Brussels Guidelines 2018

USING DATA TO EMPOWER CITIES AND THEIR CITIZENS

The Brussels Uraía Citizenship Series was possible thanks to the contribution of:

This document is the product of the debate generated during the 2018 Uraia "Citizenship Series" that took place in Brussels, Belgium on 30 and 31st May 2018 hosted by the Brussels Capital Region and its Informatics Center (CIRB). The publication is the result of a collaborative effort by the participants who attended the workshop including representatives of local governments, national governments, international organizations, research institutes and private sector.

We present here different approaches on how cities around the world are leveraging the power those technologies to provide a more effective public service delivery and drive positive impact on citizens´ lives. The document has been put together by the Uraia Coordinator, Gabriel Bello Barros under the supervision of Diana López Caramazana, Head of local government and decentralization Unit at UN-Habitat).

This publication has been made possible thanks to the contribution of the Swedish International Development Agency – SIDA.

For additional information, contact the Uraia team at info@uraia.org or visit www.uraia.org

TABLE OF CONTENTS

I - INTRODUCTION

The main goal of Uraia Guidelines 2018 is to offer an overview and to present different approaches on how cities around the world are leveraging the power those technologies to provide a more effective public service delivery and drive positive impact on citizens´ lives. It identifies eight case studies and general recommendations on the impact of the use of data in cities that we hope are useful for urban decision makers and practitioners alike.

The Uraia Platform

Launched in June 2014 in Santander, the Uraia Platform (*which means citizenship in Swahili*) has become a key instrument for cities and their partners in addressing the challenges of implementing innovation in municipal management through the use of SMART technologies. The objective of Uraia is to support cities in implementing SMART strategies to improve municipal finances, service management efficiency, increase transparency and accountability by offering opportunities to share experience, build capacity and develop pilot projects as well as applications. Today, the platform constitutes a network with over 100 partners from around the world, including cities, their associations, research institutions and the private sector.

Uraia SMART City Solutions for an Active Citizenship

The continuous introduction of SMART technologies for city management is producing an impact at the local public administration; this aspect presents both opportunities and challenges due to the rapidity of change and the difficulties for public administration to follow with the pattern of the current digital transformation. Contemporarily, and thanks to the use of mobile devices, citizens all over the world are increasingly demanding information on how public goods are managed, and correspondingly local governments are increasingly demanded to deliver more and better. Uraia's members recognize the need to communicate more with their citizens in order and to introduce and increase transparency in the management of public services, including their cost, efficiency on how and where taxes are allocated.

Uraia is a joint project of UN-Habitat, the United Nations Human Settlement Programme and FMDV, the Global Fund for Cities Development.

Uraía Citizenship Series

Once a year, the members of Uraia meet up to discuss a topic that is a priority in their agendas and jointly elaborate guidelines, collect practices and assess projects with common elements of interest. The past editions of these “Citizenship Series” events include:

- ✓ Santander, June 2014: Launch of the Uraia Platform, Marketplace, and project design exercise
- ✓ Oslo, June 2015: Public-Private Partnerships for SMART city management
- ✓ Nicosia, April 2016: The impact of SMART technologies in the municipal budget: increased revenue and reduced expenses for better public services
- ✓ Madrid, 2017: Transparent and accountable cities: innovative solutions for municipal management and finance

The 2018 Uraía Citizenship Series Brussels - *"Using data to empower cities and their citizens"*

The 2018 edition of the "Uraia Citizenship Series" focused on how local and regional governments are using big and open data to solve local problems. A two-day workshop under theme of "Using data to empower cities and their citizens¨ was organized in Brussels on 30 and 31st May 2018, hosted by the Government of the Brussels-Capital Region and its Informatics Center (BRIC). The event shared the interest and commitment of cities all over the world to the explore how the use of data can provide great opportunities to improve cities´ planning capabilities, to provide inputs for better decision-making, to optimize operations and their related costs, and to foster economic development and citizen engagement.

Hosted by:

be.brussels Brussels Smart City cirb.brussels IT is for you

Acknowledging that networking among local administrations and stakeholders has become an essential platform to find solutions and exchange instruments that can improve the design and development of public policies; Uraía Brussels offered a space for exchange and debate on different experiences to promote innovation as key factor to optimize the use of data by cities and their constituents, and how to provide better services and to foster economic development and innovation.

The workshop brought together 67 representatives of local governments and their partners (networks of cities, civil society and international organizations, service providers from the private sector, universities, etc.) from all around the world.

The objective of the workshop was to present and exchange experiences on how local governments and their partners are using big and open data in city management.

During two days, participants had a chance to discuss different approaches about the advantages of innovation and technology, about how to implement public policies towards the use of open and big data in cities. Additionally, participants had the opportunity to discover

how the use of data can have impact on economic development, municipal finances, citizen-oriented services and citizen participation.

The experiences presented gathered around four thematic trails:

1. **Thematic trail BLUE – the financial and economic impact of big and open data in cities**
2. **Thematic trail GREEN: The impact of open and big data in the lives of citizens**
3. **Thematic trail ORANGE – Data as a meaningful instrument for city participation and city efficiency**
4. **Thematic trail MAGENTA – Governing data: who does what?**

The case studies presented, some of them highlighted in this publication, showcased practical examples of how these initiatives were implemented in several countries, detailing approaches and specific tools. Additionally, participants had a chance to gather in working groups to provide recommendations and to exchange their own experiences and opinions about the great opportunities provided by using big and open data at city-level.

Unlocking the opportunities provided by data in cities

The use of data by cities provides great opportunities to improve their planning capabilities, to provide inputs for better decision-making, to optimize operations and to foster economic development.

Big data requires advanced analytics methods to correlate information and extract value to improve city management and real-time decision-making. In the other hand, open data involves that data should be freely available to everyone.

Other opportunities are offered by the advent of the Internet of Things (IoT). This new system includes devices owned by the city, but also the ones that people carry such smartphones and "*wearables*", vehicles with sensoring capabilities connected to the internet. All of those data sources are enabling a true urban revolution. The vast amount of data produced by IoT devices/sensors can be use to improve city management and to develop innovative SMART urban services. But cities need to know how.

Therefore, the combination of data, the IoT (Internet of Things) connecting multiple sensors across the city and the ability to standardize, access, analyze and open this large, complex data is becoming a crucial element for city officials when planning and implementing successful urban public policies. Cities around the world are already leveraging the power those

technologies to provide a more effective public service delivery and drive positive impact on citizens´ lives.

What we understand by Open Data and Big Data?

- ✓ **Open data**

Open data policies involve governments (at all levels) making 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 regarding budget, transportation, crime statistics, pollution, etc. These sets are published in an open source format; and regularly updated to be easily used by businesses, developers, researchers, who can create services based on that information. Some of the benefits of open data include:

- Providing 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 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.

- ✓ **Big data**

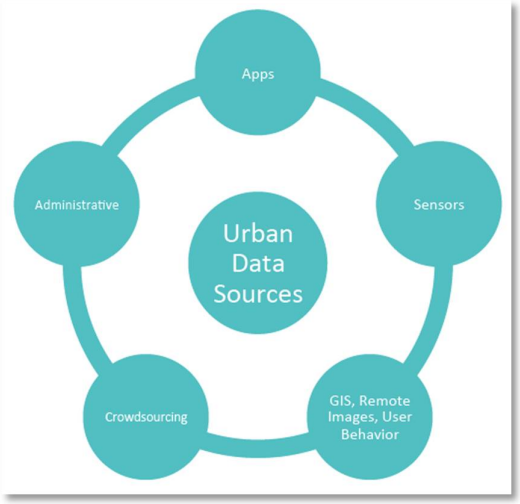
In a technology-driven world, cities are dealing with ever-increasing amount of information. Data is produced from different sources such as the Internet of Things (IoT), networked sensors and devices, cameras, smartphones, social media, and diverse interactions and transactions across networked systems. 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 to interpret trends and patterns and predict possible future scenarios.

Besides allowing 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 organized and manage resources, towards more transparent, inclusive, innovative and collaborative organizations.

Where does the data come from?

According to the literature[1], an urban big data platform may store data from various sources such as sensors, apps, geographic information systems (GIS), images and videos, user behavior (e.g., social media) and crowdsourcing efforts, as illustrated in the graphic below.

1. **Administrative:** In an effort to improve transparency and accountability, several cities are moving toward a culture of open data with several initiatives worldwide. Another common effort is the digitization and compilation of existing administration data, increasing the data available digitally.
2. **Sensors:** with the advent of the IOT, sensors are perhaps becoming the most well known form of collecting urban big data. Placed in structures and buildings to measure a variety of input, their capillarity provides useful data for city management.
3. **Apps:** New uses for smartphones as tools that use data output from online sources are proliferating. Smartphones also allow for users to consciously input data, or for applications to monitor their behavior. Internet connectivity then allows centralized databases to collect such data.
4. **Crowdsourcing:** Crowdsourcing is where a large number of people, often volunteers, produce data collectively on particular issues. One form of crowdsourcing is known as citizen science, where volunteers generate, prepare, and process observations and detailed measurements of some phenomenon.
5. **Remote Image, GIS and User Behavior:** Given the explosion in the number and variety of digital devices in use around the world, it is not surprising that they provide ways of interaction with each other that further create sophisticated datasets. Also, user-generated data from social media and chip readers are now being used extensively in research on people's behavior.



[1] Barkahm, R; Bokhari, S; Saiz, A: *¨Urban Big Data: City Management and Real Estate Markets¨,* Urban Economics Lab MIT Center for Real Estate and DUSP

II. THE FINANCIAL IMPACT OF BIG AND OPEN DATA IN CITIES

Smart cities and smart technologies are already in the political and technical agenda of cities for several years now. Although many cities are still trying to capture the opportunities of such technologies in their day-to-day operations, many ¨cities are beginning to grapple with the movement´s next phase: documenting its costs, benefits[2] and economic impact.

There are also great expectations that such technologies improve the quality of life and the productivity of cities in the long run, thus helping the social and economic development of cities and their citizens. In addition, the use of data by cities can not only drive internal operational efficiency, but be used as a tool to analyze the impact of urban innovations and in evaluating new investments efforts, whether in infrastructure, new technologies or in service delivery.

Another related desired effect is the possibility of fast policy evaluation, allowing the responsible departments of public administrations to find out within a short time whether their policies have the desired effect or not. In addition, emerging technologies provide cities the opportunity to leapfrog the provision local public services.

The potential economic impact of Big Data

The use of urban big data can improve urban life standards in many areas by reducing energy consumption, improving transportation systems, reducing municipal waste, and creating solutions that adapt and respond to citizens needs. All of these examples cannot only improve citizens' quality of life, but foster local economic development and correlated savings.

The potential economic impact of Open Data

¨It is clear that the benefits of open data extend far beyond greater transparency and revitalized civic engagement¨[3]. Government open data is creating a virtuous cycle of innovation and economic development in many cities across the globe.

While the use of urban data is not a novelty to larger companies, cities should also promote the development of local start-ups and related businesses, especially to monitor and improve digital tools.

Although the rate of business growth attributable to open data has spiked in the last few years[4], data-driven policies and policymakers should ensure that no one is left out. They should understand not only the needs of large companies, but also the local innovation ecosystem (startups, SMEs, amongst other stakeholders).

There is mounting evidence that open data can and is already making a measurable difference in contributing jobs, consumer spending, and tax revenue towards local economies. Economic

[2] Article: *¨Data Insights: Measuring the Economic Impact of "Smart City" Innovations¨*. Mastercard Center for Inclusive Growth. December 2017.
[3] Cashman, T. Article: *¨The Economic Impact of Open Data¨* . Socrata blog
[4] Ibid.

data in both the U.S.A. and the European Union indicate a trend linking the availability of open data and the implementation of new technologies to economic growth[5].

By 2020, the smart city technology market is expected to exceed $ 1.5 trillion, according to a study by the consulting firm Frost and Sullivan. For instance, the digital applications market currently contributes to 794,000 jobs and more than 10 billion euros of revenue per year in the European Union[6].

In the other hand, a study from Cisco on the economic benefits of smart technologies in the public sector reveals that $ 4.6 billion in savings could be achieved through the adoption of smart technologies in 40 key public sector activities over the next decade: smart water, smart buildings, smart energy, parking intelligent, etc[7].

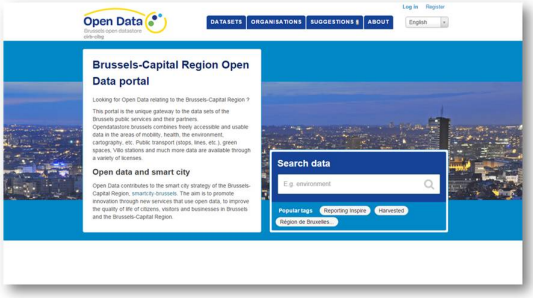
Case study 1: Open data: innovation in the Brussels Capital Region, Belgium

BRIC

The Brussels Regional Informatics Centre (BRIC) is the public interest agency that aims to become the technologically neutral, competitive, reliable and high-quality partner of all public institutions in the Brussels-Capital Region. Supporting them in introducing innovative and coherent ICT in order to optimize efficiency on the one hand and improve the user-friendliness of the services offered to the people and businesses of Brussels as well as visitors to the Region on the other hand.

Brussels Open Data Strategy

The open data strategy of the Brussels region is supported by a regional regulation that has made open data compulsory for all its administrations since 27 October 2016. Three contracts have been implemented and an open data portal has been set up. (www.opendatastore.bru).



[5] White Paper. The Socrata Open Data Value Framework: *¨Recognizing the Four Pillars of Value is Key to Unlocking The Value Of Your Open Data Initiatives¨*

[6] Christophe Girard, (2017), "La ville intelligente , une avancée d'abord économique », in les Echos

[7] CISCO, IoE-Based Rio Operations Center Improves Safety, Traffic Flow, Emergency Response Capabilities , 2014, 7p, http://www.rio.rj.gov.br/web/corio

After having encountered various obstacles to implement this portal, the Brussels Capital Region has created a new portal (www.api.brussels) to facilitate the reuse of data. These two tools reinforce the provision of open data and are free for all administrations. The ultimate goal is to help administrations work together.

Challenges

The main challenges encountered in setting up these portals have been the lack of knowledge on digital technology and the resistance from the administrations to provide data regarding their activities. The region worked with three pilot municipalities (out of 19). This led to the creation of a dataset list to make the information available. However, a great effort to raise awareness on digitalization and training remains to be achieved. One of the major challenges to overcome is the implementation of common standards and formats in order to compare data and experiences.

Case study 2: Reinventing cities: The Chicago experiment, USA

Chicago City Tech Collaborative

City Tech is supporting innovation in cities worldwide. The Chicago based institution transforms essential city services and infrastructure, using advanced technology, and then expands these solutions to other cities. Together with its partners, City Tech is providing solutions to divert rainwater from overloaded sewer systems, easing subway congestion during large events, and launching a digital directory of public health services in Chicago.

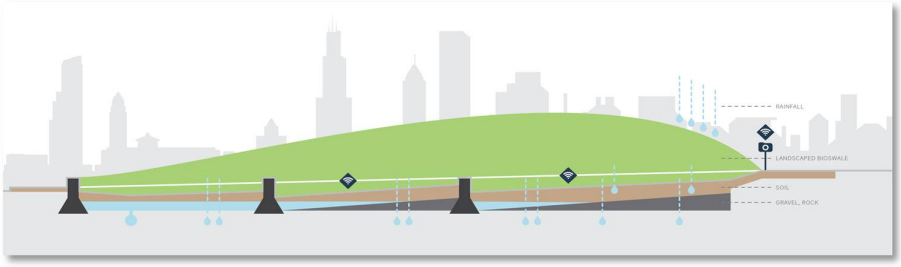
The strategy

The strategy is based on a fourth part methodology: opportunity-discovery, solution-definition, solution-implementation and solution-scaling.

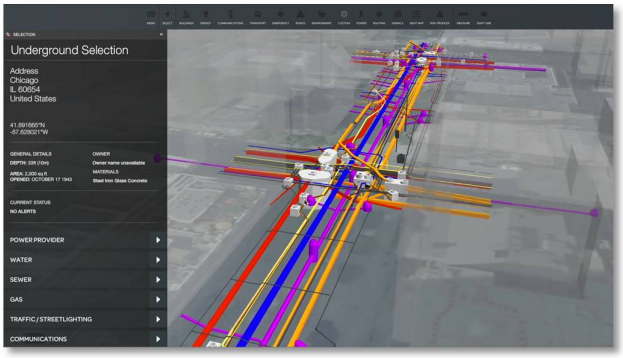
A testbed for piloting smart solutions

Two examples of how City Tech-driven solutions have addressed economic costs associated with compromised infrastructure are described here:

- Flooding in Chicagoland due to excess storm water led to more than 181,000 claims of property damage between 2007 and 2011. According to the Center for Neighborhood Technology, this costed an estimated $773 million. Nationally, the Federal Emergency Management Agency says total flood insurance claims average more than $1.9 billion per year. Cities are investing in green infrastructure techniques – like permeable pavements, landscaped elements, rain gardens, and more – to better manage storm water collection and prevent flooding, but few tools have existed to evaluate the effectiveness of these methods. City Tech's Smart Green Infrastructure Monitoring solution is a significant opportunity to curtail Chicago's flood damage through prioritized impact investment. The solution's data analytics platform is informing the City of Chicago's $50M commitment to utilize green infrastructure to divert storm water and damages.



- Because of inaccurate or obsolete data on belowground infrastructure, an underground utility line is hit on average every 60 seconds in the United States, according to the American Public Works Association. The result is inefficient and delayed construction projects, dangerous accidents, and interruptions of services to citizens – utility hits have been estimated by the Common Ground Alliance to have resulted in $1.7 billion in property damage, 1,906 injuries, and 421 deaths in the U.S. over the past 20 years. City Tech's Underground Infrastructure Mapping solution will curtail these coordination and damage issues in Chicago and beyond.



Case study 3: Seoul big-data initiatives, South Korea

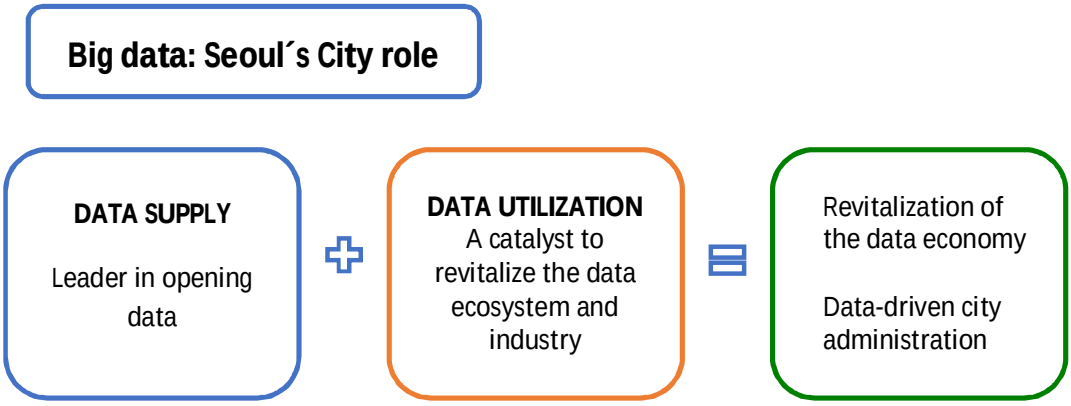
Seoul Metropolitan Government

Seoul, officially the Seoul Special Metropolitan City, governed by its Metropolitan Government – is the capital and largest metropolis of South Korea. Seoul forms the heart of the Seoul Capital Area, and includes the surrounding Incheon metropolis and Gyeonggi province, altogether home to roughly half of the country's population. On its 605.21 km2, hosts approximately 9,838,892 inhabitants (2018).

Seoul Metropolitan Government

Seoul City´s big data policy

The Seoul Metropolitan Government is taking bold steps towards the use of big data by offering 4,743 kinds of datasets in 12 areas as diverse as transportation, public facilities, civil petitions, housing, welfare, etc. With over 10 million inhabitants, the city of Seoul is using public data to face the growing number of urban issues. Public transportation has become a top priority that to tackle through the use of big data in many different ways. The strategy of the city aims at exploring and analyzing urban issues based on public data.

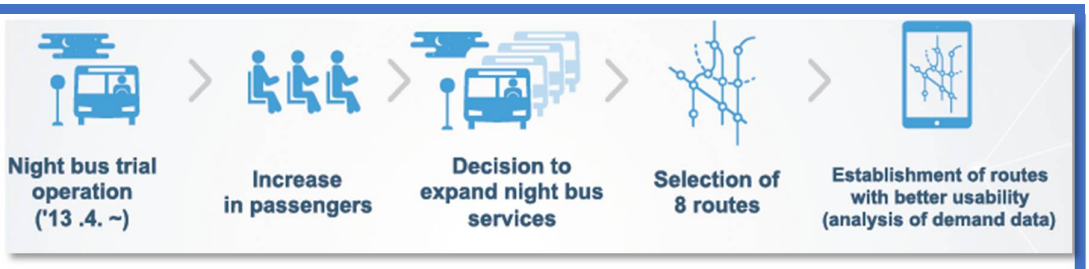


Mobility: a key priority for Seoul´s big data strategy

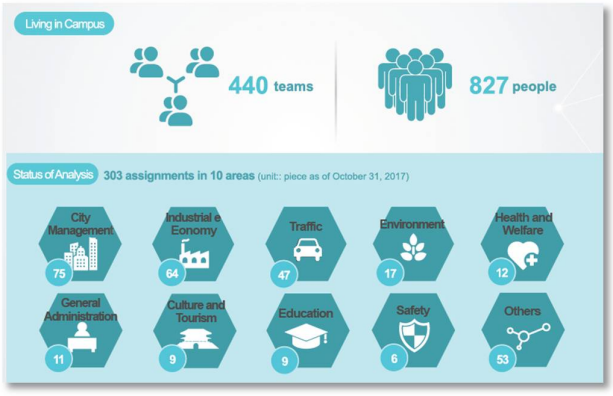
In order to identify daily urban travels and create services accordingly, the municipality of Seoul analyzed public transportation cards used by 90% of Seoul's citizens, conducted a survey over 70,000 taxis and assessed 600,000 pieces of data from the 120 Dasan Call Center, a service that takes inquiries about and provides information on life in Seoul.

Unfolding several big data initiatives. Some examples

- Three billion mobile phone calls have been analyzed by the city government to discover the most frequented places at night and establish late-night buses and subways.



- Based on data from DTGs (digital tachographs) installed in taxis, a map was created based on the taxi routes and whether passengers had used the taxis along those routes. This enables to reduce the taxi vacancy rate by 10 percent and the average waiting time has decreased by three minutes, from 27.4 minutes to 24.5 minutes.
- A platform was created to register all traffic accident hotspots and locations.
- A Big Data Campus was launched to analyze data from both the public and private sector to solve social issues through cooperation and to help bridge the information divide between the privileged and the disadvantaged, such as small businesses and young entrepreneurs.



III. THE IMPACT OF OPEN AND BIG DATA IN THE LIVES OF CITIZENS

Smart City managers can apply data analysis to monitor and anticipate urban phenomena in new ways, and, so the argument goes, efficiently manage urban activity for the benefit of 'smart citizens'[8].

For the citizens, big data analytics processes may cut down paperwork as processes reorganized internally to better integrate data for analytics will facilitate cooperation among ICT systems, which reduces the need for citizens to repeatedly provide the same information. As a result, citizens will get questions answered, and receive benefits they are entitled to, more quickly. Furthermore, services may be proactively proposed as a result of large-scale predictive analytics, based on services used by comparable citizens[9].

Nonetheless, in order to legitimately tap the advantages of data into policy making, city governments must make available systems and services that are usable and are accessible by all citizens, which require a socio-technical vision of the problem[10]. For that, educational and information campaigns that target all citizens are needed. Not only to educate them in the use of new ICT tools, but also in ¨old-fashioned, street-level skills in community development¨[11].

That´s when the technocrat and the citizenship point of view sometimes clash. ¨For experts, building big data city platforms, one sensor in one square is simply a data point. On the other side of that point, however, are residents connecting that data to life in all its richness in their square[12].

As outlined in the previous chapter, open data can have a huge economic impact in cities and for the people living in them. It has the potential to open up new markets for a young and highly qualified population in the digital domain from developing countries, particularly in Asia and Africa. Thus driving next-generation employment opportunities and therefore social inclusion and economic development.

Case study 4: La Marsa´s Smart Bins project, Tunisia

La Marsa Municipality

La Marsa is a coastal town in north eastern Tunisia located 18 kilometers northeast of the capital Tunis. The population is estimated as 92,987 (2014), distributed on its 31 km^2 of area. The old summer capital of pre-colonial Tunisia, it is today a popular vacation spot and tourism, its main economic activity. The municipality of La Marsa is divided into four districts: La Marsa, Gammarth, Sidi Daoued and Cité Er-Riadh.

بلدية المرسى
COMMUNE DE LA MARSA

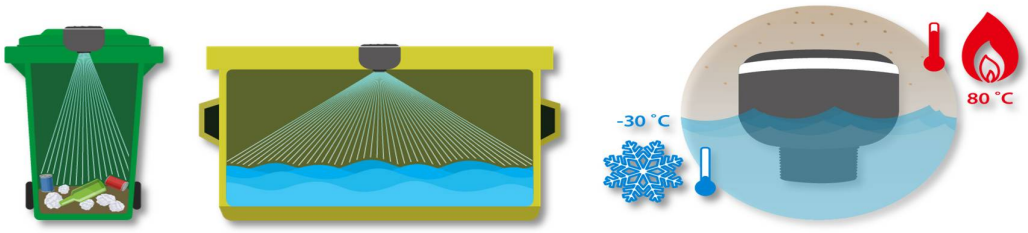
[8] Smith, A. *¨Smart cities need thick data, not big data¨.* Article Guardian Cities
[9] Ibid.
[10] Calani Baranauskas, M. C. E-Cidadania: Systems and methods for constitution of a culture mediated by information and communication technology
[11] Smith, A. *¨Smart cities need thick data, not big data¨*. Article Guardian Cities
[12] Ibid.

Smart Bins project implementation

The municipality of La Marsa implemented the Clean City Networks (CCN) in one of its neighborhoods (Corniche) as is the main platform for waste management. CCN provides the service-monitoring environment with an intelligent dashboard, an analysis and the control center in one complete and simple set. CCN is available on the web and hosted in the cloud. It is available wherever the city operator has a modern browser and an Internet connection. It gives the city the complete control and insight into their waste management operations and has demonstrated cost-saving benefits in all operations areas.

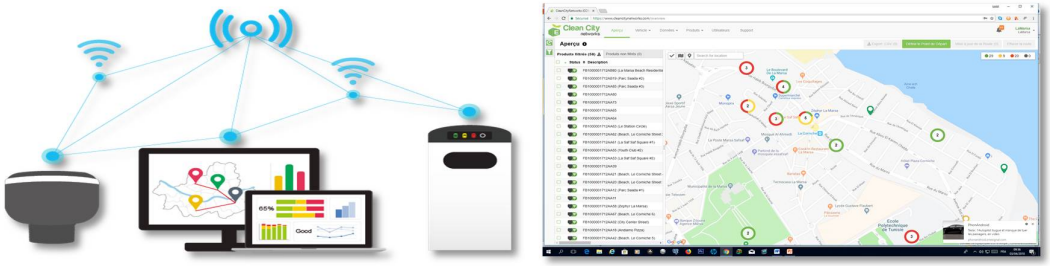
Sensoring system

The clean CAP sensor can detect the filling rate of containers from 750 to 8000 liters. It can detect liquid and solid materials and cover a distance of 30 to 400 cm. It has also been tested to go beyond the limits of its operation and withstands from very low to very high temperatures. The battery is a protected from dust and water by a case and can have a lifespan of 5 to 10 years.



Main benefits

The city can easily track assigned containers in real time and calculate shortcuts for each single collection and provide dynamic collection schedules using predictive algorithms. This allows the city operator to make decisions based on the data in advance. Thank to clean CAP sensor shortcuts can go up to 80% in terms of labor savings, fuel, etc.



In addition, CCN sends notifications informing when and where collections are needed. The system provides an historical overview of waste generation, waste overflow, and collection performance. By identifying areas with very high waste generation and regular waste overflow incidents, the La Marsa Municipality can focus their resources more efficiently and plan the optimal number of bins according and garbage collection based on the data history.

IV. DATA AS A MEANINGFUL INSTRUMENT FOR CITY PARTICIPATION AND ENGAGEMNT

More and more data and its subsequently treatment and analyses are helping city administrators solve pressing social challenges. But not only that, the right use of data may enhance citizen and policymakers´ collaboration in new forms of data-driven assessment and data-driven engagement.

Technology and analytics can directly influence the urban policy making cycle and its governance. It may support early-warning systems; social media analysis or real-time decision support applications that are already vastly used by cities. This leads to a ¨increased speed of (re-) action allowing policymakers, public servants, and citizens to take informed and organized collective action¨[13].

In our societies a growing number of citizens are disappointed with traditional forms of representative democracy, resulting in an always-lower voting rate. Keeping this in mind, technology can be an opportunity as it is a fast and massive way to reach and engage with people. But it can also be a risk, as it empowers citizens to take control of their lives and demand change by more informed decision-making and new forms of social mobilization. And governments not necessarily have the adequate political institutions to respond such demands in such a rapid pace as the social change occurs.

In order to mitigate risk, cities should think beyond participation. They should envision a co-developed participatory process with citizens. Including beneficiaries of digital services' from the design phase will improve user experience and therefore its impact and legitimacy. Citizen participation is at the heart of the issues of appropriation and development of big data strategies. In order for participatory processes to support decision-making, cities must know what data to collect, which to involve, how to implement the process and, especially, how to interpret the data collected.

[13] Höchtl, J; Parycek, P; Schöllhammer, R (2016): ¨*Big data in the policy cycle: Policy decision making in the digital era*¨, Journal of Organizational Computing and Electronic Commerce

Case study 5: Patio Digitaİ initiative: fostering innovation and collaboration in Sao Paulo's public education policy through open data and transparency, Brazil

Sao Paulo Municipality

São Paulo is a Brazilian municipality, capital of the state of São Paulo and main financial, corporate and mercantile center of South America. With over 12 million inhabitants, it is the most populous city in Brazil, in the whole American continent, amongst the Portuguese speaking cities and the entire southern hemisphere**.**

The Patio Digital initiative

For Sao Paulo, education is a key challenge in order to reduce inequality gaps. The Patio Digital ['Digital Schoolyard'] is an initiative led by Sao Paulo City Department of Education which implements an open government policy through three interconnected components:

(i) Transparency and Open Data;
(ii) Government and Society Collaboration and
(iii) Technological Innovation.

It was launched in April 2017 in alliance with UNESCO in Brazil. At the 1-year mark, Patio Digital has managed to significantly increase the levels of active transparency of the education policies, making this Department the first in the open data portal rank in the municipality. Citizens are engaged in all the open data life cycle, from developing a collaborative Open Data Plan to prototyping and building tools with open source community support. Open data subjects include transportation, childcare center openings, evaluation, infrastructure and other topics of interest.

Patio Digital open data plan

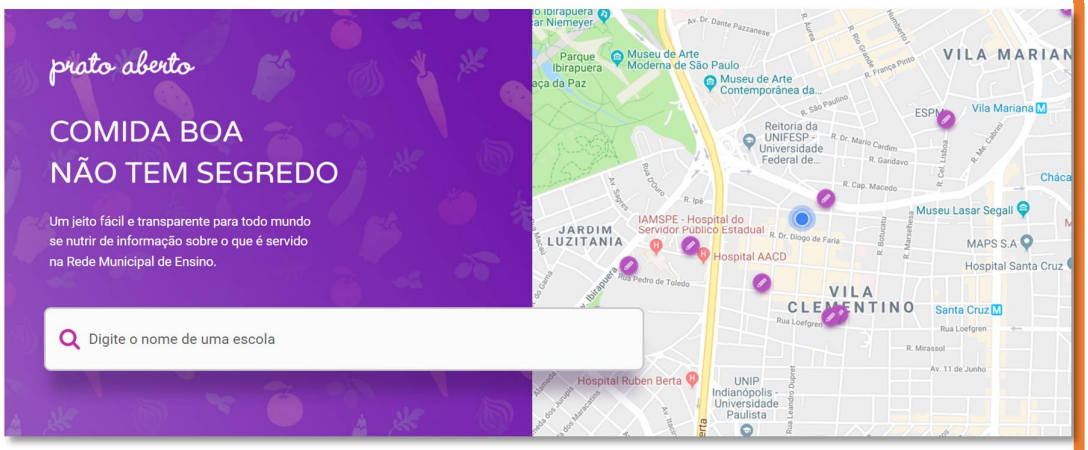
Three examples of how Patio Digital have implemented its open data plan:

- The project *Fila da Creche* makes available information about openings at childcare center. Now, 60 000 parents use it to identify kindergartens for their children. It's the first time the waitlist is available by region, making comparisons possible.
- An app has also been developed regarding data literacy, providing really simple tutorial to understand the program and understand the data. Teachers, users, and students of the services can co-create the program.
- Another app innovation called open schools meals enables families and students can

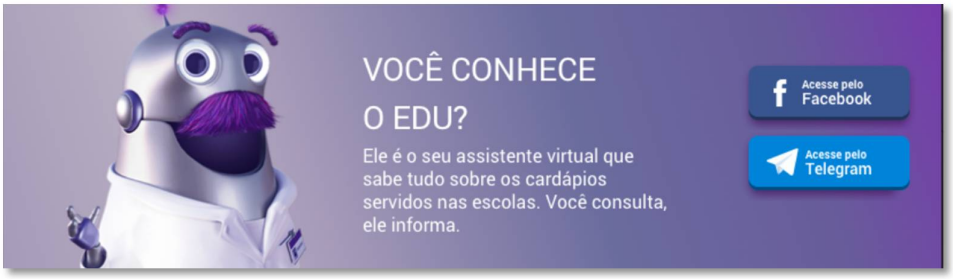
check planned menus.

With its 'Open Innovation Cycle', Patio Digital engages different actors in the process of creating new digital services and tools designed for and by families, students, and teachers.

The first completed Cycle delivered a transparency platform for schools' meals, where families and students can check planned menus – an unprecedented information disclosure in the Brazilian landscape. It was the first time this information was structured and published in a daily basis and for each of the 3,200 municipal schools – around 1 million children and their families. Before that, generic menus were published at the city's "official journal". Questions about food in schools were among the most frequently asked questions in the Citizen Attention Service in Education.



The process also resulted in the first chatbot of the City Hall, "Edu Bot", which provides information to families.



Challenges

The main difficulties are related to the lack or fragility of regulation regarding innovation and the collaborative relation between public bodies and civil society – especially in terms of contracting and rewarding open solutions. In this sense, third parties (alliances with civil society and agencies) are facilitators.

Other challenges relate to absorbing, maintaining and sustaining new technologies in the Department's infrastructure. The Municipality of São Paulo is working in ways of transferring knowledge from civil society experts to government specialists.

Case study 6: A More enlightened Community, a More Participative Community, Valongo, Portugal

Valongo Municipality

Valongo is a Portuguese municipality located in the District of Porto. The city population is 18,698, and the municipality is composed of 4 parishes, of which three are cities (Alfena, Valongo and Ermesinde). The population in 2011 was 93,858, in an area of 75.12 km². The two most populous cities (and parishes) in the Valongo municipality are Ermesinde, with a population of 38,315 and Alfena, which has the most industry in the municipality[14].

A More enlightened Community, a More Participative Community

The project "A More enlightened Community, a More Participative Community" consists of several tools and actions that are being developed since 2014 with the objective to promote more trust, participation and engagements of citizens. The initiative consists in turning the municipality as a living school of citizenship, making available all political decisions online. The Mayor's first ambition is to involve young people that have always been the hardest

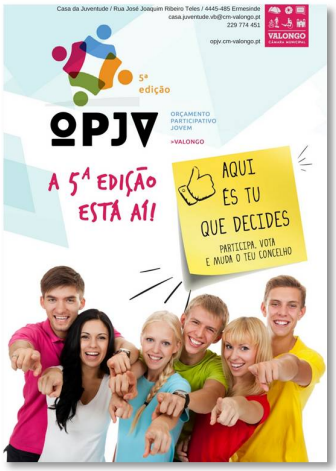
[14] From Wikipedia, the free encyclopedia: https://en.wikipedia.org/wiki/Valongo

population to involve in democratic participating processes.

SAIBA QUANTO CUSTOU

Related initiatives

Some initiatives developed under this umbrella namely the "Know How Much it Costs", "Ta Claro" and "Participatory Youth Budget of Valongo", focuses on the same principle and objective, starting from online platforms, where information related to the projects, be it financial or processual, is available for consultation and discussion. Transparency sheets on the usage of the municipal budget, stand-point of processes, and education on topics related to democracy, citizenship and the function and organization of the local authority are all available online. By having these online platforms available citizens are encouraged to participate in the local decision-making, stay informed throughout all stages of the processes, find their voice and contribute to their community.



- "Know how much it costs" aims to stimulate/promote the involvement of the population in the local government, namely regarding what was done in the last economical year in the Municipality. After the final calculation associated to each municipal expenditure, this total cost is separate by items and placed in the official site of Valongo Municipality in a due entitled card "Transparency Card", being available for consultation of the civil society.
- "Participatory Youth Budget of Valongo" aimed at citizens as young as 6 years to 35 years old, in order to engage them in a more constructive and participatory way in the community by creating a dynamic and critical thinking about the region where they are inserted, allowing them to present ideas, build them, debate and lead to their realization.
- Subsequently to these two projects, the platform "Tá Claro!" was launched, which aims to enlighten the population on basic notions and ways of functioning of the Municipality and all its services.

Results and impact

All of these three initiatives allow for a more rigorous and detailed description of costs. The administrative process has become more clear and transparent both to the employees of the Municipality, as well as its citizens. This unlimited access to the files, allows citizens understand and see whether their elected representatives are focusing on the needs of the citizens and how it is being managed in overall.

The implementation of the project and its initiatives, also contributed to the rise of 115 places in the National Ranking of Municipal Transparency (from 123rd place to 8th). With the introduction of this transparency and communication culture, it has had an impact on the technical action and policy of the local authority. Today, the city hall and all services involved are more disciplined and rigorous with the organization of the resources, have a better

understanding of the annual evolution of the budget/costs, have a more organized base of information that we now use to support decisions, as well as an increased interaction with the communities of the municipality.

V. GOVERNING DATA: WHO DOES WHAT?

In order to understand the implications of data governance across different levels of government, it is important to explore the concept of data governance within an organization, whether it is public or private.

Data governance can be summarized as "the specification of decision rights and an accountability framework to encourage desirable behavior in the valuation, creation, storage, use, archival and deletion of data and information. It includes the processes, roles, standards and metrics that ensure the effective and efficient use of data and information in enabling an organization to achieve its goals[15]".

There are many ways in which to apply this concept on the day-to-day of a city administration; it will depend on several factors, including the city administrative structure, competencies and stage of technological development.

Case Study 7 - Smart Society Charter - IoT Architecture principles & guidelines / City of Eindhoven[16], The Netherlands

As a pioneer of the Smart Society, the city of Eindhoven has co-developed with its local innovation ecosystem (commercial partners, start-ups and small enterprises, independent IoT developers, academic and research institutes, citizen-driven initiatives and other public organizations) a few simple common principles to apply to architecture of all current and emerging IoT and data-driven initiatives across the city. Although it has been developed having Eindhoven specificities in mind, those principles can be scaled to other cities around the globe.

[15] *Enterprise Information Management, Best Practices in Data Governance*. An Oracle White Paper on Enterprise Architecture, May 2011

[16] *¨Smart Society Charter - IoT Architecture principles & guidelines¨* / City of Eindhoven Retrieved on: https://data.eindhoven.nl/explore/dataset/eindhoven-smart-society-iot-charter/

1. Privacy first

First and foremost, the privacy of the users and citizens should be guaranteed.

People should be given insight into the data that is collected and control over the way it is and will be used. Ethical aspects should be taken into account when extending practices into areas not addressed by current legislation.

2. Open data and interfaces

We facilitate innovation by making data publicly available and enabling access to IoT & data systems through open interfaces.

We stimulate new business models and emerging services that rely on generating added value, rather than exploiting licenses on data or exclusive rights on the infrastructure. We recommend making the infrastructure open on the lowest level and making raw data publicly available whenever this can be done without compromising the privacy and security of the citizens.

3. Embrace open standards

Wherever available, the IoT infrastructure, connectivity, platforms, devices and services should be built on open or broadly agreed de-facto standards.

Using established standards will facilitate evolution of infrastructure and services, sustain a competitive market and prevent vendor lock-in. Where standards are not yet available, maintaining openness and sharing best practices will help to lay a foundation for the future.

4. Share where possible

We expect all IoT and Data developments to provide well-defined, easily accessible stable interfaces for sharing and reusing existing assets.

Shared use of grids, sensor networks, connectivity and software components will lower the barriers for their adoption, increase connectivity and stimulate interoperability. The IoT & Data infrastructure should be available for re-use, as well as open to innovation and expansion.

5. Support modularity

We recommend adopting a modular architecture with well-defined open interfaces as the core of any IoT or data-driven development.

Modularity helps to ensure interoperability between platforms, services and applications and facilitates re-use and cooperation between partners.

6. Maintain security

The reliability of components, platforms, solutions and services must be constantly safeguarded.

Ensuring confidentiality, integrity and availability is vital to essential services and core parts of the infrastructure, which need to be safeguarded to the highest possible degree. In addition, all digital assets must be well protected from attack, damage or unauthorized access.

7. Accept social responsibility

Providing new technologies and services, and collecting and combining data may result in unforeseen effects on society or individuals.

We cannot predict the future. We encourage experimentation, provided responsibility is taken for the consequences.

According to the International Open Data Charter[17], cities and local governments are often responsible for the delivery of programs and services that citizen's use or encounter in their daily lives (e.g. sanitation services, public transportation, traffic regulations, etc.). As such, they have an important role to play in engaging citizens on issues related to open data, and in encouraging citizens to seek out information about open data initiatives at all levels of government, in order to support better informed public engagement.

At the national level national governments should be accountable for their own open data initiatives. But also to drive data openness at the local level by setting the legal framework, guidance on data standards, and to providing funding and technical capacity to make this happen, specially for cities with less resources.

It is unquestionable that the value of city or local government data can also be amplified when it is combined or compared with national-level data. But this governance is not only restricted to how different levels of government coordinate and correlate.

The implementation of smart technologies by cities, among them those directed to the use of data, should also encompass strong multi-stakeholder partnerships in order to be sustainable and impactful. In order to resolve urban challenges, it is urgent to set up a governance framework that combines different data to drive new knowledge, solutions and applications.

This is a key to co-produce business models, to develop city data architecture, setting open shared standards and making data a public issue so that data can be accepted and used by citizens.

Case study 8: Abuja Mobile Big Data Analytics Initiatives, Nigeria

Nigeria´s National Information Technology Development Agency (NITDA)

NITDA was created in April 2001 to implement the Nigerian Information Technology Policy and to co-ordinate general IT development in the country. Its role is to develop information technology in the country through regulatory standards, guidelines and policies. Additionally, NITDA is the clearinghouse for all IT projects and infrastructural development in the country. It is the prime Agency for e-government implementation, Internet governance and general IT development in Nigeria.

[17] The Open Data Charter is a collaboration between governments and experts working to open up data. It was founded in 2015 around six principles for how governments should be publishing information. The aspiration was that data should be open by default, timely and interoperable. More than 70 governments and organisations have joined the movement.

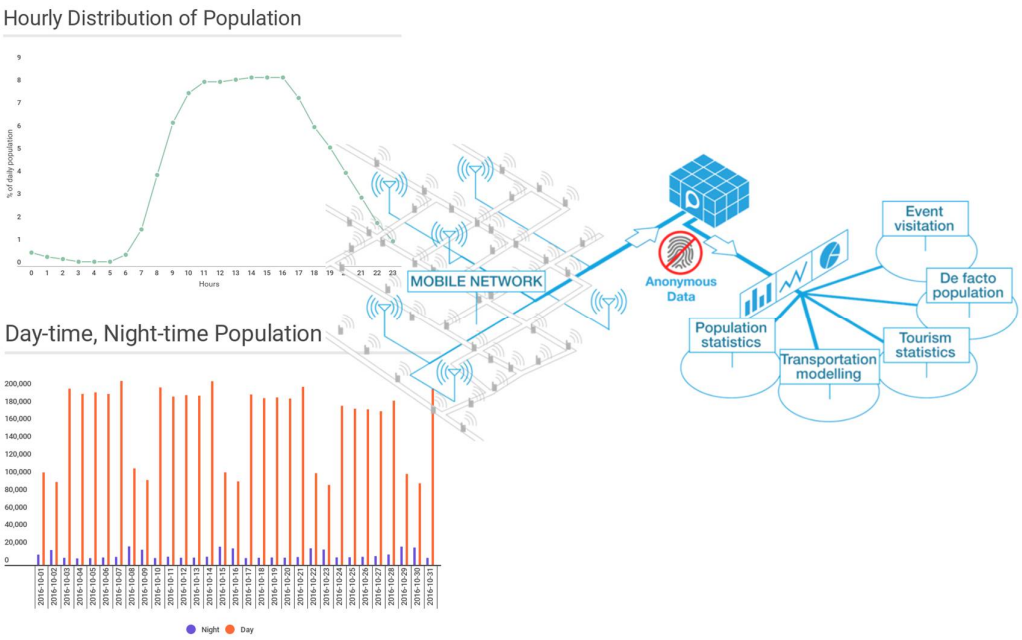
Background and project´s rationale

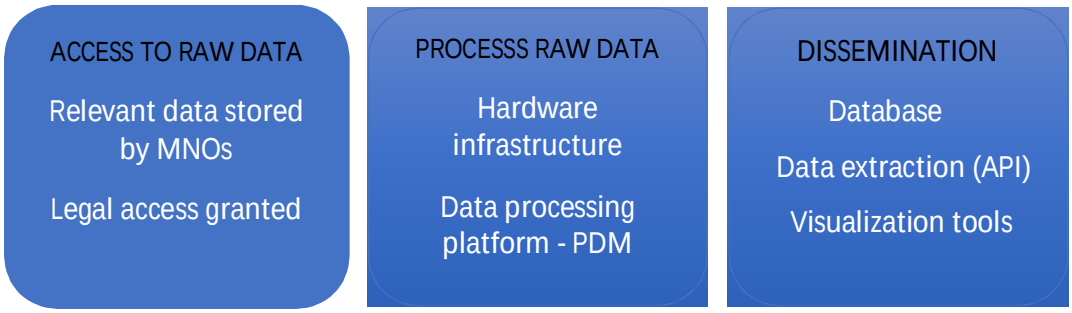
In the early 1960's, 90% of the national revenue came from oil. In the last couple of years, Nigerian economy decreases to the second one in Africa because of a crash in oil prices. Last year, the government launched a new economic program to leverage information technology. This program intends to empower its citizens and its governmental organizations. From 2002, the total number of mobile lines grew from 500 000 to over 90 million. There are now four mobiles networks in Algeria with massive position data. Nigeria is currently the number 8th in the world in terms of mobile connections, with 154 million active mobile subscribers, generating enormous amounts of data in the mobile networks. Data that can be put to use for the development of the country's communities. Cities authorities throughout Nigeria lack verifiable data to function efficiently. In the same vein, the presence of improved data could be a catalyst for social and economic growth as individuals and governments alike, stand to gain from new products and services developed from its further application in key sectors such as public security, health, education, tourism, to mention a few.

Abuja Mobile Big Data Analytics Initiatives

The Mobile Big Data project involves the use of anonymized mobile position data obtained from Mobile Network Operators (MNOs) to produce various statistical modeling for the Federal Capital Territory Administration (FCTA) and Abuja Municipal Area Council. The first phase of the project is prioritizing population statistics, to be followed by mobility data.

The population statistics will reveal such dynamic data as de facto population of the city of Abuja, including day v night populations by city district, or hourly, weekly or monthly population statistics.





Expected outcomes

By processing existing data generated by mobile phone subscribers, this project will address the above challenges facing Abuja city administrators by producing data on population and mobility. Even more important to the economy of the city, the spin-off effect in terms of new jobs and businesses will lead to a reduction in existing poverty and inequality levels. Abuja has been chosen as the pilot city because it has 2.8 million inhabitants and to be able to measure success of a project it's important to start at a smaller scale. 60% of population comes from suburban areas and this is why the municipality faces difficulties to determine appropriate level of health supply for instance and allocate resources accordingly.

The population statistics generated by mobile phone data will allow governments, municipalities, urban and transportation planners, and many other users to answer the questions like how many people are in the location at particular time, compare de facto population of different locations, what is the breakdown of these people, their home area, etc. This will unlock several planning and operation improvements in city management.

VI. THE BRUSSELS RECOMMENDATIONS

Despite numerous examples of local governments leveraging data to improve cities' management, foster public engagement and promote local economic development, there are still barriers to its full deployment.

Hereafter we present a few recommendations to which local governments should pay attention to when implementing initiatives to unlock data´s full potential.

Awareness and capacity building

1. Raise awareness of local authorities to better understand the opportunities data can bring them and to its citizens

Local governments must first become aware of the potential offered by big data and specifically how it can be useful for preventing and resolving pressing social challenges. Many cities are unaware of their data resources and their potential for innovation and economic development. Guided by fear and misunderstanding of digital tools, cities often distance themselves from the opportunities offered by big data.

2. Training and deploying new administrative human resources

For this, new professional skills are required. Local governments need develop capacity building programs to train and integrate new trades into their teams. More and more, city leaders are seeing innovation as a process to help solve challenging problems. And this is influencing directly in the emergence new roles as data managers, but also of innovations teams, labs, incubators, etc. Those people and teams need to have analytical capacity to conduct qualitative and quantitative data research and analyses and will also need to be empowered to develop innovative solutions.

3. Training and awareness should also focus citizens

In addition to targeting public authorities, educational and information campaigns must target citizens and should not only focus in the use of new ICT tools, but also in old-fashioned, street-level skills in community development. This need will also open up new markets for a young and highly qualified population in the digital domain from developing countries, particularly in Asia and Africa. Thus driving next-generation employment opportunities and therefore social and economic development. It is also important to involve start-ups and companies in this mission of education and continuous standardized training.

4. Cities must learn how to collect and understand data

Cities need to first learn how to collect and understand data before implementing open data platforms. Therefore, they should have a structured approach to data collection, combining qualitative and quantitative methods in order to make data actionable and useable. To obtain these benefits a strong collaboration between ICT and the business is required – i.e. poor data and information quality is NOT just an ICT problem.

5. Tapping opportunities requires good quality understandable and standardized data

Cities still fall short of tapping into urban data´s full potential and effectively utilizing in it to improve decision making and capitalizing on its fiscal value. The content of the data, its quality, accuracy, integrity, availability and interoperability will ultimately limit its usefulness. In order to improve its efficiency, urban data initiatives should move towards using/providing good quality understandable and standardized urban data. Cities should make key decisions with high quality data and information. And, without a common and information language, cities cannot communicate information and collaborate effectively with its constituents.

Monitoring and evaluation

6. Data as a public policy evaluation and monitoring tool

It is important to monitor the data collected to optimize public services. Besides being used to analyze the impact of urban innovations, data can be a useful tool to evaluate new urban investments efforts, whether in infrastructure, new technologies or in service delivery.

7. Monitoring the impact of the use data

Besides creating open data portals, local governments should foster communication with their stakeholders and civil society to understand of how they are using the data and which impact it is having in the local economic development, with easy to understand, concrete and tangible examples.

Governance

8. A good data policy is a governance issue

The challenge of big data to stimulate data and evidence-driven policymaking is not only a technical issue but also a governance one. First, cities need to understand their data and information processes to successfully manage them. Cities and local governments are often responsible for citizen service delivery and therefore play an important role in them citizens on issues related to open data. In the other, national governments should be accountable for their own open data initiatives. But also to drive data openness at the local level by setting the legal framework, guidance on data standards, and to providing funding and technical capacity to make this happen, specially for cities with less resources.

9. A good data policy requires political leadership at all levels

Political leadership and coordination at all levels is crucial for the deployment of smart technologies in urban governance. Cities and city leaders need to take bold steps in order to unlock all potential data brings to urban management. In order to do so, they need to create a long-term vision, inserting data-driven initiatives at the most strategic level, not just as data management and statistical programming.

Partnership arrangements

10. Cities should push for and facilitate strong multi-stakeholder partnership arrangements

The implementation of smart technologies by cities, among them those directed to the use of data, should encompass strong multi-stakeholder partnerships in order to be sustainable. Local governments can have a crucial role in order to foster and facilitate those collaboration arrangements.

11. No one should be left behind!

Data-driven policies and policymakers should understand not only the needs of large companies, but also startups, local SMEs, amongst other stakeholders from the innovation ecosystem to ensure that no one is left behind!

Economic impact

12. Creating and developing new business models

Cities need to develop new business models and understand new ways to provide data and services. Data is both a product and a service; and if it could be monetized, it could become a new source of revenue for cities. Business models and emerging services that rely on generating added value, rather than exploiting licenses on data or exclusive rights on the infrastructure.

Data and Citizen participation

13. Good data management means better leadership and better engagement.

Citizen participation is at the heart of the issues of appropriation and development of big data strategies. In order for participatory processes to support decision-making, cities must know what data to collect, which to involve, how to implement the process and especially how to interpret the data collected.

14. Cities should co-develop simplified participative processes and tools

In terms of data appropriation, it is necessary to go beyond participation and start co-developing participatory processes with citizens. It is necessary to include the beneficiaries of the digital services from the creation stage and not to encourage them to participate once the product is designed.

VII. REFERENCES

- Barkahm, R; Bokhari, S; Saiz, A: *¨Urban Big Data: City Management and Real Estate Markets¨,* Urban Economics Lab MIT Center for Real Estate and DUSP
- Article: *¨Data Insights: Measuring the Economic Impact of "Smart City" Innovations¨*. Mastercard Center for Inclusive Growth. December 2017.
- Cashman, T. Article: *¨The Economic Impact of Open Data¨*. Socrata blog
- White Paper. The Socrata Open Data Value Framework: *¨Recognizing the Four Pillars of Value is Key to Unlocking The Value Of Your Open Data Initiatives¨*
- Christophe Girard, (2017), "La ville intelligente , une avancée d'abord économique », in les Echos
- CISCO, IoE-Based Rio Operations Center Improves Safety, Traffic Flow, Emergency Response Capabilities , 2014, 7p, http://www.rio.rj.gov.br/web/corio
- Smith, A. *¨Smart cities need thick data, not big data¨.* Article Guardian Cities
- Höchtl, J; Parycek, P; Schöllhammer, R (2016): *¨Big data in the policy cycle: Policy decision making in the digital era¨*, Journal of Organizational Computing and Electronic Commerce
- Calani Baranauskas, M. C. E-Cidadania: Systems and methods for constitution of a culture mediated by information and communication technology
- Smith, A. *¨Smart cities need thick data, not big data¨*. Article Guardian Cities
- *Enterprise Information Management, Best Practices in Data Governance*. An Oracle White Paper on Enterprise Architecture, May 2011
- *¨Smart Society Charter - IoT Architecture principles & guidelines¨* / City of Eindhoven Retrieved on: https://data.eindhoven.nl/explore/dataset/eindhoven-smart-society-iot-charter/