Using Public Private Partnership models in smart cities– proposal for Croatia

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Abstract - How smart is a "smart city"? According to Asian examples of newly growing smart cities, usage of technology can improve life standard and reduce cost of living, improve operational efficiency, environmental sustainability, ecofriendly infrastructure, smart technology Internet of Things (IoT), smart living and direct citizen participation in decision making process. Learning, adaptation and innovation could be the future for Croatian cities by using all mentioned, which will improve social, regulatory and safety indicators for designing a better living environment for Croatian citizens. While using Public Private Partnership (PPP) models, crowdsourcing and democratic ecologies which provide better and more efficient public services by taking advantage of private sector's "knowhow", cities will create long-term investment opportunities and sustain real time optimization strategies by providing safe and reliable place to invest. The intention of this paper is to show how the (local) government's role in PPP projects is to evaluate and approve detailed execution plans of the concessionaire while the private partner's role is to design, build, finance, and operate the facilities. In futuro, digital technologies offer numerous possibilities for citizen participation in decision making at local and regional government level.

The key words: Internet of Things, smart city, Public Private Partnership, concession models, public procurement, decision making.

I. INTRODUCTION

A common definition of a 'smart city' has not yet been determined. Many authors use various definitions to clarify what is a 'smart city'. Authors define it as a city that bets a lot on the quality of living and where the citizens are involved as main actors in decision processes [1]. At the beginning of an attempt to define a smart city, we should start by pondering upon cities and systems which operate in them. Cities have a duty to fulfill the needs of their citizens through various systems. The types of systems are by no means exhaustive, but certainly include public services such as light management, traffic and transport organization, waste and water management, administration policies, security, energy sustainability and information services. Regular cities operate and supervise every system as a separate unit, which in return produces more costs for taxpayers with slight to no improvements in the quality of living. On the contrary, 'smart cities' use Information and Communications Technologies (ICT) with Internet of Things (IoT), to create connections and interactions between some or all the systems, cutting expenses and improving the quality of life for citizens during the process.

We believe that a 'smart city' is a city where investments are focused towards smart citizens who use renewable energy resources wisely and widespread technological networks to combine sustainable economic growth whilst improving the quality of life, through the open government model by the interaction of all stakeholders. Regarding future, Croatian 'smart cities' use of renewable sources of energy, ICT and sustainability combined with usage of Public Private Partnerships (PPP) is a crucial model which could easily adapt to Croatian legislation and Croatian way of living.

In terms of innovation and quality of living a set of indicators, such as: air quality, water, greens, waste handling, energy consumption health issues, urban mobility and logistics should be analyzed. Also, the key features of the 'smart city' are: smart governance, smart mobility and smart energy as an educational and communicational tool for opinions of the citizens, the technology supporting the Social Networks like YouTube, Facebook, Twitter and others can be employed when influencing political decisions including functions in cities, urban spaces, water, waste, in one word living [2].

The aim of this paper is to set forth in which direction should Croatian cities advance in the near future, according to the successful models of smart cities worldwide, and implementation of PPP models for building smart cities in Croatia. Furthermore, the paper will recommend improvements of current legislation towards an open government.

II. DEVELOPING SMART CITIES

Today is the age of technological revolutions! Technology and science have brought many conveniences to the citizens of the world, most of which we are not even aware of. The idea of a 'smart city' has drawn governments' attention, especially in South Korea, Japan, India and China. They believe that 'smart cities' could bring more benefits to their citizens.

Cities around the world are facing the impact of series of emerging megatrends like accelerating urbanization, new technological developments, increased connectivity, demographic shifts, climate change, scarcity of natural resources and many more changes. But so, has the need for cities and regions to collaborate on global issues like climate change and public safety. In this context, it has become important for a city to understand its national, regional and global position. This enables the city and its stakeholders to set appropriate policies, develop an effective strategy and plan for actions accordingly, all aimed at the sustainable development of the city [3].

According to the research conducted by the United Nations in 2014 more people live in urban areas than in rural areas globally. As stated in Figure 1 below, in 1950, 70% of people worldwide lived in rural settlements and less than 30% in urban settlements. In 2014, 54% of the world's population is urban. The urban population is expected to continually grow, so by 2050, the world will be 1/3 rural and 2/3 urban, roughly the population will reverse in comparison to what we had during the 1950s. Europe already consists of 73% of its population living in urban areas. The United Nations' research predicts that over 80% of Europe's population will be living in urban areas by 2050. [4]

Development of 'smart cities' requires continuous and joint effort of all participants in the process. Urban stakeholders include governments, scientific institutes, companies, citizens and NGOs who innovate together to up the quality of life of the 'smart cities'. However, the connection between citizens, technologists, and urbanists is not strong enough. In order to improve the current urban settings Croatia needs to design a pattern to develop a universal platform between stakeholders on a local level.



Many corporations and investors assume that fixing cities is the purview of government, and that the government will proceed in that manner. But governments around the world are stuck—financially, politically, or even both. They can't rely to single-handedly address the problems of urbanization or to start solutions, such as efficient electrification and reliable public transport which will instantly drive economic growth. By implementing those solutions large amounts of capital, exceptional managerial skill, and significant alignment of interests all of which are often in short supply in city governments but abound in the private sector are required. That is the main reason that South Korean 'smart cities' like Songdo (the city built on reclaimed land) [5] used PPPs to define infrastructure types, and the roles of public and private parties when they were looking and arranging the means and ways for financing 'smart cities'.

III. THE HOWS AND THE WHYS TO BUILD A 'SMART CITY'

A. Financial support

The Smart City industry is growing constantly, and it's predicted to be worth more than 20 billion dollars by 2020, while the annual global Smart City revenue is expected to reach 88.7 billion dollars by 2025. [6] In the Asian countries, funding of 'smart cities' have been conducted through government incentives, local subsidies and private entrepreneurships projects.¹

As for Croatia, the possibilities are more diverse; other than national and local subsidies, there are European Structural and Cohesion Funds. The European Union (EU) is encouraging Member States to develop smart cities by allocating 365 million euros for this purpose. [7] Also the EU brought new financial instruments supporting environmental and climate action projects from which, cities can withdraw the funds. They include: the Financial Instrument for the Environment and Climate Action (LIFE) Programme, Horizon 2020 and Intelligent Energy Europe (IEE).

Barcelona and Amsterdam developed systems by which citizens and companies can interact on solving key city issues with 'smart' solutions. Barcelona's project "BCN Open Challenge" set out six challenges for businesses and entrepreneurs to provide solutions for transforming public spaces and services. The city government sought to procure innovative solutions, support winning companies and validate projects. Winning solutions were provided with public service contracts to fulfill their solutions. [8]

B. Government's role in the PPP projects in the 'smart cities' development

In the local governments sequence of events in the development of 'smart cities' largely depends on the mayors. If they are willing to promote sustainability, then it becomes the priority, and some of these categories of sustainability include: transportation, utilities, electricity, thermal energy, renewable energy and others. The point is; after the establishment of the 'smart grid', infrastructure will significantly reduce the environmental impact of the whole electricity supply system. The goal is a holistic

¹ For example, IBM provides cities around the world with grants of IBM expertise and technology which will aid cities with their strategic challenges. To find out more: https://www.smartercitieschallenge.org/

approach in which all the processes are conducted by applying IoT (Internet of things) technology and application of VTV (Vehicle to Vehicle), intelligent transport systems. It's expected a real-time optimization of traffic routes, traffic on the roads and to allow easy selection of different modes of transport and measure the effectiveness of the current system of distribution of energy available at any time on any smartphone app. E.g., in how much time does the tram or bus arrive or in which street is lesser traffic, how much moisture is in the air, what is the current outdoor or indoor temperature, CO₂ and other pollutants level? Possibility for a new clean mobility solutions that complement bicycling and public transport and the application of VTV intelligent transport systems; communications are expected within real-time optimization of traffic routes, traffic on the roads, by simply choosing between different modes of transport.

The possibility of cooperation between the public and private sector (PPP) - (following the example of South Korea's Songdo and other smart cities of Asia), which opens the possibility for withdrawal of additional funds from the EU Structural and Cohesion funds. When speaking of Croatia, investing in innovative strategies improve the efficiency, savings and promote the development of the real sector. For such operations, it's necessary for local governments to reduce utility fees in order to encourage the construction of smart infrastructure and significant energy savings, reduction of municipal fees and increase incentives for small and medium-sized enterprises (SMEs).

As one of Europe's examples of a proactive and 'smart city' oriented government - Amsterdam appointed a Chief Technology Officer (CTO) for the city. Also, they founded the Amsterdam Metropolitan Solutions (AMS) as an institute focused on applied technology. It's built by a consortium of public and private partners. AMS aims to attract and retain talent in the field of applied technology, create sustainable connections, drive a positive economic impact for Amsterdam by innovating, developing and marketing metropolitan solutions in urban themes such as water, energy, waste, food, data and mobility. In addition, their Amsterdam Smart City [9] is an online platform which connects all interested parties in one goal: dealing with 'smart city' problems and solutions. [10]

C. Benefits

Smart cities aim to improve the functioning infrastructure, access to resources, and safety and security for the population [11]. The European Commission tells us that: in 'smart cities', digital technologies translate into better public services for citizens, better use of resources and less impact on the environment [14]. Figure 2 shows an independent and symbiotic energy management system in which the value is expanded by the next generation energy use, where the residents and city itself cooperate in conservation of renewable energy resources.

There are some small changes that can save huge amounts of energy, and it can be obtained when for instance active measures (building automation systems) and passive measure (low energy bulbs) are used constantly, furthermore, some European countries like Italy have already implemented mentioned measures and the savings in thermal consumptions for heating and cooling can bring up to 26% [2].

Sustainable strategies application should already start today since those will increase energy efficiency in the next half century. Some of the most effective models of combining the PPP in order to develop smart cities in Asia (Songdo, Seoul, Fujisawa) and the EU (Barcelona, Amsterdam, Vienna) have already benefit from the implementation of 'smart city' strategies. Barcelona saved \$58 million annually using smart water technology, and the city has increased parking-fee revenues by \$50 million annually utilizing smart parking technology. The government also stated that Barcelona has created 47,000 new jobs through its Smart City efforts. [13]



Figure 2: From smart management to power savings. [15]

Cities that implement 'smart' solutions for usage of energy resources, manage water supply and have a waste management system reduce pollution and use less energyaccording to Cisco, their energy efficiency will increase by up to 30 percent within the period of 20 years. [16]

In the city of Songdo, this is obvious throughout the city. The city's garbage collection is so automated that it only takes seven employees to serve the current 35,000 residents. [17] The kind of efficiency which is unimaginable in European cities.

A Croatian example of implementing IoT into cities include Dubrovnik's praiseworthy efforts. As a part of the comprehensive Dubrovnik Smart City project, in 2016 Dubrovnik opened a Smart street which features public lighting with multifunctional sensory network, alongside a variety of access technologies, from optical links and 4G network to the Wi-Fi network, cameras to identify traffic violations, parking technology which recognizes vehicles and performs contactless charging of parking fees and offers real-time information on the parking vacancy status in the Smart Street, but also all over Dubrovnik. [18] In addition to this, Dubrovnik also held conferences and competitions which resulted in other IoT solutions towards a smart city. [19]

Other measures for improving transport sustainability in Croatian cities are the inter-modal mobility as well as carpooling and car sharing and support to the soft mobility (on foot and bikes). Cities 'green areas' such as: parks, gardens vertical gardens, green roofs and facades show not only that people prefer to live in those cities where they can breathe and see plants, trees and flowers but also contribute to climate protection (improved air quality and cooling down air temperature while producing its own microclimate and help save on heating, cooling and increasing comfort inside the building), [2] which can easily be connected and implemented by IoT (e.g. Songdo's remote energy monitoring systems which bring the power to IoT and save the energy), especially in the Croatian cities by the sea.

IV. SUCCESSFULNESS OF IMPLEMENTATION OF PPP MODELS TO THE CROATIAN ECONOMY

The promotion of PPP projects is expected to ripple effects on the national economy through three channels:

• economic growth resulting from the inflow of private capital

• increased social welfare resulting from the timely delivery of social services and the early realization of social benefits

• reduction in the government fiscal burdens through better VFM (value for money) [12].

A. Institutional settings

In accordance with the Croatian PPP Act², article 2, paragraph 7 the public partner may allow the establishment of the right of construction in favor of the private partner and free of charge. All issues related to the establishment or transfer the right of construction and awarding of concessions, including the question of fees, public and private partner, regulate contractually. The basic principles in the implementation of PPP projects are the principles of public procurement, the principle of protecting the public interest and the principle of economy. The PPP Act is proposed and authorized only by the public authority, and that is the reason why; primarily mayors should try to establish a setting where entrepreneurs can create solutions to improve quality of life --- without added any of government expense. In order to facilitate PPP implementation, the PPP grants land expropriation rights to the concessionaire. The concessionaire may entrust the competent authority or the local government with the following responsibilities of execution of the land purchase, compensation for loss and more [12].

² The PPP Act, Official Gazette [in Croatian] Zakon o javno-privatnom partnerstvu, Narodne novine, nb. 152/14, (Narodne novine are an official Gazette of Republic of Croatia)

PPP Act, The Concession Act³ and the Public Procurement Act⁴ regulate the procurement procedure designed in a way to ensure value for money (VFM) of PPP projects. Korean study analyzed the efficiency of PPP project from 3 different perspectives: users. concessionaires and the government and it showed both cost savings and efficiency gains. The main problem that the study discovered was the level of user fees between government financed and privately invested projects, which decreased over the time in proportion to accumulated experience in PPP projects. For PPP projects to be carried out efficiently, one of the most important prompting competition among private issues is participants bidding for the project [12].

Agency for Investments and Competitiveness is a Croatian Agency set up by the PPP Act whose main tasks are to give investors full view of services to invest and implement in projects for the improvement of the economic growth and business environment and to promote Croatian PPP model as competitive. [20] In 2016 only one PPP project worth 4.6 million Croatian kuna has been contracted. But in 2014 and 2015 no PPP contracts have been signed. [21]

On the EU level, in 2014 new procurement directives have been adopted, replacing the 2004 directives and covering the award of concessions. The new directives open several opportunities for 'smart city' investments, while maintaining the basic requirements of competition, transparency, equal treatment and compliance with EU state aid rules.

The key directives are:

- 1. Directive 2014/24/EU on public procurement⁵,
- 2. Directive 2014/23/EU on the award of concession contracts⁶,
- 3. Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors⁷.

B. Open government

The *E-government* is changing the way in which politics interacts with citizens and the democratic processes can be enhanced but the main goal is to turn the government tools from an 'office-centric' mode to a 'citizen-centric' mode [2]. These new and innovative forms of governance have been included into the term 'smart governance' under which the government manages and implements policies toward the improvement in quality of life of citizens by leveraging ICTs and institutions and by actively involving and collaborating with stakeholders [22].

While it may be true that ICTs are introducing a range of new capacities for the design and planning of human urbanization, questions remain about the network

³ The Concessions Act, Official Gazette [in Croatian] Zakon o koncesijama, Narodne novine, nb. 143/12

⁴ Public Procurement Act, The Concessions Act, Official Gazette [in Croatian] Zakon o koncesijama, Narodne novine, nb. 120/16

⁵ OJ L 094, 2014, implemented by Croatia

⁶ OJ L 094, 2014 currently not implemented by Croatia

⁷ OJ L 094, 2014 currently not implemented by Croatia

capabilities of smart cities to remake systems of government. Government systems are now increasingly under pressure to develop institutional frameworks that support tools and resources for empowering citizen agency.

The overarching idea is that smart city planning should - at the very least - incorporate experimentation with new forms of community and citizenship [23]. Citizens have a leading role in designing, building and maintaining 'smart cities'. This calls for a fundamental shift when we think of our cities and about urban development in the near future. Citizen participation reduces government corruption by expanding public insight and decentralizing government power, [23] by giving them the ultimate decision in the adoption of the city's services and the creation and management of public value out of them. Even large-scale projects can be enhanced by crowdsourcing, while cities can collect data, give answers to simple questions e.g. about how they want to use their public spaces or acquire services for bringing innovation and 'smart' thinking to acquire powerful results. [24]

In the USA, the Open Government was introduced by Ex-president Obama in 2009 in legislations such as: The Freedom of Information Act, E-government Act and The Paperwork Reduction Act. Open Government could improve and advance citizen participation in the process of building democratic ecologies of 21st century in The Republic of Croatia.

Croatian *Central country portal*⁸ and within it an Ecitizen system is an example of enabling citizens' various options within a single platform by merging and connecting IT platforms. That example should be followed on decentralized levels of cities and regions, which should include a 'smart city' sector for all stakeholders to interact.

C. Building 'smart cities' through the concession agreements and public procurement models

Decision-making within contracting authorities (especially on the local level) is generally carried out by a small number of government officials who, we believe, do not have in-depth ICT and IoT knowledge in solving a public issue. Furthermore, the process of procurement leads to nothing more than a race to the lowest price point between a small number of large suppliers. Therefore, new models offer alternatives for building 'smart cities'.

Preconditions for the application of the new Croatian Concessions Act (currently in its second reading in the Croatian Parliament) promote use of concessions through the high-quality medium- and long-term sectoral strategy, establishes safe, secure and clear rules in cases of awarding a concession in a way to protect the public interest. Also, it strengthens the competences of operators responsible for the development and maintenance of infrastructure and introduces administrative contracts into the practice which enables administrative protection during the administrative procedure.

The new Croatian Public Procurement Act introduced two new procedures which are likely to be particularly relevant as models for authorities who wish to purchase innovative goods, services or works:

- the innovation partnership enables a public authority to enter a structured partnership with a supplier with the objective of developing an innovative product, service or works, with the subsequent purchase of the outcome and which will enable public authorities to select partners on a competitive basis and allow them to develop an innovative solution tailored to their requirements;
- the competitive procedure with negotiation enables the procurement of goods, services or works that includes an element of adaptation, design or innovation, or other features which make the award of a contract without prior negotiations unsuitable. Unlike the competitive dialogue, it requires that the authority may specify the required characteristics of the goods or services in advance of the competition. [25]

Other important changes in the new Public Procurement Act include: increased flexibility and simplification on the procedures to follow, negotiations and time limits, use of 'most economically advantageous tender' as default criteria within the public procurement process, use of life cycle costing (LCC) as a method for assessing tender costs and the competitive dialogue procedure which has been simplified particularly for technically and financially complex projects.

This will in turn enable to de-risk the most promising innovations step-by-step via solution design, prototyping, development and first product testing. [26]

V. CONLUSION

Many of the challenges faced by smart cities surpass the capacities, capabilities, and reaches of their traditional institutions and their classical processes of governing, and therefore require new and innovative forms of governance [22].

Alongside 'top-down' master-planning, we need to enable 'bottom-up' innovation and collaborative ways of developing systems. The notion of the 'smart citizen' as a co-creator draws on a rich intellectual backdrop in both technology design and urban design. In practice, engaging citizens in these processes is immensely challenging. [27]

PPPs are the most effective way to make Croatian cities 'smart cities'. Certainly, it's unreasonable to expect Croatian cities to become 'smart' in a short period but by implementing the measures and strategies like creating walkable localities – reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security bring Croatian cities step closer to the 'smart cities'.

Cities should ensure the visibility of procurement and PPP opportunities through a single portal and use problem-based methods for solving key issues. However, it should be noted that cities cannot simply copy the best practices from successful 'smart cities', hence must

⁸ http://gov.hr

develop approaches that fit their own mindset, organization and culture in terms of broader strategies, human resource policies and demographics. Forming Egroups to listen to people and obtain feedback and use online monitoring of programs and activities with the aid of cyber tour of worksites. For example, making areas less vulnerable to disasters, using fewer resources, and providing cheaper services; green buildings and poolsharing. [28]

That is the main reason why Croatian PPP Act should intend to simplify use of PPPs and give equal possibilities to both private and public sector companies. In that manner, we believe Croatian cities will be able to develop and have similar appearance as the cities from South Korea, Japan, China, India and other countries in the world who detected and adopted wise 'smart city' policy and achieved advanced economic conditions and improved life of its citizens.

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