Smart governance: A tool for climate mitigation in cities?

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Abstract. Label of smart city is in recent years very fashionable and attractive. Because of this we are focusing on one of the main pillars of this concept, in our case it is Smart governance. Smart governance is emerging concept that can be used at different scales and environments. In our paper, we address the potential of implementation of smart governance towards mitigation of climate change effects in cities. By these changes we have in our mind's heat island effect which is felt especially in the hot summer time. We are about to provide a literature review of smart governance and how it's implementation can improve the urban environment. The reason why the use of smart governance is inevitable is that the implementation of this concept may improve the communication of all stakeholders starting from local residents through non-governmental organization to municipalities. Improvement of communication can also lead to better addressing of the requirements of local residents towards improvement of their lives and also to mitigate the effects of climate change in cities. When people can see profits from the actions that have been taken to manage the local environment then they are likely to participate into the system.

Keywords: Climate mitigation, community, heat islands, multi-level governance, semi-public, smart city, smart governance

1 Introduction

Nowadays, more and more people live in urban areas. This transition brings numerous challenges, providing the necessary utilities to large amounts of people living in the same area. Thanks to the revolution of the information technology and big data sets, the concept of the "smart city" has emerged, and nowadays a lot more information is available about different types of utilities. According to Caragliu et al. (2011), the increasing urbanization is creating a need for the city planners to deal with reinforced complexity regarding urban factors, such as food and water supply, traffic management and waste disposal and climate change. Against this background, the concept of "smart cities" has been introduced, described as a device for dealing with these service problems in a common framework. When it comes to climate change, Mancarella (2012) states further that reducing the energy footprint in cities is crucial. Integrated operation and planning of the urban system are described as essential tools for maximizing the environmental efficiency. It also means that the cities should strive to reduce their problem with heat islands. Especially cities where temperature in summer exceeds 30 degrees of Celsius and for day temperatures stay over 30 degrees for more than one or two days.

Climate change in cities raises at plenty of challenges for the community. These challenges are mitigation of the negative effects of climate change and adaptation to them. Heavy rainfall and connected, flooding and extreme temperatures are commonly regarded as the effect of climate change (Shaw & Theobald 2011). These factors are already influencing the society especially in cities in case of abnormal temperatures. In summer cities are struggling with residual heat and they are not able to handle this problem or just ignoring it and ascribe this to climate change. Some cities use water showers as a solution, but we all know that it is not the solution and just patching of problem definitely not solving. These measures are only technical and are not sufficient enough to achieve mitigation of heat islands in the long term. In this paper, we will focus on improvement of understanding of concept of smart governance and though this concept subscribes the outline of the system for mitigation of heat islands in cities.

The main problem is prevailing struggle with extremely high temperatures in some parts of the city (heat island) and continuous denial of the attention of authorities to this problem. Following problem is that broad community weakly understands the problem of heat islands and just complaining about increasing of temperatures in during summer especially in time of the peaks of temperature. The concept of smart governance can bring more light into this problem and contribute to the mitigation of temperatures during extreme days.

A growing number of concepts of smart city consider a smart governance as one of the main pillars of smart city concept. The main focus of "smart city" concept seem to be concentrated on the role of ITC (information Communication Technologies). Although the vast research was carried out on the role of human capital, social capital and environmental capital as important drivers of growth of the cities(Caragliu et al. 2011).

Extensive research has been carried out in the area of heat islands in cities using modern satellite technologies and thermal sensitive cameras to identify heat spots in the cities(Chen et al. 2006; Stathopoulou & Cartalis 2007). Also the literature about a smart governance concept is focused on different levels and measures from global scale down to the local (Janssen & Estevez 2013). Research done in this field is considerable and can provide information and basics for new concepts of smart governance.

Academic research in the field of smart cities and smart governance is relatively young and researchers are not united in defining what is "smart governance". Usually they vary in minor differences or the scale of the focus, but the main idea behind the theory is same (Mooij 2003; Willke 2007; Johnston & Hansen 2011). Mooji (2003) and Willke (2007) and Johnston & Hansen (2011) agree that the information technologies play a significant role in the implementation of smart governance concepts. Some researchers pay more attention towards participants and involving people rather than in the technical background of concept and believe that they can positively contribute to the system of local government. All concepts are developed from already working governance concepts and researchers are trying to improve them. All these concepts are based on a decision making system where multiple actors can contribute and defend their interests in different levels and also across multiple levels (Bache & Flinders 2010) this concept is called multi level governance. We were looking for more focused concepts, local scale is visible in the work of Janssen & Estevez (2013) where they proposed new term "I-Government" with a focus on close up local scale. Despite these works, little is known about the specific use of the concept of smart governance on climate change mitigation in local scale. In this scale residents can contribute to the system and therefore influence local climate. During table research we did not encounter any paper or work which pays attention towards our issue.

The purpose of this paper is to contribute to the theory about smart governance and to justify managerial abilities/possibilities of this theory. We see potential in the use of smart governance in managing of urban areas towards climate change mitigation. So the paper's research objective is: How smart governance model can contribute to the mitigation of heat islands in urban areas?

2 Smart Governance

2.1 Role of Governance

There is a difference between government (control/steering mechanism) and governance (decision making/managing). Term governance is usually used for the description of the process of governing and government is connected with public administration of municipalities or states. Therefore, government is broadly known as some kind of formal institution of government and control while term governance is far broader and we can say that governance is an interaction of processes, relations between the state and other institutions (including private business and civil society), information structure, rules, etc.(Kluvánková-Oravská et al. 2009). We argue that the classic understanding of governance seems as inefficient in the modern world. Nowadays we are adopting to multi-level governance where the nature of vertical relationships is redefined and overcoming existing structures. While the traditional way of understanding is connected to political control and centralization, multi-level governance puts in favor coordination of social relations while there is no authority. The multi-level governance is prevailing in the European Union as well as in other developed countries (BACHE et. al., 2010). The understanding of multi-level governance system is necessary for further understanding of smart governance, which adapts the principles of multi-level governance for environment of the new technology era where many actors are involved in different levels. In particular, multiple actors can interact at different levels and contribute to system and also the system and environment can prosper from these contributions.

Governance is alternative to sustaining hierarchical control in policy making. This hierarchical form can be found in both, the public and private sector. Smart Governance can be defined as new form which has better conditions for cooperation and interaction between state (as authority) and civil society actors in the process of decision making as a network. The local government needs to be a permanent process with continuous comparison and exchange between private sector and public sector rather than just copy the current state where is single actor (State, municipality, etc.) who operates with the support of bureaucracy according to its own vision of common public good(Staden & Musco 2010). This is what we are trying to promote by this paper.

2.2 Defining Smart Governance

The concept of smart governance can provide easy access to data and information to local residents as well as for local authorities and all other stakeholders and encourage them to participate on mitigation of climate change. Following the first definition of smart governance by Eger (1997) who stated that in the time of post-industrial world full of the global economy which rapidly expands is the age of information. On this wave of change, all institutions, it does not matter if private or public, should be forced to adapt on this change. So the prevailing forms of governance are going to be replaced with new form which is called smart community so sustaining governance is changing into "smart governance". There was no specification of what should smart governance consist of so there was need to set some basic factors for further specifications and already aware of this need Mooji (2003) outlined elemental factors which defines main attributes of smart governance. In this purpose smart should be moral, responsible

for its actions, react to unforeseen circumstances, act according to moral rules and be transparent. The first outline of specific factors is set and it creates an environment for advancement of the theory and researches took the opportunity. Willke (2007) defines smart governance as a complex group of assumptions, aspects and capacities that consists a structure of governance, which is capable to deal with the circumstances and needs of modern community based on knowledge, information technologies and expertise. As he commented, new forms of governance should transform into smart governance and by this way the transform prevailing system of governance. This new smart governance supposes to be sufficient for current needs of modern society. Further development of the concept proposed above inspired Johnston & Hansen (2011) to the idea that the smart governance infrastructure should provide more clarity in the manner of public aspiration, promotes the prosperity of culture and further raise accountability. The assumption to be accountable is to be highly responsible. So in an ideal state, the one who is in governing position should be responsible for his actions. In this work authors determined a smart governance as a tool for participation and the way of collecting information from contributors because they are convinced that people want to contribute as an individual. They see a problem in creating the structure for system of smart governance, but opportunity in meaningful contributions while individuals are still enabled to engage in the system. Despite that this development of the concept is far more narrowed down than Wilke (2007) and Mooji (2003) and is accurate for the purpose of local governance, academics Janssen & Estevez (2013) introduced the concept of smart government which they call "I-Government". Concept of I-Government is very interesting due to its innovation and more concentrated focus. This concept concentrates its focus on smaller groups in the small scale environment and thanks to ICT (Information and Communication Technology) better address problems and solutions between groups, communities, places and so on. This is what they call "Doing more with less" and it is an accurate name for the concept.

The concept of smart governance is nested in principles of multi-level governance (similar to Earth system governance and global governance (Biermann 2007)) so it shares the same structure of multiple actors involved in different levels and in some cases actors can be involved across multiple levels. Smart governance concentrates on the implementation of new information technologies into the existing concept of multi-level governance following the Eger's (1997) definition "Cyberspace and cyberplace" (Eger 1997). There is common agreement of scientists that a prevailing system need to be changed and that implementation of new technologies in ICT (information and Communication Technologies) needs to be used while the system has to be moral, responsible, able to adapt to changes and be transparent (Mooij 2003). And we do agree that the change is inevitable for functioning systems of governance.

There are multiple theories about smart governance, however Mooji (2003) and Willke (2007) and Johnston & Hansen (2011) agree that information technologies are significantly important and innovation of governance is vital for further development. Some of them pay more attention towards people and their aspiration for participation in decision making. Johnston and Hansen highlighted that participation of the common people can provide a positive contribution to society (Johnston & Hansen 2011). Janssen and Estevez went even further with their "I-Government" where the approach is more bottom up than top down, because they focus on small environments and not on the big scale environment (Janssen & Estevez 2013). So the most significant difference is just on the scale of an environment where theory is implemented.

In our work we use the concept of smart governance to manage semi public areas. We argue that these areas can be defined as common pool resources because they are shared with local communities where every individual is an actor (Maco 2015). Common pool resource includes natural and anthropogenic resources which are in our case semi public areas (inner blocks). As we are about to encounter multiple actors the managing of these semi public areas

is complex. Ostrom (1999) already identified that the vast number of actors creates difficulties in system, organization and agreeing on rules and enforcement of those rules. We agree that especially in local scale individuals play a very important role. Usually in this kind of environment where individuals are facing choices, all others will be affected by "one-man choice" because they are interdependent. If the individual prefers short-term self interest choice that means for the others that this one individual leaves them worse (McGinnis 2000). This is where smart governance should step in and use of new technologies can improve processes of common agreement on rules and enforcement. With smart governance, we create better, more accurate and responsive system of local governance. Thus governance becomes more transparent and more beneficial.

So smart governance should provide individuals enough information to not take selfish decisions and focus on long term benefit. From a past we already know about many cases such as case from Nepal, where irrigation systems are the example of well managed common pool resources which rely on rules and norms created and developed by local participants who are in this case local farmers. In case where authorities created the system of irrigation it was less efficient than one created by farmers themselves. It was caused mainly because of strict focus of authorities on modern engineering and ignoring of rules and norms that farmers had before (Ostrom et al. 1999). It seems logic that the communication of participants is vital for livable system or concept. Only if local stakeholders and individuals are involved in creation of norms and rules, system have the chance to work with highest efficiency. It was proven by many studies and in case of Nepal irrigation systems it is nicely described. Use of new information and communication technologies can improve the process of developing rules and norms, especially if it is in the interest of local residents. Inclusion of new technologies in local government does not immediately means that the city can promote itself as smart city, but it is a step towards it because smart governance is one of the pillars of smart city concept.

The fact is that the term smart governance is relatively young and there is no common agreement on its definition and there is still a considerable level of vagueness. Definitions are mostly the variety of the same idea and they differ slightly, but we can say that the main interest of all authors is concentrated in connecting of people to government through new ways of information technologies. Probably strict focus on information communication technologies is not the best way how to define smart governance. Of course that ICT's are important for the concept, but it is not the only important part. So we should provide further development of concept of smart governance and by this way contribute to this issue. In this paper, we will put a greater focus on the possibility of mitigation of heat islands in cities by using the concept of smart governance, so this concept is relevant for us. We will focus on lower levels of governance such as local governance of urban areas and discuss the possibilities that semi-public places offer opportunity for mitigation of the negative effects of global climate change in cities. By this way we should fulfil the research question and propose the possibilities of urban areas towards mitigation of heat islands which affect cities.

Stakeholders can play a role as sensors that can measure the quality of public green spaces and the scientific measurements should be used as a supplement for the research. Data obtained from stakeholders in the form of interviews are crucial for research.

3. Smart governance as tool for local climate mitigation

Information and Communication Technology (ICT) is literally changing every aspect of our life. It can be found in our workplace, homes, sports, free-time even in bars. All aspects are affected by the ICT so it is no wonder that these technologies are now applied or are in the process of application in many countries in state governance and are used as a way of communication between authorities and common people.

Community is a term which represents correlation of three nexuses. The community of relationship, the community of place and the community of interest. People are their activities

and organizations – *community of relationship*, they have tended to communicate about questions of common interest with their neighbors – *community of* place, and also they usually have a common goal which make them cooperate – *community of interest* (Morse 2004).

There is a global trend which leads people to cooperate towards everyday happiness and they do not wait for governance to build or serve anything for them. Todays condition may drive people to start cooperating and build a community on their own without intervention of the government. Thank to advancing technologies, building communities is far easier, thanks to the fact that people still have the comfort of their homes but simultaneously they can communicate together. Smart community emerges, especially from the fast developing technologies. Last few years in development of mobile devices such as laptops and phones is making them more affordable and widespread. Now even elder people are using these devices. Also, many devices are equipped with computing technologies. Another recent trend is rapid the growth of social networks. Social networking can be described as a group of individuals connected through diverse social relations, like friends, family, coworkers, school, to mention at least few. Spread of the internet strategically contributed to the creation of social sites like, Facebook, LinkedIn, MySpace and others. Also the internet is the source of information used by a variety of people, like teenagers, managers, businessman or researcher. So the Smart community can be seen as a group of connected individuals that interact between each other on the network and deliver smart services or solutions. These individuals can be anyone or anything, dog or tree can also interact by playing a significant role in the decision making process(Xia & Ma 2011). According to Feng Xia and Jianhua Ma smart community could by identified by these attributes:

– Smart communities are socially and physically aware systems.
– The scale of community varies with each case.
– Smart communities will be developed in time and also the size of the community is changing during this development. That means that the smart community and it's size are flexible.
– Internet based community is not the condition for the smart community, smart community may be functional in the local scale environment even without an Internet connection.
– In some cases lifetime of smart community can be long, while the life cycle of the other smart community can be short, depending on the supported application(Xia & Ma 2011).

The use of ICT for development of a community at present is not a novelty. Now we are striving to add some higher value to the communities. So we do believe that only the implementation of ICT in communities does not make them instantly SMART. Smart community should be not just informed community, but also has to be concerned about environment and be able to communicate issues about the environment with authorities and care about future generations.

3.1 Semi-public in smart governance

The inner blocks are always facing the problem of open access and lack of rules for managing them. Usually the municipalities manage these places, but in many cases provided maintenance by municipalities is not sufficient enough to fulfil the needs under the absence of participation of local residents.

Definition of Public space as research object have been discussed for decades (Maco 2015). Our focus concentrates on management of semi-public spaces represented by inner blocks. Authors usually involve exterior and interior places in their understanding of what public space

is. The concept of semi-public spaces is new concept and is missing the exact scientific definition (Maco 2015). WAUA (2009) a blog about architecture, urbanism and art differentiates semi-private and semi-public spaces. We have to keep in our minds that both share the characteristics of private space. Although first group represents access controlled environment which is accessible only for residents and their associates, while the second represents private space which is publicly accessible and access is not controlled. In the figure below can be seen in the actual scheme of where semi-public spaces are situated. From this scheme is also clear that the semi-public spaces have the characteristics of public space, but from a legal point of view they have private owners who share this place.

There are three basic attributes of semi-public spaces which are defined by Maco (2015) in his thesis.

A: physical environment – these are reflected as physical, visual and functional qualities of the environment. In semi-public spaces these objects are usually used by smaller groups of people than thing that are in open public space so their function is more specific. Also the visual aspect is more specific and depends on the taste of local users.

B: property relations – in the city we can say that the objects in open or public space is symbolically managed by the people but actually these objects are managed by public authorities. In semi-public space it is different. Objects are in close range of residential living so people tend to manage these spaces and objects by themselves as individuals or groups.

C: institutional – in this attribute we can include regulation, rules, competences and arrangements. Semi-public spaces do not require as much management from authorities because self-management is higher than in public space. Usually in public space there is always set of rules created by the authorities, in case of semi-public spaces it is more common that this rule establishment process is bottom up. People from local community tend to create their own set of rules and then the self-control mechanism is more effective (Maco 2015).
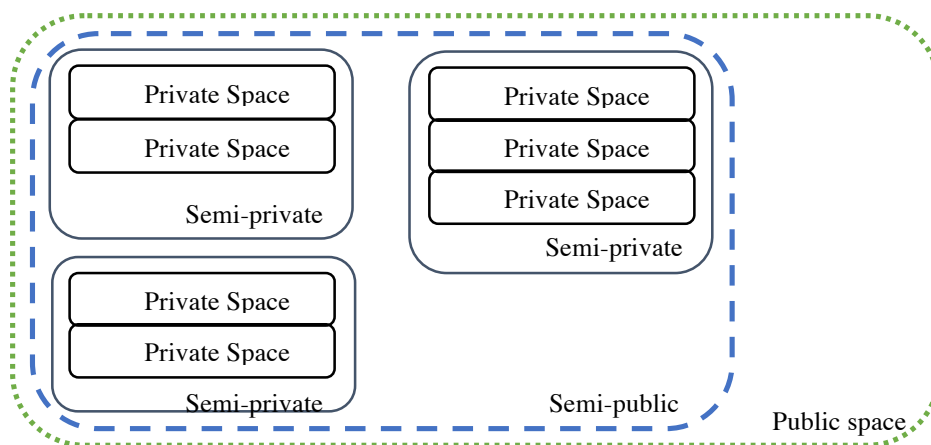

Figure 1: Semi-public spaces (adopted from WAUA, 2008)

4.   Conclusion

In our paper, we use smart governance concept of governing local environment towards mitigation of phenomena of heat island. Heat islands appear to be a continuous problem, especially in dense cities. The increasing temperature in urban areas is caused by high concentration of soil sealing and surfaces like concrete, tarmac or interlocking paving. For this reason, there is need to create a concept which can be used in a wide range of environments like urban areas, inner blocks and many more.

There are usually many actors and stakeholders to who tend to use and manage one specific semi-public space. The theory of the commons is concentrated on common-pool resources (CPRs), products which are coming from these resources and on the question, how these resources should be managed. The commons are acknowledged as a term for shared resource where each stakeholder has an equal share or interest (Hess 2008). CPRs are either natural or human made and in case of inner blocks it is human made even if it has natural character but it has been created by anthropologic activity. The traditional distinction of commons is on forest, irrigation system, groundwater, fisheries, agriculture, pasture or even the air, which we share all around the World (Ostrom et al. 1994). Along traditional commons, new type of commons has developed. The new commons are urban commons and digital commons (Hess 2008). For our research is relevant, especially urban commons because we will focus on developing collective regimes for semi-public spaces inside the inner blocks. Goods from CPR are suppose to benefit certain group of stakeholders who are related to clearly specified common-pool resource. In our case it is inner block and stakeholders are represented by local residents and close surrounding residents who are facing a social dilemma.

References

Bache, I. & Flinders, M., 2010. *Multi-level Governance*, New York: Oxford University Press Inc., New york.

Biermann, F., 2007. "Earth system governance" as a crosscutting theme of global change research. *Global Environmental Change*, 17(3–4), pp.326–337.

Caragliu, A., Del Bo, C. & Nijkamp, P., 2011. Smart cities in Europe. *Journal of urban technology*, 18(2), pp.65–82.

Eger, J., 1997. Cyberspace and cyberplace: building the smart communities of tomorrow. *San Diego Union-Tribune, Insight*, 2.

Hess, C., 2008. Mapping the New Commons Mapping the New Commons. *Syracuse University: SURFACE*, (July), pp.14–18.

Chen, X.L. et al., 2006. Remote sensing image-based analysis of the relationship between urban heat island and land use/cover changes. *Remote Sensing of Environment*, 104(2), pp.133–146.

Janssen, M. & Estevez, E., 2013. Lean government and platform-based governance—Doing more with less. *Government Information Quarterly*, 30, pp.S1–S8.

Johnston, E.W. & Hansen, D.L., 2011. Design lessons for smart governance infrastructures. *Transforming American governance: Rebooting the public square*, pp.197–212.

Kluvánková-Oravská, T. et al., 2009. From government to governance for biodiversity: The perspective of Central and Eastern European transition countries. *Environmental Policy and Governance*, 19(3), pp.186–196.

Maco, M., 2015. *Theory of Commons in Urban Governance : Application to Semi-public Spaces Theory of Commons in Urban Governance : Application to Semi-public Spaces*. Slovak University of Technology.

Mancarella, P., 2012. Distributed multi-generation options to increase environmental efficiency in smart cities. In *2012 IEEE Power and Energy Society General Meeting*. IEEE, pp. 1–8.

McGinnis, M.D., 2000. *Polycentric games and institutions: readings from the workshop in political theory and policy analysis*, University of Michigan Press.

Mooij, J.E., 2003. *Smart Governance?: Politics in the Policy Process in Andhra Pradesh, India*,

Morse, S.W., 2004. *Smart communities - How Citizens and Local Leaders Can Use Strategic Thinking to Build a Brighter Future*, San Francisco: Jossey-Bass. Available at: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:smart+communities#9.

Ostrom, E. et al., 1999. Revisiting the Commons: Local Lessions, Global Challenges. *Science*, 284(5412), pp.278–282.

Ostrom, E., Gardner, R. & Walker, J., 1994. *Rules, games, and common-pool resources*, University of Michigan Press.

Shaw, K. & Theobald, K., 2011. Resilient local government and climate change interventions in the UK. *Local Environment*, 16(1), pp.1–15.

Staden, M. van & Musco, F., 2010. *Local Governments and Climate Change: Sustainable Energy Planning and Implementation in Small and Medium Sized Communities*, Springer Dordrecht Heidelberg London New York.

Stathopoulou, M. & Cartalis, C., 2007. Daytime urban heat islands from Landsat ETM+ and Corine land cover data: An application to major cities in Greece. *Solar Energy*, 81(3), pp.358–368.

Willke, H., 2007. *Smart governance: governing the global knowledge society*, Campus Verlag.

Xia, F. & Ma, J., 2011. Building smart communities with cyber-physical systems. *Proceedings of 1st international symposium on From digital footprints to social and community intelligence - SCI '11*, p.1. Available at: http://dl.acm.org/citation.cfm?id=2030066.2030068.