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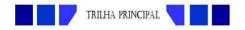
# Smart Cities as Support and Legacy of Huge Sport Events

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Abstract. In this paper we discuss the concept of a smart city and the importance of huge Sport events as an incentive to the creation of the infrastructure necessary for the development of cities that provide quality of life for all its citizens using information technology.

*Keywords* — **smart cities, strategy, management, infrastructure, megacities, huge events, technology.**

The 21st century was called "The Century of the Cities" in 2008, when the world's urban population surpassed the rural one. Urbanization brings several advantages for the economic development – cities are innovation, cultural and knowledge centers, where new ideas are developed and applied. There is a clear positive correlation between a country's economic growth and it urbanization degree. In spite of the fact that not all urban countries are developed, there is no developed country that is not highly urban.

Hence, we are witness of an acceleration of the human migration to the cities. The modern city is one of the biggest collective inventions of humankind, allowing for the creation of an economy of scale that would be unthinkable is an agricultural world. The city, with its agglomeration of complex processes, makes it possible for contemporary civilization to exist.

In 1800, the largest city in the world was London, which had close to a million citizens. In 1960, the planet had 111 cities with more than one million inhabitants. In 1985 they were over 280 and now more than 300. According to UN projections, in 2025 they will be 527. In Brazil, we have 13 cities that have more than one million citizens. The number of megacities (with 10 million persons or more) climbed from five in 1975 to 14 in 1995. In only twenty years the number of megacities more than doubled. Each year more than 60 million persons, all over the world, migrate to the cities.

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In 2008, half of the Earth's population lived in cities. It is estimated that in 2050, at least 70% of humankind will live either in cities or megacities. Studies from the WorldWatch Institute (World Studies, , O'Meara, 1999) show that urban areas are responsible for 80% of carbon emissions and 60% of the world water consumption.

In Brazil, the situation is not easy either. In 1975, 61,8% of the population lived in cities. In 2000, this number came to 81,2% and in 2015 it will amount to 87,7%. Actually, in two generations we changed from a rural country into an urban one. Our cities had to accommodate between 1950 and 2000 close to 120 million Brazilians, coming from the vegetative growth and from the migrations from the rural to the urban world. In Brazil's case, medium sized cities also presented a higher population growth than the bigger ones, averaging about 2% growth per year, quite above the national average. This migration occurs due to the simple fact that humankind seeks in the cities for the opportunities of human, economic and social development opportunities that become feasible in the conditions of economy of scale that are offered by urban agglomerates.

Cities are becoming ever more important. In the USA, for instance, New York has a GNP of 1.2 trillion dollars, which is equivalent to the GNP of Australia, while Los Angeles, with is 732 billion dollars GNP is equivalent to Turkey. Brazil, like most countries, is ever more urban and its population is more concentrated in the cities. São Paulo, for instance, with its 11,3 million inhabitant, has a GNP of 389 billion reais, which amounts to 12% of Brazil's GNP.

According to a study from McKinsey Global Institute, Latin American 198 bigger cities (with 200.000 or more dwellers) contribute with more than 60% of the GNP. Besides, this region will have close to 85% of its population living in cities (against the current 79%), a number smaller only to North America's 86%.

Analyzing our country, we realize that the unordered growth of the big cities has created many problems, such as traffic jams, the growth of the slums, higher criminality and serious infrastructure problems such as saturated hospitals and serious deficiencies in the public schools.

The challenge that arises is to create smarter cities, minimizing or eliminating those problems and creating conditions for sustainable economic growth.

The technological convergence made possible by the dissemination of computers, their cheaper price and the wide use of the Internet are fundamental weapons, but it is also essential to modernize structures and governance models.

A big part of the current problems was created by governance models that are oriented to short term goals and by a deficient planning, both of with take to unordered occupation and to an inadequate infrastructure when the city demands are taken into consideration. Hence, in order to be considered smart, cities must be redesigned, creating a more modern and more sustainable urban infrastructure, expanding significantly its multimodal public transportation network and integrating technology into its daily life.

But the real question is how to act. It cannot be denied that the world has more instrumentation (we have more technologies such as sensors and electronic labels with Radio Frequency ID that can show use what is happening in real time) and is more connected (those sensors can be connected through the Internet, creating a true "Internet of Things").

Technology brings significant change in itself. For example, in the end of the XIX century, the London City Council had a great problem: how to deal with the thousands of tons of horse manure that covered the streets all through the year? The solution can with a radical technological change: the automobile, which simply eliminated the need for horses. This is an example of elimination of existing urban problems which makes the city nicer to live in that is made possible by technological evolution.

Redesigning cities to make them smarter is to add efforts and knowledge from different areas, such as architecture, urban planning, engineers and CIT (communications and information technology) professionals, uniting the traditional technological world with the operational technology one (embedded technologies in elevators, sensors, roads, bridges and semaphores).

Hence, it is only natural that we think of converging the world of physical infrastructure of the cities with the world of IT. These worlds have evolved in parallel. Physical infrastructure was always thought analogically, such as roads, buildings and ports, while IT is the world of data centers, software and routers.

The concept of Smart Cities intends to integrate both worlds, using the concept of Internet of Things as the subjacent communication mechanism. For instance, instead of building more roads and avenues, why not make the current ones smart? The way to put this intelligence into practice is by using instrumentation and interconnection technology that already exists, applying them to the new applications and uses.

This example shows a new way to look at CIT – not only as administrative tasks support, but as a driving force for new ways to use our infrastructure and as its modernization and optimization brokers. The technology and the systems that make the city must be ever more interconnected and cannot live in isolation.

A more instrumented city can gather and treat data much more quickly and efficiently. A simple example may be the installation of sensors that can monitor in real time the water distribution network in order to detect contamination and leaks in the moment they occur. Technology already allows us to measure and control things that used to be beyond our reach. Besides, interconnection allows for sensors to trade information among themselves and with other computer systems, initiating and coordinating either corrective or preventive actions in a fully automatic way. We can also say that the city becomes more intelligent if it applies analytical models and algorithms on the raw data gathered by those sensors, improving significantly the decision making process in public management.

My perception is that in the next years we will see a huge evolution of the solutions that are included in the concept of smart cities, that is, solutions that allow for the convergence of the digital world and the physical infrastructure one. We will see more innovative solutions that will include embedded technologies, such as sensors and actuators, which will be able to gather, transmit and analyze a huge amount of information, allowing for automatic reactor to changes in the environment that they will be monitoring and controlling.

One example of this idea is Singapore, which created an intelligent transport system that can even predict future traffic jams based on information collected by sensors and analyzed by sophisticated algorithms.

Nevertheless, in order to achieve this goal we have to take many steps. Cities, in order to adopt the concept of smarter cities, must define a Smarter Cities Roadmap that contemplates the following issues:

a) A long term strategy that includes goals and concrete short term actions in an adequate and constantly updated master plan ;
b) Priority must be given to investments that cause the larger impact in society;
c) Integration of the  many systems that make up the complex city infrastructure connection network;
d) Optimization of its service and operations.

Unfortunately, we see that many of the existing master plans are either a simple wish list or futuristic visions, without compromises to the real world. Most of the times, city systems respond to crisis instead of acting to prevent them.  For instance, after unordered growth in a certain area, corrective measures are taken to improve traffic bottlenecks caused by the increase of vehicles on streets that were not conceived to

receive such traffic.  A preventive system would coordinate population growth in that are with traffic, security, waterworks systems, among others. Traffic experts estimate that a big city must review its circulation goals and strategies every five years, but is there any city that does that?

Therefore, the first step in the direction of creating a Smart City is to define what the city intends to be in 15 to 20 years, which is the essence of an adequate and well done master plan. A Smart City is one that offers quality of life and is attractive to new business, two goals that are deeply influenced by the efficiency of the city's core systems, such as transportation, public security, health and education, among others.

How to do it? A simple suggestion is to start with a diagnostic of the current situation of all the city's systems that will help to build a vision of what it will be 20 years from now.

Cities can be seen as a complex and multidimensional network of integrated components or as a system made of systems that make its basic infrastructure, such as transportation, energy, communications, education and health. Its cultural, economic, social and geographic characteristic create unique contexts, making it absolutely necessary for us to have an analytical and holistic view  in order to understand its challenges and to propose specific solutions in order to make them Smart Cities.

Therefore, each city has its own characteristics, priority and vocations.  Hence, a strategy that is adequate for a city cannot be automatically transposed to another. A simple example is the traffic system. In some cities there is a strong traffic towards the downtown are in the morning and the reverse traffic in the afternoon. In others, traffic flows in all directions, without a strongly defined flow and counterflow notion. Hence, a solution for a characteristic traffic model will not always work adequately to the others.

 When looking at the economic aspect, we can see that the economies of some cities are mainly industrial, while others are based on services.  Demands for certain types of infrastructure have different characteristics on those two types. For instance, in industrial economies, there is a certain concentration of traffic at certain specific times. In service based economies, traffic is diluted all through the day and becomes lighter at peak periods.

The master plan must serve as a planning mechanism and integrate all links of the city's chain of services, creating a holistic view of the city and its systems.  For instance, in service based economies, using the home office and, consequently, broadband Internet must be a priority. Hence, we must think of the integration of energy, transportation and communication plans.  Many of those services can be made available without the physical presence of those involved. Besides, a decision that involves one of those systems cannot be made without considering the impact on all others. An example of this situation is the fact that a decision on the energy system must consider the impact it will cause on the city's water, transportation and business systems.

Turning a city into a Smart City requires a strong alliance among govern, business and society itself. An example of the bigger participation of society in the discussion of its problems and its future is the portal PortoAlegre.cc (http://portoalegre.cc/).

The master plan must also define clearly the short term goals that will be reached. Specifications such as "improve traffic" must be well defined into goals such as "reducing the average trip time between neighborhoods X and Y from 30 to 15 minutes in a year". Another good example of improved specification would be to change "improve school attendance" into "reduce the level of school absenteeism by 30% until the end of 2012".

In order to spread the use of communication and information technologies, which are as important as water services nowadays, we must give special attention to specific metrics such as the percent of the city that will have broadband access (either through cable or wireless), the percent of homes with computers, the percent of the population with Internet access or that accesses e-gov services, the percent of the public offices that have websites, the percent of the public acquisitions that are done through electronic purchases and many others.

Let us exemplify this concept with hypothetical strategies. The first idea must be to reduce traffic jams. Management and operation of transportation systems have a great influence on the cities economies. Traffic jams cause a negative impact on quality of life and decrease economic productivity. Some estimatives show that traffic jam can decrease cities GNP between 1.5% and 4%. A recent survey performed by IBM (The Globalization of Traffic Congestion: Commuter Pain Survey) showed that the negative impact on the GNP is at 2,4% in São Paulo, 2,6% at Mexico City and 4% at Manilla, Philippines. If nothing is done, the situation tends to become even worse. Close to 1000 new cars are licensed every day in São Paulo at traffic grows four times faster than the population in cities such as New Dheli and Bangalore, in India.

Improving traffic can bring measurable gains. There is an estimation that a small reduction of 5% in travel time in UK roads could generate an increase of 0,2% in GNP. Hence, we have a great challenge that cannot be left behind. Urban mobility requires concrete and swift actions, like those taken by some cities such as Stockholm, Sweden, that created a tax to avoid traffic jams (details of those can be found at http://en.wikipedia.org/wiki/Stockholm_congestion_tax ) using a license plate recognition system that is described in http://domino.research.ibm.com/odis/odis.nsf/pages/case.32.html.

Another important target is public security. A city's touristic and economic attraction is directly linked to its security level.

Nevertheless, public security does not imply solely on hiring more policemen but also on using more intelligent systems that integrate resources such as intelligent cameras and detection systems able to analyze police statistics in real time, increasing the intelligence of the police force and its city. With those systems, we can identify incident patterns in order for the police force to act to prevent occurrences, eliminating potential problems before they occur. Besides, public security systems must be integrated with the health system (emergency response system) and the transportation one (traffic management).

A simple method to improve diagnostic quality is to adopt benchmarks among cities that share similar characteristics. Besides, sharing best practices, which is a common practice in private companies, can and should be adopted in public management.

The challenges are huge. Many cities have an obsolete and inadequate infrastructure that cannot support their population and economic growth. Others have to create an infrastructure that is practically non-existing. Studies from McKinsey (Preparing for China's Urban Billion) estimate that China will have to create 170 new transportation systems until 2025. This is a challenge, but also an opportunity to create an infrastructure that is already adequate to the concept of Smart Cities that we describe in this paper.

Budgets are limited and increasing taxes in not a solution in any country. Our reality in Brazil is proof of that – we have one of the highest tax burdens in the world and our cities have deficient infrastructure to show. We must increase public revenue by creating more efficient and transparent taxing systems, eliminating loopholes that allow for fiscal elusion and reducing operational cost of the cities' own systems. Many cities have departments and organs that work in an independent and non synchronized way that is both redundant and expensive. By applying the concept of holistic view, tasks can be integrated and public databases instrumented in order to increase public corporative intelligence and increase the power to uncover iniquitous evasion strategies.

Technological advancements have allowed for cities to search for different and innovative solutions for these problems. It allow for better instrumentation of infrastructures – with ever smaller technologies, we can add intelligence to the networks, allowing for cities' management and operation to decentralization, with a local decision process, improving its performance, scalability and decision speed.

The path towards a Smart City does not go only through technology, but IT is the driving force of these transformations and improvements. Gathering and analyzing data in real time created opportunities that were not imaginable in infrastructure management. We can think in innovative ways to create public policy, supported by the massive use of sensors and actuators. Population involvement is also increased by using technologies such as social networks. In the end, people,

processes and management are the true pillars of a more intelligent city.

In the next few years we will have an unique opportunity of organizing two huge sport events, the Soccer World Cup in 2014 and the Summer Olympics in 2016, in Rio de Janeiro. These events are driving forces for infrastructure works that should go beyond the scope of the events. These events are a picture, but their legacy must be cities that are more prepared to support their own economic growth. Time is short and all of us must demand that he legacy is the main goal of the huge investments that are being made toward hosting these events.

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