# A web platform for evaluating public policies in smart city initiatives

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***Abstract*— For urban planners and policy makers, the sustainable development aimed for smart cities initiatives should be supported by monitoring large amounts of data generated continuously and by sources of varied nature. The evaluation of programs and actions included in these initiatives has to deal with such a dynamic and complex scenario. This paper aims at presenting a web platform designed to support the evaluation of public policies in multi-sector environments and it can be applied for monitoring, assessment and planning in the governance context of smart cities.**

***Keywords*— *Smart cities, policy evaluation, public policies, web platform***

## I. Introduction

The migration of people to urban areas, the continuous increase in population density, the mobility challenges in large cities, the need to optimize the consumption of natural resources and reduce carbon emissions that affect the quality of life have greatly exacerbated the problems of public administration. The consensus rhetoric on the urgent need to mitigate climate change, the pace of technological innovations, the ICT diffusion through all social and productive sectors create favorable conditions to become "more intelligent" cities, by elevating them to a new management level and to higher standards of community life.

The concept of smart city has gained form and despite the fruitful debate on the establishment of a common view on this matter, some definitions have been formulated in order to congregate its main features. In accordance to the Group of the European Innovation Partnership for Smart Cities and Communities, for instance, "smart cities should be regarded as systems of people interacting with and using flows of energy, materials, services and financing to catalyse sustainable economic development, resilience, and high quality of life" [1]. In turn, the ITU-T Focus Group on Smart Sustainable Cities has developed the following definition[1]:

"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects".

In summary, the basic idea behind the conception of smart cities is the assumption that technologies are essential elements to modernize the urban space, so that it is possible to meet the new energy and urban infrastructure requirements, allowing to improve the quality of life of its citizens.

Some solutions for smart cities have been progressively deployed worldwide and, even though corresponding to universal trends and formats, such solutions need to be adapted to the cultural, environmental, political and socio-economic characteristics of the location [2]. To a greater or lesser degree, the solutions are based on the organizing rationality, the creative intelligence, the extent of public policies, the technological advances in general as well on the urban connectivity infrastructure.

Large urban centers are increasingly considered as highly complex systems, maintaining connections between their multiple environments and individuals, hence the growing importance of urban planning and dynamic decision-making mechanisms [3]. According to these authors, the city become intelligent as it can address its challenges in a comprehensive manner and, moreover, there is often in the Latin America, "a lack of understanding and knowledge in the public sector on how to combine technology and management to improve people's lives" [3].

In order to dynamically support decisions and evaluation processes, it is necessary to develop infrastructure, common architectures and monitoring platforms for smart city information, making huge volume data available. Faced with this context, as highlighted by Finguerut and Fernandes in [2], the public managers of most Brazilian cities should face urban renewal processes, among others, with the challenge of dealing with their ability to build scenarios from the analysis of this data volume.

Note that for urban planners and policy makers, sustainable urban development is entirely dependent on data generated continuously in large amounts and by sources of varied nature. The management of an urban plan and its policies is an

[1] Retrieved from <www.itu.int/en/ITU-T/focusgroups/ssc>. Access on 3/11/2016.

ongoing and fundamental process to the achievement of the stated objectives, and should be supported by monitoring performance indicators, during policy evaluation as well as in corrective actions or (re)planning efforts.

To the materialization of such purposes, some actions are strongly necessary. ISO/IEC report of 2015 [4] lists a sort of these actions, for instance:

- The city should be instrumented to allow the compilation of large amounts of data from different sources;
- The data should be presented in a variety of formats, in function of the context and of the technical systems;
- Statistical analyses and decision-making systems should be used, in a manner that data and the constructed knowledge might be used by public administrators and policy makers.

This paper aims at presenting a web platform designed to support the evaluation of public policies in multi-sector environments, so that it can be applied for monitoring, assessment and planning in the governance context of smart cities.

## II. Data and Sustainable Urban Planning

The intelligent use of energy and natural resources of a city, as well as the optimization of transport infrastructure, public services and mobility management, among other needs, relies heavily on sensors, media, connectivity level provided by the internet and a wide variety of associated digital technologies.

Amongst such technologies there are:

- Network access technologies (fiber, mobile, 4G, wifi, etc.);
- Sensor networks and internet of things (IoT), interconnecting devices, systems and services;
- Open data, adherent to public policies;
- Big Data, regarding the collection, processing and analyzing large volumes of data;
- Geographic information system (GIS), to provide location based services;
- Service-oriented architecture (SOA) and microservice approach, in order to provide application functionality independent of vendors and technology standards.

It is clear that all this infrastructure generates a huge volume of data and the interworking control of technological networks within big cities, including in real-time, increases further the amount of information that needs to be addressed. Such information is comprised of structured and non-structured data, generated by numerous sources and stored on different servers and platforms, that need to suit the individual needs of processing and transfer between systems.

To overcome such challenges, architectures and systems for capturing and processing of big data have been developed to combine not only innovative technologies of collection, storage, curatorship, processing and data transfer, but also methods and techniques that allow to extract value from data and provide means for viewing the generated information.

In this sense, analytics has assumed a key role, in descriptive, predictive and prescriptive terms, based on quantitative approaches and statistical analyses, as well as on explanatory and predictive models [5]. Thus, the combination of methods in technological architectures, enabling to work in this scenario, involves interface compatibility between different patterns, dynamic storage systems and relational data management, Business Intelligence (BI) capabilities, and other technologies, which need to be brought together in integrated platforms to support decisions of public managers of smart cities and sustainable development initiatives.

## III. A Platform for Comprehensive Evaluations

An integrated platform for monitoring and analysis, structured with the purpose of supporting public administrators and policy makers, is been designed under the activities of the ICT Policy Instruments Lab (poli.TIC), of the Center for Information Technology Renato Archer (CTI). The basic architecture of this platform, denominated as POLITICSys, is shown in Figure 1.

One assumption is that the data provided by this solution be available for use in the cloud or locally hosted (on-premises), with open source tools in the following layers and process:

- Extraction, cleansing, reformatting and insertion into storage mechanisms (Extract Transform Load - ETL);
- Storage (Data Warehouse - DW);
- Processing large volumes of data (Big Data);

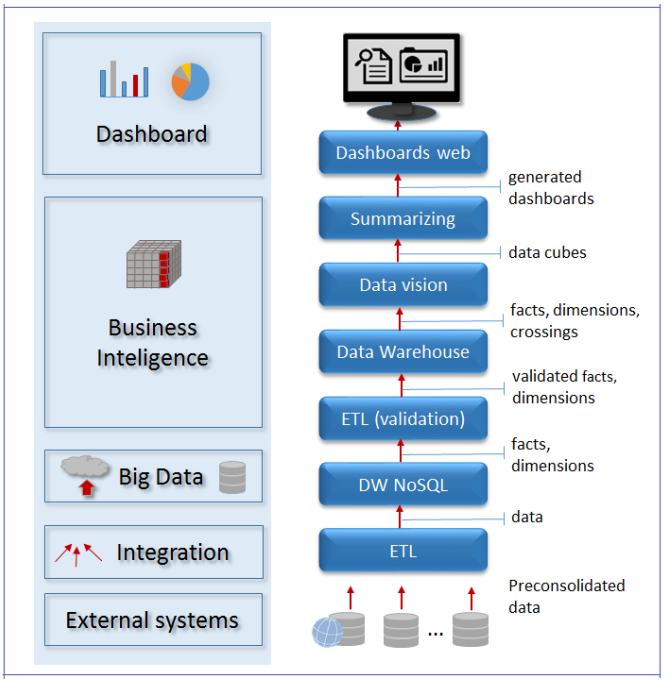


Figure 1 – POLITICSys' general architecture
Source: Authors own elaboration

The authors are grateful to the Brazilian National Council for Scientific and Technological Development (CNPq) for supporting part of this work.

- Intelligence to support decisions (BI) and construction of data views;
- Declarative query language for relational databases (Structured Query Language - SQL) and non-relational databases (Not Only SQL - NoSQL) that support large data amounts;
- Besides open source, web based and lightweight data visualization tools to build charts and dashboards.

By means of these charts and dashboards it is possible to extract management information and track actions registered in any system or smart platform of a city, provided it is integrated into the POLITICSys. The charts and dashboards are generated from BI practices, for example, mining, dimensional modeling, processing and construction of various analytical views.

Another important characteristic of such a platform is the alignment and compatibility with eventual demands for open data by governmental institutions, which is making efforts in this direction. In Brazil, an example in this direction is the Action Plan for Implantation of INDA – National Open Data Infrastructure [6]-[7].

## IV. Final remarks

Data and information generated in the POLITICSys repository may eventually be made available for aggregation and use in the various monitoring systems of public policies, providing a comprehensive and multisectoral framework of indicators. This framework may covers a large range of indicators, from the efficient use of natural resources – for example, energy and fuel consumptions, smart grid operation, water capture and demand –, including mobility and data generated in the urban security repository, up to the use of ICT and actions for digital and social inclusion.

An integrated platform with these characteristics can help public administrators and policy makers in the evaluation, planning and management of smart cities, incorporating solutions that can effectively contribute to save natural resources, promote sustainable development and improve quality of life of citizens.

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