SMART WATER MANAGEMENT

INNOVATIONWITH IN TRADITION

Abstract:

In global water arena, a consensus had been emerged that urban water management urgently calls for smart solutions in order to adapt to climate change. The ways our society is managing water resources are clearly in need of innovation and experimentation, but on the other hand call for reinstatement of traditional knowledge based on locally developed practices of water use. This paper describes a smart water system as a system that implements meaningful data and transforms it into actionable intelligence, but in the same time as a system build upon traditional knowledge. Transect coding is used as research method, to answer the question, how to smartly manage urban water systems at different scales and in different type of urbanized landscape.

Keywords: smart water management, water governance, transect coding, urbanized landscape.

❖ INTRODUCTION

In recent decades, the world has experienced unprecedented urban growth. According to the United Nations predictions, by 2050, seventy percent of the world population will be living in cities (United Nations, 2007). Europe is, for example, an increasingly urbanizing continent, where currently roughly three quarters of total EU population lives in cities, towns and suburbs (Eurostat, 2016). With such urban population grows, it is inevitable that the demand for water increases and pressure on finite water resources intensifies (PAI, 2011; Nilsson, 2006). Another starting point for this research is the assumption that global climate is changing, as stated in many scientific records (IPCC, 2007; COM, 2015; Fried lingstein, 2014) and, according to several publications has an increasing trend (Tin, 2008; Richardson, 2009; PBL, 2009; Sommerkorn and Hassol, 2009). The urban water cycle (incl. water supply, sewage, storm water, ground water, aquatic ecosystem – see Figure 1) is particularly at risk because the climate change mainly manifests itself through increase of extreme events (Howe et al. 2011, Fletcher, 2008). Consequently, the need to ensure that water can be managed sustainably, operated efficiently and maintained in high quality standard has been raised. Using big data techniques from all urban water components (Figure 1) have potential to enable the smart water management.

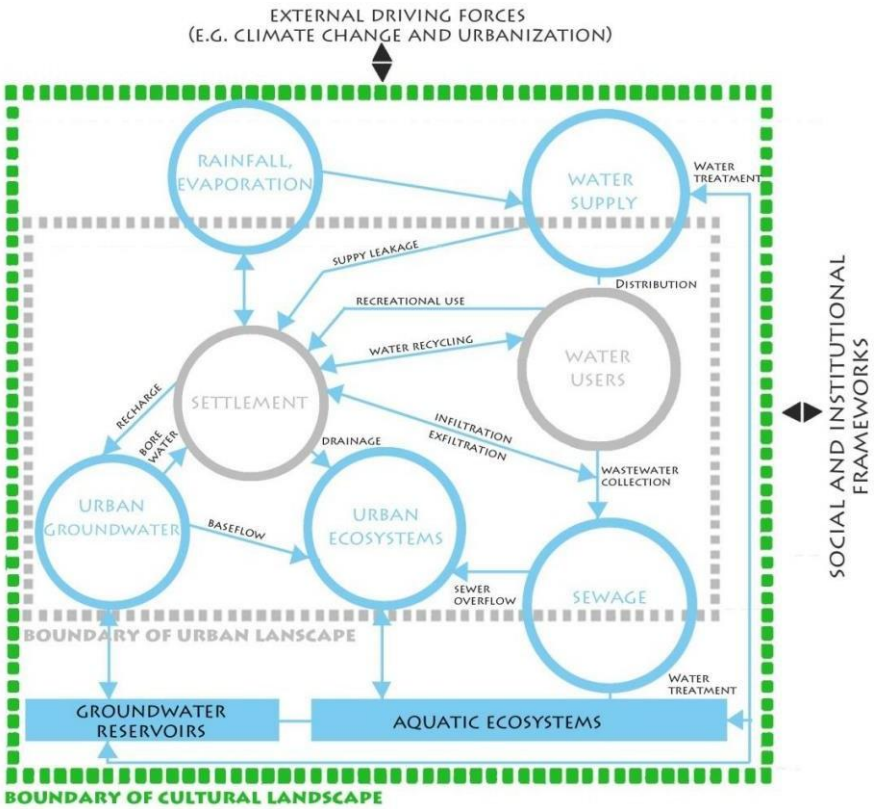

Figure 1. Urban water system interactions within urban landscape.

Resource: Author according (Fletcher, 2008)

The concept of the smart city has recently been introduced as "*a strategic device to links legacy systems with new communication chains in order to achieve a common goal of human welfare without compromising the sustainability of dependent ecosystems*" (ITU, 2015). Under water management perspective, the smart city concept highlights the importance of information and communication technologies in the last 20 years for enhancing water sustainability. The concept was originally developed by large IT companies that focus on analyzing "big data" using software-centric, top-down approach.

❖ PROBLEM STATEMENT

Over the past decade, the concerns about extreme events and water scarcity have grown also within the EU (Rahaman, Varis, and Kajander, 2004). And why it is so? Simply put, water scarcity is often a by-product of climate change, current water management practice and unsustainable water policies. Moreover, current spatial planning practice does not enhance smart water management of urban landscape with an adaptive capacity to water related problems. Hence, cities do not easily adapt to the unpredictable events. As a result, the current academic debates are mostly talking about global water crisis that is heavy on problems and light on solutions.

❖ SMART WATER MANAGEMENT

By assuming that the smart management of water is messy and contested concept, the research takes different schools of thoughts that describe how water management can be influenced by various underlying perspectives.

❖ PERSPECTIVE OF TECHNOLOGICAL INNOVATIONS

Until just a few decades ago, the materialization of great possibilities caused by industrial revolution brought the massive hydraulic development with large-scale, centralized water infrastructure systems for flood control, irrigation, water treatment, water distribution and sewage systems (known as "hard path"). On the one hand, there was the precondition that technologies generate wealth and development. Under this view, the ancient wish to transport water from where it is abundant to where it is scarce was satisfied and applied. In general, we know that water is both a key to socio-economic growth and quality of life (Priscoli, 1999).

❖ LANDSCAPE PERSPECTIVE

In light of describing environmental concerns (global climate change, water pollution, landscape dewatering, etc.), industrialized world faces a massive decrease in biodiversity what is reflected to political debates, and new approaches (Tin, 2008; Richardson, 2009; PBL, 2009; Sommerkorn and Hassol, 2009). Taking into consideration the scope of water crises, ecologist and landscape architects warn that the current water management practices in urban landscape are no longer resilient. A review of the way in which the natural hydrological cycle and adaptive capacity of landscape are in the core, gives the first priority to the natural ecosystems. Under this perspective, ecosystems have similar rights to people, and should be treated with the same sensibility.

❖ CULTURAL PERSPECTIVE

What is important for the following perspective of cultural approach to water management is the fact that basic and collective perceptions about the world (such knowledge, attitudes, values, ethic etc.) are stored within every culture. These long- time preserved patterns influence our behavior and management practice (Johnston 2012).

Under this view, the water culture refers to a certain stage of knowledge that is a result of mutual interactions between people and natural resources – as water. This knowledge is rooted locally in management practices, values, religions and ethics that have preserved in customary laws. Over the millennia people shaped their traditions in response to the distinct environment they inhabit. Along the way, the current water crises have been partially generated by techno-scientific cultures. Scientists who follow this cultural approach argue that current management models are still dominated by a paradigm of 'expertise'.

➢ DEFINING SMART WATER MANAGEMENT

The paper focuses on three discourses of smart water management that are deeply describes above. Firstly, engineering perspective has in fact too narrow focus on maintaining efficiency, constancy of the system, and predictable future. It aims to conserve what we have and to "fight the water". To do so, it offers progressive replacement of time-tested strategies by "one-type-fits-all" solutions. The invention of electrical pump was to water management what the elevator was to high-rise building or the car to transport.

The paper defines the smart water management concept as an overarching, interdisciplinary framework in which insights from different approaches (engineering, landscape-oriented and cultural) will fit and will result the development of water resilient city. The paper considers mentioned approaches to be complementary and both useful at different territories and different scales (Figure 2).

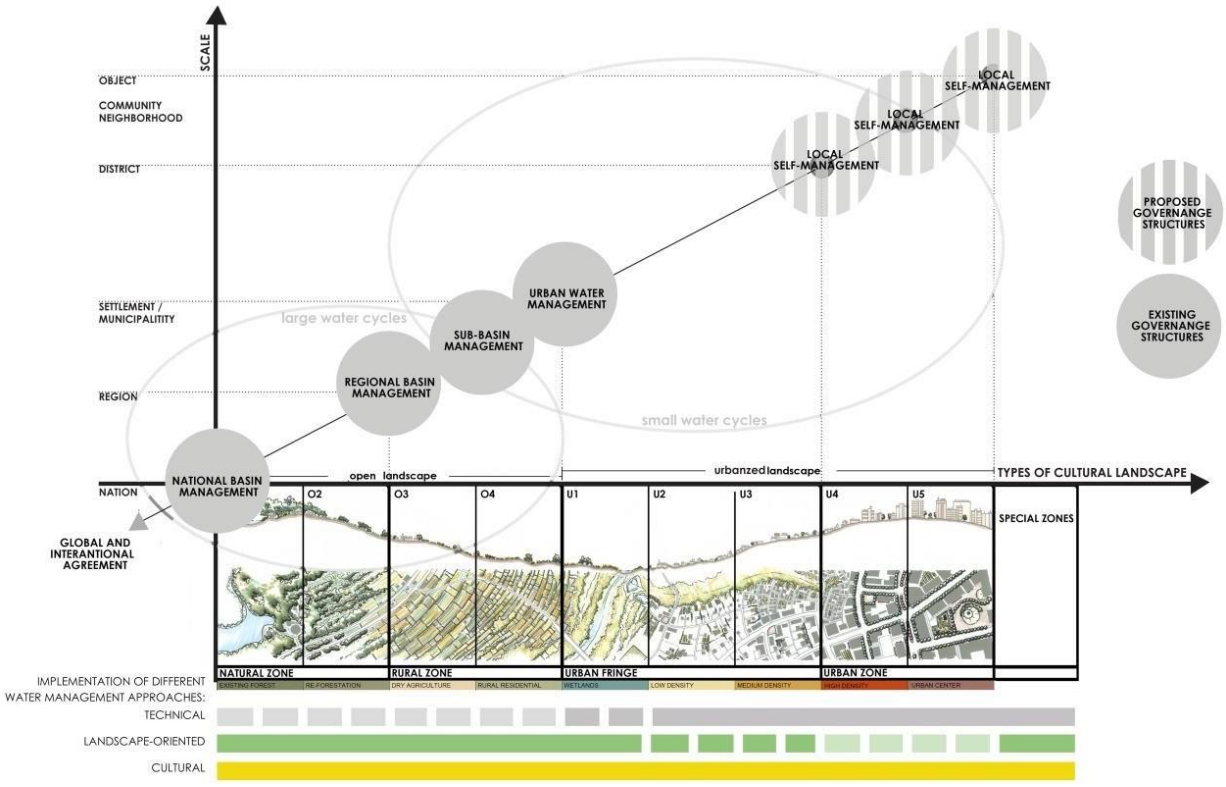

Figure 2. Model of smart water management as a cross-scale theoretical model that provides a proper insight on localizing water management solutions (model´s horizontal axis) and governance options (model´s nodes).
Resource: Author according AECOM (2010)

- **MODEL´S VERTICAL AXIS**

Smart water management requires institutions at different scales (see Figure 2 – vertical axis). Model points it that water issues must be tackled at various levels. Smart and adaptive water governance requires a 'dance between levels'. Potential synergies between **Regional Basin Management** and **Local Self-Management** should be strengthened. Development and implementation of both of these management options have potential for:

- bringing a long-term, strategic focus covering large areas by using **Regional Basin Management** (The European Union's "top-down" governancearrangements e.g. Danube River Basin District with its sub-districts),
- translation of water management strategies — such as measures for more efficient water consumption — into **Local Self-Management action** (The United States "bottom-up" approaches e.g. San Francisco Bay Area whichhas a long history of local control over water management)

- **MODEL´S HORIZONTAL AXIS**

A transect method was used to illustrate different type of urbanized landscape from open space natural landscape to urban core. This code shows how future aspects of urbanization, such as buildings, infrastructure, land uses, and density should respond to water management (see Figure 2 - horizontal axis).

- **MODEL´S NODES**

Scale captures construct´s nodes that are water governance options. These nodes can be qualitatively assessed by comparing the type of urbanized landscape (horizontal perspective) with a particular vertical scope. What is important to realize that smart scale mismatch is more likely to be the rule rather than the exception for most natural resource problems. For example, river systems cover a wide range of scales; from international (such as the Danube River basin) to multiple states (such Vah River sub-basin).

❖ **Conclusions**

In Following an increasing series of unpredictable events (such as floods or droughts), more and more collective actions and initiatives calling for change are emerged. Furthermore, the current uncertainties pose special challenges, because planning processes based on uncertain predictions provides only an unclear approximation of the future and is a weak basis for smart water management. Therefore, the purpose of the research is not to find "best solution", but outline the strategy to accept the unexpected as expected, and planning ahead to fight current environmental changes.

organizational mechanisms. As a result, water resources are brought under centralized, bureaucratic control, and the resilience of local water forms is strongly weakened (Johnston, 2012). Therefore, a better understanding of cultural values together with implementation of new and next level technologies is essential tocatalyse change for smart water management regimes.

❖ **Acknowledgement**

This contribution is the result of the project implementation: SPECTRA+ No. 26240120002 "Centre of Excellence for the Development of Settlement Infrastructure of Knowledge Economy" supported by the Research & Development Operational Programme funded by the ERDF.

❖ **References**

AECOM. 2010. *Kigali Conceptual Master Plan.* Denver: Oz Architecture, 2010.

Arup. 2011. *Water resilience.* s.l. : Arup Urban Life, 2011.

Cabrera. 2010. *Water Engeneering and Management trough Time, Learning fromHistory.* Valencia : CRC Press, 2010. ISBN 9780415480024.