Accessing real-time information allows water utilities to remotely diagnose problems such as leaks before they turn into large bursts, changes and trends in water pressure, anomalous usage patterns, supply interruptions, water thefts, water quality issues, faults in meters, valves and other assets, among others. When one incident is detected, an automatic alert is triggered and early warning is sent to operators that can deliver a faster response prioritizing repairs based on the amount of water loss.
- **Have a better knowledge of the state of infrastructure.** ICT allows utilities to monitor the physical condition of water infrastructure by giving a highly accurate picture of location and health of infrastructure such as

Municipalities can use SMART technologies to improve services in simple ways; project does not need to be costly to have an important impact. In Guarulhos for example, we used ICT technologies to optimize water management in a period of crisis, it helped us optimize the resources without spending more.

THIAGO SANTIM,
MANAGEMENT PLATFORM
OF WATER AND SEWAGE
MUNICIPAL COMPANY, CITY
OF GUARULHOS, BRAZIL

pipes and valves. Possessing a clear and comprehensive picture of the entire infrastructure can reduce importantly repairs expenditures. Over time, the data collected helps managers to know where to concentrate their modernization efforts.

- **Improve disaster risk management** by forecasting systems for floods, overflows and drought. Automated fault management can ensure problems are found and dealt with before they affect a wide area.
- **Improve irrigation efficiency.** SMART devices can optimize irrigation of green public spaces and agricultural zones in the municipal territory. Information collected from sensors located in the water network or underground in green areas, calculate the exact amount of water necessary to irrigate. The city of Santander in Spain has applied this solution and has managed to save 25% of water used for the irrigation of green public areas.
- **Provide better information to end users for improved customer satisfaction.** Increased transparency increases public awareness with regards to water consumption, allowing customers and companies to better track and monitor water usage and make informed choices based on real-time and reliable information about water situation, leading to increased control and changed behaviour. It also helps in scheduling the maintenance and shutdown of pumps on a regular basis and in informing beforehand citizens about the unavailability of water during any particular point of time. Communication is improved between local administration and residents leading to way for increased responsiveness, cooperation and greater public involvement.

Technologies help cities to be more resource efficient, to do more with less and to offer a better quality of life to citizens. By embracing SMART technologies, in Nicosia, we have made organizational changes that will eliminate overlapping roles and contain expenses. Change is not easy. To keep up with innovation, we need to build strong city teams that adapt easily to change.

VASILIS KONTOS, CITY COUNCILLOR, NICOSIA, CYPRUS

NEXTDROP: MOBILE TECHNOLOGY FOR IMPROVED WATER SERVICES

BANGALORE, INDIA

ABOUT NEXTDROP¹

NextDrop is an Indian start-up created in 2011 that offers a crowdsourcing data program aiming at improving urban water services management with mobile technologies. It provides access to real-time information regarding water availability and improves cooperation between citizens, government bodies and water utilities. NextDrop saw an opportunity to contribute to solving India's urban water scarcity problem by betting on mobile technologies as 100% of India's urban population is covered by mobile networks. To date, the NextDrop service has been implemented in four Indian cities: Hubli, Dharwad, Bangalore and Mysore.

BACKGROUND ON BANGALORE

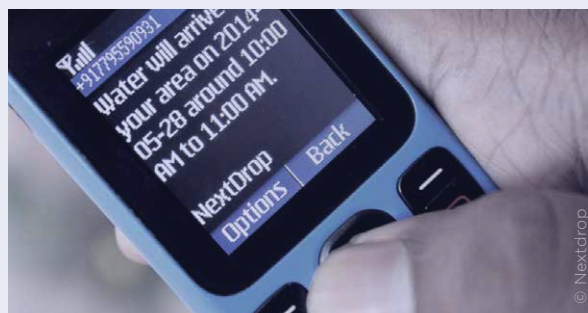
The city of Bangalore faces a severe water crisis: while the population grew 47% from 2001 to 2011 to over 8.4 million, the water supply has risen only 12% from 2002 to 2012. The governmental agency responsible for water supply and sewage disposal in the city is the Bangalore Water Supply and Sewerage Board (BWSSB). Due to water scarcity, BWSSB is forced to ration supply to the extent that some areas of the city receive water once every two days through the piped network. BWSSB estimated that the proportion of non-revenue water was as high as 45%. The water supply is controlled by about 400 "valve men" who manually operate by turning on and off 8000 valves around the city each day. Valve men are assigned a schedule but are unable to always follow it for a variety of reasons making supply times unpredictable. So far, BWSSB and consumers have not had visibility into actual supply times because there has been no real-time feedback from the valve men. As a result, BWSSB engineers say they receive 100-150 calls every day for information on water supply. To bridge the information gap, BWSSB started working with NextDrop in 2014. The start-up had deployed its service in 40% of the city's territory by the end of 2014, corresponding to an area with over 250.000 households and had 7.004 households signed up. In September 2015, NextDrop

won the tender of BWSSB to implement the program in the remaining territory of Bangalore.

THE NEXTDROP SOLUTION

At the core of NextDrop's service is the use of mobile communication technology to gather and disseminate information. Concretely, the NextDrop solution works as follows:

- Valve men submit information to NextDrop servers through an IVR system (voice call) or, more recently, a mobile app, regarding whether the valve is being closed or opened in order to gather accurate information regarding water distribution schedules in different areas of the city.
- Once the NextDrop central server receives water supply information from the valve men, it creates an SMS alert addressed to the appropriate set of consumers, adapted both to Smartphones and traditional mobiles. Service is free to household consumers.
- The solution also allows household consumers to give feedback to NextDrop on whether the water supply arrived on time through call centre, and feedback is registered in a Complaint Management System.
- All the information that NextDrop gathers from various channels and stakeholders is aggregated, analysed and available near real-time through interactive maps and dashboards to BWSSB officials as well as monthly meetings.



¹ Sources: <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/01/NextDrop-Water-Simplified1.pdf>

RESULTS

The NextDrop solution has had very positive results and brings benefits to all the parties involved:

- Water services providers get a clear view into their own operations, obtaining actionable data and gaining access to a convenient platform for consumer feedback. This opens possibilities to improve organizational efficiency, to make data-driven decisions and to reduce non-revenue water. Water utilities can improve knowledge about customer satisfaction and identify problems more easily; as well as monitor valve men work. Access to timely information on the status of water services (open, closed, broken) ensures a rapid response to technical issues. As a result, both the service's quality and the customer's willingness to pay improve. As NextDrop's pilot highlighted, providing near real-time information of water valves' status to BWSSB and to consumers led to a regularization and stabilization frequency and supply timing and to a 90% reduction in complaints. Moreover, by providing a better service to more consumers and earning more revenue, water services providers can become more financially sustainable and less dependent on national government subsidies.
- Consumers benefit of improved and reliable services. Household consumers benefit from water alerts that helps them better plan their daily routine (avoid missing a day of work to wait for the water supply, for example) and increases the convenience (reduce queues to collect water) thus saving money and time for consumers. This is particularly important for vulnerable urban poor households. NextDrop provides a two-way communication channel between BWSSB and its customers, increasing transparency, accountability and trust in the water utility.
- Benefits for local governments by greater awareness and accountability. The ability for the Government to access information on water utilities' operations increases accountability of how public funds are spent, ensuring that the right services are being delivered with the public money invested.

CHALLENGES AND LESSONS LEARNED

Although the solution proposed by NextDrop seems simple, it has faced several challenges during implementation:

- BWSSB's piped network map was 15 years old, reflecting inaccuracies in the mapping of consumers



in relation to valve areas. NextDrop had to refine its processes to proactively identify incorrectly mapped consumers and valves and had to work closely with BWSSB, consumers and valve men to correct it.

- NextDrop encountered difficulties in obtaining consistent and accurate data from “human sensors” showing how voluntary stakeholder participation is very sensitive. As Valve men are contracted by a third party company and do not respond to BWSSB, NextDrop found difficulties to get them to submit the correct information. Sometimes because they don't have the information, or have too many valves to operate; they often forgot to report water timings, or submit it in batches of valves leading to delayed water alerts, etc. NextDrop had to implement training and incentive programs and active follow-up by supervisors for more than six months to ensure the valve men participation in the program, which increased with nearly 90% of valve men actively reporting by December 2014. To overcome this issue, NextDrop created the ValveKey mobile app to partially automate the process of data gathering, but that requires the valve men to use a Smartphone, which triggered resistance at first but was overcome with education and training.
- As NextDrop is a crowdsourcing data program, it needs to have a lot of users and consumers to make it work. Thus it was key to spread awareness of the services through several communication channels to ensure the success of the program.

4.3.C

LESSONS LEARNED

BENEFITS

SMART water management systems generate economic, social and environmental benefits through improved water resource sustainability and reliance, which, in turn, contributes to the well-being of urban residents. Some of the benefits associated to water and wastewater management include:

Water savings are generated thanks to the identification and response to leakages, improved control in individual consumption and irrigation. According to the ITU, water utilities can save up to 20% of water leakage levels thanks to SMART technologies. In the UK for example, the water distribution company Southern Water has installed 450 000 SMART meters in cities since 2010, which has led consumers to reduce their consumption by 16.5%, and allowed the utility to save 27 million litres of treated water a day¹. To solve the problem of losing 50% of potable water in distribution networks, the water utility of Mumbai, India, partnered with the private company Itron in 2013 to install SMART remotely controlled water meters and managed to reduce water leakage by 50 %, amounting to 700 million litres a day².

Costs savings. Administration costs can be reduced by improvements in operational efficiencies, including: (i) reduced expenses linked to important leakages; (ii) targeted maintenance and replacement of prioritized ageing infrastructure, reducing the need for capital expenditure on new pipelines; (iii) substitution of traditional meters by SMART meters yields a dramatic decrease in labour requirements specific to meter reading, reductions in meter reader injury-related costs and reductions in vehicle expense and fuel. Increased efficiency in water management also brings intangible benefits and indirect cost savings such as improved management processes, planning and decision-making, staff performance and safety, and enhanced information quality. According to the Israeli company Takadu, for every dollar spent on reducing water leaks, 5 dollars' worth of water can be saved thanks to investment in SMART technologies³. It is estimated that SMART water solutions can help utilities save between \$7.1 and \$12.5 billion USD each year⁴. The city of Tokyo, for example is generating high savings from its investment in sensor technologies to address water leakages. It estimates that, since its implementation in 2006, it has halved the amount of water

34% of the world's drinking water supply is lost in the distribution system before getting to the final consumer. This number can hit 50% in low-income countries.

1 Source : <http://www.metering.com/uk-SMART-water-meters-ami-project-saving-27m-litres-a-day/>

2 Source : <http://www.bloomberg.com/news/articles/2013-03-15/water-losses-in-india-cut-in-half-by-SMART-meters-itron>

3 Source : <http://www.bloomberg.com/news/articles/2016-07-18/israel-s-biggest-energy-firm-shops-in-u-k-to-pad-global-assets>

4 Source : https://www.itu.int/dms_pub/itu-t/oth/0b/11/TOB110000253301PDFE.pdf

wasted by the city from 150 million m³ water to 68 million m³; has helped to drastically reduce the leakage rate from 20% in 1956 to 3.6% in 2006; has saved \$170 million USD each year by early detection of water leakage problems; and has reduced carbon dioxide emissions by about 73,000 tons of CO₂ annually.¹

Increased revenue by a reduction of non-revenue water and arrears resulting from leakage and theft identification, better measuring to ensure customers are billed correctly, Smarter payment methods through mobile banking for example. The World Bank estimates that NRW costs utilities worldwide about \$14 billion USD annually and by reducing these losses by half in areas with the highest NRW, it is estimated that \$2.9 billion USD would be generated and an additional 90 million people could have access to water.²

Reduced energy consumption.³ The water industry is one of the largest users of electricity on a global basis. Great amounts of electricity are needed to move water around a particular system as pumps shifts treated water through mains to customer premises. Energy is very expensive both for drinking water and wastewater utilities and for the municipality as a whole. Electricity is often the second highest budget item for the water utilities after labour costs, and energy consumption by water utilities can represent 30-40% of a municipality's energy bill, right after street lighting and public building management costs. Moreover, as electricity rates increase, energy conservation and efficiency are issues of increasing importance to many water utilities and there is growing recognition that saving water saves energy. Energy efficiency initiatives offer opportunities for delivering significant water savings, and likewise, water efficiency initiatives offer opportunities for delivering significant energy savings. Initiatives can be implemented in several categories, such as upgrading to more efficient equipment, improving energy management, and generating energy on-site to offset purchased electricity. By some estimates, potential energy savings by drinking water and wastewater utilities are in the range of 15-30% per year.



SMART technologies can help utilities to save up to 20% of water leakage levels.

1 Source : http://www.c40.org/case_studies/tokyo-world-leader-in-stopping-water-leakage

2 Source : <http://siteresources.worldbank.org/INTWSS/Resources/WSS8fin4.pdf>

3 Source: Energy-Water Nexus: The Water Sector's Energy Use, 2014 <https://www.fas.org/sgp/crs/misc/R43200.pdf>

IMPROVING MEASUREMENT TO REDUCE WATER LOSSES

GUARULHOS, BRAZIL*

BACKGROUND

Guarulhos is a city with 1.3 million people, located in the state of São Paulo, Brazil. The municipality estimates that 98,32% of its population has access to water services and 83,99% to sewage and sanitation services. However, since 2014, the metropolitan region is facing a water crisis due to lack of rain; challenging the water supply service, and, to face the problem, a rotation system had to be implemented, leaving several areas of the city with irregular access to water. The challenges in water distribution are accentuated by an important increase in the demand (every year Guarulhos receives 30,000 new inhabitants) and by high levels of losses in distribution (35% of the water distributed was lost before it arrived to the end consumer in 2013, mainly due to leakages, clandestine connections, measurement errors and theft). In addition, the Water State Company (SABESP), that supply the water distribution, to the regions' municipal utilities, reduced the flow of its water supply by 32,5% from 2013 to 2015. During the same period, the inhabitants and the industry of Guarulhos reduced their water consumption. As a consequence, the Autonomous Service of Water and Sewage (Serviço Autônomo de Água e Esgoto - SAAE), the municipal company in charge of water management saw its water billing revenue decrease by 39% from 2013 to 2014. Thus, the Guarulhos municipal water utility had its capacity to face the crisis diminished and needed to adopt actions that would reduce non-revenue water and optimize water management efficiency.

CHALLENGE TO MONITOR WATER LOSSES

During the past decade, the municipality of Guarulhos through the SAAE implemented a strong policy of water losses reduction. As a result, the non-revenue water went from 51,06% of total water distributed in 2000 to

35% in 2013; before the water crisis. Besides this success, the water utility still faced challenges in monitoring its non-revenue water, in particular: (i) difficulty in obtaining information (important delays in collecting information, not updated cadastres and registries of network infrastructure), (ii) a lack of reliability on the information collected from water meters (errors in measurement regarding the volume of water provided to consumers, does making difficult to determine the exact amount of real and apparent water loss), (iii) lack of information collected about the shape and performance of the network infrastructure, (iv) a lack of monitoring tools to analyse the state of the water network.

SMART SOLUTIONS TO IMPROVE WATER MANAGEMENT EFFICIENCY

In order to reduce the amount of non-revenue water, the SAAE Guarulhos identified the need to improve data collection, and in 2014 implemented four initiatives using SMART technologies.

- **Installation of a telemetry system in all public buildings water meters** (SMART meters) that provide automatic and real-time information about the pressure, flow and consumption level. This also allows



* Information based on inputs from Luiz Mendes and Thiago Santim, managers at SAAE and from the following web addresses: <http://www.assem-ae.org.br/noticias-assembleia/item/1589-assem-ae-premia-trabalhos-vencedores-da-20-eems> and <http://www.saaeguarulhos.sp.gov.br:8081/node/493> And <http://www.guarulhosemrede.com.br/desperdicio-de-agua-e-mais-de-40-da-receita-do-saae/>

the water utility to define consumers' profiles and to notify them in case of unusual behaviour, related to potential leakages or wastefulness. In this way, it offers them the opportunity to change their behaviour and reduce water consumption. SAAE's goal is to install by mid-2017, telemetry in all water meters of public buildings such as schools and hospitals, and users that have a water consumption higher than 50 m³/month. As of today, SAAE has already installed the telemetry system in 2% of the 382,000 water meters of the city's water network.

- **Creation a software tool to update water network infrastructure registries in real time.** The tool allows collecting information about location, size, material, fabrication date, installation date, etc. of all the water distribution system components (pipes, connections, valves, meters, etc.) and is linked to the GIS database of the utility.
- **Definition of a Meter Performance Index (Índice de Desempenho Metrológico – IDM).** The index was created to monitor the performance of water meters based on a technical criterion instead of using the life expectancy basis. An algorithm in the software tool allows SAAE to identify malfunctioning meters and to know exactly when they need to be replaced, which leads to an increase in billed water and revenue for the utility. It also saves the utility money by avoiding unnecessary infrastructure replacement thanks to a better knowledge of the actual state of the devices.
- **Creation of the Support System to Monitor Losses (Sistema de Apoio ao Controle de Perdas – SACP),** an analytics software tool that integrates the raw data collected from the devices, processes and transforms it into intelligible reports about the amount of real and apparent water losses. The system also advises on the actions to be taken and allows operators to make better informed decisions. SAAE has also developed a mobile app to create a communication channel with its consumers. With more than 5000 downloads in a few months, the app enables the water utility to inform users about their consumption, the rotation system in the user area, among others.

RESULTS

Despite its recent implementation, the SAAE initiative to improve water loss control has yielded important results. The actions have improved the data collection system (automated and in real time); increased the quantity of available information regarding water volume and pressure and the amount of water loss (both real and



apparent); ensured the reliability and quality of the information; improved knowledge about the state of the infrastructure. Better knowledge allows the utility to improve planning and decision making. The initiatives have also enabled SAAE to improve the identification of anomalies in the system. Consequently, water losses have been importantly reduced since the beginning of the implementation of actions going from 35% of total water distributed in 2013 to 28,10% in 2016. Looking at the concrete example of the neighbourhood of Bonsucesso, SAAE observed that from November 2013 to November 2015, water losses went from 868 to 212 litres per day per branch, meaning a 400% reduction in water losses. By reducing water losses, the utility was able to improve water distribution to the population. In fact, although SAAE faced difficulties due to the water crisis and saw its water supply and revenue reduce (32,5% for the water supply from SABESP and 39% in revenue from billing between 2013 and 2014), its innovative actions have improved water distribution to Guarulhos' consumers, which had a lower reduction of 5% in 2014 and 17% in 2015 compared to 2013.

LESSONS LEARNED: CHALLENGES & RECOMMENDATIONS

While implementing these initiatives SAAE found challenging to implement telemetry systems in the whole city at a quick pace, keeping up with technological changes. To ensure the success of the initiative, SAAE had to be very careful when choosing the meter technology and the negotiation with vendors and service providers. Training to operators in using the new tools was essential to ensure the success of the initiative. Using only internal financial and human resources allowed a quick development process and an increased acceptance and support of the actions from SAAE employees.

CHALLENGES AND RECOMMENDATIONS

Despite the demonstrated success of SMART technologies in water management, local governments still encounter challenges to implement SMART water projects, including:

- **High costs.** Budget limitations are the largest obstacle to faster adoption of SMART water solutions. SMART water devices and management network are often more expensive than traditional water management systems regarding initial investment, training and project management. Vendors are coming up with solutions by offering a managed services business model to utility companies. For example, SaaS & Cloud Computing solutions are less expensive as the solutions provider is responsible for the infrastructure installation. This eliminates the need for the city to make a big capital purchase and install, maintain and update all the hardware and software on its own. Instead, the supplier handles it in the cloud, and the city pays a monthly charge. For example, the Israeli start-up TaKaDu provides water utilities with a software that allows them to minimize water loss and to improve operational productivity without any network changes and or capital expenditures¹.
- **Changing technologies.** Durability of SMART water technology is challenging for local governments. Utilities may be afraid that a more recent technology may outgrow the devices just installed and this may hold back investment in SMART water management systems. This means that a change in policy approach is needed regarding water management. In fact, local government and water utilities expect water infrastructure to last 20 years and plan accordingly, however, this conception is outdated as a major innovation appear every few years, which implies a permanent focus on the evolution of water management processes.²
- **Skilled human resources.** Hardware and software improvements necessitate upgrades or replacements, which require management by skilled utility personnel, who are not always readily available. Thus, it is critical that the utility provides training for the field staff who will work with the endpoints and meters, the responsible for installation and maintenance of the data collectors, the IT staff responsible of the servers and software, the staff responsible for billing, the customer service and engineering staff using and the administrative staff, responsible for the overall system.
- **Data analysis.** Intelligent devices installed in water network collect huge amounts of data and often utilities do not use them up to their potential.
- **Cooperation between stakeholders.** A SMART water vision requires a collaborative approach between a variety of stakeholders, including other cities in the watershed, regional and national government entities, regulatory authority, utilities, private sector, agricultural organizations,

1 Source : http://media.wix.com/ugd/05a510_aee2a841f2794248b93634236355c3ad.pdf

2 Source : <http://SMARTcitiescouncil.com/article/how-plug-your-water-supply%E2%80%99s-money-leaks>

citizen and community groups, etc. Particular attention must be given to proper communication and integration between local government and water utilities, in order to ensure circulation of information, data sharing and transparency. Local governments need to have access to the data provided by SMART infrastructure to ensure the data conforms to citywide data management policy. Strong dialogue must also be undertaken with consumers and residents' associations. Inclusive processes increase awareness and understanding of issues and challenges, generate more data, help determine priorities, increase support for remediation programs, and generally enhance the likelihood of success.

- **Integration of services.** Ensure the interoperability and integration among different services. For instance, cities should not build a communications network just for SMART water purpose, it is preferable to build a system that can be used by all services departments (transportation, waste, etc.).
- **Standardization and policies.** The lack of standardization within the SMART water sector may foster future problems of interoperability and reliability of SMART water management tools possibly preventing future integration of system solutions. Added to this, improper policy development may hinder SMART water management systems deployments. In fact, utilities cannot easily support pilots because their risk appetite is low and they have to follow procedural norms. Typically, innovation is being spurred in the water sector by solution providers and not by utilities. However, while most utilities cannot support pilots, start-ups do not have the lifeline to self-fund pilots. Thus, it is important that national governments and international institutions support the SMART water management sector through regulatory based enforcements in addition to carefully developed economic incentives. Grants and incentive policies can help create proof points that can eventually mainstream applications of technology to improve services in the water sector.

Talking about technology in municipal management means talking about people. Local governments should always remember that, in SMART projects, the citizen comes first and that technology can only be effective if people use it. SMART cities are very much about how the municipality interacts with people.

First, SMART technology enables local governments to better communicate, listen and understand citizens' needs and demands. And particularly when it comes to municipal finances, local administrations have a deep responsibility to use resources well and communicate on how the money is being used.

Second, as technology can change how public servants work, municipalities must work closely with its officials to make sure they accept these new ways of doing business. Third, with new technologies come new partnerships and new forms of collaboration and interaction with local actors.

CHRISTOPHER SWOPE, MANAGING EDITOR, CITISCOPE



CONCLUSIONS

**FINAL REMARKS AND
RECOMMENDATIONS**

INTERVIEW WITH IÑIGO DE LA SERNA

FORMER MAYOR OF SANTANDER AND MINISTER OF INFRASTRUCTURES AND PUBLIC WORKS, SPAIN

WHAT IS SANTANDER'S VISION REGARDING SMART TECHNOLOGIES IN MUNICIPAL MANAGEMENT AND ITS POTENTIAL IMPACT ON MUNICIPAL FINANCES?

A SMART city is not only about the use of technology. It also corresponds to a new vision of the city and the way that urban services are managed. A SMART city involves transversal management and the integration between different city departments. It means using innovation to offer more and better services to citizens. The technology allows us to collect information about the city, and this knowledge must be used to support better decision-making, to optimize the use of resources and to produce greater efficiency.

For a municipality, adapting to the socio-economic changes that technology brings to urban life is a great challenge. For instance, the collaborative economy shows us how today the citizen is not only a consumer of services, but also a potential producer. Cities must be co-constructed with citizens. Our role as local governments is to offer the necessary conditions for citizens, entrepreneurs and researchers to use the infrastructure and information that the municipality owns, and to use it to produce ecosystems of innovation that will contribute to build more competitive cities.

WHAT ARE THE MAIN INITIATIVES YOU HAVE TAKEN TO BUILD SANTANDER AS A SMART CITY?

We started in 2009 with a project financed by the European Union called SmartSantander. It entailed in the installation of an Internet of Things network in the city centre, composed of 12 000 devices such as sensors, captors, actuators and cameras which is today one of the biggest in the world. Such devices measure a variety of parameters, including traffic intensity, air humidity, outdoor noise or pollution, among others. Subsequently, we have launched a myriad of initiatives and SMART solutions based on the IoT infrastructure and the collected data. We have worked in four areas: the improvement of public services, the increase of transparency and citizen participation, the promotion of economic development and modernising our administration.



Some specific initiatives developed in Santander to improve services' efficiency are:

- In the field of mobility: A SMART parking project where sensors identify parking spaces and relay the information to drivers through a mobile app. We have also implemented a MobiWallet offering a centralised payment system based on NFC and smartphone technology and applied to different transportation modes to facilitate intermodal commuting.
- In the field of water: Sensors have been placed in public gardens to irrigate them only when needed, saving water and money to the city. The municipality is also working together with the water company to install SMART meters and sensor devices to reduce leakages and to monitor water quality and consumption. An app improves the residents' control over their consumption and facilitates communication with the provider.
- In the field of waste: We are installing sensors into garbage bins and GPS in collecting trucks for more efficient routes to reduce operational costs.
- Energy projects: A complete reform of the street lighting system is underway. Light bulbs will be replaced by LED technology and a remote management system will be implemented. The expectation is to cut energy costs by 80%. Another

project will adapt 65 municipal buildings in order to reduce energy consumption by 25%.

Some other projects are aimed to increase transparency and citizen engagement, for example:

- Platforms for citizen participation. The app “The pulse of the city – el pulso de la ciudad” allows citizens to report hazards. In the past four years, the app has been downloaded 8.500 times and citizens have reported more than 7.029 hazards. Another online platform, the Santander City Brain, collects ideas to improve urban services and quality of life. Since its inception in 2013, it has already collected 1.357 ideas through 6 different public competitions.
- Smartphone applications to facilitate access to information. The SMART Santander Augmented Reality provides information regarding municipal activities and touristic sites using NFC and QR technologies. The app has been downloaded 25.000 times and tags are used more than 180.000 times per month.
- An open data portal, created in 2014, provides 90 datasets, including the data collected by the IoT infrastructure, on a wide range of topics (economy, transportation, safety, health, etc.). The municipality often organizes competitions and hackathons to encourage the use of this data by local entrepreneurs and to create SMART solutions and services for the city.

Regarding the modernization of the municipal administration, besides improving the IT infrastructure within each of the municipal departments, we have also increased the online services for the citizens. For instance, we are automating tax and fees collection, and centralizing their management in a single municipal department. The main project has been to build a SMART City Platform which will act as a “brain” and will integrate information from the different systems of city departments. It will start by integrating data information regarding transportation, waste, water and street lighting, and will slowly integrate information from all the 65 services of the municipality. The goal is to make better informed decisions for more efficient management. We hope, in the future, to reach a “predictive and reactive intelligence” able to establish predictive models and to react automatically. We could imagine the example of a street accident where the platform automatically will activate the traffic lights, alert the residents, increase lighting and change public transportation routes.

Finally, we have seen in SMART technologies an opportunity to promote local economic development and job creation. Santander aims at building an innovation ecosystem by encouraging research and providing support to start-ups that use the IoT infrastructure. We offer fiscal incentives, co-working spaces, organize competitions and create innovation incubators.



WHAT RESULTS HAVE THESE INITIATIVES PRODUCED?

Results are promising, although not easily quantifiable since many projects are still at an initial phase. The first impact of SMART technologies is the modernization of the municipality's management processes. Thanks to better integration between city departments and improved allocation of resources we have experienced increased efficiency in urban services. As an example, the sensors localized in the city gardens have enabled the municipality to save 25% of water per year. The different initiatives have also had a significant impact in the quality of life. The SMART parking project, for example, has led to a reduction of 80% in traffic congestion in the city centre. New communication channels such as mobile applications have increased transparency and citizen engagement. By betting on technological innovation, we expect to generate economic activity and to create new local businesses and jobs. Santander has built an international image as a "living lab", allowing the city to attract investments from companies that see in the city the opportunity to test their products in real size, and catalyse funding from international institutions. Since 2009, Santander has been involved in 16 European Union projects amounting to 66.7 million euro.

WHAT WERE THE MAIN DIFFICULTIES ENCOUNTERED WHEN DEVELOPING SMART CITY INITIATIVES IN SANTANDER?

Building Santander as a smart city has not been an easy task. One of the main difficulties we have encountered was to convince both citizens and city employees of the utility of SMART city projects, as they tend to be very costly and not always have immediately visible impacts. Another difficulty we have encountered is to find the best way to use the data collected by the sensor devices, and to make it available and accessible to citizens, businesses and city departments. A very close collaboration with the University of Cantabria, the private sector and the European Union has been key to experiment our SMART solutions.

WHAT ADVICE WOULD YOU GIVE TO OTHER CITIES THAT WISH TO FOLLOW YOUR EXPERIENCE?

I would give two main advices to other cities. First, plan and prepare, and second collaborate and dialogue. Before implementing SMART projects, it is crucial to define the strategic vision for the city and a precise action plan. Municipalities must be careful not to choose a project according to the private vendors' offer, but to choose the technology that corresponds to their city model. In Santander, we have three main plans: the Santander Strategic Plan 2010-2020; the 2012 Innovation Masterplan and the SMART City Plan adopted in 2015. Besides the city-wide strategic plan, it is important to take the necessary time to carry out detailed feasibility studies. In Santander, for example, thanks to funding from the European Investment Bank, we were able to carry out studies regarding street lighting and energy efficiency in buildings that were essential to inform the tender process.

In SMART city projects, collaboration is essential. The case of the SmartSantander project, counted with the participation of 25 companies and institutions from 10 different countries. One of our most important partnerships has been with the University of Cantabria, which brought technical knowledge and coordinated all the SMART initiatives; from the design of the technological devices to the creation of innovative services. Collaboration with the private sector is key to implement costly projects that need strong capital investment such as street lighting, waste and water management. Collaboration with the citizen is equally key to gather their inputs and knowledge. Collaboration with the national government and international institutions is necessary to access funding. Finally, there is the issue of collaboration with other cities at national and international level. Santander has today more than 260 partners in the world and we are member of several network of cities such as the Spanish Network of SMART Cities (RECI).

Throughout this report, we have seen that SMART technologies represent a huge opportunity to assist cities in increasing revenue or reducing expenses in all sectors of city administration. However, local governments often remain reluctant to SMART projects for several reasons. The main factor is the lack of capacity and resources to effectively implement SMART technologies, but sometimes it may be a simple lack of information and understanding regarding the potential of technology. Considering this reluctance, the goal of this report is to identify main trends, but also to gather advice given by city managers around the world based on their own experience. Hereafter, we sum up the main general recommendations that have been highlighted throughout the document to ensure the success of a SMART project.

PREPARATION

Developing and maintaining SMART technology projects can be costly both financially and in terms of human resources. Thus, local governments must follow a few preparation steps to make sure they want to initiate SMART projects, including:

1. To choose the technology and projects according to the city's vision.

Technology must be seen as a means to an end, and not as the end in itself. Having clear goals and targets regarding digital innovation should help in the selection process of the numerous solutions offered to cities by providers. A Digital Government Strategy needs to be defined in coordination with all city departments and broadly supported by the top level of municipal government and civil society organizations. It should establish specific targets and actions to be taken on the long-term, and be oriented to improve municipal services in an integrated manner. Besides, SMART elements should also be included in each sectorial plan, such as transportation, waste or water.

2. To choose the technology according to the municipality's capacities.

First, local governments should not engage in SMART projects before deploying the necessary IT infrastructure and connectivity. This is particularly important in developing economies

that face challenges such as frequent power cuts, slower network speeds or system failures. For example, African cities where IT structures are still low should not engage in sophisticated projects, but can instead opt for solutions based on mobile technology, given the prevalent mobile phone and network usage and availability. Other municipalities that wish to avoid heavy IT infrastructure could opt for formats such as SaaS and Cloud Computing which are less expensive and easier to manage. Second, local governments should avoid choosing complex technologies that are not readily available either internally, within the university or local providers, to avoid being constrained to import technology and risking being dependent from international providers. Thirdly, local governments must make sure to have the capacities to follow-up on SMART projects: not to install sensors to collect data, if the city cannot use the data; not to implement crowdsourcing reporting applications if all incidents reported can't be addressed, etc.

3. To strengthen institutional capacities and invest in skilled human resources.

SMART projects usually require highly skilled human resources and bring important organizational changes within the city processes. Besides a lack of technical capacity, it is common to find a lack of motivation of civil servants (and particularly in senior staff) and strong resistance to changes. To ensure that employees are willing and able to use SMART systems, local governments must address organisational efficiencies and ensure to have well-trained and motivated staff by providing: i) effective communication about the change and benefits it will deliver, ii) training to build awareness and employee confidence in using new systems, iii) associating employees to the project design and implementation to avoid reticence and to ensure endorsement.

4. To provide political leadership. Support and commitment from leadership are key to ensure the sustainability of the project, to overcome divergences among city departments, to ensure all stakeholders are on board and to define the appropriate regulatory frameworks.

5. To start with pilot projects in small areas. Pilot projects are particularly important for transformative technologies as they provide proof of concept, test reticence of stakeholders and citizens, and can help leverage funding with central government or other actors for further expansion.

6. To define a clear and flexible legal and regulatory framework. Most legal frameworks regulating issues such as citizen participation, services and goods procurement, or land and building occupation are several decades old. They overlook the opportunities presented by SMART technologies and do not reflect recent innovations. Sometimes local governments may even be reluctant to use digital tools because they believe laws do not allow them. Prior to entering SMART projects, local governments must make sure to adapt the legislation to make room for innovation in city management, they must guarantee enough flexibility to adapt to the quickly changing pace of technologies, and to ensure the project continuity beyond political cycles.

7. To ensure data privacy and cybersecurity.

SMART projects often collect huge amounts of data regarding urban life parameters but also citizens' habits. While this information is useful for city managers, consumers may be apprehensive towards SMART solutions and devices due to privacy concerns. Open Data policies illustrate well this difficulty: a balance must be found between the need for transparency, making available the data and ensuring protection of privacy. Local governments and service utilities must carefully address data ownership by taking the necessary regulatory measures and working closely to address fears and build trust with users. Managers should also guarantee cybersecurity of the SMART ICT infrastructure, to protect assets from any hazards such as deliberate cyber security attacks, equipment failures, information theft and natural disasters. This may be especially challenging issue for smaller cities.

8. To carry out the necessary studies, and particularly when the municipality is considering to implement SMART projects in partnership with the private sector. Before looking for a private provider, it is essential to know what the city wants and needs, in order for the private sector to adapt to the demand and offer an adequate product and not the contrary.

9. To ensure systems interoperability and avoid isolated initiatives. On top of the usual selection criteria (improvement compared to the existing solution, value for money, operational costs, etc...), cities should assess to what extent the SMART solution can be integrated into their operations and make sure that it is interoperable with the existing system. Interoperability is crucial because if the solutions are not interoperable, their effectiveness is highly restricted. For instance, a web interface for paying taxes is useless if all the background procedures are still manual; and a SMART management platform is ineffective if it isn't compatible with existing systems from all the municipal services.

COLLABORATION

SMART projects are usually transversal and involve a variety of stakeholders, which means that cooperation is key to ensure their success. Local governments can:

10. To cooperate with national government and association of cities.

National institutions can assist local governments by supporting the identification of adapted products and solutions by providing information about business cases or checking the reliability of providers. Second, they can strengthen their institutional capacities to develop SMART projects. For instance, they could offer training and technical assistance to the elaboration of feasibility studies, but also propose SMART tools such as ready to use SaaS structure models to cities that have less IT capacity. Third, by putting in place financing mechanisms, legal and regulatory frameworks, and by supporting experimentation and pilot-projects. This is particularly relevant in sectors that need long-term planning and are not always under local governments' responsibilities, such as the energy, building or water. Finally, by defining policies and standards for technological solutions to enable comparability and compatibility between systems. This should ensure vendors offer interoperable services and unlock the benefits of choice of innovation for cities and utilities by avoiding lock-in in one vendor.

11. To ensure dialogue and coordination with multiple stakeholders.

Bold projects are often likely to encounter resistance, which is why local governments should ensure a strong dialogue with all actors involved to make sure that all interests are taken into account from the beginning. For example, tax recovery projects that use Mobile Money technology require a strong dialogue with banks and mobile operators; SMART water projects require a collaborative approach between a variety of actors, including other cities sharing the watershed, utilities, residents' associations, etc. In many cases, collaboration with local universities and civil society can bring many benefits to SMART city projects.

12. To guarantee integration between city departments.

Transversal SMART projects require a holistic and integrated approach. Ensuring consistent communication and data sharing in-between services and government agencies is key. In the case of projects related to revenue collection, for example, integration between departments for payments of fees, fines and taxes, should offer citizens a more convenient experience while also increasing efficiency.

ENCOURAGING USE

SMART projects are only successful if they are used, but local governments often face difficulties to recruit participants. This may be due to difficult access to SMART technologies combined with cultural and literacy barriers, but also highly educated people may not be familiar with the latest technologies and may refuse to participate. Sometimes, part of the population may lack of time and interest to participate in such activities. Some of the actions that local governments can undertake to maximize citizen participation in SMART initiatives are:

13. To conduct strong on-going communication and sensitization campaigns. In order to ensure acceptance, understanding and usage of SMART tools, local governments should be transparent about the cost and benefits of the initiatives. It is also important to use different communications tools to sensitize the citizen: both traditional (radio, television, mail, cars with speakerphones to reach remote areas, etc.) and digital (mobiles, social media, online platforms, etc.). Sensitization is especially important in SMART projects related to tax recovery or crowdsourcing applications where citizen engagement is key for success, but also in initiatives that require important behavioural change like energy efficiency or waste management policies.

14. To establish incentives. Local governments can establish financial incentives to encourage local actors to take action (e.g. private buildings owners to engage in SMART efficiency projects, start-ups to innovate, etc.), use gamification, competition and awards to encourage citizen engagement, define regulations to foster private initiatives (such as ride-hailing services), among others.

15. To combine traditional and online solutions. Local governments must ensure that the SMART initiatives are inclusive and accessible to all segments of the population, even those with low level of literacy, digital proficiency or limited internet access. To uncover blockages in user pathways and to ensure the needs of different groups are being met, municipalities can address the digital divide by adapting the information in online platforms to people with language and literacy difficulties, to ensure that people have access to in-person support, telephone call centres and provide assisted digital services, including computer and internet access in libraries and community centres. In addition, local governments should make sure to combine both online and offline solutions to let the citizen chose the option that he prefers.



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