

Porto Alegre: a Brazilian city searching to be smarter

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ABSTRACT

This article presents the findings from the first-round analysis of some initiatives in Porto Alegre, capital of the State of Rio Grande do Sul (Brazil), following the Smart Cities Initiatives Framework from Chourabi *et al.* In order to do that, secondary data from official websites and other available and reliable information sources are examined. The data collected combined with the framework factors of smart cities provide a faithful overview of the evolution of Porto Alegre as a city searching to be smarter. The objective here is not making a deep analysis of these initiatives. Instead, this paper aims at giving an overview of the several initiatives taking into account the eight factors produced by the members of the *Smart Cities and Service Integration Project* research team. The findings demonstrate the potential and the needs of further studies into some of these initiatives by using the interview protocol developed and already used in semi-structured interviews made by this group. This preliminary analysis may lead to the conclusion that the city has fully achieved the requirements of a smart city. However, since most of second data come from official sources that could be considered overly positive.

Categories and Subject Descriptors

H.4.2 [Information Systems Applications]: Type of systems – *e- government applications*

General Terms

Management, Performance, Human Factors, Standardization

Keywords

Smart city, Service integration, E-government

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1. INTRODUCTION

Over the last century, development of urban areas has represented a real challenge for mankind. After World War II most western populations have left the countryside looking for better living standards, thought to be found in urban communities. Migration and people's concentration in cities have increased the challenges for government authorities and their branches, demanding innovation, new ideas and projects to overcome problems like mobility, education and etc.

The impact is stronger in developing countries since the relation between needs and challenges represents many demands to be addressed by insufficient resources. In fact, this deficiency requires a government ready to face it by using modern management techniques and coming up with creative solutions.

The problems mentioned above and the corresponding solutions are not restricted to the boundaries of cities; they are part of the context of the metropolitan area. Furthermore, the increase in population density has allowed metropolitan areas to become regions of economic and strategic importance in their countries.

Analyzing the phenomenon of metropolitan areas in Latin America, Gil-Garcia and Nalda [10] state that they

...are of great importance for economic growth and social development. According to a report published by IBD, these cities produce almost a half of the national GDPs around the world. For example, São Paulo comprises almost 60% of the whole Brazilian economy's value. Similarly, Santiago produces more than 47% of the total Chilean economy. Due to their economic growth, metropolitan cities will continue to grow in the next years. In fact, it has been predicted that around 80% of the total Latin American population will live in cities (p.137).

In addition to that, the World Bank [46] estimates that

...city populations of emerging economies are expected to double, between 2000 and 2030, from 2 billion to 4 billion people. Megacities, such as Tokyo, Mexico City, and São Paulo, are already home to 30 million people or more. The built up area of cities worldwide will triple in size, from 200,000 to 600,000 square kilometers (p. 1).

However, metropolitan areas cannot be considered as an archipelago where several islands are governed independently disregarding what happens beyond their borders. The displacement of people across cities, the need for security - once crime can spread among neighboring urban centers - health policies that require strategies and numerous other

factors demand the establishment of common policies among the cities forming a metropolitan area. There are different reasons for cooperation between cities, but the focus is how to cooperate. According to Gil-Garcia and Nalda, the institutionalization of cooperation can be carried out in three ways [10]: (a) communication conducted through meetings, activities and discussions between governments; (b) coordination flowing through joint projects; and (c) consolidation, which happens, for example, when a program or service has been contracted by different municipalities in a cooperative way.

Overcoming the problems and challenges of major metropolitan areas requires cooperation and integration policies, and technology is a great tool to achieve this cooperation between city members. E-government is the research area that seeks to understand and organize the use of ICT to improve citizen life in a public value perspective. It involves the delivery of public value to people, such as providing information, services and products and it refers to transparency and participation using ICT as a tool in the relationship between citizen and authority [11]. Therefore, it can be stated that e-government encompasses the means of promoting citizenship.

Population growth, economic concentration, urban issues, open government and quality of life were the basic inputs for the construction of a municipal government's new concept: Smart City.

However, smart city is a building concept. Nam and Pardo [23] believe that

A set of the common multidimensional component underlying the smart city concept and the core factors for a successful smart city initiative is identified by exploring current working definitions of smart city and a diversity of various conceptual relatives similar to smart city (p.282)

These authors explored current working definitions of smartness aiming to identify the core factors for a successful smart city initiative. Among several definitions, there is reference to Giffinger e Gudrun's work defining a smart city as "a city well-performing in a forward-looking way in various characteristics, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens". Toppeta [43] introduces the concept of a smart city, according to an approach based on people's point of view and perspectives. According to the author

People want to live in smart cities, with a higher quality of work, study, life and social relations; capable of supporting the expectation of a better future, individually and collectively; compatible with the planets finite resources and people's human right (p.4).

On the one hand, a smart city is the exercise of e-Government, representing a part of its domain. Scholl [35] states that e-Government "is far from maturity and is undeveloped and underdeveloped in various areas". Smart city's concept, scope and understanding have the same inaccuracy as the e-Government, such as lack of organization, standards and more systematic scholarly studies.

On the other hand, some authors have established structures that can be used to systematize the subject, as the smart city innovation framework, comprising technology, organization, policy and context [24]; the preliminary framework in

metropolitan areas, encompassing policy, metropolitan coordination and information sharing [10]; the smart cities model composed by smart economy, smart mobility, smart governance, smart living, smart people and smart environment [9]; and the smart city initiatives framework, divided into two levels, inner circle (technology, organization, policy) and outside (governance, natural environment, economy and built infrastructure and people and community) [4].

This paper aims to analyze the city of Porto Alegre, capital of the State of Rio Grande do Sul, Brazil. However, in the present phase of the study, no specific initiative was chosen. Rather, this preliminary study of Porto Alegre, as a smart city, has found out what has been already done in the city based on Chourabi *et al.* [4] integrative framework factors.

To build this scenario, secondary data related to each of the eight components of the Smart City Initiatives Framework have been analyzed. Our data was taken from official websites and other reliable information sources available providing a faithful overview of the evolution of Porto Alegre as a smart city.

The city's vocation to become a smart city was recognized by IBM's "Smarter Cities Challenge Program Summit", that chose Porto Alegre one of 31 winning cities around the world and gave the city an award on November 15th, 2012, in New York [32].

This paper is organized as follows: section 2 provides an overview of the Smart City Integrative Framework produced by the members of the *Smart Cities and Service Integration Project* research team. Section 3 reports the findings from the first-round analysis of the data, and then the final section presents concluding remarks and signals the direction of future research.

2. SMART CITY INTEGRATIVE FRAMEWORK

Chourabi *et al.* [4] have studied a wide and extensive array of literature from various disciplinary areas and identified eight critical factors of smart city initiatives: management and organization, technology, governance, policy context, people and communities, economy, built infrastructure, and natural environment. These factors form the basis of the smart city integrative framework.

According to Alawadhi *et al.* [1], "this set of factors can help understand differences in smart city initiatives implemented in different contexts and for different purposes. The framework also helps explain the relationships and influences between these factors and smart city initiatives. As illustrated in the framework, all factors have a two-way impact on smart city initiatives. The framework also reflects the differentiated levels of the impact. Three core factors (technology, management and organization, and policy) shape and form smart city initiatives. As well, smart city initiatives may lead to some change in the three factors. Smart city initiatives have a significant impact on various sides of a smart city (governance, people and communities, economy, natural environment, and built infrastructure). These are not only the aspects of outcomes made by smart city initiatives, but the components as contexts and conditions of localities also shape the characteristics of smart city initiatives" (p.3).

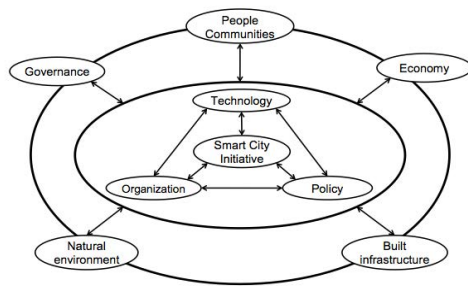


Fig. 1. Smart City Initiatives Framework (Source: Chourabi et al., 2012)

3. FINDINGS FROM THE FIRST-ROUND ANALYSIS

Porto Alegre is located in the northeast of the state and has approximately 1,4 million inhabitants, around one-fifth of the state's population. Being the tenth largest city in the country with a gross domestic product (GDP) that accounts for 18% of the wealth produced in Rio Grande do Sul [13]. Its metropolitan area is composed of 31 cities, with 3.99 million inhabitants, the fourth of the country, and produces about 44% of the state's GDP [8]. In terms of quality of life, the city belongs to the group which has better human development indicators based on three universal needs: education, longevity and income.

The city was included in the table of smart cities of 2010, based on the findings of "Intelligent Community Forum" [42]. This forum included Porto Alegre on the list of "The Smart21 Communities of 2010 - highlights communities from 13 nations" and describes Porto Alegre as "the capital city of an agrarian state" whose

community was a success story in heavy industry until rising costs in the Seventies drove industry to relocate to surrounding 'satellite cities.' To fill the employment gap, the community has focused on building a high-skilled service sector and 'clean' industry clusters in IT and life sciences [42].

This section will analyze several initiatives tackle in the city, during the last few years, based on the eight factors proposed by Chourabi *et al.* [4].

3.1 Technology

Analyzing Porto Alegre from a technological perspective, in *The Smart21 Communities of 2010*, the Intelligent Community Forum emphasized: "It has been a 'greenfield' effort, in which government has labored to build digital infrastructure, create the skills and demand for it, and use it to develop a knowledge workforce. A 350km fiber network called Infovia now connects 190 government buildings" [42].

Nowadays, this optical fiber network is 600km long [5]. The local company, Procempa (Data Processing Company of Porto Alegre), is in charge of this network, called "Infovia", resulting in a backbone that provides a wireless broadband, gathering all the municipal schools in a wide network extending throughout the city¹. Currently, all the scholar data, like evaluations, school records, schedule of classes etc. can be accessed (by login and password) in any place of the regular municipal network [5].

¹ 100% of public schools are connected to the Internet.

The project "Wireless Education" resulted in several benefits to public schools: support in the learning process, annual savings of US\$ 400.000 in the school system by reducing spending on corporate data transmission, telephoning and Internet connection. At the same time, this project faced the digital divide problem, including students of the public educational system in the *World Wide Web*. These gains are in compliance with Helbig *et al* [12]'s conclusions:

...a more integrative approach can help to understand the complex and recursive relationships between E-Government and the digital divide. For practice, this new understanding has the potential to create a more comprehensive strategy that takes into consideration the alignment of E-Government initiatives and digital divide policies such as access, education, and identification of individual needs. (p.95)

Porto Alegre also has another important developing project called "Wireless Health". The main objective of this initiative is to create an integrated information system that qualifies the user service, the working conditions and the management of the healthcare activities in the capital [45]. According to Procempa's website, the system will enable to identify the city's patients of the Brazilian Public Health System (SUS) and create their electronic records, implementing the continued assistance concept. Currently, 131 city health units' establishments - out of 187 - are connected on the Infovia [16].

Still concerning the public health system, Porto Alegre has had a service based on IT provided by its municipal company, the "Telemedicina", since 2008. Using a mobile unity, a doctor can make an obstetrical ultrasound picture on a pregnant woman on-site and the procedure can be simultaneously monitored by specialists in remote hospitals, using the Infovia that connects the entire city. According to official information, "the number of (such) tests is eight times higher than those recorded in the health care centers not yet equipped with the service" [40].

Porto Alegre is among the twelve Brazilian cities that will host 2014 World Cup games, an event that will demand great investment. IBM and the city of Porto Alegre have recently signed an agreement called "Porto Alegre, a Smart City" [33] whose main purpose is to create an intelligent system integrating important data from three municipal services providers: (1) DMAE (water and sewage), (2) DMLU (street cleaning), and (3) SMOV (building and roads). These two different state companies and one department, having the 2014 World Cup as the deadline, must execute it. These data will be inserted in IBM's Maximum Asset Management, customizable software installed on the servers of Procempa. The expected results of the project can be summarized as follows:

reduction of time while providing services; cost reduction; transparency; rework reduction; reduction of material use and wearing out; improve the life span of equipment; and optimize the performance of teams [33].

3.2 Management and Organization

Three main units compose the strategic administration and management of the city: Municipal Department of Management and Strategic Monitoring (SMGAE); (Office of Strategic Planning (GPE) and Office of Innovation and Technology (INOVAPOA).

The SMGAE is responsible for implementing governmental strategic projects: financing, providing resources for its

implementation and promoting the administrative and operational efficiency of strategic projects [37]. Its function is to control projects from development to delivery, to support private initiatives considered strategic to the city and also to assist the mayor's office. Nowadays, the three main projects are: (1) the "Integrated City Entry Gate Project"- an urban restructuring and environmental restoration, involving 30,000 people; (2) the "Bus Rapid Transit" (BRT system) - which combines sustainability, safety, passenger comfort, systems using bus lanes and other integration concepts; and (3) the "CUP 2014" - a comprehensive program aiming to accomplish FIFA's demands, related to the 2014 FIFA World Cup (e.g. airport refurbishment, road infrastructure's restructuring, intelligent traffic control and public transport, improvement in urban mobility etc.).

As stated by the Porto Alegre's official website, the management model is characterized by transversality. It seeks integration between departments; territoriality, considering the 17 districts of the municipality; and transparency by making information available in its Portal [20]. According to the Office of Strategic Planning, strategic programs are classified into four main themes: (1) Sustainable Environmental, (2) Social, (3) Economic/ Finance and (4) Management. Moreover, the city management model is grounded in adding value to the relationship between government, society and local solidarity governance, and its premises are democratic plurality and social responsibility [20].

The INOVAPOA aims to link business and university, stimulate and support interaction between them, develop projects, promote the innovation and technological decision. The department is in charge of seeking local and international partners to make business and articulate innovation and technological public policies. Its vision of future is: "The city as an international benchmark for technological excellence and innovation" [17].

In fact, technology creates a new environment when properly directed by management. Technology is just a tool, which will only generate usefulness and value when conducted by administration, which represents the intelligence of a smart city. Valdés *et al* [44] are aligned with this assertion in defending

...technological change should be accompanied by organizational change (e.g., new institutions for new forms of interaction between public agencies), process redesign (e.g., new processes to operate under new service delivery modes), information technology (IT) governance implementation (to achieve alignment between IT resources and business objectives), and human capital training (e.g., training for staff to operate new technologies). It is also essential to consider how all these aspects interact with each other (p.177).

3.3 Policy Context

The city of Porto Alegre has been recognized as a politicized population and strong regional identity. By cultural, historical and geographical identity, the claims and demands of the population are very persistent, requiring transparency, innovation and accountability in public acts of the Administration. Transparency, the window through which the public sees what the government does and a means of monitoring the acts of the government [7], has been a strong point of the city.

Just to have an idea of how important this characteristic is, the Ethos Institute, an important Brazilian NGO that focus on social responsibility of public and private entities, recently created a municipality transparency index. Despite ranking first among other cities, the city's score was considered intermediate level, with 48.7 out of a total of 90 points [18].

Since 1989 the Participatory Budget has served as an instrument of popular participation in Porto Alegre. It is used to identify the priorities that should be observed in the preparation of the municipal budget. The participatory budget process gathers open participation in regional meetings and election of representatives to specific organs and is divided into three stages: preparatory meetings of government accountability; general meeting of regional and thematic assemblies (seventeen regional and six thematic) and the municipal assembly. Its main goals are to "overcome the serious inequalities in living conditions among residents and to improve the city for social participation in the process" [27]. The positive reception to the initiative, whose success is now well known around the world, determined its continuity despite successive changes of party in charge of capital's government.

The capital of Rio Grande do Sul is characterized by its multiculturalism and by hosting the most diverse currents of thought. Porto Alegre was the site where the World Social Forum was born and has gained the greatest impact all over the world. The *International Free Software Forum*, the main meeting on free software in Latin America and one of the world's largest free software events, also occurs in Porto Alegre. Another important event taking place in the city is the International Observatory on Participatory Democracy (IOPD), where

all cities in the world and all associations, organizations and research centers interested in learning about, exchanging impressions and applying experiences of participatory democracy on a local scale with the aim of deepening the roots of democracy in municipal government [41].

As could be observed, the city government seeks to align the actions of government in accordance with the policy principles for information-based transparency raised by Dawes [6]: stewardships and usefulness. An example of stewardship may be the Telemedicine service, which reduces health risks to patients. In terms of usefulness, the Participatory Budget, an innovative system of popular participation, adopted by cities like Saint-Denis (France), Rosario (Argentina), Montevideo (Uruguay), Barcelona (Spain), Toronto (Canada), Brussels (Belgium) and several cities in Brazil, is essentially a transparent process that generates public value by its democratic character of construction of public accounts.

3.4 Governance

The "Transparency Portal" [31] is the instrument by which the municipality provides all its financial data in real time, allowing citizens to monitor the use of public resources. Since 2010 the portal has also been providing information about revenue, financial and budget execution bids, agreements, contracts, employees' salaries, travel and stay, staff, payroll, staffing and services, procedures for responding the fiscal responsibility law/contracts and works for the 2014 World Cup. Inside the portal a banner called "Citizens Information Service" provides all the explanations about the type of services, accesses

(personally, on the Internet or by phone), response time and information deemed restricted.

The city ombudsman service is divided into four channels: (1) the "Speak Porto Alegre² - 156"; (2) the health ombudsman, to whom complaints can be filed personally, by phone, by e-mail or on the Internet; (3) the ombudsman of the city guard (by phone, email or personally); and (4) municipal employee ombudsman who deals with disputes between employees and their superiors.

The website handles complaints about service irregularities, focusing on four main areas: (1) queueing time in banks, which may not exceed twenty minutes; (2) vandalism acts against public lighting, in order to reduce depredations (savings obtained from 74.5% of spending); (3) pruning and removal of plants without the permission of the municipality, shares of deforestation, earthmoving, occupation of hills, parks and plaza areas invasions; and (4) claims of irregularities in works and tours.

An important initiative under construction involving a public-private partnership is called "Gates of the City" [28], that is an integrated transport system which will establish three major portals near the city center for buses coming from different neighborhoods. These portals are interconnected, integrated and comfortable. The initiative will rely on funding from the private sector since each portal will be a shopping center with supermarkets, shops, pharmacies, etc.

Another interesting initiative is called "Porto Alegre.cc" (Creative Commons), a joint project with the University of the Vale dos Sinos, which created the concept of wikicity for Porto Alegre. Each of the 82 city districts are mapped on the website, through which citizens can give their opinion, create wikispots and stimulate discussion. The navigation enables publishing content on social networks like Facebook, Twitter, YouTube and Vimeo [34].

Yet another source of information available to citizens is the website "ObservaPOA" [25] providing demographic and socio-economic neighborhood information of the city, allowing crosschecks as illiteracy rate and number of neighborhood schools. The data can be accessed on a personal computer or smartphone. The website makes use of geomatic concepts, allowing the spatial geo-referenced visualization of socio-economic indicators. It is a tool that applies a magnifying glass on the topic of interest, whether by geographic location, topics or projects [45].

3.5 People and Communities

Several local initiatives have been created to tackle the problem of digital divide in Porto Alegre. One of them, the "Digital Training Center", was created and has been managed by Procempa, which has already trained 15,000 people at free computer courses, allowing in 800 monthly applications. The free courses "Introduction to Computers", "Operating Systems", "Office Package" and "Internet" are conducted in three shifts (morning, afternoon and evening) and are offered at various

locations in the central area of the city and neighborhoods with lower income population [14].

Besides, since 2001, Porto Alegre has had a "Telecenter Project" which is nowadays managed by the Secretary of Human Rights and has around 35 telecenters spread over the city searching to decrease the digital gap in local and poor communities over 18 regions.

Still concerning the issue of digital inclusion, Caixa Econômica Federal (the second largest public bank in Brazil) and Trensurb (Porto Alegre's metropolitan train company), have signed an agreement to provide financial support to Porto Alegre, aiming to expand the network of Digital Centers, democratizing digital access with 500 new computers to be installed in communities, an initiative seeking success through joint efforts.

An agreement with the Architecture and Urbanism Faculty of PUCRS, the Municipal Accessibility and Social Inclusion Department and the Ministry of Cities resulted in the decision to create the Master Plan for accessibility, making Porto Alegre pioneer in the country in the issue.

In the field of accessibility various initiatives have been developed and improved like: (1) the "Accessible Route", a project that intends to make service, tourism and culture sites accessible to all; (2) "Blue Area", free parking to people with disabilities; (3) "Free Pass": an initiative through which mentally, physically, visually or hearing disabled persons are entitled to free pass on buses, as long as their monthly income does not exceed six times the minimum wage; (4) public program of access to employment for people with disabilities; and (5) Ombudsman's Special Department for Social Inclusion and Accessibility that deals with complaints by people with disabilities concerning services provided by the city.

In the chart of the Capital, the Municipal Department of Urban Security and Human Rights [36], established in 2002, is divided into five areas: affirmative public policies and with the care and referral of complaints of rights violations; security policies and violence prevention; preparation of studies, research and projects in human rights and urban security; improvement actions to be developed in communities, mobilization, inclusion, participation in collective understanding of the issues of security; and digital inclusion of people without access to new information technologies. This department seeks to promote, in an integrated manner, the actions pursuing the inclusion of all segments of the population aiming at improving quality of life in the city.

Analyzing all these initiatives related to people and communities, it could be argued that they are aligned with Servon's statement:

Partnerships between government bodies and other actors will be critical to successful strategy. Governments at all levels can play a key role by creating incentives for the actors that are separately confronting the digital divide to work together [38].

3.6 Economy

Capital of a state whose economy is characterized by strong participation of agribusiness, Porto Alegre has a different distribution, as services account for 62.6% of GDP and industry contributes 30.3%, while agriculture ranks third with only 7.1%. In the metropolitan area the industry's role is quite important, although agriculture remains a secondary position [39].

² "Speak Porto Alegre" is the channel the city offers to the population to fulfill obligations orders stated on Federal Law 12.527/11, called the "Transparency Law", which guarantees public access to city's information.

In the export area, it can be stated that its trade balance is predominantly surplus. According to the 2010 data report there was exported an amount equal to 1,444,159 thousand dollars, distributed as follows: approximately 80% were intermediate goods, 12% of consumer goods and 6% of capital goods [39].

Porto Alegre is ranked the sixth among the capitals, considering the number of establishments with formal employment positions, behind São Paulo, Rio de Janeiro, Belo Horizonte, Brasília and Curitiba. The establishments that grew faster between 2004 and 2010 were those with between 100 and 249 employees and those with 1000 employees or more (both with average growth of 7.7% per year), while establishments with up to 4 employees were the least expanded at a rate of 1.6% per annum [26].

There were 726,098 formal jobs in Porto Alegre in 2010, but a worrying figure referring to job growth from 2004 to 2010 is an average of 3.9% per year, compared to 5.8% of the country. On the other hand, the unemployment rate has decreased steadily to 9.7% in 2009, 7.7% in 2010 and 6.5% in 2011 [26].

The average wage of a formal employee in Porto Alegre in 2010 was approximately US\$1,100, 16.6% higher than the average pay of the metropolitan area and 32.1% greater than the average income of the country. The GDP per capita of the city was about US\$14,500 while Brazil's was nearly US\$9,700 [15].

The distribution of employment by activity shows a high concentration in certain sectors. In 2010, 43% of the jobs were linked to services, 27% to public administration, 16% to trading - a significant employer in the city. The manufacturing industry has reduced participation, accounting for 7.1% of the stock of jobs in 2010 and construction was 4.8% of the total [26].

Some indicators of the city clearly demonstrate its contradictions. According to the data from UNDP [15], the human development index of the municipality can be considered high with an average of 0.830 in the metropolitan area. There are neighborhoods with indexes of 0.977, higher than the most developed country the world in this matter and others with 0.634, which can be compared to Namibia's index. The average human development index of the city can be considered medium-high-high in income and education scale and medium scale in longevity.

Despite being the capital of a state more developed than the average Brazilian states and belonging to one of the most important countries in the world, part of the so-called BRICS, Porto Alegre remains a city of a developing country. The economy, therefore, represents the weaker component, more distant from what should be expected of a smart city, because the economy boosts the competitiveness of cities, improving growth expectations and is one of the strongest drivers of a smart city [4].

3.7 Built Infrastructure

While technology is the tool and management is the way to handle it in a smart way, service is the result. Good results and good services derive from the use of the best tools available to deliver the outcomes the citizen really wants. The acceptance of public services delivering value depends on external components that will validate this provision: perceived ease of use, compatibility and trustworthiness. The perceived ease of use is the utility that the public finds in the service, compatibility establishes the relationship between what is offered and what is desired and trustworthiness derives from the legitimacy of the institution providing the service [3].

Besides the initiatives previously described, many others in Porto Alegre have created the "...capacity to deliver city services seamlessly to residents and business" [1, p.11] alike:

- Infrastructure and technological parks that attracted high-tech companies like HP, Microsoft and Dell and incubators that encourage the creation of new companies.
- The municipal legislation requires of ICT private companies that when installing cabling underground in the city, instead of paying taxes, they should open space identical to PROCEMPA, the public ICT company, a fact that allowed continued growth of the infrastructure of optic fiber (the largest city-owned optic-fiber infrastructure of Brazil) [5].
- Smart roads - through the structure of fiber optics, surveillance cameras at major intersections, allowing traffic monitoring and rapid response to accidents and problems in the flow.
- Besides the services mentioned before, the city is also providing to its citizens free wireless Internet access available through radio equipment connected to the fiber network (information highway). The network covers major parks, squares, important buildings, such as the municipal market, cultural center, etc. and events that are highlighted in the calendar of the capital like, for instance, the Book Fair and Mercosul Biennial. This service, available since 2006, provides free access to the system to whoever owns portable equipment with wireless connection.
- Digital Station - directed to children with cancer who cannot leave the hospital. Through the computer labs, with PCs, cameras and broadband, they can virtually be connected with people and the world from which they are separated [5].
- Bike PoA – a public rental bike system (SAMBA) –which allows the person to withdraw a bike in a specific station by sending a text to a pre-paid system. Porto Alegre has currently 170 bikes distributed in 17 bike stations in several strategic places [2].
- Porto Alegre provides information about ordinary services available on the Internet, like, for example, maps of the city, of neighboring cities and their boundaries, information about bus lines and their connections to the metropolitan train linking the capital city with five other cities, connecting around 2,500,000 people, addresses, phone numbers, email and main data from all the municipal schools [21].
- Other services available online and by phone are: duplicates of water bills, monthly consumption and clarification of doubts, requests about quality and lack of water, reporting accidents and sewage environmental problems. Consultations and monitoring of applications and requests can also be made through the same channel. Through the Internet, all municipal taxes can be obtained from the taxpayer and its tax status can be checked. Likewise, the tax compliance certificates from Secretary of the Treasury may be issued, allowing the citizen to exercise all civil acts that depend on proof of payment of city taxes.
- Regarding construction, it is possible to apply for approval of construction projects by filling out an electronic form via Internet. Likewise, through the indication of a street

name and number of the residence is possible to identify the urban scheme and alignment building to which the property must submit within the City Urban Planning.

- In the field of consumer rights protection, PROCON, the agency that aims to promote consumer protection at the municipal level, allows the consumer to fill out a complain via internet about any violation of consumer rights, such as in food, goods, services etc, regardless of the offense being committed in public or private sector.

Pardo *et al* [29] argue that “many of the services traditionally provided by single government agencies are now the responsibility of complex inter-organizational networks, which sometimes include numerous government agencies”. It could be observed that Porto Alegre’s website tries to fit this philosophy, seeking to integrate the full range of services provided by a complex network in a single repository, allowing citizens to use multiple services in one place, within an integrated concept and smart layout, making it an easy and user-friendly navigation. All these services, provided by different offices, departments, agencies and even private contractors, begin to compose a large menu driven by the needs of the consumer.

3.8 Natural Environment

Traditionally, the environmental issue has been a constant concern of the city, one of the first in Brazil to worry about the subject, even during the military dictatorship period when defending the environment was not well seen by the official authorities. José A. Lutzenberger, one of the most important and well-known Brazilian environmentalists, who received in 1988 the "Right Livelihood Award" prize and also known as the Alternative Nobel prize, was the driving force behind the environmental movement in the state [19].

The legacy of pioneering environmentalist movement strongly influenced the green conscience of the local population, so that the municipal authorities have chosen to pursue sustainability policies, maintaining the green guideline as a goal and a capital strategic option [1].

Following this environmental spirit, municipal government has based its work on several fronts, especially raising awareness about the issue [22]. Porto Alegre is known as “a city of environmental education”, which has been developing various projects and actions such as: (a) Green Collective - seeking the recovery and proper use of the squares by the community, raising awareness about the importance of sustainable occupation of green areas, setting a schedule of occupancy of squares and the maintenance of shared spaces and introducing concepts of environmental education; (b) Using drama and puppetry arts to educate children; (c) Trails in urban parks in Porto Alegre; (d) Environmental Education for All, as tools for inclusion (Braille booklets, etc sensory games); (e) Courses for Educators with experience and practices in environmental education; and (f) Environmental Course for Offenders.

Besides these initiatives, there are some key environmental projects worth mentioning:

- Biomonitoring - it is based on an agreement established in 2008 with the Federal University of Rio Grande do Sul, using the methodology of biomonitoring of air in twelve distinct points (six municipal schools). In each site where a native tree, the "strawberry guava", object of biomonitoring, was planted, information is gathered and used in priority areas for studies of major pollutants.

- Reference Center for Renewable Energy and Energy Efficiency – whose goal is, through public policies, projects and actions, to promote and encourage renewable energy technology, integrating all stakeholders and allowing the sharing of knowledge on the subject, firming partnerships and networking with other networks and reference centers.

The Master Plan of Planting of Porto Alegre, city covered with an estimated one million and three hundred thousand trees, deals with the preservation, management and expansion of the trees in the city. Based on an inventory of trees in the city, guidelines have been established for "planning, production, conservation and management of public trees" [30]. The plan was approved in 2006 and in the following year the Secretary of Municipal Environment launched the revised and expanded edition of the Urban Forestry Master Plan.

4. FUTURE RESEARCH AND CONCLUDING REMARKS

Without a deep study, it is always possible to identify and record initiatives that seem to fit some classification and this may lead to the conclusion that a city has fully achieved the requirements of a smart city. But the conclusion may be incorrect.

The city stands out in several ways, some of them served as a benchmark for other communities within the country and the world. However, by being inserted in a country in the developing world, Porto Alegre has some extremely worrying social data and significant income disparities.

According to the information provided by the official website, it is possible to say that the city has simplified administration, improved access to education and reduced costs in this area, adopted new technologies in diagnosis and health, improved public transport and has also been designing measures to reduce spending energy. Moreover, local media, including editorials and public opinion, indicate that there are serious gaps in security, traffic flow and cutback of costs of public administration.

These contradictions, inherent in all urban conglomerates, stimulate the challenge of improving the city, using technology to enhance the quality of life of its citizens, to deliver better service, to provide accountability of public spending, to instigate participation and cooperation within an transparent environment and economic growth, and also to enable people to live happier in their cities, the ultimate goal of any government.

This article presented the findings from the first-round analysis of some initiatives in Porto Alegre following the Smart Cities Initiatives Framework [4]. The present paper, however, does not analyze any of these initiatives. Instead, the objective here was to give an overview of the several initiatives taking into account the eight factors produced by the members of the *Smart Cities and Service Iniegration Project* research team.

This group has recently created the *Smart Cities, Smart Governments Research Practice Consortium*, which is composed of international teams of researchers and graduate students from the US, Canada, Mexico, and China³. The

³ The Pontifical Catholic University of Rio Grande do Sul (Brazil) is working together with the CTG, which is the leader of this Consortium, and soon will be part of this team.

mission of the Consortium is to ensure the development of a robust smart cities and smart governments research and practice community [47]. This article aims to collaborate with this Consortium offering an additional analysis, in Porto Alegre city, using the smart city integrative framework.

This first-round findings show the potential and the needs of further studies about some of these Porto Alegre's initiatives by using the interview protocol developed and already used in semi-structured interviews made by this group [1]. This protocol offers a standard way to approach the management of initiatives and the interview process. The interview questions focus on management, technology, policy and governance aspects of the initiatives as well as their impact on the environment and communities.

The present paper is limited in its analysis, since most of second data come from official sources that could be considered overly positive. Future publications must focus in person interviews and local observations, aimed to show different views of the initiatives and perhaps report some of their negative aspects

5. REFERENCES

- [1] Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J.R., Leung, S., Mellouli, S., Nam, T., Pardo, T.A., Scholl, H.J. and Walker, S. 2011. Building Understanding of Smart City Initiatives. In Proceedings of the 11st IFIP WG 8.5 International Conference, EGOV 2012 Kristiansand, Norway, September 3-6, 2012
- [2] BikePoa. 2013. Available at <http://www.mobilicidade.com.br/bikepoa.asp>
- [3] Carter, L. and Bélanger, F. 2005. The utilization of e-government services: citizen trust, innovation and acceptance Factors. *Information Systems Journal*, 15(1), pp.5–25
- [4] Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo, T. A., and Scholl, H. J. 2012. Understanding smart cities: An integrative framework. In *Proceedings of the 45th Hawaii International Conference on System Sciences*, January 4–7, Maui, Hawaii, USA.
- [5] Cruz, L. *A Model of Participatory Democracy: A conversation with Luis Cunha of Procempa in Porto Alegre, Brazil*. Available at <http://www.smartconnectedcommunities.org/docs/DOC-2056.pdf?jsessionid=9A3668A70BF73489B6E8CF24082F3390.node0>
- [6] Dawes, S.S. 2010. Stewardship and usefulness: Policy principles for information-based transparency. *Government Information Quarterly* 27(4), pp.377-383.
- [7] Dawes, S.S., and Helbig, N. 2010. Information Strategies for Open Government: Challenges and Prospects for Deriving Public Value from Government Transparency. In *Electronic Government: Lecture Notes in Computer Science*, M.A. Wimmer et al. (Eds.): EGOV 2010, LNCS 6228, pp. 50–60.
- [8] Fundação de Economia e Estatística. FEE. 2013. Available at http://www.fee.tche.br/sitefee/pt/content/estatisticas/pg_pi_b_municipal_sh_pib_nova.php?ano=2009&serie=1999-2009&letra=P
- [9] Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., and Meijers, E. 2007. *Smart Cities: Ranking of European Medium-Sized Cities*. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology.
- [10] Gil- Garcia, J. R. and Aldama-Nalda, A.A. 2011. Government Information Sharing and Integration in Metropolitan Areas: A Conceptual Framework. In Marijn Janssen, H. Jochen Scholl, Maria A. Wimmer, Yao-Hua Tan (Eds.). *Electronic Government. Proceedings of the 10th IFIP WG 8.5 International Conference, EGOV 2011* Delft, The Netherlands, August/September 2011. Springer Verlag: Heidelberg et al, LNCS # 6846, 2011.
- [11] Gil-Garcia, J.R. and Luna-Reyes, L.F. 2008. A Brief Introduction to Electronic Government: Definition, Applications and Stages (In Spanish). *Revista de Administración Pública*. XLIII (2):49-72. (Translated to English in the same journal, p.221-241) Cidade de México, México. Available at http://www.inap.org.mx/portal/images/REVISTA_A_P/revista%20rap%20116ok.pdf
- [12] Helbig, N, Gil-García, J.R. and Ferro, E. 2009. Understanding the complexity of electronic government: Implications from the digital divide literature. *Government Information Quarterly*, 26(1), pp.89-97.
- [13] IBGE divulga as estimativas populacionais dos municípios em 2012. Instituto Brasileiro de Geografia e Estatística, IBGE. 2013. Available at http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=2204&id_pagina=1
- [14] Inclusão Digital: Centro de Capacitação Digital . PROCempa. Available at http://www.procempa.com.br/default.php?p_secao=73
- [15] Índice de Desenvolvimento Humano de Porto Alegre, PNUD. 2013. Available at <http://www.pnud.org.br/Noticia.aspx?id=2103>
- [16] Informatização da Saúde já conecta 131 unidades em rede. Porto Alegre's Official Website. 2013. Available a http://www2.portoalegre.rs.gov.br/portal_pmpa_novo/default.php?p_noticia=157920&INFORMATIZACAO+DA+S AUDE+JA+CONECTA+131+UNIDADES+EM+REDE#
- [17] InovaPoa Official website. 2013. Available at http://www.inovapoa.com/default.php?p_secao=41
- [18] Instituto ETHOS. 2012. Na 15ª IACC, Ethos lança Indicadores de Transparência Municipal, Available at <http://www3.ethos.org.br/cedoc/na-15a-iacc-ethos-lanca-indicadores-de-transparencia-municipal/#.UOSkz2-un6s>
- [19] Lições de um ilustre gaúcho, Zero Hora Newspaper. 2013. Available at <http://zerohora.clicrbs.com.br/rs/geral/pagina/10-anos-sem-lutzenberger.html>
- [20] Management Model, Porto Alegre's Official Website. 2013. Available at http://www2.portoalegre.rs.gov.br/gpe/default.php?p_secao=16
- [21] Mapa Digital Oficial de Porto Alegre. 2013. Available at <http://geo.procempa.com.br/geo/>
- [22] Meio Ambiente, 2013. Porto Alegre's Official Website. Available at <http://www2.portoalegre.rs.gov.br/smam/#>
- [23] Nam, T. and Pardo, T. A. 2011. Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th Annual International Conference on Digital Government Research*, June 12–15, College Park, MA, USA.
- [24] Nam, T. and Pardo, T.A. 2012. Smart City as Urban Innovation: Focusing on Management, Policy, and Context. In *Proceedings of the 6th International*

Conference on Theory and Practice of Electronic Governance, ICEGOV, October 22-25, Albany, NY, USA.

- [25] ObservaPOA Official website. 2013. Available at www.observaPOA.com.br
- [26] Observatório do Trabalho, Porto Alegre's Official Website. 2013. Available at http://geo.dieese.org.br/poa/estudos/trimestral_3_2012.pdf
- [27] Orçamento Participativo, Programa Cidades Sustentáveis. 2013. Available at http://www.cidadessustentaveis.org.br/boas_praticas/exibir/16
- [28] Parcerias Público Privadas, Porto Alegre's Official Website. 2013. Available at http://www.ppp.portoalegre.rs.gov.br/default.php?p_secao=59
- [29] Pardo, T.A., Gil-Garcia, J.R. and Luna-Reyes, L.F. 2008. Collaborative Governance and Cross-Boundary Information Sharing: Envisioning a Networked and IT-Enabled Public Administration. In Proceedings of the Minnowbrook III Conference, Lake Placid, NY, USA.
- [30] Plano Diretor de Arborização Urbana, 2013. Porto Alegre's Official Website. Available at http://www2.portoalegre.rs.gov.br/smam/default.php?p_secao=143
- [31] Portal Transparência Porto Alegre, Porto Alegre's Official Website. 2013. Available at <http://transparencia.portoalegre.rs.gov.br/default.php>
- [32] Porto Alegre conquista prêmio internacional de cidade inteligente. 2012. Available at <http://portoimagem.wordpress.com/2012/11/15/porto-alegre-conquista-premio-internacional-de-cidade-inteligente/>
- [33] Porto Alegre, a Smart City. 2013. Case PROCEMPA. Available at http://lproweb.procempa.com.br/pmpa/prefpoa/procempa_ing/usu_doc/smart_city_case_procempa.pdf
- [34] Porto Alegre.cc (Creative Commons). Official website. 2013. Available at <http://www.portoalegre.cc/>
- [35] Scholl, H.J. 2010. A Study Domain Past Its Infancy. Hans J.Scholl, ed., *E-Government: Information, Technology and Transformation*, Volume 17, Advances in Management Information Systems (Armonk, NY: M.E. Sharp, 2010), 11-30.
- [36] Secretaria dos Direitos Humanos, Porto Alegre's Official Website. 2013. Available at http://www2.portoalegre.rs.gov.br/smdhsu/default.php?p_secao=125
- [37] Secretaria Municipal de Gestão e Acompanhamento Estratégico. 2013. SMGAE, Porto Alegre's Official Website. Available at http://www2.portoalegre.rs.gov.br/smgae/default.php?p_secao=10
- [38] Servon, L.J., 2002. *Bridging the digital divide: Technology, community and public policy*. Malden, MA; Oxford, England: Blackwell Publishing.
- [39] Statistics from Porto Alegre, Instituto Brasileiro de Geografia e Estatística, IBGE. 2013. Available at <http://www.ibge.gov.br/cidadesat/painel/painel.php?codmun=431490#>
- [40] Telemedicine. 2013. PROCEMPA, Information and Communication Technology of Porto Alegre. Available at http://www2.portoalegre.rs.gov.br/procempa_ing/default.php?p_secao=8
- [41] The International Observatory on Participatory Democracy (IOPD). 2013. Available at <http://www.oidp.net/en/about-iodp/about-us/>
- [42] The Smart21 Communities of 2010. Intelligent Community Forum. Available at www.intelligentcommunity.org/index.php?src=gendocs&ref=Smart21_2010&category=Events&link=Smart21_2010
- [43] Toppeta, D. 2010. *The Smart City Vision: How Innovation and ICT Can Build Smart, "Livable", Sustainable Cities*. The Innovation Knowledge Foundation. Available at http://www.thinkinnovation.org/file/research/23/en/Top_peta_Report_005_2010.pdf.
- [44] Valdés, G., Solar, M., Astudillo, H., Iribarren, M., Concha, G. and Visconti, M. 2011. Conception, development and implementation of an e-Government maturity model in public agencies. *Government Information Quarterly*, 28 (2), pp. 176-187.
- [45] Wireless Health. 2013. PROCEMPA, Information and Communication Technology of Porto Alegre. Available at http://www2.portoalegre.rs.gov.br/procempa_ing/default.php?p_secao=11
- [46] World Bank. 2013. Planning, Connecting and Financing cities – now: priorities for city leaders. International Bank for Reconstruction and Development. The World Bank. Available at <http://siteresources.worldbank.org/EXTSDNET/Resources/Urbanization-Planning-Connecting-Financing-2013.pdf>
- [47] CTG is Founding Member of the Smart Cities, Smart Governments Research Practice Consortium. Available at <http://www.ctg.albany.edu/homephotoalbum?photo=14>