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Managing Water Supply through Joint Regional Municipal Authorities in Finland: Two Comparative Cases

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Abstract: The aim of this paper is to analyze two Finnish Joint Regional Authorities for Water Supply—namely the Raisio-Naantali Joint Municipal Authority for Water Supply (established in 1957) and the Tuusula Region Joint Municipal Authority for Water Supply (established in 1967)—for assessing the development of supra-municipal water governance. The above two cases make it possible to analyze and assess water policies in settings where the owners are groups of municipalities. The analysis is based on two separately conducted case studies. The study data consist of several types of materials: Annual reports, local government documents, *etc.* The conducted interviews were semi-structured with some themes defined beforehand. The studies describe two authorities in the context of historical development and as a part of local development.

Keywords: supra-municipal co-operation; water management; water policy

1. Introduction

Being a sparsely populated country, Finland has a large number of municipalities. Local and regional cooperation has its roots in the idea of independent local communities which oversee the common good in specific areas. The demand for efficiency, an increase in public services and dwindling financial resources have led to a situation where the number of municipalities is decreasing.

In 1957 there were 549 municipalities of which 342 remained in 2010. As independence is not freedom from responsibilities, small municipalities are now faced with the challenge of organizing adequate services for citizens and industrial and commercial enterprises. Municipalities have a long history of providing water and sanitation services (WSS). In Finland, known as the land of a thousand lakes, water resources are unequally distributed. Especially southwestern Finland lacks natural water resources of good quality.

The role played by Finnish water authorities in water supply and sanitation services has gained attention in past years [1,2]. Inter- and supra-municipal cooperation between municipalities in water services is increasing. According to Kurki *et al.* [3], intermunicipal cooperation in water and sewerage services has increased: During the last three decades the number of bilateral contracts between neighboring municipalities has tripled. Concerning water services and their management, individual municipalities have traditionally been responsible for providing both, although the production of services has been open also to others according to the Water Services Act 2001. That distinction is also made, e.g., by Ostrom [4].

The water supply infrastructure depends on water resources and technical solutions, which is why WSS systems are subject to strong path dependence. The impact of WSS policy decisions can easily last 50 or even 100 years in the case of pipelines. Once pipelines have been laid, they are difficult to remove or relocate. The installation of pipelines can be as complicated as their removal.

In addition to the systemic character of infrastructure, there is the question of ownership. In the Scandinavian context—as in most of the Western world—public services are mainly owned by local governments, either directly or indirectly through water authorities or municipal companies. Since the actual owners are the municipal citizen-voters, ownership is indirect and distant. This complexity leads to a situation where there is no specific owner but only various representatives of the owner.

Although there is increasing interest for research on water history, studies on long-term water policies have so far been few. An example of a historical approach to water policy is the study by Hamlin [5] on changing water paradigms and their influence on water policy. Conceptions of water affect strategic decisions and how water supply and sanitation systems are planned and managed. Hamlin [5] found that water history for those who decide about water policy that in human history water has been “a contested concept... that changing conceptions of it do have social and political, as well as ethical and moral, significations, which can, however, be incorporated in quite different ways into water policy.”

The aim of this paper is to analyze the long-term development of supra-municipal water governance through two Joint Regional Municipal Authorities for water supply in Finland. These are the Raisio-Naantali Joint Municipal Authority for Water Supply (RNWS) (established in 1957) in southwestern Finland, and the Tuusula Region Joint Municipal Authority for Water Supply (TRWS) (established in 1967) north of the Helsinki metropolitan area. These cases provide the possibility to assess a setting where the owners consist of several municipalities. The comparative analysis is based on two case studies conducted separately. It includes a description of two authorities in the context of historical and local development. In the case studies, attention was paid especially to the following features: (i) Role of customers; (ii) Investments; (iii) Choice of technology; and (iv) Roles of the governing board and executive manager in the decision-making process. The particular aim was to find any possible linkages and separating factors between the cases.

The research questions were the following: How does the mode of ownership affect the operation and choices of the organization in longitudinal development? In particular, the role of the board and the CEO and their relationships were studied. Secondly, how was the joint WSS organized over the long-term considering group interests. Especially the role of the national government and big industries and their relationship with the municipalities was studied.

2. Research Strategy, Approach and Methods

The case study approach was selected since it makes it possible to focus on a single case and ask “how” and “why” questions allowing the context to explain the phenomena explored. Case study is suitable especially for this kind of in-depth, longitudinal research where the setting is complex and the focus can be an individual, a group or overall phenomena. In fact, case study can be described as a research strategy rather than as a research method, since it can combine several, both qualitative and quantitative, methods.

Stake [6] and Yin [7] have formulated two key approaches for case study. Although their approaches differ from each other, both are based on the constructivist paradigm. Constructivism assumes that truth is relative and based on social construction of reality [8,9]. In the field of technology, social construction of technology is used. As the approach emphasizes the role of the individual, it enables collaboration between the researcher and the participant. In that setting, interviewees are able to tell stories. Through stories the participants tell the structure of reality as they see it and provide a better understanding of phenomena.

In the case of a regional water authority, local context and conditions are fundamental. They determine the structure of local government when managing infrastructure such as water and sanitation services. As a result, the case study approach allows making generalizations based on more or less similar or comparable local conditions. However, it is essential that a case study is based on empirical material including exploration of historical documents, archives and interviews. Both our cases are based on empirical material combining longitudinal national, regional and local contexts. The cases share roughly the same timeline, and are located in southern parts of Finland, close to the coast. The case communities are quite similar, small and medium sized, and located near urbanized areas.

This study included several types of materials: Annual reports, local government documents and utility related studies and papers. The conducted interviews were semi-structured, where some themes were formulated during the interviews.

3. Theoretical Background

3.1. From Infrastructure to Sociotechnical System

According to the infrastructure approach and studies on Large Technical Systems (LTS) [10-12], the concept of infrastructure can be defined as a sociotechnical system combining social, economical, political, environmental and technological aspects. Infrastructure consists of collaborative networks producing and distributing services and goods [10]. Latour [13] states our perceptions constitute a “black box” where infrastructure functions seamlessly binding hardware and internal social organization to wider social structures. “Blackboxing” enables the rhetorical separation of society from

technology in the modern society. To understand infrastructure systems and their evolution, one has to understand the relationship between socio-technical systems and society [12]. According to Castro [14], there is strong bind between policy formulation and the socio-political-economic context.

In research, infrastructure is often referred to as a “technological system”. By referring to a technological system—instead of a technical one—we introduce social and societal features into the mix. Here, the interplay between various systems and structures is obvious. These systems are connected to each other and therefore the network metaphor is used when speaking about infrastructure or socio-technical systems [11].

Geels argues that studies on LTS focus too much on the macro and micro levels [15]. Like Misa [16], Geels sees that there is also need for studies focusing on the meso level. Misa’s categories include the micro, meso and macro levels. The micro level includes individuals, small groups; the meso level includes institutions like corporations while the macro level consists of large systems and structures like political economies. Macro-level explanations of infrastructures tend to be functional and systemic according to Misa.

According to Hughes [17], it seems that large technical systems follow a certain path in development in a certain historical time scale. After invention is made by system builder his visions are followed by diffusion state where networks emerge pursuing momentum usually described by Hughes as mass, velocity and direction. In the consolidation phase, commonly accepted standards are harmonized into uniform infrastructure, sometimes in the form of a “public utility”. Another view regarding water and the LTS theory is that, particularly water services are managed at the local “lowest possible level” as described by the 1992 Dublin Principles [18].

3.2. Principal-Agent Theory and Public Firms

As modern corporations evolved ownership and control became separated [19]. Such separation leads to a situation where asymmetric information between ownership and control exists. The agency theory describes this situation as a relation between principal (owner/shareholder) and agent (manager) who are assumed to have different objectives. The agency theory provides the conceptual framework for this study.

Public firms resemble agencies in several ways: First, there is the relationship between the citizen-voters and the local government (agent). Theoretically, the citizens are the owners of the public firms, and principals in the relationship, while the local government is their agent. Since the principals of public firms cannot exercise their ownership rights, they delegate control to the local government. Thus, another agency relationship exists between the government (principal) and the managers (agent). The relationship between voters (citizens) and local government and public utilities constitutes a set of interests which may be different in the case of government and the voters. Furthermore, voters’ interests are likely to be quite heterogeneous since they represent the interests of various interest groups and individuals. In public firms, citizen’s control is more indirect than shareholders’ control because of the nature of the ownership rights in the public firm. Governmental control in public firms is rather weak. This is due to the multiple objectives associated with public firms. Private firms operate for profit while public firms operate for benefit (or at least they should), which protects public utilities from the market failures and general externalities.

3.3. Water Supply as Infrastructure

Water supply can be described as classical and static, yet invisible, infrastructure. To a large extent, it lacks co-creation possibility since the user end of a water system is highly regulated. Like other infrastructures or so-called “urban technological systems” they are highly capital-intensive.

Community water supply in the modern sense was born in the late 19th century along with overall urban reforms. The question of citizen welfare was merged with the question of efficiency and the growing concern among various groups about hygiene. Other infrastructures, including transportation, gas, electricity, water and sewerage, emerged more or less at the same time. As cities suffered under the debt of several simultaneous investments, the question was raised whether these networked services should be privately or publicly owned. As they were large systems, there were infrastructural, investment, management and other concerns, which required an organization capable of managing them [20].

Yet, the question of public ownership of infrastructures has a long history in the Nordic as well as most other countries [21] Water supply and sewerage was considered too important a service to be operated by a private company. It was also thought that private ownership was not sufficiently interested in promoting public health and improved hygiene. The question of public ownership is not a simple issue since it involves a complex set of interests. Public ownership differs from profit-maximization in that ownership and control are separated. Profit seeking is not the only issue: Its distribution and establishment among community participants might also be crucial.

Water as public good is described by non-excludability and non-rivalry. These characteristics include indivisibility of service provision, a capital-intensive nature and a complex distribution system, and a high relative share of fixed costs. In addition, these characteristics make water supply a type of natural monopoly. With a sole supplier, there is the risk of abusing market position as the service provider might under-provide certain groups or areas and which may also be realized in the case of public authority. According to Mirás-Araujo and Piñeiro-Sánchez [22], municipal utilities lack the market discipline to maintain an investment program. That could result in high building and operating costs leading to overcapitalization and use of debt streams as well as the tendency to avoid innovation.

3.4. Water Supply and Sanitation in Finland

In Finland, bigger townships have four levels of water and sanitation systems. At the lowest level are the on-site systems outside networks in dispersed rural areas. The next level, the village or small community water cooperatives are the most common type of service producer. They are also increasingly involved in managing wastewaters. There are a total of about 1,400 water cooperatives in Finland. Bigger townships and cities normally own their water supply and wastewater utilities, which are fairly autonomous and generally integrated into a single entity [23]. The fourth level consists of a variety of inter- and supra-municipal arrangements for water supply or wastewater, or both. This paper deals with systems of this level, particularly with two joint municipal water supply authorities, and their evolution in the local and national context.

A water supply infrastructure is the product of available water resources, technical solutions and strong path dependence. The impact of choices made lasts easily 30 to 50, if not 100 years in the case

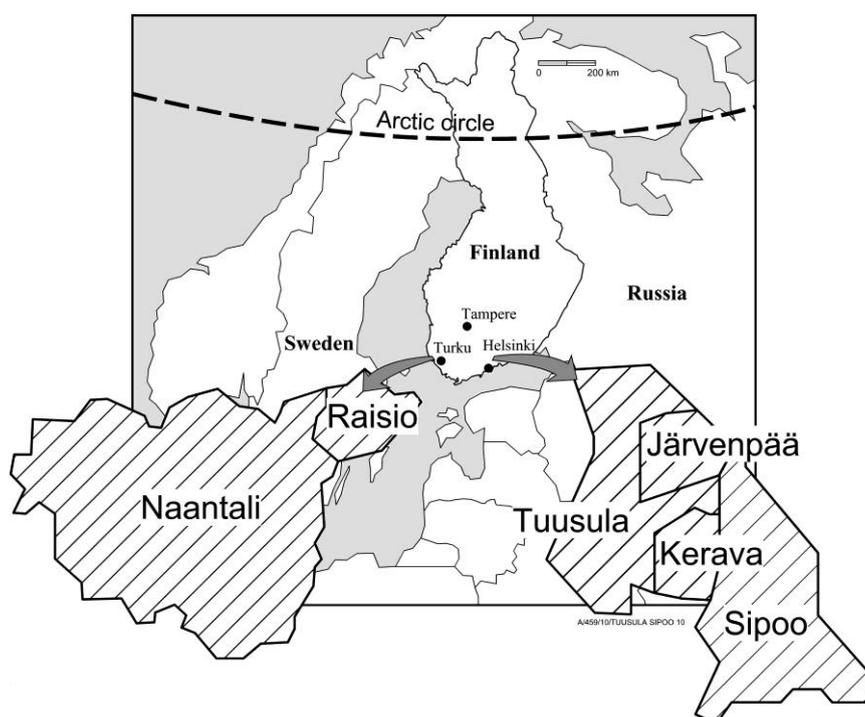
of pipelines. Once pipelines have been laid they are difficult to remove or relocate. The installation of pipelines can be as complex as removing them.

4. Case Contexts and Descriptions

4.1. Case 1: Raisio-Naantali

The Raisio Naantali joint municipal authority for water supply was founded in 1954 primarily to supply water to industry, namely the oil refinery of Neste Public Limited Company (Plc.) in Naantali. The attempts by the neighboring city of Turku to connect small neighboring municipalities to the city promoted the cooperation between Raisio and Naantali in terms of water supply (Figure 1).

Figure 1. Location of the joint municipal authorities for water supply: Raisio-Naantali on the south-western coast close to Turku, and Tuusula region north of Helsinki.



When the administrative council of Neste Plc. made the decision to build an oil refinery in Naantali in 1955, there was an urgent need for infrastructure in the area: Roads, electricity and water supply. After the establishment of the oil refinery, other enterprises also came to the area: Mobil Plc., the sugar mill of Juurikassokeri Plc., the power plant of Imatran Voima Plc., and the national grain storage center. The municipality of Raisio also had a special interest to get good quality water after the agro-industrial plants of Raisio Co. were founded in 1939.

Neighboring municipalities competed for the water works. The nearest water works was located in the city of Turku. It was interested in supplying water if the area where the refinery was to be built would be merged with it. The annexation committee of the town of Naantali asked a consultant to prepare plans to arrange the water supply of the refinery. In the planning phase of the water works, the consultant suggested using Raisio Bay as a basin of the Raisio River or damming up the Raisio River. Turku broke off the negotiations on merging the area of the oil refinery with the city, because it had

problems with its water supply and there were underlying social reasons that favored Neste Plc. over Naantali as the site of the oil refinery. The key persons planning water supply for the oil refineries in Naantali and Raisio also had close contacts with top national government officials.

Naantali and Neste Plc. carried on negotiations in the spring of 1955 where construction of infrastructure, namely water and electricity supply systems and communication networks, was discussed. At the beginning of the following year, Naantali undertook to supply water to Neste Plc. Correspondingly, Neste Plc. undertook to buy a certain amount of water from the water works to be established. The Raisio River was chosen as an alternative source, the decision to dam up the river and to build water works were made on 27 May 1956. Water supply started on 11 February 1957. Initially Neste Plc. consumed 85% of the water supplied by the water works. In the early 1990s its share was still about 19%.

On 24 April 1956, a federation of municipalities consisting of Naantali, Raisio and the rural district of Naantali was established to manage the water works project. The provincial government confirmed the establishment of the federation of municipalities on 21 February 1959. Municipalities acted as principals and owners of water works, but according to the contract between Neste Plc. and the municipalities, every investment has to be approved by Neste Plc. Soon after the water works started operating, the members of the federation of municipalities also started to plan the building of water supply networks in their area. An example of the complexity of the principal-agent-shareholder setting is that initially Neste Plc. refused to participate in supply network investments. In the early stages municipalities as shareholders also had to apply for permission from the federation of municipalities to enlarge their supply network.

The estimated water demand by industrial plants and municipalities was surprisingly high from the beginning. The water works had to increase its supply in order to be able to provide Neste Plc. the contracted amount and meet its obligations to shareholding municipalities. Before the federation of municipalities gained a legal status, the Raisio River was dammed to secure a supply of raw water. The main events during the first 20 years of the water works were the three extensions of the water works, the extension of the main line, and the purchase of additional raw water. Since the middle of the 1970s, the water works has been able to meet the demand for water without additional investments due to declining per capita water consumption. Distribution of water use among the municipalities of RNWS in 2010 is shown in Table 1.

Table 1. Raisio-Naantali Water Authority water use for 2010.

Customer/Municipality	Water use m³a	% of total use
Raisio	1,723,227	36.9
Naantali	1,675,073	35.9
Raisio Plc.	603,080	12.9
Neste Oil Plc.	646,480	13.8
Masku-Nousiainen	23,550	0.5
Total	4,671,410	100.00

The large investments in infrastructure required by increasing water demand strained the economy of the federation of municipalities, but the situation was eased by the growth of water consumption. When reorganizations of technological water treatment solutions continued in the 1980s, water works

started outlining their long-term plans, the big investment of the following decade: Intensification of water treatment and continued treatment of water.

In terms of environmental factors, namely of water quality, the water works faced another challenge at the end of the 1980s. In order to be able to use the Raisio River as a water source two things had to be done: The process of water treatment had to be improved and the bad smell and taste due to algae had to be reduced. The river had become a good substratum for algae growth. According to workers, water purification filters were clogged due to algae already in the summertime in the 1960s. Algae was a hot topic in Raisio towards end of the 1980s, as elsewhere in Finland. Slow sand filtration combined with ozonization was added to the treatment process to improve water treatment.

The Raisio-Naantali water works came virtually unscathed through the economic recession which shook Finnish society in the 1990s. Even though the financing costs of the water works had increased because of investments, the economic situation was better than expected because water consumption did not even decline during the slump. From an administrative point of view, the economic recession was less significant than the conversion of the federation of municipalities in 1992 into a public limited company owned by municipalities.

The municipalities of Raisio and Naantali participated in the Turku Region water supply project in the 1970s. A public utility company was established for that purpose. Its objective was to extract and deliver water to meet the needs of the region's reviving industry and to increase public welfare. After years of planning and political discussion, the Supreme Administrative Court gave a permit for water extraction in 1987. Yet, the project failed because the shareholders thought the national government's share of the costs of the project was too small. The regional water supply company was reorganized in 1994. The project will be finally completed in 2011 after a decade of preparation. The Regional water authority will be maintained until a possible larger water supply company for the Turku Region (a so-called network company) is established.

4.2. Case 2: Tuusula Region Water

In 2010 the Tuusula Region Joint Municipal Authority for Water Supply (TRWS, Figure 1) supplied drinking water to consumers in Järvenpää, Kerava, Sipoo and Tuusula through an integrated pipe network on a wholesale basis. The system included in total 14 groundwater and artificial recharge plants or intakes, eight water towers, and 160 km of pipeline connecting built-up areas. All supplied water is ground water, 70% of it being artificially recharged. The system supplies drinking water to 110,000 private connections and, for instance, the Sinebrychoff Brewery in Kerava and the Ingman Dairy in Sipoo. Distribution of water use among the municipalities of TRWS in 2010 is shown in Table 2. The water and sewage works of the partner municipalities take care of water supply within their areas while wastewaters are managed by the Keski-Uusimaa Region Joint Municipal Authority for Water Protection [24,25].

Table 2. Water consumption in Tuusula region municipal water authority in 2010.

Municipalities/Customer	Water use	% of total use
Järvenpää	2.20 Mm ³	24.7%
Kerava	3.31 Mm ³	38.1%
Sipoo	1.08 Mm ³	11.7%
Tuusula	2.15 Mm ³	24.1%
Hospitals	0.03 Mm ³	0.4%
Mäntsälä	0.08 Mm ³	0.9%
Pornainen	0.004 Mm ³	0.1%

4.3. Establishment of a Joint Municipal Authority

The initiative to establish water supply in the Tuusula Region came in 1964 from the National Board of Roads and Waterways (NBRW), which was assigned the urgent task of drawing a general plan for domestic water supply in southern Finland in cooperation with the region's municipalities and industry. It was soon decided that Tuusula, Kerava and Järvenpää should constitute a separate northern planning area. In 1965, Tuusula was found to have the largest untapped groundwater resources. The structure of the Joint Municipal Authority was adopted from the Raisio-Naantali authority. At the time, organizations based on wholesale water supply through intermunicipal joint-stock companies also started to emerge especially in the river valleys of Ostrobothnia.

TRWS was established in October 1967 and the facility was to operate on a self-sufficient, non-profit basis. In 1968, TRWS started its operations and the first full-time managing director was selected. In 1972, TRWS became a shareholder in Helsinki Metropolitan Area Water Company Ltd that had a 120 km long tunnel from Lake Pääjärvi constructed in 1973–1982. On completion of the second stage in 1979, its raw water could be conducted to the first artificial recharge plant of TRWS. In the Finnish context artificial recharge normally means also biological treatment of raw water in the aquifer, not only storage.

4.4. Improvement of Technology

In spite of its small size (9 permanent staff in 2010) TRWS has developed over the years and adopted various methods for treating groundwater and artificial recharge: The VYR method, basin recharge, slow sand filtration, limestone filtration, spray irrigation as a recharge method, UV treatment and rapid sand filtration. TRWS has also improved protection of its groundwater resources and implemented expansions and modifications. In addition, TRWS has used and developed automation systems which allow it to operate across an area measuring about 50 × 50 km.

Initially the pipes were made of cast iron; today their share is just 10%, the majority being plastic pipes, PVC or PEH. The structure of the trunk water supply network has changed from tree-like to loop-like, the latter being more reliable and secure. TRWS has over the years participated in R&D projects both at its own plant and on the national level.

4.5. Struggle over Groundwater Resources and Areas

TRWS has engaged in active and proactive dissemination of information since the 1960s. Since its early years, TRWS has strived to protect groundwater areas from polluting activity by buying them and by reconditioning old gravel extraction areas. A nearly 40-year war, or at least a battle, has been fought to protect groundwater areas and to take them into public use. In 2000, TRWS received a public recognition of its active work in groundwater protection. Future challenges will be posed by town planning and increasing traffic. In fact, the Joint Municipal Authority made it possible to build up the social pressure to protect the ground waters located mainly in Tuusula, one of the partner municipalities.

4.6. Joint Municipal Authority as an Operator of Public Water Supply

Until 1996 the council and board of the joint municipal authority were elected for four-year terms, hereafter for two years at a time. The positions of elected officials at TRWS continue to be held in high value and are sought after. A key form of operational development has been seminar visits primarily by the board. They have included tours of target city waterworks, lectures on topical subjects and group work. Decision making at TRWS is and has been democratic. Water has not, however, been a party-political issue, but has been managed and promoted for the common good.

TRWS has provided its staff opportunities to take part in training to improve skills and know-how, and its representatives have actively lectured at courses and conferences. Since its first construction project, TRWS has purchased design and contracting services, equipment and other services from the private sector on a competitive basis while also cooperating with member municipalities. In 2006–08 an initiative on merging the water and a nearby wastewater authority was submitted but still declined.

5. Main Findings

The analyses of the two studies consist of several phases: First they look at the evolution of the organization and how and why the water authority was established. More importantly, they determine the most active stakeholders or actors creating the demand in the initial phase. Other parts of the analyses focus on decision making and how the sociotechnical system handled it. Decision making is strongly linked to the choices of technological and organizational solutions.

5.1. Demand for Water and Establishment of Authority

In the 1950s and 1960s Finland was a country in transition from an agricultural to an industrial society where people moved from rural to urban areas in pursuit of employment. Migration caused housing shortages and increased water consumption. In addition, in the 1960s water consumption was expected to be at least 300 L per person per day or even more.

One trend in the country's industrialization was to establish state-owned companies in so-called strategic industries. The Neste Plc. oil refinery was one of them. The state-owned companies were not located only in urban areas but also in small and medium-sized municipalities. One solution for starting supra-municipal cooperation between small and medium-sized municipalities was to establish regional authorities. That allowed dividing the investment costs between several municipalities.

The demand for water came from the industrial side in the RNWS case. The municipalities could not finance the water works without assistance from Neste Plc. The decision about the water works had to be made quickly and some municipal councilors felt that they had been bypassed in the decision-making process. In the planning phase a consultant from YIT Engineering reviewed the different alternatives for governance of water supply. He proposed, based on Swedish experience, the establishment of a supra-municipal Joint Regional Municipal authority for water supply. Although there were doubts about the financial soundness of the municipalities, the investment was made. This time the decision was based on industry's need of water, not hygienic concerns.

Tuusula Region had an urgent need for water supply, but the municipality was unable to organize it alone. The region has significant ground water resources, but gravel extraction threatened the quality of the water. It seemed that a regional water authority was needed to protect the ground water and supply it to the community. In the planning phase, the consultant used in the RNWS case proposed the same kind of governance model for Tuusula region.

The State of Finland played an indirect role in the development of both WS. In the 1960s the National Board of Roads and Waterways was given the task to plan a regional water supply system for the Helsinki Metropolitan Area and the Turku Region, on the southwestern coast. Around the same time the National Board of Agriculture started to prepare regional plans for water supply and water pollution control in various parts of the country. Many of the ideas originally presented in these plans were in fact implemented by the 1990s [26].

5.2. Stakeholders and Customers

The main interest groups in both cases were municipalities and different industrial groups. The customer's role in the development of water works differed: The industrial stakeholders' role in both establishing and developing the RNWS was crucial. After the RNWS started to operate, every investment had to be approved by Neste Plc. This made negotiations and planning quite challenging since everything always boiled down to who would pay for the investments. The contract conditions allowed Neste Plc. to act like it owned the water works.

Industrial plants have always been important for municipalities. They bring tax revenue and provided jobs for the citizens. Tuusula Region municipalities also competed for big industrial plants. In the case of agro industries like dairies, municipalities and industries are known to have signed contracts which give industries a discount depending on the volume of water bought or lower rents. This was the case also with the RNWS. In the case of Tuusula Region the system worked so that the municipality of Sipoo along with a large industrial plant joined the TRWS in order to have good quality ground water.

As the RNWS operated as a bulk company, municipalities played an important role in the distribution of water. Household demand for water increased all the time. Demand for water quality also grew, and when quality problems occurred, households complained to the water works.

The national government was a key stakeholder in both cases. It had an interest in the Raisio-Naantali waterworks as a major shareholder of Neste Plc. Both cases were also linked to national government driven plans to develop water supply in southern and southwestern Finland. Another goal was to ensure the social and economic development of these regions where water supply was a challenge. In the

RNWS case the national government did not directly participate in the planning of water supply, but it seems that the close relationship between local key people and top national government authorities had an impact on the plans.

5.3. Role of the Board and Executive Director

Cooperation within the joint municipal authority was regarded as democratic and participative. In both cases, there were long-standing board members which may indicate that once they had familiarized themselves with water supply, they wanted to commit themselves to decision making. It seems that it was possible to react quickly to changes within a small organization.

The board members and operational officers of TRWS organized seminars in order to find a common understanding and reduce information asymmetry between municipalities and water works. TRWS also organized professional visits abroad, where the objective was to support strategic thinking while finding out how things were organized elsewhere. The main objective of the municipal water authority was to achieve consensus on governance. Consensus was actually achieved only after a long process.

The relationship between the press and the water works were taken seriously at TRWS. That may have been due to local control mechanisms which are different in small municipalities than in larger urban areas. The distance between the water works and the consumers may also be shorter in smaller municipalities. The relationship between the press and the water works worked differently at RNWS where water quality problems made the local press more critical about the water works and its operations.

An interesting feature of both cases is that they carried out experimental research in order to find new techniques to improve water quality. Here, the role of the executive director of the water works was fundamental. The executive director of RNWS held regular meetings where ideas were exchanged. It was still up to individual executive director how actively ideas and interests turned into concrete water supply technology. As the board and executive director of the water works shared the same information about the water works' development, they strived for consensus financial conditions allowing.

6. Conclusions

This article focused on the socio-technical system approach where ownership is public. The main issues were the roles of the customers, investments, the choice of technology, and the roles of the governing board and executive manager in the decision-making—in the decision making.

The theoretical background was based on the theory of the socio-technical system in the longitudinal sense. The theory has been developed towards the meso-level by combining the macro and micro levels of the socio-technical system. The meso-level approach was used to avoid deterministic argumentation at the macro-level and a too heavy emphasis on local conditions at the micro-level. The momentum of the socio-economical infrasystem may also give rise to contingencies in both studied cases as new larger regional water authorities will likely be established in the 2010s for the Turku region. Possible expansions or mergers may also take place, for instance in the Tuusula

region. The socio-technical system theory proved useful in these cases because it allowed examining political, economical, social, technical and environmental issues.

The agency theory was applied as a framing concept rather than a theoretical framework in the article. Its use helped describe the public firm setting where no actual owner exists. The issue of ownership was superseded by stakeholders who act like shareholders. In our case big industry which had a special contract with a regional water authority was such a stakeholder. Investments had to be approved together with the industrial partner in order to be realized.

The roles of the customers of both regional water authorities are ambiguous, since the roles of shareholders and customers are mixed. Shareholding municipalities were on an equal footing with industrial customers even when they were not directly involved in decision making. Each individual municipality had to consider its own interests as well as broader regional interests and demands. The role of partner municipalities as customers of a regional water authority still needs further study. As to the research question, we still do not know how shareholding municipalities operated their water supply in comparison to the water authority. It would be interesting to compare results to find out whether political interests are expressed more clearly in a local political context than by a regional Water Authority. One can also ask how shareholding municipalities organize their pricing when the Water Authority operates as a wholesale utility.

Investments and choice of technology seems to be interdependent according to our results. In the case of RNWS, supply of raw water was and is challenging but despite the environmental factors, the water authority managed to meet water demand by seeking common understanding and decisions. As the water works' organization was small, it was easier to adopt solutions different from mainstream solutions at that particular time.

The roles of the board and executive manager were crucial throughout the evolution of both cases. Board members aggregated complex set of interest in participative and committed sense. It seems that the political interests of individual municipalities did not play a significant role in decision making. It was in the board members' and the executive manager's interest to share common knowledge of demands, possibilities, threats and limiting factors concerning water works. And when new technological solutions were adopted, the executive manager played the leading role. In both cases the executive manager presented new ideas to the board.

Public health and fire protection have usually been the key arguments for water supply. It is worth noting that despite the hygienic paradigm, industrial use played an important part in both cases. There was also the need to protect ground water, and based on the cases, the best way to protect ground water was to use it for community water supply.

In both cases there were plans to outsource water supply to a regional water supply utility. The planning started in both cases at same time in the 1960s: The TRWS project was completed in the 1980s—the RNWS project is planned for completion in 2011. The starting point for both projects was the challenging water supply conditions. Since there was a shortage of water in the region, it was feasible to centralize water acquisition. A water authority is a public utility operating as a wholesale company with the municipalities as shareholders. The benefit of this kind of utility is that it leaves less room for local political manipulation since there is an embedded structural need for mutual understanding.

According to our findings, there are both externalities and internalities which have to be taken into consideration when policymakers deal with a socio-technical system, for instance, shape its water policy. One of the interesting conclusions of the study is that despite the fact that water and sanitation services are generally operated by individual municipalities; supra-municipal cooperation has proved successful. Challenge in a socio-technical system level still concerns all forms of WSS operations. Structural changes in society, whether in demography, migration or industrial production, also change the socio-technical system. Therefore, planning for future needs is very challenging since plans are usually overestimated, which brings extra costs to both operators and consumers in the future.

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