TRANSFORMATION OF URBAN WATER SERVICE PROVISION: POTENTIAL OF HYBRID SYSTEMS

ABSTRACT

Rapid urbanization poses severe challenges to the water management of growing cities. Conventionally, the suitable way to solve problems has been to expand the capacity of existing centralized infrastructures. It is important to consider how resources of a city's inner water cycle could be utilized more efficiently, on the one hand, and how the system of provision shapes the functional roles of the service, the ways of using it, and ultimately the consumption itself. This consideration is the reference point of this paper in which we will explore hybrid systems of water management as a promising way to address these problems. We focus particularly on the relationship between water users and the water supply system. The study is based on interviews with water users and literature on the hybridization of water services. We reflect on these issues in relation to the context of transformation of infrastructure services. The results of this study indicate that the successful adaptation of hybrid systems has the potential to facilitate urban transformation. However, certain barriers deeply rooted in water management hinder it from reaching this potential.

Keywords: hybrid water supply systems; sustainable consumption; transformation of service provision; water management

1 INTRODUCTION

Today, half of the world's population lives in urban areas, and this proportion is projected to grow to two-thirds by 2050 (United Nations 2014). Accelerating urbanization makes sustainable development ever more complex and challenging. Growing urban areas need to be able to renew and extend critical infrastructures, such as water supply, energy, transportation, and information and communication technology (Riffat et al. 2016). In addition, this renewal process is expected to contribute to and generate more sustainable urban lives.

It is therefore necessary to consider how policies support and encourage new ways of thinking, organizing and governing various city functions and how to deal efficiently with the resource flows within and through cities. One aspect in this is how infrastructures contribute to the development of more sustainable and vital urban areas and how operations can have long-lasting positive or negative impacts (Moss et al. 2011). An integrative and holistic perspective sets infrastructures as a central part of the development, culture, and investment politics of urban areas. Infrastructures shape the formation of everyday activities and routines, as well as the structuration of consumer habits. Therefore, what is considered legitimate knowledge and who are legitimate actors in relation to infrastructure management is everything but trivial.

Conceptually, this phenomenon can be approached through the transformation of infrastructures whose social and governmental dimensions are still largely unknown (Bolton & Foxon 2015). In water services, transformation necessitates innovativeness and preparedness to change the management and operations of water management systems (Khansari et al. 2013). A key question is how water services among other socio-technical infrastructure services are able to produce and support sustainable lifestyles. Furthermore, following Valkama et al. (2015) the production of infrastructure services must be in line with societal principles of ethics and justice such as fairness, trust and transparency.

Energy and waste services sectors have undergone significant changes in their operational roles and power relations over the last few decades. The same cannot be said of water services. Modern water supply has traditionally relied on centralized systems that have been complemented with decentralized ones in areas where centralized systems have not been considered cost-effective. This way of managing and operating water services with all the associated structures of governance and actors has succeeded in grounding itself as a natural state of affairs (see Heino & Takala 2015).

Centralized systems have followed the top-down design and decision-making approach typical of large technical systems (LTS) and the growth logic which has meant in the case of water services that capacity has been increased to meet growing demand. Maintaining this basic premise has required an emphasis on technical expertise in system management (Joerges 1999), meaning that an engineering-based view has represented the legitimate form of knowledge in designing systems. Alternative ways to produce service and formulate problems have been largely overlooked.

Yet, the scarcity of water resources on the one hand and the demands of resource efficiency on the other have given impetus to the solutions offered by the so-called hybrid systems. These refer to the combination of decentralized and centralized systems. Combining the strengths of these systems and compensating for their respective weaknesses provide a better ability to adapt to various challenges. For example, tailoring water sources for different purposes and needs can decrease the need for potable water and decrease the resources needed for transportation and treatment. (Daigger & Crawford 2007; Bieker et al. 2010; Sapkota et al. 2013; 2015; Bell 2018.) Hybrid systems would thus represent a step towards more sustainable consumption and smarter service production.

We suggest that hybridization not only affects resource use and efficiency, but also provides an interesting way to examine the transformation of the service. Our starting point is that the adaptation of hybrids will have profound impacts on the dynamics of water supply and consumption, thus, transforming the operational roles and the way the various actors are used to seeing themselves in relation to water services[1]. Connecting centralized and decentralized systems causes some tensions and necessitates new institutional and governmental structures and practices. In this paper, we examine the transformation of water service provision in relation to hybridization. It is not our purpose to test or evaluate the advantages or disadvantages of the transformation of water services in relation to a specific goal, but to focus on the conceptualization of this phenomenon.

[1] Our focus in this paper is on the developed countries with existing and established water services infrastructure. For example, in Finland it is estimated that 98 % of the population have access to improved sanitation and 100 % to improved water sources (UNICEF and World Health Organization 2015). This does not imply that hybrid systems would be irrelevant in other contexts but they are outside the scope of this article.

2 METHODS AND STRUCTURE

This paper illuminates the transformation of infrastructure services from different perspectives and discusses the hybridization of water services as a manifestation and application of this transformation. In the next section, we look at the transformation of infrastructure services in general to clarify the background idea of this study. Furthermore, we briefly discuss experiences from energy and waste service sectors. After that, we will look at the general characteristics of water services and analyze them from the point of view of transformation. We argue that one key aspect in transformation is the role of water users.

Thus, in Section 4, we will look at how Finnish water users perceive water services and their role in it. To grasp the perspective of water users we conducted 74 interviews on the streets of 11 Finnish municipalities. The municipalities were chosen to include diversity, so their water services represent different scales, the organizational structures of water services are different, and they are located in different parts of the country. The interviews were in Finnish and the excerpts presented in this paper have been translated by the researchers.

There is one particular issue related to the context of this study that needs to be mentioned. Much of the discussion on hybrid water systems has been contextualized by the scarcity of water resources. We examine hybridization in the context of Finland – a country of one thousand lakes and an abundance of high-quality water resources. The scarcity of water is, thus, not the driving force for hybridization. Therefore, we expect our study to reveal some novel aspects and considerations of the hybridization of water services, aspects that do not reduce to argumentation on the scarcity of water resources.

In Section 5, the findings from the interviews and transformation literature are discussed in relation to hybridization of water services. We cover both the potential and challenges associated with hybridization. Finally, we will provide concise conclusions and main points of the study.

3 TRANSFORMATION OF INFRASTRUCTURE SERVICES

Humanity is living through a historical transition period as people are conglomerating in ever-expanding and densening urban areas that lure people with promises of economic, social, and cultural well-being. This development, however, brings forth the question how housing, mobility, waste, energy, and water issues can be managed strategically and sustainably in urban areas. Management of these infrastructures not only impacts the crucial material and nonmaterial flows but also has a profound influence on social relations. As Coward (2012, p. 479) maintains, "between us in the city is neither an empty space nor simply of human bond. Rather between us is a surface of contact, a point of articulation, at which heterogeneous elements are assembled into complex ecologies of subjectivity. Between us is the urban fabric — from houses to large technical infrastructures." In this sense, urban infrastructures are not only material and technical constructions but also thoroughly social systems that determine and contextualize how humans collaborate to achieve desired goals.

When the sustainability challenges associated with urbanization are viewed through the framework of transformation, urban areas should be perceived as places where structures enable and support change, learning, and innovation. Tranos and Gertner (2012), for example, maintain that the urbanites' creative potential and ability to combine various competencies and knowledge to produce solutions should be better utilized. Transformation of infrastructure services is contextualized by the goals of urban development—to form new, active communities and initiate local activity. Innovative initiatives transform the distribution of work, shuffle actor roles, and modify conceptualizations and conditions of consumption that are related to service production. From the perspective of infrastructure transformation, this means that connection of infrastructure to the challenges of urban sustainability will prompt novel and increasingly diverse interpretations of problems and their solutions (Guy & Marvin 2001).

Next, we will look at the example of energy and waste service provision and briefly discuss how these systems have been transformed. After this, we will turn our attention to water services and identify the key challenges in their transformation.

3.1 Transformation of energy and waste service provision

Both energy and waste service sectors have traditionally been seen as rather rigid and conservative. For example, for the last century, the energy sector has mainly relied on centralized structures formed by large-scale power plants and extensive distribution networks. The logic has been that society consumes energy in a specific way, and this demand has to be met in the most cost-effective way possible. However, the development of decentralized energy production systems and smart grids, together with changes in the institutional environment, have enabled micro-scale energy producers to enter and alter the energy markets. Households can buy energy from the producer they prefer,[2] participate in crowdfunding efforts to finance sustainable energy systems, or function as co-producers, for example, by investing in energy-plus-houses. All in all, the supply and demand of energy is no longer taken for granted, but rather their dynamics has been transformed.

Many recent studies highlight that the development of energy systems needs to be incorporated with more overarching narratives of sustainability and to take into account also practice-based consumption patterns (see e.g., Smale et al. 2017; Ballo 2015; Nicholls & Strengers 2015; Schick & Gad 2015; Nyborg & Røpke 2013). These studies emphasize that the societal and social aspects of development are not to be overlooked.

The transformation is also advancing in the waste management sector. Typical centralized waste management systems are based on waste collection and landfills, guided by the idea that society's activities produce a certain amount of waste that should be disposed of in the most cost-effective way possible. However, technological, administrative, and legal changes have diversified the definitions of waste, and as a result, disposal of waste has been perceived as "unsmart."[3] As an example of changes in legislation, the European Union Landfill Directive (Council Directive 1999/31/EC)[4] restricts waste disposal in landfills, making alternatives based on utilizing energy content and the recycling of the material content of waste

[2] For example, in the service concept of Dutch energy company Vandebron, decentralized producers of renewable energy can directly trade with consumers.
[3] Greater Manchester waste management provides an illustrating example of this kind of transformation (Uyarra & Gee 2013).
[4] Available at: <https://eur-lex.europa.eu/eli/dir/1999/31/oj>.

more lucrative. Waste minimization, circular economy, dematerialization, and zero waste are concepts that depict the alteration of the way waste is perceived and understood. Various services and communities that have spawned on digital platforms and social media constantly create solutions of sharing access to goods, recycling materials, and overall diminishing the need for individual ownership. People are no longer solely producers of waste but active participants in the management of material flows.

This change in waste management has meant that the public utilities responsible for the operation of waste management have had to reconsider their own identity, their service portfolio, and their principle of earnings. Recent research in waste management supports the view that decision-making should be opened for societal dialogue, and waste management systems should be incorporated as a part of the national and global sustainability efforts (see e.g., Hornsby et al. 2017; Garnett et al. 2017; Kirkman & Voulvoulis 2016; Garnett & Cooper 2014; Song et al. 2015). Waste generation and waste management are no longer perceived as given, but the logic of the whole system has been altered and it can be said that they are going through transformation.

Examples from the energy and waste services sector imply that centralized service production has been accompanied by decentralized activities that make management more complex and diverse. Transformation of services has changed perceptions on, among others, how the service is used and who is involved in its production. It has altered the value structure transmitted through these infrastructure services and redefined consumption patterns. With this increase in complexity, the ability and potential of the service – without taking a stance on which forms of development are positive or negative – have risen to a new level.

3.2 Characteristics of water services infrastructures

Infrastructures that are utilized to manage movement and characteristics of water have been and most likely will be central in enabling more sustainable and smarter urban lives. Throughout history, management of water has been interlocked with the survival and success of communities. Dependence on water and uncertainty of its availability has led to the need to manage it. Hence, water management has been integrated into the politics of modern societies. In this sense, expanding urban areas can be seen as mega-structures where water management strategies are an inseparable part of the fabric of urban vitality. They contribute to the dialogue between human, nonhuman, and natural elements that embody and frame development patterns. (Simone 2015; Swyngedouw 2004.)

In modern urban areas, water services have typically been organized through centralized infrastructures as these have been viewed to be the ideal solution for cities (Libralato et al. 2012). In this sense, water service infrastructures follow the logic of growth, cost-effectiveness, and professionalization particular to Large Technical Systems (LTS). In a historical perspective, infrastructures that are based on the LTS logics were originally created in stable circumstances where it was possible to have sufficient management capacity and resource base for investments and maintenance. Thus, it was possible to provide adequate, homogenous, and cost-effective water services for urban residents, industries, and commerce. This system has, however, also meant that water users have been assigned a passive role, isolated from the system of service provision. Water demand is taken as a given, and the water provision system simply needs to meet this demand. (Moss et al. 2011; Sofoulis 2005; van Vliet et al. 2005.)

In other words, the system of water services provision, with all its massive technological apparatus and guiding institutions, has consolidated specific roles and practices related to water use. The system in question is, thus, very stable and resistant to rapid change. Innovations in this system are incremental rather than radical, and they strengthen the system rather than disturb it. High initial investment costs and low production costs achieved through mass production lead to path-dependent ways of organizing that produce technological, operational, institutional, normative, and conceptual lock-ins (Salo & Mäntysalo 2017; Dixon et al. 2014; Rixen & Viola 2009). Thus, once a centralized water management system has been adopted, learning, regeneration, and management are harnessed to maintain it. The centralized systems have produced indisputable benefits but also resistance to change and diversity.

Societal transitions in service production force the re-examination of established structures and processes. A central concern, then, is how water services enable citizens' participation and contribution to build sustainable urban lives. The dominant position of centralized systems has been strengthened by the relatively stable circumstances related to the availability of water. This position has allowed utilities to offer a "one size fits all" kind of service that has solidified the idea of an unlimited water supply (Sofoulis 2005; Bell 2018). The dominance of centralized water service systems has shaped the structure of consumption and contributed to linear consumption patterns. Daigger (2009) refers to these as "take, make, waste" systems in which consumers are mostly at the mercy of the supply system. Thus, the unsustainability of water consumption is, in many ways, determined by the characteristics of the supply system.

Megatrends like urbanization and climate change have made people question the dominant centralized model of water services despite its undeniable historical accomplishments of improving human health and state of environment in developed countries. The need to transform the system providing services is acute in areas where the promise of an unlimited water supply has failed. However, the transformation of water services is also related to the transformation of its context (Butler et al. 2014; Sapkota et al. 2013; Binney 2012). This view implies linking the calculable design of the demand for water resources with the profound transformation of water services that calls for the re-examination of producers, consumers, resources, and the basic assumptions of institutions. Thus, we will next examine the role of water users in water services.

4 THE ROLE OF WATER USERS

In order to understand the relationship between ordinary water users and water services, we interviewed 74 people in 11 municipalities in Finland. We paid attention to the diversity of interviewees in regards to demographic factors. The purpose, however, is not to conduct statistical analysis or to discuss the situation in particular municipalities, thus the results are presented on a very general level.

The willingness to be interviewed provides the first observation of this study. Many people were very hesitant about their knowledge of water services. When we asked people if they would be willing to participate in an interview about water services, the most common initial response was "I don't know enough about it". We tried to convince the interviewees that they did not need any particular knowledge but that we are interested in their views on water services.

People’s perceptions about the development of water services were closely linked to the questions of fairness and responsibility. Water was not seen as a mere techno-economic commodity but as the enabler and provider of basic necessities. Despite the abundant water resources, people felt that water should be used responsibly and not be wasted: “Think about it: What kind of world do we live in? Others suffer with a lack of water, and we use it without further thought.” In addition to the amount of water used, the purpose water is used for is laden with moral rules: “It sucks how we flush toilets with pure water. And shower all too often. Young people [shower] both in the mornings and in the evenings.” It is somewhat surprising that people’s perspectives on water use are not overly utilitarian; people do not think about how they could get maximum material benefit from an abundant resource but link their consumption to values and moral considerations.

Because water use is dependent on the water supply system, many of the interviewees felt that water management should reflect the interlinkage of supply and demand. They wished that public utilities operating in water services would be committed to environmentally sustainable and morally responsible activities. In other words, supply and demand should work together to promote what is valued. People, for example, were of the opinion that water utilities should “radically inform … water use” and “guide … water conservation.” Values should also be reflected in the tariff structure and all communication efforts by the utilities. Unfortunately, people felt that utilities are doing the exact opposite: “Just at the turn of the year, there was a feature saying that people have saved water, and now there is not enough income, and [the water utility] has to raise prices.” The following excerpts demonstrate the problematics of the “one size fits all” type of product portfolio in relation to water users’ conceptions about sustainable water systems.

> “It would make sense that incentives would work the other way around and there would be other ways. I’ve been thinking, would it be possible that when one washes hands then that water would go to the toilet’s tank? As you could very well reuse the water at some other point. You could also use it to water that meadow.”

“We have to consider that water is also used for washing. In Finland, we use good water for everything. Maybe we should have some public wells with not so finely purified water that you could use for watering. […] This shows our true wealth. We can flush the toilet [with clean water]. I wonder if anyone has considered having separate systems.”

”[I’d be willing to pay] if you could separate pure water from water that is used for cleaning. I mean, the water you drink needs to be purer than the one that is used for cleaning. But it wouldn’t be profitable as you’d need separate pipes.”

“It’s totally crazy, but I’d want to have a dry toilet. If we ever live in a place where it would be possible, I’d absolutely want it. I so remember the first time I started to talk with my father about how much it irritates me that so much water is used for flushing. He told me that already in the year ’82, when they were building their house in [the municipality of] Eurajoki, he would have wanted to build the kind of toilet that would reuse water that’s been used for rinsing hands. But they [the authorities] just laughed at him. That never ever. That you can’t do something like that. He thought already back then that it is just unthinkable that we flush with pure water when the water you’ve washed your hands with would be clean enough.”

As these excerpts illustrate, consumer behavior that represents different lifestyles and values is blocked. Water supply systems that rely on LTS were criticized because people feel that they focus only on techno-economic factors at the expense of other values that are more difficult to define. LTS-based logic provides very limited room for those who would be willing to adopt new ways of using water that can be considered as more sustainable. It can be said that the prevailing technologies, and the ways they are governed and managed are effectively defining what is considered meaningful and what absurd.

”I ’ve understood that it is also a problem that people have started saving water, [it’s a problem] as the pipes need water. In Western countries water is wasted. It doesn ’t make any sense to splurge purified water.”

The preceding excerpt illustrates how the interviewee feels that water is being used in an unsustainable way, but that it has been implied that "the pipes need water". As a summarizing observation based on the interviews, we suggest that water users are positioned as captive consumers who assimilate to the logic of the dominant system. This obstacle appears to be the main one in sustainability transformation in water services. Structures of the current water services system that can be characterized as LTS seem invariably powerful. This perception is explained by the high quality of water services when assessed against traditional criteria. Water services have succeeded in providing safe water to people and protecting the environment against the pollution of wastewaters. As a result, development focuses only on aspects that reproduce and enforce the current structures, whereas initiatives and innovations that would disrupt these structures are blocked.

Another summarizing observation is that people feel that water services are an essential part of the welfare system. Water services are perceived as a part of a superstructure that generates social well-being, which explains why the elements of reasonableness, fairness and justice manifested so strongly in the interviews. Based on the interviews, it is noteworthy that water services are highly appreciated despite their invisibility and “being taken for granted.” The loosely structured interviews allowed interviewees to contemplate their relationship to water services and helped to raise aspects that are not evident amongst the mundane routines. It can be concluded that, in reality, people have quite strong views regarding water services. However, due to the role of water users in the current system, these views are not actively taken into consideration when developing water services.

5 HYBRIDIZATION OF WATER SERVICES

Now, attention will be turned to hybrid systems particularly from the point of view of service transformation. Hybrid water supply systems typically refer to small-or medium-size systems that utilize resources located near the point of consumption—for example, the utilization of storm-water runoff, greywater, or wastewater (Biggs et al. 2009; Sapkota et al. 2015; Rathnayaka et al. 2016). Decentralized systems can be operated in a variety of spatial scales: 1) On-site scale; service provided at the scale of an individual property, 2) Cluster or development scale; serve two or more dwellings or a whole development, system is typically co-owned, 3) Distribute systems; typically serve large communities with hundreds of properties, and have their own utility. (Sharma et al. 2013.) These systems are modular and initial investment costs are typically moderate which enhances the adaptability and flexibility of the water supply system. Decentralized systems can utilize resources that are already in the urban water cycle and this way diminish the need to extract water outside the city (Wong & Brown 2009).

5.1 Potential of hybrid water systems

Discussion and debate about centralized versus decentralized water services have traditionally been focused on the potential of onsite systems in areas beyond centralized systems (Sharma et al. 2013). Lately, however, the discussion has focused on the combination of these systems—more specifically, adapting decentralized systems as a part of centralized one. These hybrids (Sapkota et al. 2015; 2016) transform the service system, which can, then again, enable the transformation of resources, technologies, service providers, and consumers (van Vliet 2003; van Vliet et al. 2005). In other words, hybrids can spawn a radically different form of urban water services systems by novel combinations of technologies, governance, and institutions.

Adaptation of a decentralized system as a part of centralized systems can diversify the available options for resources, which can also diversify the range of end products. Hybrid systems can decrease the need for potable water that can then be used to serve the needs of a growing population. Additionally, it has been argued that hybrids can diminish the need for pumping and treatment. (Sapkota et al. 2015.) Other benefits of hybrids are that they increase the redundancy of systems by increasing the number of options that can be utilized when a component of the overall system fails (Zimmerman 2005). Growing system redundancy is, thus, one contribution that hybridization can make to the resiliency of the overall system (Daigger & Crawford 2007; Bieker et al. 2010).

Hybridization can be driven by public utilities, but it is more typically initiated by user-driven micro-infrastructures. Micro-infrastructures can be characterized as organizations that create solutions to perceived problems at the local level. Egyedi and Mehos (2012) utilize the term "inverse infrastructure" to describe this phenomenon. Inverse infrastructures rely on the local community and users for their creativity and ability to invest and operate instead of a professionally driven comprehensive design that is based on predictability. Research has shown that one prerequisite for the development of micro-infrastructures is that the infrastructure policy of cities supports and enables self-organization of local communities to produce water services; thus, the implementation of hybridization is also a question of encountering two different ways of governing (Heino & Anttiroiko 2015). Furthermore, it has been observed that with self-organizing micro-infrastructures people perceive their efforts to be more meaningful and to reflect societal responsibility (Egyedi 2012; Egyedi & Mehos 2012). In addition to direct and immediate results, this kind of self-organization and action reform our way of understanding water services and participation in the development of urban areas.

As has been discussed, hybrids utilize atypical resource flows and provide water of different qualities for different purposes. From the consumer's perspective, the "one size fits all" type of product range is replaced by tailored solutions following the principle of "fit for purpose." This principle implies adapting water services to local demand while taking into account both the needs and lifestyles. In other words, the development of hybrid systems develops new interactions between supply and demand and supports consumption patterns that are viewed responsible. Water users have traditionally been seen as captive consumers, but in hybrid systems, their role has more leeway. Thus, hybrid systems can enable water services to support environmentally responsible lifestyle choices and grassroots-level activities and participation (van Vliet et al. 2005, pp. 42–62).

5.2 Tensions related to hybrid water systems

It is evident that radical transformation will not occur without challenges. Adapting decentralized systems to centralized systems can cause tensions for several reasons. To begin with, hybrid systems alter the growth logic that is typical of LTS; it is no longer a matter of seeking cost-effectiveness in the production of standardized services but rather development through diversification (Offner 2001). Decentralized systems disrupt the basic assumptions under which centralized systems have developed and for which they have been developed. Development of hybrid systems, thus, induces a more complex infrastructure system. It is a challenge to try to manage systems with different logics and disturbing elements.

Hybrid systems move the historically dominant view of water services as a production machinery towards a view of the system where the dynamics between actors are altered, hierarchies are lowered, and the value of water commodities is re-evaluated in the value creation processes (Heino & Takala 2015). Decentralized systems also disrupt the system of service provision physically. For example, the quality and quantity of water in centralized systems change when linked with a decentralized system (Sapkota et al. 2013; 2015; 2016). Changes urge operators of centralized systems to rethink the logic of their income generation and pricing of water services.

Centralized systems in developed countries have been successful in responding to the water demands of societies, promoting public health, protecting the environment, and doing all this with reasonable costs. Thus, it is only sensible to ask whether hybrid systems can cope with the same task. It is perhaps not very surprising that experiences of practical applications with hybrid systems have proved challenging. For example, according to Farrelly and Brown (2011), successes have mainly been limited to demonstration projects in which it is precisely the experimental character and intensive innovation that have secured success and acceptance. Poff et al. (2016) explain this as a battle between two paradigms: the engineering perspective that is dominant in water management and conservative ecology. In infrastructure planning, these two paradigms have been positioned as mutually exclusive. Van Vliet (2003) observes that every time water supply alternatives are brought up in the media, decision-makers and experts hasten to shoot them down, invoking a variety of explanations, such as the sufficiency of water resources, increases in the unit prices, loss of utility revenues, and the protection of safety and health. Thus, it is fair to say that hybrid systems in water services have not yet become part of the integrative urban design and transformation (Bieker et al. 2010).

6 CONCLUSIONS

In light of this research, it seems that hybrid systems have the potential to introduce such characteristics and changes to water services that would better integrate it into the processes of sustainable development. In energy and waste services, this kind of transformation is well underway. Water services seem, however, to be associated with basic characteristics that cause inertia and restrain transformation.

Water services play a central role in fulfilling daily needs, and it is an elementary part of our mundane practices. The views of Finnish water users on the sustainability of the water supply imply at a minimum, that Finns would be willing to assume a more active role in building more sustainable urban lives in which water services play an important role if only this would be made possible and encouraged by the system. The centralized water services system, however, hides and blurs practices associated with water consumption. We argue that hybrid systems have the potential to reveal these characters and open dialogue, but this is challenging and necessitates new thinking from decision-makers, experts, operators, and all professionals involved in the production of water services.

When it comes to the transformation of water services, it should be noted that most people may not necessarily want to change their role as a customer. Thus, their water consumption behavior may still be similar to the captive consumers, but the dynamics of provision and consumption will change. That is, people are able to define what kind of a customer role they want to assume in a particular case. In our view, the ultimate value of water supply transformation lies hidden behind its visible and direct applicability. It gives an opportunity for a more in-depth discussion on the service, where things that are currently considered as non-negotiable, intact and impossible to change are given an opportunity to be discussed. In this sense, we underline the transformation of the water service as a conceptualization over a predetermined goal, trusting that a service capable of transformation will find its own goals, for example, and most importantly, in relation to sustainable development.

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1. Our focus in this article is on the developed countries with existing and established water services infrastructure. For example, in Finland, it is estimated that 98% of the population have access to improved sanitation and 100% to improved water sources (UNICEF and World Health Organization, 2015). This does not imply that hybrid systems would be irrelevant in other contexts, but they are outside the scope of this article.

2. For example, in the service concept of Dutch energy company Vandebron, decentralized producers of renewable energy can directly trade with consumers.

3. Greater Manchester waste management provides an illustrating example of this kind of transformation (Uyarra & Gee, 2013).

4. Available at https://eur-lex.europa.eu/eli/dir/1999/31/oj.

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