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Vuokko Kurki

Negotiating Groundwater Governance

Lessons from Contentious Aquifer Recharge Projects

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ABSTRACT

Groundwater is an invaluable part of our natural, built, and socio-economic environments. In global context, groundwater is the largest freshwater resource: almost half of all drinking water is abstracted from underground. During the last few decades, Finnish community water supply has increasingly relied on natural and artificially recharged groundwater as raw water source. Currently, their combined share of the water supplied is some 66 percent, out of which 16 percent is artificially recharged. However, potential groundwater areas and places for groundwater recharge are sparsely situated. Thus, large city centres, with their increasing need for fresh water supply, are obliged to withdraw groundwater from afar, often crossing municipal borders. This may cause tensions between different jurisdictional units; generally, between rural and urban areas. This research illustrates how cooperation between municipalities can turn into a conflict. Indeed, there are several examples of local conflicts around the inter-municipal groundwater projects in Finland. Many projects which are justified on both technical and economic grounds have problems in gaining legitimacy among local inhabitants. Oppositions emerge and projects may go through long litigation processes.

A contentious groundwater project can be classified as a complex management problem: it is unpredictable, uncontrollable, and it has several, often contradictory interpretations. Therefore, conventional groundwater management approaches, drawing from expert-based instrumental rationality, often are insufficient for successful project planning and implementation. Indeed, the emerging paradigm emphasizes collaborative approaches to complex management problems in the fields of natural resources management as well as urban planning. Water services (water supply, wastewater treatment, and storm water management) are inherently bound to these fields through their multiple connections with aquatic environment, required technical infrastructures, and influence on socio-economic development.

The main objective of this study was to find new perspectives for groundwater governance by analysing contentious cases that operate in field of water services, thus connecting the contexts of natural resources management and urban planning. Accordingly, the research problem was formulated as follows: Which are the major constraints in large scale groundwater projects from the perspective of collaborative governance, and what lessons can be drawn for future collaboration?

The research problem was addressed through negotiation theory and discursive framework which adhere to social constructionist tradition. Through these theoretical and methodological considerations, this study enclosed conflict analysis and discourse analysis. These methods were exploited in a comprehensive analysis of the two case studies where inter-municipal water supply projects, based on the managed aquifer recharge (MAR) technology, were contested by local inhabitants. First case is situated to southwestern coastal area of Turku Region. It started already in the 1970s as a long-distance water transfer project, and was finalized in 2010 when an MAR plant started to operate on the esker of Virttaankangas. However, the other case, situated to Tampere Region, started in 1993, and the process is still unfinished.

The results of this study indicate that the water management sector is strongly grounded on instrumental rationality when solely expert knowledge is considered as a legitimate source of information. Accordingly, planning and management of the MAR projects concentrated mainly on the visible tip of an iceberg, instead of managing the whole. The interaction between parties was based on competitive mindset and zero-sum game; thus, the underlying interests and the complexity of the project were not recognized. Strong positions were taken, which precluded the possibility of finding mutual gains.

Although cases involved some collaborative efforts, they were used only as casual tools without really relying on collaborative rationality. However, in groundwater governance it should be other way round: the *core* should be in collaborative rationality while some of the tools can be obtained from rationalistic expert-based planning. Thus, legitimacy for the project should be gained through joint knowledge production as well as interaction, where addressing stakeholders' interests instead of predefined goals could help in finding mutual gains and creative new options for collaboration. Furthermore, in this process, water managers and experts should be more like facilitators than holders of the only legitimate source of knowledge and the stakeholders like partners rather than informants or adversaries.

Keywords managed aquifer recharge, conflict analysis, discourse analysis, complexity, groundwater conflicts, negotiation, instrumental rationality, collaborative governance

Kurki, V.O. 2016. Vesi neuvottelupöydissä: oppeja ristiriitaisista tekopohjavesihankkeista. (Negotiating groundwater governance: lessons from contentious aquifer recharge projects). Tampereen teknillinen yliopisto. Julkaisu 1387 (Alkuperäinen englanniksi).

TIIVISTELMÄ

Pohjavesi on korvaamaton osa luonnollista, rakennettua ja sosio-ekonomista ympäristöämme. Se on maapallon suurin makean veden varanto (lukuun ottamatta jäätiköitä) ja noin puolet maapallon talousvedestä koostuu pohjavedestä. Viime vuosikymmenten aikana myös Suomessa on käytetty enenevissä määrin sekä luonnollista että tekopohjavettä raakavesilähteenä. Maamme vedentuotannosta 66 prosenttia nojautuu pohjaveteen, josta noin 16 prosenttia on tekopohjavettä. Potentiaaliset pohjavesi- sekä tekopohjavesialueet ovat kuitenkin sijoittuneet hajanaisesti ja lisääntyvän vedentarpeen myötä erityisesti suuret kasvukeskukset joutuvat hakemaan sopivia pohjavesialueita kauempaa, usein yli kuntarajojen. Tästä voi aiheutua jännitteitä eri hallinnollisten alueiden välille ja usein asetelma on nähtävissä muodossa ”kaupunki vastaan maaseutu”. Suomesta löytyy useita esimerkkejä ylikunnallisten pohjavesihankkeiden ympärille muodostuneista kiistoista. Hankkeet, jotka voidaan perustella teknisestä ja taloudellisesta näkökulmasta, eivät välttämättä saavuta legitimiteettiä paikallisten keskuudessa, jolloin vastakkainasettelut kärjistyvät ja seurauksena saattaa olla pitkittyvät valitusprosessit eri oikeusasteissa.

Kiistanalaiset pohjavesihankkeet voidaan luokitella kompleksisiksi ongelmiksi: niiden kulkua ei voi ennustaa tai kontrolloida ja hankkeista on vallalla monia, usein kiistanalaisia tulkintoja. Tästä syystä tavanomaiset pohjavesien hallintaan liittyvät lähestymistavat, jotka pohjautuvat asiantuntijavetoiseen instrumentaaliseen rationaliteettiin (instrumental rationality), ovat riittämättömiä jouhevan hankesuunnittelun ja toteutuksen kannalta. Uusi nouseva paradigma painottaakin yhteistoiminnallisia menetelmiä kompleksisten ongelmien käsittelyssä sekä yhdyskuntasuunnittelussa että luonnonvarojen hallinnassa. Vesihuolto (vedenhankinta, jätevesihuolto ja hulevesien hallinta) on luontaisesti sidoksissa molempiin aloihin: fyysinen vuorovaikutus luonnollisen akvaattisen ympäristön kanssa tapahtuu vesihuoltoinfrastruktuuri kautta. Vesihuolto vaikuttaa myös suuresti sosio-ekonomiseen kehitykseen osana yhdyskuntasuunnittelua ja luonnonvarojen hallintaa.

Tämän väitöstyön päätavoitteena on löytää uusia näkökulmia pohjavesihankkeiden hallintaan analysoimalla kahta ristiriitaista tekopohjavesihanketta vesihuoltosektorin näkökulmasta. Tällöin tutkimusongelma muotoutuu seuraavasti: mitkä ovat kiistanalaisten pohjavesihankkeiden suurimmat

ongelmat yhteistoiminnallisen suunnittelun ja toteutuksen näkökulmasta (collaborative governance), ja millaisia oppeja voimme tämän perustella esittää tulevaisuuden yhteistyöhankkeille.

Tutkimusongelmaa lähestyttiin neuvotteluteorian ja diskursiivisen viitekehyksen kautta, näin kiinnittyen sosiaalisen konstruktionismin traditioon. Teoreettisen ja metodologisen viitekehyksen pohjalta tutkimuksessa hyödynnettiin diskurssianalyysiä ja konfliktinkartoitusta. Tämä väitöstyö perustuu kahteen tapaustutkimukseen, joista ensimmäinen sijoittuu Lounais-Suomeen Turun seudulle, jossa kaukovedenhankintaan tähtäävä hanke aloitettiin jo 1970-luvulla. Hanke valmistui vuonna 2010, jolloin tekopohjavesilaitos aloitti toimintansa Virttaankankaan harjulla. Toinen tapaus sijoittuu Tampereen ja Valkeakosken seudulle. Hankkeen voidaan katsoa alkaneen vuonna 1993, mutta lopputulosta ei vielä tiedetä.

Tutkimuksen tulokset osoittavat, että vesisektori nojaa edelleen vahvasti instrumentaaliseen rationaliteettiin, jolloin vain asiantuntijatieto nähdään legitiimin tiedon lähteenä. Tekopohjavesihankkeiden suunnittelussa ja hallinnassa keskityttiin vain näkyvään jäävuoren huippuun kokonaisuuden sijaan. Molemmissa tapauksissa vallalla oli kilpailulähtöinen ajattelutapa, ja vuorovaikutus perustui nollasummapeliin jolloin osapuolten intressejä ja ongelman kompleksisuutta ei kyetty huomioimaan. Osapuolten vahvat positiot estivät myös potentiaalisten hyötyjen tunnistamisen.

Vaikka tapaukset sisälsivät yhteistoiminnallisia piirteitä, ne kertoivat enemmän satunnaisista yrityksistä kuin todellisesta yhteistyöhön perustuvasta rationaliteetista. Tämän tulisi kuitenkin olla kompleksisten pohjavesihankkeiden hallinnan ytimessä, kun taas yksittäisiä työkaluja voidaan hankkia asiantuntijavetoisen suunnittelun kentältä. Näin ollen hankkeen legitimiteetti tulisi varmistaa yhteistoimintaan perustuvan tiedonmuodostuksen ja vuorovaikutuksen avulla, jolloin osapuolten intressejä painotetaan ennalta määrättyjen tavoitteiden sijaan. Tällöin eri osapuolten potentiaalisia hyötyjä kyetään tunnistamaan ja uusia luovia ratkaisuja voidaan löytää yhteistyön edistämiseksi. Vesialan ammattilaisten tulisi toimia asiantuntijoina, mutta myös yhteistyön edistäjinä, sen sijaan että heidät nähtäisiin ainoan legitiimin tiedon haltijoina. Sidosryhmät puolestaan tulisi nähdä tärkeinä tiedontuottajina ja yhteistyökumppaneina eikä ainoastaan tietolähteinä tai vastustajina.

Avainsanat tekopohjavesi, konfliktinkartoitus, diskurssianalyysi, pohjavesikonfliktit, neuvotteluteoria, instrumentaalinen rationaliteetti, yhteistoimintaan perustuva hallinta

PREFACE AND ACKNOWLEDGEMENTS

Defeat means to defeat the mind of contention that we harbor within.

Morihei Ueshiba

Through my 16 years of experience in martial arts, I have learned that the only defeat that is worth pursuing is to defeat the mind of contention, as expressed by Morihei Ueshiba, the founder of aikido. In this work I have examined conflicts that are, in the end, the result of competitive mindsets of human beings. As it is said, every victory creates new enemies. These thoughts and a humble mind were my guides in the search for ways towards collaboration in contentious groundwater projects.

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Tampere on 9 December 2015 – the day I became an aunt.

Vuokko Kurki

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LIST OF ORIGINAL PUBLICATIONS

This doctoral dissertation is based on the following peer-reviewed original articles, and referred to in this dissertation by the Roman numerals:

I Kurki, V., Katko, T. and Pietilä, P. 2016. Assessing regional cooperation in water services: Finnish lessons compared with international findings. *Public Works Management and Policy,* 1-12. DOI: 10.1177/1087724X16629962

II Kurki, V., Lipponen, A. and Katko, T. 2013. Managed aquifer recharge in community water supply – the Finnish experiences and some international comparisons. *Water International 38*(6): 774–789. DOI: 10.1080/02508060.2013.843374

III Kurki, V., Takala, A. and Vinnari, E. 2015. Clashing coalitions: a discourse analysis of an artificial groundwater recharge project in Finland. *Local Environment,* DOI: 10.1080/13549839.2015.1113516

IV Kurki, V. and Katko, T. 2015. Groundwater as a source of conflict and cooperation: towards creating mutual gains. *Water alternatives 8*(3): 337–351.

AUTHOR'S CONTRIBUTION

Article I: Vuokko Kurki wrote the paper and is the corresponding author. The article is largely based on material collected and analysed by Pekka Pietilä. Both co-authors commented on the text and its content.

Article II: Vuokko Kurki wrote the paper and is the corresponding author. The co-authors commented on the text and its content.

Article III: Vuokko Kurki wrote the paper together with the co-authors and is the corresponding author. The co-authors also participated in the analysis of the empirical material.

Article IV: Vuokko Kurki wrote the paper and is the corresponding author. The co-author commented on the text and its content.

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ABBREVIATIONS AND ACRONYMS

ADR	Alternative Dispute Resolution
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
IAH	International Association of Hydrogeologists
IWRM	Integrated Water Resources Management
MAR	Managed Aquifer Recharge
MGA	Mutual Gains Approach
OECD	Organisation for Economic Cooperation and Development
Tavase	MAR project for Tampere and Valkeakoski Region
TRW	Turku Region Water
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank

TERMS AND DEFINITIONS

Common-pool resource	Natural or a human-made resource, which any appropriator can exploit in order to obtain benefits from its use. The supply of the resource is limited, thus it is often overexploited.
Discourse	Written and spoken communication where a set of meanings, metaphors, statements and stories together construct a particular version of events. Discourses produce conceptual generalization and knowledge through which we interpret the world in certain way.
Discourse analysis	An analysis of a text or speech which reveals the discourses operating within them and the argumentations that are used in the construction of the discourse. The analysis examines the ways social reality is produced through various social practices.
Emergent property	Interaction of different parts of a system produce emergent properties, which cannot be predicted by observing the functioning of individual parts. Emergent properties are thus unpredictable.
Institution	Underlying rules of the game with formal laws and regulations together with informal social norms and cultural, religious, and historical perceptions that underlie and supplement formal rules. Shape the human interaction within their environment.
Laissez-faire approach	There are no management efforts at all.
Nonlinearity	Does not follow the linear cause-effect relations and thus results in unpredictable outcomes.
Paradigm	A lens, through which we see, interpret, and explain the world. The lens is composed of a series of beliefs and assumptions about the world, which are often subconscious, and thus we seldom question them.
Performativity	A term for the capacity of a description to participate also in the construction of a phenomenon or action.
Self-organizing	A system can organize itself without external manipulation or control and displays emergent properties.

1. INTRODUCTION

The water poured into the well does not stay in there.

A Finnish proverb

The Finnish proverb above could technically describe managed aquifer recharge (MAR). The water pumped from a lake or a river does not stay in the well or in a recharge basin, but it infiltrates the ground and forms new artificial groundwater sources for water supply. However, this proverb figuratively refers to social interaction where one person tries to present new ideas to others. If these other persons are not ready for those ideas, these will disappear like water in an empty well. Conversely, if those ideas already somehow touch these persons, and they have some understanding on this particular subject, they can have a fruitful conversation with the person who introduced the ideas, and they can learn from each other. Accordingly, in the beginning of a water project, the first task for a water manager would be to ensure that the project's stakeholders have some common ground and readiness before starting negotiating.

The common ground was sought between the municipalities of Tampere region in the end of the 1980s, as their agenda was to find a proper solution for future water supply of the region. In consensus, the municipal representatives and regional authorities established a plan that aimed towards establishing an MAR project, which would be implemented on an esker situated in the rural areas of the region. However, local people from that area started to oppose the project and the opposition spread throughout the years. This caused years of delay and a litigation process and the final result is still, in 2015, open. These few decades showed how cooperation can turn into a conflict.

Simultaneously, another conflict occurred around an MAR project in Turku Region, southwestern part of Finland. These two projects, which have many similar features, are analysed in this research. They are typical examples of complex management problems[1], where neither problem nor the answers can be clearly defined. In addition to technical artefacts, these projects involve multiple socio-economic features which increase the unpredictability of the system. Furthermore, these complex systems are characterized with several unknowable and uncontrollable interactions.

[1] Also the term wicked problem is often used in relation to this kind of complex management problems (see e.g. Brown et al. 2010, Rittel and Webber 1973).

1.1 Background

Groundwater is mainly invisible to human beings. Thus, we often forget that it is the largest fresh water supply on the earth: approximately 95% of available sources, excluding those locked in polar ice caps, are underground (UNEP 2003). Driven by population growth, increase in technological capacity, and economic development, the use of groundwater increased explosively during the twentieth century (van der Gun 2012). Globally, its use has more than tripled over the past 50 years; currently, nearly half of all drinking water in the world is abstracted from underground (Schneegans 2013). Globally groundwater is used for irrigation (67%), industrial (22%) and domestic purposes (11%) (IGRAC 2010).

However, groundwater is a classic common-pool resource (CPR), which means that any appropriator can deplete the supply of that resource available to others. It is difficult to exclude users gaining access to it, but it can become unavailable to other users after certain users have extensively used it. (Adams et al. 2003, Heikkila 2004, Ostrom 1995.) This is problematic since CPRs are often overexploited, which is a serious problem concerning groundwater use, especially in arid regions. This can cause, for example, land subsidence or contamination of groundwater by seawater intrusion (Kemper 2003). Moreover, in some parts of the world unsustainable groundwater use causes a major threat to social and political stability (Howard 2007).

One solution to overcome many challenges related to groundwater is to infiltrate surface water to the aquifers in order to raise groundwater level (e.g., Brunner et al. 2014). This system, called managed aquifer recharge (MAR[2]), can be seen as a technological effort to respond to the water demand. It is used for many purposes such as storing freshwater, improving water quality, and reuse of storm- or wastewater (British Geological Survey 2006). In fact, MAR has been practiced since the 19th century in countries such as England, France, Germany, and the USA. Currently, it is used worldwide but especially in arid and semi-arid countries, where the main purpose is to store surface water in aquifers, and use it during dry seasons (see article II). However, Finland, as a part of the boreal region of the globe, has abundant water resources, and here MAR is mainly used as a water treatment method (Kolehmainen 2008) in order to gain good quality water supply for domestic use and industry.

In Finland, the popularity of the use of MAR techniques can be partly explained by a kind of groundwater paradigm, which started to develop in the 1970s. Concurrently, the contamination of

[2] The term artificial groundwater recharge (AGR) is also widely used as a substitute.

surface waters peaked due to industrial and other point source pollutants, including untreated wastewaters. Since then, the surface water quality has dramatically improved, due to effective water protection programs and actions, albeit it that the quality of groundwater is still clearly superior. The paradigm has remained and the groundwater is the dominant source of community water supply. The share of groundwater has gradually increased, and in 2011 it reached the 66%, out of which 16% is artificially recharged groundwater. (Katko 2013.) In 2015, there are 25 plants producing artificial groundwater in Finland (see Table 1 in article II[3]).

Due to geological reasons, potential areas for natural and artificial groundwater recharge in Finland are in eskers and in ice marginal delta formations which are sparsely situated (Hatva 1996). Furthermore, these are located in inland areas, whereas most of the population is currently located along the coast. Thus, large city centers, with their increasing need for fresh water supply, are obliged to withdraw groundwater from afar, often crossing municipal borders. This may cause tensions between different jurisdictional units, generally between rural and urban areas, which, in an extreme situation, may lead to a groundwater conflict. Indeed, water is a fluid and boundary-crossing substance; it crosses political, social, and ecological boundaries, and related decisions are often part of wider geopolitical processes.

1.2 Groundwater conflicts and governance

In practice, management of modern water systems have emphasized technological matters, not acknowledging the importance of governance experimentations (Bos and Brown 2012). However, a shift from water management towards water governance is taking place. OECD (2011, 17) acknowledges that "[c]learly, the current water 'crisis' is not a crisis of scarcity but a crisis of mismanagement, with strong public governance features" (see also Carius et al. 2004, Rogers et al., 2006, Saleth and Dinar 2004). According to Massarutto (2012, 305) the focus should be moved from a rationalistic emphasis towards legitimacy and ultimately social capital (see also Bos et al. 2013, van Buuren 2013), where public participation and direct involvement will appear much more valuable in long term than short-term technological and economic interventions.

Narrowing the scope to groundwater, several international organizations **(**FAO, UNESCO, IAH, WB, and GEF) have joined forces to address groundwater governance issues. They define groundwater governance as "the art of coordinating administrative actions and decision making between and among different jurisdictional levels - one of which may be global." Governance is a complex and

[3] The information was gathered in 2013, but the number of MAR plants have not changed since.

over-arching framework that determines groundwater policies – *how* strategies are executed and how actors from various fields interact – whereas management is about concrete activities, *what* we do, in order to achieve goals and objectives. (A Global Framework for Action 2015, 1.) Furthermore, at the European Union level, legal frameworks, such as the Water Framework Directive (Directive 2000/60/EC), and the Directive on the Protection of Groundwater against Pollution and Deterioration (Directive 2006/118/EC), seek for new groundwater-specific governance arrangements in order to promote sustainable and participatory outcomes.

Accordingly, sustainability, and public participation are also visible in academic literature concerning groundwater governance. Kemper (2003), for example, analyses how careless laissez-faire approaches have shifted towards more comprehensive management practices where incentives and stakeholder participation are combined in order to overcome the pollution and overexploitation of groundwater resources. Furthermore, public participation in groundwater governance is analysed from the perspectives of spatial planning (Cuadrado-Quesada 2014), community-based management of rural groundwater issues (Reddy et al. 2014, van Steenbergen 2006), collaborative decision-making processes (Holley and Sinclair 2013), as well as institutional arrangements both in local and multinational levels (Varady et al. 2012). However, Schneegans (2013) argues that research on groundwater management and governance is still in its infancy, especially if compared with research on issues related to surface water.

Indeed, groundwater is a hidden resource, which means that related issues do not attract as much policy or scientific attention as surface water issues do. This and other special features of groundwater have an influence on the governance framework. For example, due to its invisibility, groundwater flows and volumes are more complex to examine (Budds 2009) and require more fiscal resources, which may lead to the absence of proper management methods (Kemper 2003). Furthermore, as Jarvis (2014) argues, groundwater governance needs to address tensions between technical and political arenas: as a hidden resource it forms a fruitful ground for a debate about key issues, including different interpretations about water quality, quantity, economics, and history.

Unlike surface water, groundwater abstraction is much more strongly related to land use and spatial planning (see Cuadrado-Quesada 2014). For example, intensive groundwater use may cause tighter restrictions in land use; for instance, in terms of fertilizers, pesticides or heavy industry, or other possible polluters of groundwater. According to Rossi (2014) one of the main questions related to Finnish groundwater management and land use is peatland forest drainage in groundwater areas.

In addition, groundwater involves special temporal characteristics, which leads to juxtaposition in terms of social development and social equity (Kemper 2003, 123–125). For example, in the short

term, it is beneficial to abstract groundwater to all social groups, since it is easy to access and it is usually of better quality than surface water; thus, it is a driving force for socioeconomic development (van der Gun, 2012). However, in the long term, if abstraction leads to decrease in groundwater levels, pollution and extraction problems occur and groundwater is no longer available for those who cannot afford expensive pumping systems (Linton and Budds 2014, 177).

At the global level, overexploited underground resources and contaminated aquifers increase the pressures in governance of groundwater resources, which has become an increasingly conflictive issue (Jarvis 2014). Although several scholars have broadly addressed water conflicts (e.g. Barraqué 2012, Scholz and Stiftel 2005), academic contribution to groundwater conflicts in particular as well as their resolution is much more scant (Jarvis 2014). However, single case studies on groundwater conflicts can be found, concerning mainly arid regions with problems of water scarcity: for example, Macdonald and others (1995) explore conflicting interests between irrigation and community potable supply in Maharashtra, India, whereas contradiction between economic benefits from agriculture and negative environmental impacts on groundwater are studied by Salazar and others (2007) in Guanjuato, Mexico as well as by Giordano and others (2013) concerning the Apulia Region in the Mediterranean basin. Furthermore, for example, Mumme (1982) analyses groundwater controversies in the border region of Mexico–USA, and Zeitoun (2007) explains the paradox of conflict and cooperation concerning the shared aquifers of Palestinians and Israeli. In addition, Bazargan Lari and others (2009) tackle the issue of conjunctive use of surface water and groundwater resources, in Tehran, Iran.

Generally, water management problems gain attention in arid and semi-arid countries. However, in Finland, the rather water-abundant conditions have not prevented groundwater conflicts which indicate that they are not necessarily related to water scarcity. Therefore, Finland is an interesting example for studying the characteristics of water conflicts. Finnish groundwater conflicts have evoked earlier research from different perspectives. Myyrä (2007) studied the interaction between local people and a municipal water utility in a conflict concerning groundwater abstraction inside the municipality of Joensuu. As concerns inter-municipal groundwater conflicts, they have occurred at least in Tampere, Turku, Seinäjoki and Oulu Regions (Figure 1). From the latter case area, two descriptive analyses have been conducted; a discourse analysis by Junes (2013) and a frame analysis by Lauhava (2013). There is also a study with a more normative perspective by Rossi (2014), where stakeholder involvement was examined and facilitated by using a multi-criteria decision analysis method (see also Karjalainen et al. 2013). This study combined hydrological and socioeconomic perspectives inside an integrated groundwater management framework. Another framework, a

hydrosocial cycle, was used by Lyytimäki and Assmuth (2015) whose analysis focused on risk communication and management in connection with a public debate around an MAR project of Turku Region (see also Assmuth et al. 2015).

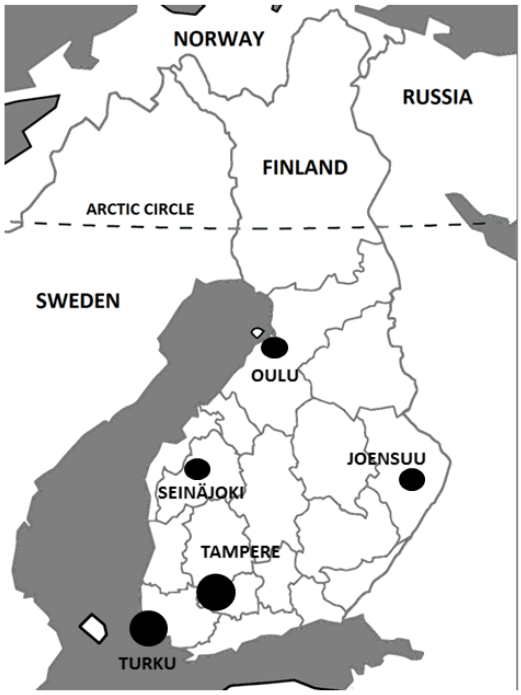

Figure 1. Contentious groundwater projects in Finland

In summary, the research on groundwater conflicts in the global as well as Finnish context emphasizes the need for recognizing socio-economic features of groundwater management and implementing more participatory, integrative, and collaborative approaches. Accordingly, this study analyses groundwater conflicts by using a collaborative governance framework (Ansell and Gash 2008, Innes and Booher 2010, Margerum 2011, Pahl-Wostl et al. 2007). In conflicts, the question is often about failed cooperation. Thus, collaborative governance framework provides tools for identifying the major constraints in groundwater governance. Certainly, collaborative governance does not provide answers to all questions and has faced strong criticism as well. The challenges of collaborative approaches are addressed in chapters 2.2 and 4.4.4.

The selection of the two case studies can be justified by local as well as global context. From global perspective the present work utilizes an exceptional context for water conflict: the land of thousands of lakes[4]. This context introduces an interesting perspective to the discussion about water problems being related to a problem of governance rather than water scarcity. Furthermore, among the Finnish

[4] Finland has altogether 187,888 lakes with a surface over 500 m².

cases, two cases concerning MAR (Turku and Tampere Regions) are chosen. MAR is a technological innovation, used for decades, but it gains continuously increasing attention inside groundwater management discussions and practices (Bloetscher 2014, Dillon et al. 2010). In addition, these cases represent the largest inter-municipal groundwater projects in Finland. As Lach and others (2005) argue, the potential for conflict increases as the sizes of water systems increase.

1.3 Objectives and research questions

The overall aim of this study is to find new perspectives for groundwater governance by analysing contentious cases that operate in the field of water services and which also include the contextual backgrounds of urban planning and natural resources management. The research problem for this study can be formulated as the following two-part question: Which are the major constraints in large scale groundwater projects from the perspective of collaborative governance, and what lessons can be drawn for future collaboration?

The research problem is examined more specifically through two Finnish case studies: First case-study is situated in coastal Turku Region (case TRW) and the second in inland Tampere Region (case Tavase). In order to address the research problem, the following research questions are established:

- How do different stakeholders construct their view on the MAR project?
- What kind of negotiation model was used and how did this affect to interaction between the stakeholders?
- What is the role of knowledge production in a contentious groundwater project?
- Which are the special features of MAR that should be addressed in groundwater governance?

1.4 Structure of the research

The approach of this research is problem-centered (see Ellis and Levy 2008). Therefore, this study stems from a phenomenon rather than from gaps in a theory (Pratt 2007). The phenomenon can be described as an iceberg and a researcher as a sailor who is observing an iceberg, first from the distance, then closer, finally reaching the floating giant. There are several question marks around it: what has happened, why this happened, and is there something fundamental that could have been done otherwise. These simple questions lead to observing and analysing the problem from various perspectives. The researcher scratches the surface and analyses its ingredients. Some of the observations lead deeper inside the iceberg than others, while some concentrate on the context, the

surrounding seawater. The researcher is inevitably surprised of the incredible size of the 90% of the iceberg that lies below the surface of water[5].

This research consists of four peer-reviewed articles and their synthesis. The metaphor of an iceberg (Figure 2) illustrates the structure and different components of this research. Following the introduction, chapter two presents the theoretical framework which is like a sky above the iceberg. It is an infinite entity of divergent ways of thinking, from which I have selected those parts that best communicate with the empirical findings. Theoretical framework acts as a kind of lens through which a researcher observes the phenomenon. Here, the collection of material and theoretical consideration are overlapping, thus forming a dialogical process. This communication can be facilitated by the chosen methodology, also presented in chapter two.

As for the sea around the iceberg, chapter three describes the contextual framework of the study. This framework illustrates first a large context of the research area and then moves towards the case-context, the sea in immediate proximity of the iceberg. The description of the case-context is largely based on the articles I and II, and involves general observations on inter-municipal water services as well as on MAR.

Chapter four summarizes the results obtained from the actual case studies; it analyses the visible tip of the iceberg (article III) as well as the bottom that lies below the sea level (article IV). However, the division between the two articles and two case studies is not that straightforward; rather, they are nested, each invading to each other's domain. Furthermore, this chapter illustrates comparison between the two cases, which has not been presented in the articles. Thereafter, in chapter five, we jump back on the sailing boat and observe the surroundings in order to see what kind of implications the empirical case studies have in practical and theoretical contexts.

[5] More precisely, 91,7% of an iceberg lies below the surface (Hokin 2015).

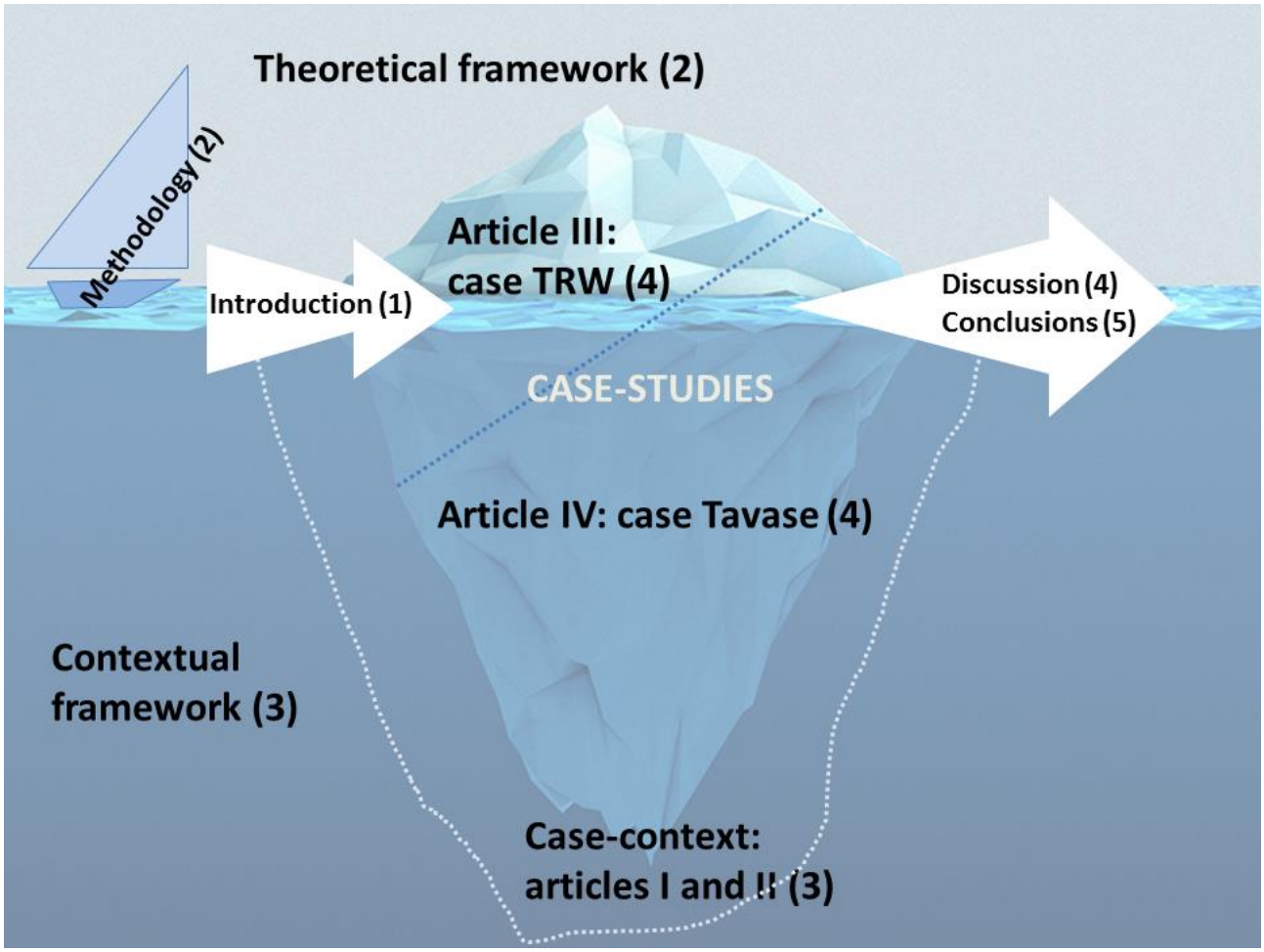

Figure 2. The structure of the research with reference to associated chapter numbers of the dissertation

2. RESEARCH APPROACH AND METHODOLOGY

Only in recent years have we begun to realize how profoundly developments in knowledge and technological capacity are linked to human self-understanding and social relations. […] To build on "natural" facts without taking stock of associated social orders is risky business.

(Jasanoff and Martello 2004, 347)

This research investigates how technological artefacts are embedded in our natural and social environments: the basic idea is to study water services not only as a physical but also as a social construction. Therefore, the theoretical foundation of the research is in social constructionism, which is rather seldom acknowledged in engineering sciences. Indeed, according to Naukkarinen (2015), engineering science can be classified mostly as design science, and there are seldom significant linkages to existing theoretical backgrounds.

2.1 Positivist epistemology vs. social constructionism

Positivist epistemology arises from the idea that knowledge is based on objective and unbiased observation of the world (Bernstein 1976, Burr 1995, 185). Indeed, traditional science assumes that a researcher can objectively analyse the world and its phenomena – which can be accurately measured and which operate under fixed laws with predictable outcomes (Stacey 1991, 20). Thus, a system can be taken apart, its details analysed, and solutions or best options in order to proceed found. Accordingly, for example, most of environmental research excludes the social aspects of a process, and concentrates only on physical and ecological features assuming that they can be separated from their social context (Budds 2009, 419). The physical or biological conditions do not exist, however, in a vacuum. Therefore, the conventional approach is not applicable to complex problems, such as water management problems that involve several unpredictable, unknowable, and uncontrollable interactions.

Since the 1960s, in order to acknowledge the profound social aspects of our everyday problems, a theoretical orientation called social constructionism has challenged the positivist epistemology mostly in social sciences and humanities (Burr 1995). One of the major contributions from the field of sociology is generally considered to be Berger and Luckmann's (1966) book called The Social Construction of Reality. They emphasize that world is socially constructed through the everyday social practices and interactions between people. Individuals interpret this constructed reality in their

own ways and experience the world as if the reality was pre-given and fixed. The *truth* is not an outcome of our objective observation of the world, but of social processes and constant interactions of people. Accordingly, for example, environmental debates are characterized by not mere uncertainty, but also by multiple and divergent truths of the phenomena in question (Thompson 1991). These contradictory truths provide evidently powerful fuel for political debates.

However, social constructionism has encountered strong criticism as well. According to Hannigan (2006, 29), its major criticism evolves from the controversy between relativism and constructionism. For example, a general assumption is that social constructionism denies the existence or at least the severity of environmental problems. However, while social constructionism claims that such phenomena are socially interpreted, this does not mean that they do not exist (Dryzek 2005, 12). On the contrary, natural reality does have a significant role in identifying these risks, but the constructionists are trying to emphasize that the role of social, cultural, and political processes should not be neglected. Accordingly, an environmental problem, for example, is a complicated construction of a natural phenomenon as well as a dynamic social process of definition, negotiation, and legitimation (Hannigan 2006, 31).

2.2 Collaborative governance

The mechanistic worldview, based on Newtonian linear model of the universe, has not only dominated natural sciences as well as other scientific disciplines, but it is also culturally embedded in our everyday policy-making (Innes and Booher 2010). Indeed, the twentieth century's policy literature and practice has approached the process of public decision-making through traditional bureaucracy, where scientists innovate, politicians make policy, and people respond – especially when they are unhappy (Islam and Susskind 2014). According to Innes and Booher (2010, 17-18) this linear model of instrumental rationality assumes that through logical steps experts can gather objective data, analyse it and find the best alternatives in order to bring them on the tables of decision-makers. Thus, decisions would be the result of an objective analysis of the observable and measurable world out there.

However, the complex world does not follow the logic of linear model of the universe and thus challenges the interaction between citizens, policy-makers and the world of science. In terms of interaction, there has been a shift from one-way traffic towards a two-way traffic, as Kooiman (1993, 4), one of the founding fathers of the governance perspective, illustrates. The dichotomy between those governing and those governed is narrowing. This is often referred to as the shift from vertical and hierarchical *government* to network-like and horizontal *governance* (Benz and Papadopoulos

2006, Michels and Meijer 2008, Pahl-Wostl et al. 2007), where collaborative efforts can be seen as key elements of less formal models of decision-making (Hajer and Wagenaar 2003, Teisman et al. 2013). In this research, the kind of public policy that brings multiple perspectives and interests to the same table in order to deliberate on the problems that various interest groups are facing together, is called collaborative governance (see e.g. Pahl-Wostl et al. 2007, Ansell and Gash 2008).

Instead of instrumental rationality, governance is supported by the paradigm of collaborative rationality (Innes and Booher 2010, 6). Collaborative rationality, based on social constructionism, has invaded especially the field of planning[6] where complexity, uncertainty, and contentious issues are commonplace. Both urban planning (e.g. Edelman 2007, Fainstein 2000, Healey 1998, Martinez and Olander 2015) as well as natural resources management (NRM) (e.g. Conley and Moote 2003, Margerum 2011, Ostrom 1990, Singleton 2002) have evoked a highly diverse body of literature which contributes to various theoretical and practical considerations of collaborative planning, bringing up multiple terms and definitions. These concepts and ideas have been used abundantly and they have developed simultaneously in various directions. This challenges academic discussion on the subject and causes contestation and misunderstandings of the collaborative planning, both in theory and practice. (Baptista 2005.)

The paradigm shift in water sector has been noticed by several scholars in the field of water planning and management as well. A pioneer example can be found from the field of water services in Denver metropolitan area where a successful collaborative process was launched in the 1980s in order to find resolution to the decades of dispute around a regional water supply project (Carpenter and Kennedy 1988). Instead of being considered as a purely hydrological element, the concept of water has started to reflect social and political dimensions as well (Linton and Budds 2014). Accordingly, Islam and Susskind (2013) argue that the dominant assumption of win-lose logic in allocation of common-pool resources has been challenged by mutual gains negotiation theory over the past few decades. Furthermore, Brown and Farrelly (2009) present that the importance of adaptive and collaborative

[6] The origins of collaborative planning can be found in two different philosophical traditions; theory of communicative rationality developed by Jürgen Habermas and American pragmatism worked out by thoughts of John Dewey and Richard Rotry (Fainstein 2000, 453). Through his theory, Habermas (1981) increases the understanding of how deliberation can be rational. Innes and Booher (2010) consider Habermas's work as a foundation for collaborative rationality, which is, however, a more practical concept than communicative rationality. It acknowledges that the ideal conditions for rational deliberation (presented by Habermas) are something to be aimed at rather than something that should be literally reached. Habermas's influence to collaborative rationality has been pointed out by several other scholars as well (e.g. Dryzek 1990, Forester 1999, Healey et al. 1997).

action is beginning to seep into current urban water policies, although the rhetoric is not always translated into practice.

Indeed, there is always a danger that a new paradigm turns out to be a popular slogan, a vague, indefinable, and theoretical concept that is repeated in every organization and institution, but wide-scale implementation still fails to occur. Accordingly, the implementation of collaborative efforts will be challenging unless our institutional structures and norms of decision-making evolve towards collaborative change (Innes and Booher 2010, 116). The institutional framework often defines who can participate and on what terms. On the other hand, for example negotiation-based collaborative approaches are strongly drawn from practice, and they emphasize their pragmatic relevance and implementable solutions (e.g., Fisher et al. 1991, Innes and Booher 2010, Shmueli et al. 2008). According to Benz and Papadopoulos (2006), the essential dynamics of governance comprise the interplay between formal and informal patterns. Thus, theory and practice as well as institutional and pragmatic change should go hand in hand, each enhancing the other.

Collaborative approaches have encountered several challenges in the field as well. For example Margerum (2002) presents a comprehensive overview of case studies with reflections to literature, and the obstacles that actors have confronted during collaborative efforts. Innes and Booher (2010) present three aspects for failure: collaborative approaches are unfamiliar, experience from the field is not adequately shared among the practitioners, and there is no a time-and-space-specific formula for implementing these approaches. On the other hand, Nolon and others (2013) argue that a review of hundreds of successful case studies indicates that there are certain general principles that those processes follow. Thus, one of the major challenges is in the dissemination of those principles in the field. Although there are several handbooks for implementing collaborative approaches (e.g., Margerum 2011, Nolon et al. 2013, Susskind et al. 1999), these might drown to the ocean of handbooks, or simply be too far away from practice.

2.3Research methodology and methods

The epistemological foundation of this research is in social constructionism, which can be seen as a base for collaborative rationality. Based on these theoretical considerations, this research has two complementary perspectives to the research problem: discursive framework and negotiation theory. The previous encloses discourse analysis, which is exploited in analysing the case TRW (article III). The latter works as a framework for practice-oriented and negotiation-based approaches, included in conflict analysis from the case Tavase (article IV). These two approaches examines the iceberg from different angles (see the metaphor of an iceberg, presented in chapter 1.4, Figure 2): while the

emphasis of discourse analysis is in the visible tip of the iceberg, conflict analysis aims at revealing the bottom, the underlying interests of each party. The distinction is not straightforward, but methods are complementary to each other. Although the two methodologies are utilized separately in the case-studies, these studies were conducted simultaneously, and thus both analyses influenced each other. Comparative approach was utilized during the whole research process and its main observations are presented in chapter four.

2.3.1 Discursive framework and discourse analysis

Acceptability of knowledge used in decision-making process is generally something that legitimizes the process. However, as the world has become increasingly complex, a growing number of cases show that this legitimacy is more and more difficult to gain. According to van Buuren and Edelenbos (2004) knowledge has become a highly contestable matter, and instead of being an instrument for legitimization it has become a medium for clashing claims. This research explores the ways knowledge was produced and discourses formed around the case TRW.

While the iceberg represents the ensemble of the two case studies, reality can be defined in multiple and divergent ways by various stakeholders, depending on the direction from which each observe the giant. Thus, the iceberg is surrounded by multiple discourses, which can be defined as "the ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer and Versteeg 2005, 175). Accordingly, drawing from the tradition of social constructionism, Hajer's (1995) discursive framework suggests that conflicts can be seen as complex struggles about the definition and meaning of a problem. Each party is fighting for the space of their own definition of reality in the arena of policy-making.

The definitions of reality are, however, not stable, but they are produced, maintained, and transformed through the social interactions in time and place; thus, they are culturally and historically specific (Burr 1995, 1). Each party participates in the construction of not only its own, but also of other truths that can be seen as different sides of the same visible part of the iceberg.

As a data analysing method, discourse analysis explores how reality is constructed through discursive practices; it analyses the visible structures of social order, perceptions, and actions in and through a text and talk (Nikander 2008). The case TRW was analysed by using two concepts; *storyline* and *discourse coalition*, introduced in Hajer's (1995) discursive framework; these concepts were complemented with the idea of *knowledge coalition* introduced by van Buuren and Edelenbos (2004).

The storyline is a generative sort of narrative which combines elements from multiple sectors but also simplifies a phenomenon in order to construct a comprehensible picture of the phenomenon in question. The storylines are like discursive cement that keeps a discourse-coalition together, while the coalition participates in maintaining and transforming the storyline. (Hajer 1995.) Since knowledge production is an important part of coalition-building, the idea of knowledge coalitions was used in order to complement the analysis of discourse-coalition. The idea contributes to the discussion of the transgression of science and society (Delvaux and Shoenaers 2012, Jasanoff and Martello 2004, Nowotny et al. 2001), and moves the focus from between the policy and knowledge worlds themselves to between the coalitions that may include actors from both worlds: for example, citizens, authorities, private sector, and policy-makers (van Buuren and Edelenbos 2004).

2.3.2 Negotiation theory and conflict analysis

While discourse analysis explores the formation of the coalitions and the construction of social order, negotiation theory and conflict analysis are used in order to study the interaction between involved parties and possibilities for future action. More precisely, the conflict analysis aims at describing the conflict, stakeholders, central issues and interests of each party. This description is viewed through the lens of negotiation theory, which provides applicable tools for analyzing the stakeholder interactions.

The dialogue between theory and practice is strongly visible in negotiation theory (Bartos 1995, Fisher et al. 1991, Walton and McKersie 1965) which is the base for several consensus-oriented practices, including alternative dispute resolution (ADR) (McDonnel 1988, O'Leary and Raines 2001), consensus building (Susskind et al. 1999) and mutual gains approach (MGA), which can be seen as an approach to consensus building (Nolon et al. 2013, Susskind and Field 1996).

Negotiation theory involves two main models of negotiation: distributive and integrative bargaining (Walton and McKersie 1965). The previous includes a strong emphasis in positional thinking. Through their positions, parties define their goals and generally engage themselves to a zero-sum negotiation, where the main purpose is to defend one’s own goals with as minor concessions as possible and to maximize the share of the fixed amount of benefit (Bartos 1995, Fisher et al. 1991). Being locked into their positions, parties cannot engage themselves in creative search for new solutions which would also satisfy their underlying interests.

While distributive bargaining concentrates on this visible tip of the iceberg, the integrative negotiation approach emphasizes the underlying interests (also known as principled negotiation or interest-based bargaining). According to Susskind (1999) the goals and positions hide the parties’ true interests, the

underlying reasons that explain why they take the positions they do. These interests can be seen as the 90% of an iceberg that lies below the surface. While the interests are revealed, alternative solutions and benefits for all parties can be searched for. Thus, this value creation process requires a shift from positional thinking to interest-based negotiation (Islam and Susskind 2013).

Over the past few decades, in multiple cases, the interest-based approach has turned the win-lose situation into value-creating win-win situations, where groups with conflicting goals are able to satisfy their interests simultaneously (Innes and Booher 1999, Islam and Susskind 2013, McKinney and Field 2008, Nolon et al. 2013). The idea of creating value is that new solutions are invented that are substantially better for all sides than the ones that are left if an agreement is not reached (Islam and Susskind 2013). Nolon and others (2013, 13) argue that hundreds of case studies show that the most successful conflict resolution processes involve the same key principles: engage early, listen and learn first, build on interests not on positions, learn jointly, use a skilled facilitator, and build relationships for the long term. Negotiation theory, including these principles, was applied in this research in order to analyse the interaction of different stakeholders of the case Tavase.

2.4 Two case studies: material and methods

Case study is an empirical method which uses wide-ranging information to analyse a phenomenon within its real-life context (Yin 1994). Context is intrinsically important since, as Flyvbjerg (2006, 221) argues, in the study of human affairs, only context-dependent knowledge appears to exist. Thus, case study is especially applicable when the boundaries between phenomenon and context are not clearly evident (Yin 2014). It is based on induction, which means that instead of hypothesis testing, the reasoning proceeds from specific observations to more general conclusions. However, these conclusions cannot directly be applied to other cases. For example, Innes and Booher (2010, 22) emphasize the interpretative view, which aims at developing narratives that clarify complex phenomena in a particular situation rather than constructing laws to apply in multiple cases.

While the main emphasis of this research is on case studies, analysed in articles III and IV, the first two articles concentrate on the case-context. Article I analyses the field of inter-municipal cooperation and article II establishes a framework for MAR projects. Table 1 summarizes the data and methods used in all four articles.

Table 1. Data collection and methods

	Article I	**Article II**	**Article III**	**Article IV**
Case study / case-context	Context: Inter-municipal WS	Context: MAR	Case TRW	Case Tavase
Data collection	Inquiries to water utilities Interviews (n=13) Two seminars for water experts and authority	Literature review Expert interviews (n=4)	Newspaper articles (approx. 400 pcs, 1999–2010)	Stakeholder interviews (n=28) Workshop (1)
Data analysis	Quantitative data analysis SWOT analysis	International comparison of the state of art in MAR	Discourse analysis	Conflict analysis
Supplementary material	Stakeholder interviews from the case Tavase	-	Expert interviews (n=9) Official documents (1969–2010) Newspaper articles (approx. 5000 pcs, 1976–1999)	Newspaper articles (2001–2010) Official documents (1993–2015)

The first two articles were based on material collected through interviews and literature review. In addition, the material of the first article was complemented with some ideas arising from the stakeholder interviews from the case Tavase.

The two cases were studied simultaneously by using an overlapping approach, which means that their analyses influenced each other and the observations from one case study was compared with the observations from the other one during the whole research process. The case studies involved multiple materials, including newspaper articles, stakeholder interviews, and material gained from a workshop. Supplementary material from the case studies refers to the material that has not been utilized in the articles directly, but has been collected and analysed in order to formulate an overall picture.

2.4.1 Interviews

Since cases do not appear similarly to everyone, it is crucial for a case study to obtain multiple views of the case. Stake (1995, 64) argues that the interview is the main road for obtaining such views. Since an interview includes direct interaction with the interviewee, it is an adjustable and flexible data collection method. Furthermore, there is an opportunity to observe the motives behind the answers (Hirsjärvi and Hurme 2011).

This study included altogether 54 semi-structured interviews: 13 interviews[7] for article I, four expert interviews for article II, nine expert interviews concerning the case TRW, and 28 stakeholder interviews concerning the case Tavase (see Table 1). Interviewees were chosen by using a snowball sampling method (Hirsijärvi and Hurme 2011, 59): first, a few key informants were interviewed and they were asked to suggest further interviewees. The interviews were recorded and transcribed, excluding two phone-interviews.

The expert interviews included mainly water professionals, one from Sweden and the rest from Finland. Although they were all water professionals, they represented various fields of expertise: academics such as hydrogeologists and a chemist, as well as practitioners such as water engineers, project managers, and managing directors of Finnish MAR projects. The aim of these interviews was to gain a general picture of the MAR projects in Finland with some Swedish comparisons. Furthermore, the nine interviews of the representatives of the case TRW opened up the historical context of the case.

The interviews concerning the case Tavase (article IV) included representatives from all the major stakeholder groups: environmental and municipal authorities, decision-makers, representatives of a water company, land-owners, representatives of an NGO, and other active citizens. A stakeholder is defined here as a party that has a direct stake in the outcome of the conflict (Wehr 1998) and has an interest in a project. Most of the interviews were conducted together with an MSc-student from the field of social sciences (Master's Degree Programme in Civil Society, University of Jyväskylä), in order to gain more perspective to the interviews[8].

[7] These interviews were conducted and analysed by Doctor Pekka Pietilä, who is the co-author of the article I.
[8] The MSc-student contributed the interviews with her perspective from social sciences during the formulation of questions as well as during the interview processes. This was complementary to the engineering perspective of the author.

2.4.2 Analysing newspaper articles

Hannigan (2006, 79) argues that media coverage is an important driver for an erstwhile problem to be included in the political process or public discourse. Accordingly, this research utilizes newspaper articles as a major source of material concerning the case TRW (article III). The newspaper articles were analysed in two phases. First, quantitative analysis of the newspaper articles from 1976 to 2010 (ca. 5000 pieces) was conducted in order to depict the case history and the argumentation related to the opposition as well as to the support of the water project. Since the material included three and a half decades of the case history, it was possible to observe temporal changes in argumentation. The quantitative analysis also enabled selection of the newspaper articles for the second phase of the analysis, which included some 400 articles from 1999 to 2010. These articles were analysed by using the method of discourse analysis. Altogether, the journalistic publicity from the case TRW during the years can be considered as a forum that documents the ensemble of the argumentation.

3. CONTEXTUAL FRAMEWORK

> *Water is constantly in motion, passing from one state to another, and from one location to another, which makes its rational planning and management a very complex and difficult task under the best of circumstances.*
>
> *(Biswas 2004, 248)*

For centuries, water has been one of the defining factors for urban development. Currently, many countries emphasize co-ordination between water and other policy areas, including spatial planning and regional development (Hartman and Spit 2014, OECD 2011). Various interconnections between different policy arenas as well as different domains, including natural, built, and socio-economic environments, transform a simple molecule of two hydrogens and oxygen to a highly complex element. Swyngedouw (2004) describes water as an element that constructs and maintains the metabolism of cities. This metabolic structure, which constitutes of water supply, circulation, and elimination, is embedded in social interactions in which nature, the city, and society can no longer be separated.

3.1 Complexity of water systems

This study addresses the water management problems through a conceptual framework of complexity, a concept which has become an important one in modern governance processes. According to Innes and Booher (2010) complexity was originally studied by physical scientists in order to understand nonlinear phenomena that could not be fitted into the Newtonian linear model of the universe. Accordingly, the concept of complexity challenges the traditional mechanistic notions of public policy and planning.

Complexity refers to several characteristics of a system. For example, a complex system involves multiple individual agents, which are connected through various networks with nonlinear interactions. Important here is the existence of interacting feedback loops, which enable emergence, self-organizing, adaptation and learning in a system. (Richardson 2008.) Although various theories have developed around the concept of complexity, most of them acknowledge the basic idea that the system is more than the sum of its parts and interactions of those parts are the driving force for the development of the system (Klijn 2008). Therefore, in order to understand system behavior, we

should – instead of studying parts of the system – concentrate on the interactions and feedback among components.

A water system is defined here as a manmade system that involves interaction between natural, built and social environments and where water is the key component. It can be understood as a complex system based on several characteristics of complexity. First, water systems consist of various networks, each including multiple parts and interactions. Furthermore, they involve multiple stakeholders competing for a limited and common resource (Islam and Susskind 2013).

Second, the interactions of water systems are often unknowable and unpredictable (Islam and Susskind 2013). These characteristics of a complex system do not result from lack of knowledge, but from the nature of the system (Sotarauta 1996, 129): it has a tendency for self-organizing, which means that a system can organize itself without external manipulation or control (Dempster 1998) and displays emergent properties which are not dependent on individual behavior of the agents alone. Accordingly, the system is sensitive to disruptions caused by unexpected events (Klijn 2008, 302) and involves non-linear causal effects (Duit and Galaz 2008). Therefore, Islam and Susskind (2013) argue that instead of concentrating on causations, we should study the interactions from the perspective of sensitivity: system behavior may be sensitive to a certain action but is not necessarily caused by it. Thus, understanding the sensitivity of the initial configurations of a network to its future evolution is intrinsic in managing water systems.

Third feature of the complexity of water systems implies that they operate inside various domains and across multiple scales and boundaries. In addition to the technical perspective, water management problems have become increasingly interconnected with political and social domains that involve human values, behavior, and organization (Linton and Budds 2014, Teisman et al. 2013). Furthermore, water combines several development sectors including agriculture, energy, industry, transportation, and communication, all these operating in multiple levels including local, regional, national and international levels (Biswas 2004, Ringler et al. 2013). Accordingly, interaction between various domains, sectors, and levels is challenging and often results in fragmentation of public administration, which is, according to Teisman and Edelenbos (2011, 102), an inevitable characteristic of governance structure as long as specialization is one of the main drivers of socio-economic development.

However, interdisciplinary approaches emerge including collaboration between various disciplines, organizations and institutions, and water management problems are no longer lying on the tables of water professionals only (Freeman 2000, 487). Complexity thinking leads us towards collaborative planning and system scale management, instead of concentrating on individual sectors (Innes and

Booher 1999, van Buuren 2013). Indeed, approaches such as integrative, adaptive, and collaborative water management have been launched in order to solve the problem of fragmentation in the field of water governance, but their functionality is often questioned (Lubell and Lippert 2011, van Buuren 2013). Probably the most known approach, integrated water resources management (IWRM), aims at interlinking management of water resources (saline-, surface, and groundwater) with water services (water supply, wastewater and drainage) (Pietilä 2006, 29–30) as well as water sector with various development sectors, within multiple levels (Biswas 2004, van Buuren 2013). Furthermore, it seeks for integration of cultural, economic, and ecological dimensions of water, not forgetting wide public participation in decision-making processes (Linton and Budds 2014). Thus, it is not surprising that the concept has been accused of being a vague albeit powerful slogan with only marginal practical impacts (see Biswas 2004).

The gap between theory and practice is often highlighted in criticism towards IWRM (Jeffrey and Gearey 2006). The problem with integrated approaches to water management, or other sectors such as forestry or agriculture, is that different concepts and related policies are not integrated (Rahaman and Varis 2005). Furthermore, most integrative approaches are still dominated by rather rationalistic and technocratic way of thinking (van Buuren 2013, 171) and they are based in classical bureaucratic structures, which are still preferred in the public domain (Teisman and Edelenbos 2011, 103). Thus, instead of solving the problem of fragmentation, these approaches may create even more fragmented and bureaucratic structures and organizations in the field of water management. However, optional ideas have been sought in network governance (Robins et al. 2011) and collaborative governance (Pahl-Wostl et al. 2007) as well as from self-organizing complex governance systems (Teisman and Edelenbos 2011, 101).

3.2 Bridging natural, built, and socio-economic environments

Grigg (1988) has studied the relationship between natural, built, and socio-economic environments in relation to large infrastructure projects (Figure 3). Here infrastructure is considered necessary to support a complex socio-economic system, but it is also dependent on the natural environment. However, while the pyramid illustrates a hierarchical order between the domains, several scholars see the relationships more like a cycle (e.g., Bouleau 2014, Budds 2009, Islam and Susskind 2013, Linton and Budds 2014), as will be illustrated later in this chapter.

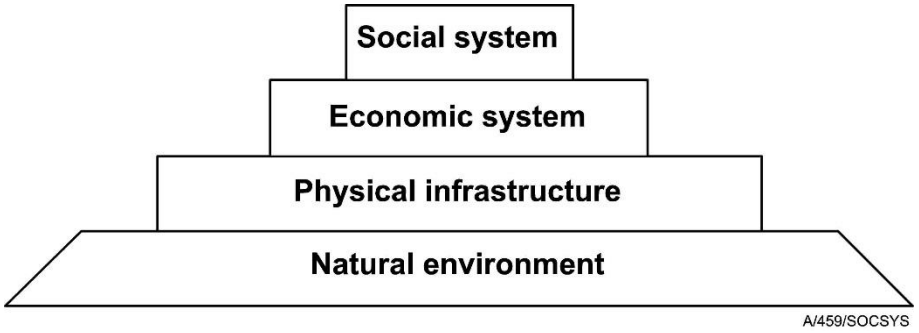

Figure 3. Relationship between natural environment, infrastructure, and socio-economic systems (Grigg 1988)

As defined in previous chapter, a complex water system involves connections with natural, built and socio-economic systems. Water circulation in its natural environment consists of various vertical transformations; from evaporation of surface water to precipitation and water infiltration to underground, finally ending back to the starting point. This hydrologic cycle is closely connected to our built environment. Through technological interventions, hydrologic cycle is manipulated and thus linked to the horizontal cycle of water supply, drinking water production, as well as collection and treatment of waste- and stormwater.

While the circulation of water in the natural and built environment is rather understandable and can be easily explained through maps, diagrams, and tables, the flows of human affairs are more difficult to grasp. Social environment can be seen as a platform where several cycles of power, decision-making processes, and actions create, transform, and maintain the water cycle in its built as well as natural environment. However, water should not be seen merely as an object of politics (Linton and Budds 2014); after all, social practices are predicated upon and conditioned by the circulation of water into, through, and out of the city (Swyngedouw 2004, 1). Accordingly, Islam and Susskind (2013, 12) describe the interactions among natural and societal processes within a political domain (Figure 4). Natural domain involves interplay among variables such as water quantity (Q), water quality (P), and ecosystems (E), which may lead to conflict that cannot be separated from variables occurring inside societal domain: governance (G), values and norms (V), and assets (C).

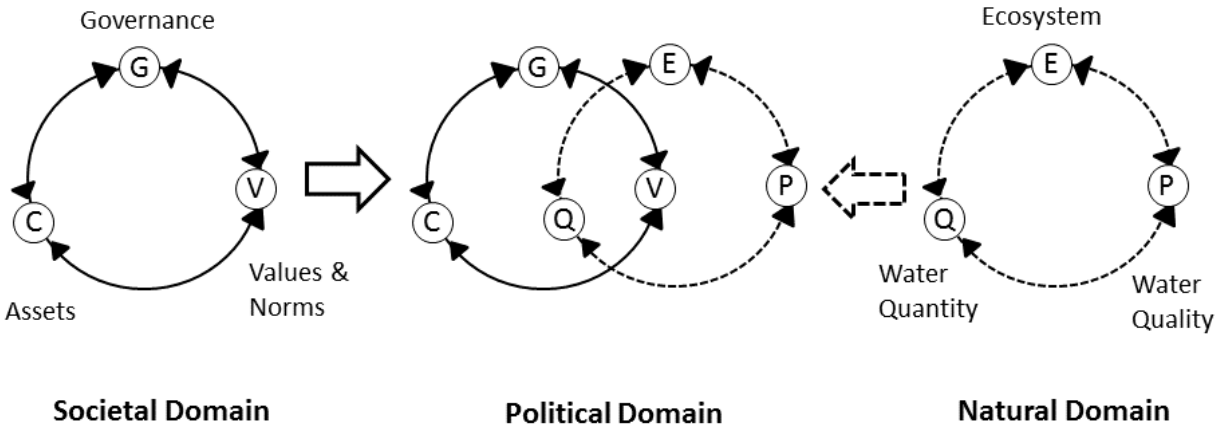

Figure 4. Interplay among variables in natural and societal processes within a political domain (Islam and Susskind 2013)

Increasingly recognized social and political characteristics of water management challenge the conventional and dualistic concept of hydrologic cycle, which was first introduced by the American hydrologist, Robert Horton, in 1931, in order to introduce a framework for emerging science of hydrology (Horton 1931, 192). According to Linton and Budds (2014, 171) "[b]y constituting a new field of scientific enquiry and an associated group of knowledge workers, the hydrologic cycle also helped legitimize a certain technical authority over water." However, during the 21st century, for example a concept of *hydro-social cycle* has been utilized by several scholars in order to abandon the dualistic worldview of water and society and study their dialectical relationship (e.g., Bouleau 2014, Budds 2009, Linton and Budds 2014, Swyngedouw 2009).

Figure 5 describes the socio-natural process of water where natural, built, and social environments internalize the relation they have with each other. Here, water (H_2O) is seen as an agent of social change and organization: the material form of water intervenes in the process, affecting the social structures, which in turn empowers alteration of hydrologic cycle through technological intervention, which then affects the materiality of water. Consequently, "water" is always a product of a particular configuration of a hydro-social cycle; thus, different stakeholders may have different meanings of water which are interrelated in complex ways. (Linton and Budds 2014.) Therefore, a hydro-social cycle also includes a discursive perspective on water (Bouleau 2014).

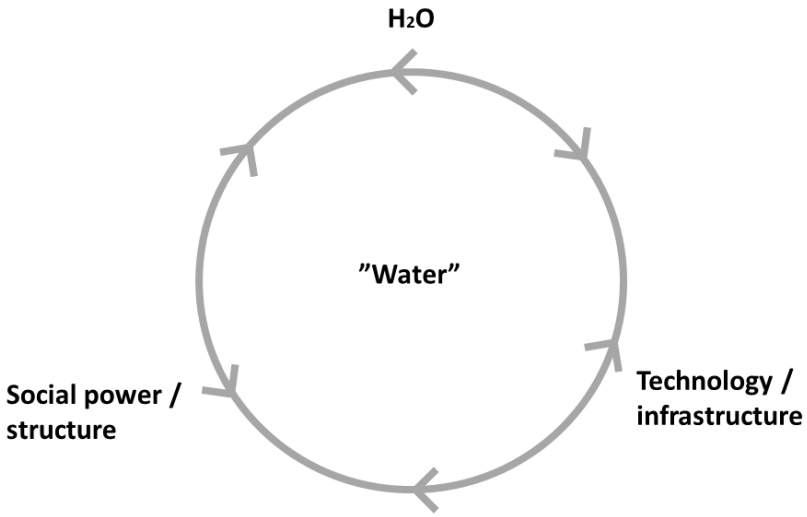

Figure 5. Hydrosocial cycle (Linton and Budds 2014)

Accordingly, while the concept of IWRM calls for integration of separate entities, the hydrosocial cycle emphasizes the hybrid nature of water, which means that it is simultaneously a natural and physical as well as a social element (Linton and Budds 2014, Swyngedouw 2004).

MAR as an example

Managed aquifer recharge (MAR) system is a clear and concrete example of an engineered system where natural, built, and socio-economic environments are all explicitly present. Interaction of the three domains can be observed from the holistic framework of an MAR system provided in article II. Here, the same framework is modified and viewed through natural, built, and socio-economic environments. Figure 6 illustrates how these environments do not provide any hierarchical order; they should rather be seen as interacting elements invading each others' domains with blurred boundaries.

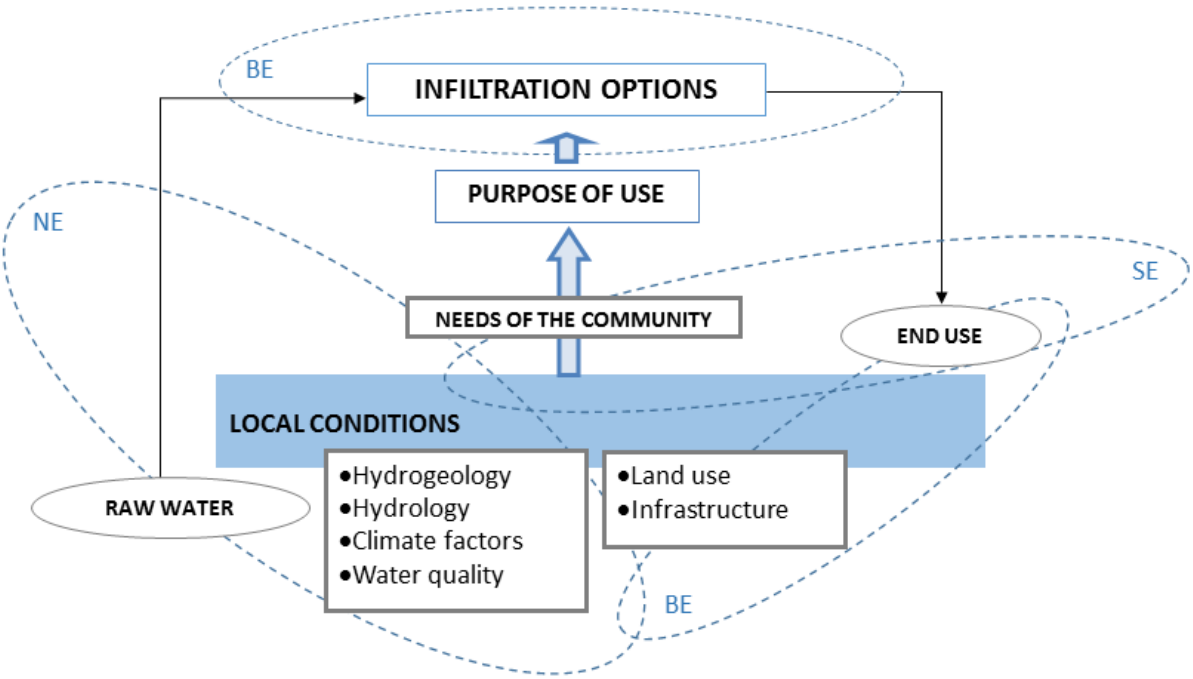

Figure 6. Relationship between natural environment (NE), built environment (BE), and socio-economic environment (SE) in MAR system (modified from article II)

From the technological point of view, the framework of an MAR project consists of three main components: local conditions, the purpose of MAR, and infiltration options. *Local conditions*, which are characterized by the natural as well as physical environments, form the base of an MAR project. Needs of the community arise from the local conditions and together they define the *purpose of MAR*, which in Finland is generally water treatment. The communal needs are clearly part of the social environment, and interconnected with economics and legislation, and these all affect the implementation of an MAR system. Finally, the local conditions and the purpose of MAR together influence the selection of *infiltration options* which consist of technical design parameters needed for an MAR system, thus being strongly connected to the built environment.

The outcome of an MAR project is the chain from water intake to infiltration and end use. In this chain, all three environments are present as well. Raw water is taken from its natural environment, infiltration options represent the physical, built environment with the water transfer pipes, excavated basins, and constructed recharge wells, and finally, the processed water is delivered to the community, to the social environment. This process modifies the material form of water, but also local conditions and social structures. Once an MAR system is established, it does not remain stable. Instead, the system is dynamic in its spatial and temporal dimensions, and new socio-natural configurations emerge (Linton and Budds 2014).

3.3 Crossing jurisdictional boundaries

Water management is largely driven by geographical interdependencies, which means that water issues operate in hydrological and ecological scales that do not follow jurisdictional or political boundaries (Lubell and Lippert 2011). Therefore, large-scale water projects generally involve spatial boundary crossing: in general, water resources management issues operate in regional, national, and even international level, whereas water services are based on more local solutions (Pietilä 2006). However, regional solutions in water services are increasingly applied and searched for, in order to meet the challenges of increasing water quality requirements, aging infrastructures, and decreasing fiscal resources.

In Finland, municipalities have a central role in organizing water services. During the last six decades, cooperation between municipalities has evolved to a level where approximately 30% of the population is served by various inter-municipal organizations. In addition, the number of bilateral contracts between single municipal utilities has more than tripled since the 1970s. Thus, regional cooperation is highly relevant in the field of Finnish water services. However, the subject has been analysed only in few studies (Katko 1993, Kurki 2010, Kurki et al. 2010, KUVENE 1975, Pietilä et al. 2010)[9]. Based on these studies and the material collected (see Table 1), the article I assesses the benefits and challenges of regional cooperation and compares the Finnish experiences with international research findings.

As different municipalities have divergent capacity in organizing water services, regional cooperation is seen as one option to overcome certain challenges. For example, a large city-center generally has more fiscal strength and professional capacity in performing water services than the surrounding smaller municipalities. However, it might not have sufficient good-quality raw water resources, whereas neighbouring municipalities may have resources over their needs. In order to balance these socio-economic and spatial differences, regional cooperation is established.

In Finland, one driving force in enhancing regional cooperation is the hegemonic discourse of the economics of scale. Large units arguably use financial, human, and technological resources more efficiently than smaller units (Frone 2008, Grigg 1996). Although the discourse has become a hegemonic one, it has also been questioned by scholars and practitioners (see article I).

Lieberherr (2015) states that regional cooperation involves the question of increased autonomy followed by the issue of legitimacy. Establishment of an inter-municipal joint organization decreases

[9] The fewness of the studies refers to the research conducted inside the water sector. However, regional cooperation is also a research field of its own with multiple sources (see e.g. Benz 2001, Fürst 2007 and Gately 1974).

the ability of a single municipality to control the system. In addition, increased organizational autonomy generally involves decoupling of an organization from the political system. This is acknowledged among the practitioners as a process that enhances organizational flexibility; for example, in terms of resilient and efficient decision-making where professionalism, not party politics, determines strategic directions.

However, the process of autonomization can be seen as a mechanism which weakens democratic structures. While the degree of autonomy increases and decision-making is removed from the political sphere, the transparency of decision-making decreases (Benz 2001). In this context, the tradeoffs between legitimacy, efficiency, and effectiveness should be acknowledged (Lieberherr 2011). However, if these tradeoffs are not properly acknowledged, it may form a significant barrier to a collaborative planning process. Stakeholder engagement may turn out to be difficult in practice if the institutional and organizational structures do not offer any support.

To put it simply, the basic idea of regional cooperation is to bring benefits for all parties. However, this aim cannot be reached in every case, especially if the legitimacy for the project is not gained. On the contrary, paradoxically, the aim for cooperation may turn into conflict between the cooperating parties. The conflict dynamics concerning the two cases will be presented in the subsequent chapter.

4. RESULTS AND DISCUSSION

Rural and urban places

are tangled together like laces.

They're like sister and brother;

They depend on each other.

They have never been opposite cases.

(Limerick 2012, 250)

This research involves two case studies where conflict is formed between a city-center and surrounding municipalities, between rural and urban. Water is an element that connects those regions in many ways. It can be a source of conflict but also a source of collaboration. As rural and urban have never been opposite cases, neither have conflict and collaboration. Rather, they are two sides of the same coin. These intertwining elements are analysed in the two case studies through discourse analysis, conflict analysis, and negotiation theory.

This chapter summarizes the main results obtained from the two case studies and discusses the reflections on theory and earlier studies. The chapter is divided into six sub-chapters. First and second sections aim at understanding the problem: which are the circumstances that led into a conflict, which are the main parties involved and how do they each see the tip of the iceberg, the visible part of the conflict, and what kind of dynamics can be seen in the interaction between these parties. Furthermore, these sections present a comparison between the two cases, not presented in the articles. The third section presents some key characteristics related to the special MAR context of this study. While the fourth section illustrates some options to address the constraints that arose from the two case studies and presents possibilities for future groundwater governance, the fifth section binds the findings in the larger context in terms of paradigm shift in the fields of urban planning and NRM. It is, however, worth of noting that, drawing from the social constructionism, this research does not aim at presenting any ultimate truth about the case studies; rather, it illustrates the complex process of conflict construction from various perspectives. Finally, sixth chapter assesses the quality of the research.

4.1 What happened in the study cases?

The two cases involve regional interest to produce enough good-quality fresh water for domestic and industrial use in efficient, economic, and ecologically sustainable manner. A growing urban area needs to secure its water supply in terms of quality and quantity, and establishes a regional project in order to cooperatively find the best solution for the whole area. Since groundwater has its advantages – such as better quality, stabile temperature, and water security (Foster et al. 1998) – an inter-municipal group decides to proceed to the direction of a rural area where good quality groundwater is available, although not in sufficient quantity. Thus, they start to explore the possibilities for artificially augmenting its quantity by using managed aquifer recharge (MAR) techniques. The rural area in question, however, does have adequate groundwater resources for the needs of the local community. In fact, they do not need regional cooperation in order to secure their water supply and thus, there is no motivation for cooperation. This is a key problem in collective action and was not solved in the two case studies. Instead, opposition emerged in the rural areas and led to long litigation processes.

4.1.1 Comparison of the case studies

The two cases analysed in this research have several similarities but also distinct differences. In public writings, the cases have been referred to as sister-projects. The case TRW, situated to southwestern coastal area of Turku Region (Figure 7), is the elder sister. It has a long history, dating back to the 1970s. During the first phase of the project, the established water company (TRW Ltd)[10] aimed at water acquisition from Lake Pyhäjärvi; however, the project was voted down in 1993. The second phase started around 1999, when there were plans aiming towards an MAR project with the water acquired from the River Kokemäenjoki. Concurrently, the plans for MAR in Tampere Region started to evolve. Whereas TRW Ltd finally got the permission for the project from the Supreme Administrative Court in 2008 and the MAR plant started to operate in 2010, the case Tavase received a negative decision from the licensing authority in June 2015. However, the company has appealed for the decision.

[10] As the cases are referred to as the case TRW and case Tavase according to the names of the water companies, the distinction between the cases and the companies will be made throughout the text with the Ltd-abbreviation.

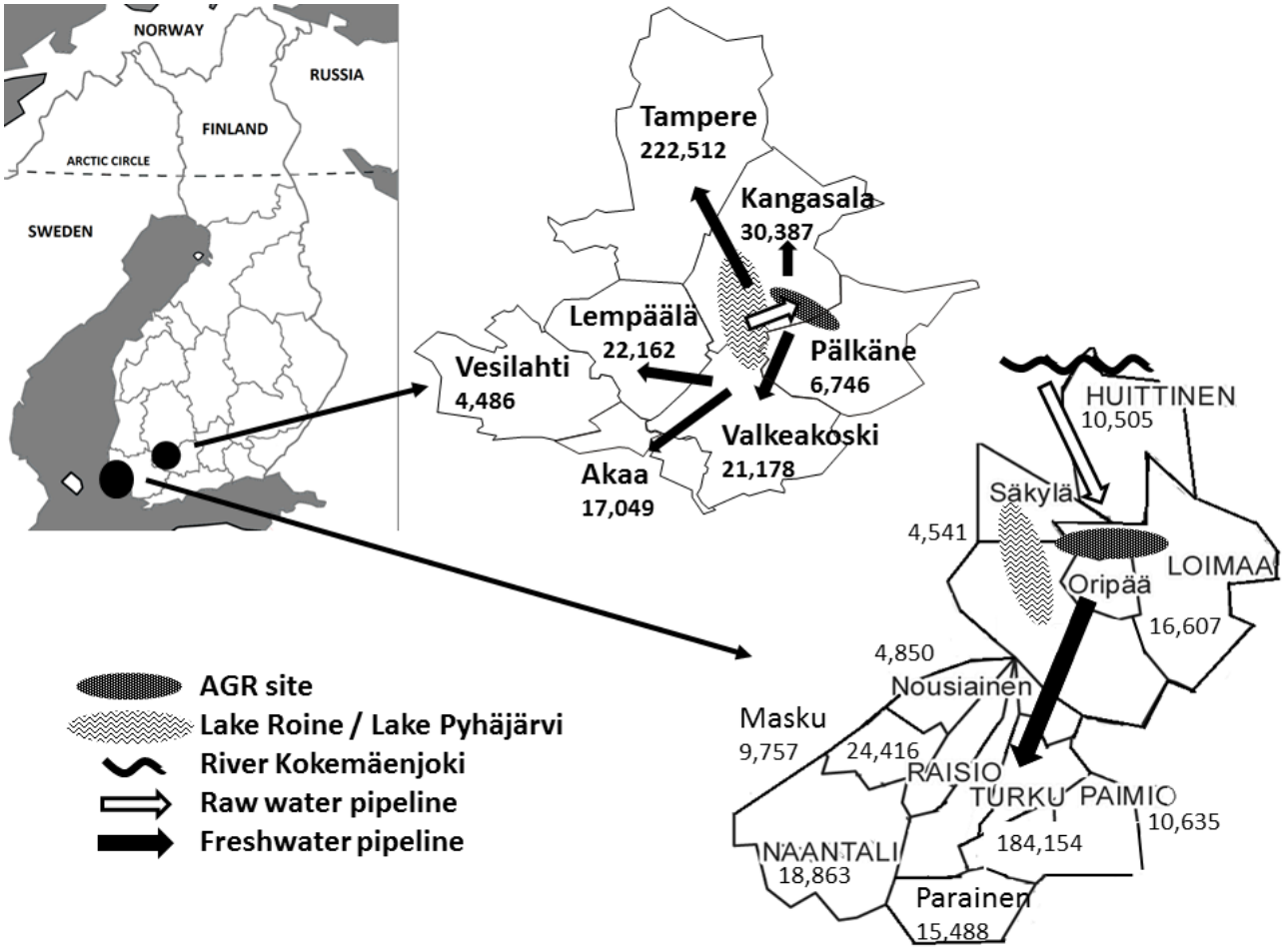

Figure 7. Geographical locations of the two case studies: Turku Region (case TRW below) and Tampere Region (case Tavase above) including the numbers of inhabitants of the municipalities

The two cases are described more in details in article III (case TRW) and article IV (case Tavase). Here, Table 2 summarizes the comparison of the selected key characteristics of these two projects. Three most significant differences between the two cases are the local hydrological conditions, their historical timelines and geographical positioning. In terms of hydrological conditions, the case TRW operates in water-scarce conditions (according to Finnish standards), which partly explains the long history of the case. Water scarcity in the southwestern coastal area as well as the bad quality of the existing raw water sources were the main motivations for instigating a long-distance water transfer project in the 1970s. In contrast, the case Tavase operates in a water-abundant region. As for geographical positioning, only the case TRW can be regarded as a long-distance water transfer project. In that case, the project is clearly managed and implemented in two separate areas (see Figure 7). The municipalities where the MAR plant is situated are not shareholders in the TRW Ltd. However, in the case Tavase, which is geographically more centralized, the MAR plant would be

constructed on the top of an esker situated in two municipalities, Pälkäne and Kangasala, the latter of which is also a shareholder of the Tavase Ltd.

Table 2. Comparison of the key selected characteristics of the two case studies

	Case TRW	**Case Tavase**
Timeline	1969–2010	1993–
Organization model of inter-municipal cooperation	Wholesale water company (TRW Ltd, established in 1974)	Wholesale water company (Tavase Ltd, established in 2002)
Number of shareholders[11]	9	6
Main owner (% of shares)	City of Turku (64,7)	City of Tampere (69,5)
Maximum volume for water recovery	105,000 m³ per day	66,150 m³ per day
Infiltration methods	Recharge basin	Recharge basin, sprinkling, and well injection
Water transfer distance	ca. 100 km	ca. 20 km (longest distance)

In addition to the case characteristics presented in Table 2, the stakeholders constitute another important element. The established water company can be seen as a cooperation agreement between municipalities. After the agreement, the company is responsible of the project implementation, though it is owned by the municipalities which have one or more representatives in the Board of Directors (see article I, wholesale water company). Furthermore, each municipality has internal sub-parties, such as municipal authorities, decision-makers, water utilities, local NGOs, and individuals. In addition, external parties, such as regional councils, licensing authorities, consulting companies, and research organizations are involved in the process either as project initiators, regulators, or evaluators.

Concerning stakeholder configuration, the major difference between the two cases is in the formation of opposing coalition, which is partly connected to geographical positioning. In the case Tavase, the coalition formed around three municipalities of which two are shareholders of Tavase Ltd. In contrast, in the case TRW, although the opposing coalition included members from the shareholder municipalities as well, it was more concentrated to the municipalities outside of the company.

[11] Due to the consolidation of municipalities the number of shareholders have decreased in both cases.

In spite of the differences between the two case studies, there were clearly more similarities than differences. For example, the argumentation of the project managers as well as project opponents is surprisingly similar between the two cases. This argumentation and the coalition formation will be discussed in further detail in the subsequent chapters.

4.1.2 Discursive construction of the case studies

Although the analysis of the discursive construction of the phenomena mostly worked as a clarifier of the visible tip of the iceberg, it also revealed the underlying driving forces. Storylines and discourses were studied, particularly in the case TRW, through the discourse analysis from the newspaper articles concerning the latter phase (1999–2010) of the project (see article III). Therefore, this chapter illustrates a discursive construction of an MAR project mainly from the perspective of the case TRW. However, similar features explored from the case Tavase will be elaborated as well.

In the 1970s, when TRW Ltd aimed at water acquisition from Lake Pyhäjärvi, opposition emerged among local residents around the lake. In the beginning, they manifested local rights, which were threatened by the project. Yet, subsequently, their attention was turned towards possible environmental impacts, such as threats that water acquisition would cause to the lake. Subsequently, between 1990s and 2010, the local opposition of the MAR project followed the same discursive pattern: local residents around the esker Virttaankangas constructed a visible local economy discourse[12], which was later overshadowed by environmental discourse. Environmental argumentation was used also by the project planners and other proponents of the project. Environmental and health risks on the one hand, and environmental benefits on the other, were fuel for argumentation that constructed and maintained the environmental discourse. Accordingly, this case illustrates how a latent but important discourse can be overshadowed by a hegemonic one (see Hajer 1995). This can be seen as part of the continuum of environmental politization process as well as the institutionalization of environmental discourse that had started in the 1970s Finland (Haila et al. 2015, Sairinen 2000).

These two discourses revealed an interesting contradiction in the argumentation of the local residents. The local economy discourse raised the concern that local economy would be threatened by the MAR project which would cause tightening land-use requirements and environmental restrictions. However, the environmental discourse emphasized the environmental threat that the project would cause to the local environment. This does not mean that their environmental arguments were false,

[12] In the article III the term *regional policy discourse* is used. However, in order to clarify the terminology the term *local economy discourse* is used in the synthesis of the dissertation.

but it does indicate that the interests and values are hidden under strong positions that actors take (Susskind 1999). Furthermore, in order to efficiently aim towards their goal, the actors need to use the language of the hegemonic discourse in their main argumentation.

The discourse structuration in the case Tavase seemed first surprisingly similar to the case TRW. Nevertheless, a more precise analysis showed that there were also some differences between them. These differences will be outlined here through the storylines that formed around the MAR projects. In the case TRW, the two discourses enclosed four overlapping storylines: Water stress, local rights, environmental changes, and health risks (Table 3). As discussed earlier, geographical positioning is one of the major differences between the two cases. Accordingly, water stress of the southwestern Finland was one of the main motivations to striving for long-distance water transfer. Furthermore, the bad quality of surface waters was used as a justification for groundwater recharge instead of directly transferring the water from River Kokemäenjoki to Turku Region. However, although argumentation based on water quantity and quality also appeared in the case Tavase, the opponents could more easily turn them down and thus question the necessity of the MAR project.

Table 3. Discourses and storylines around the case TRW. Signified in parenthesis if occurs also in the case Tavase (modified from article III)

Discourses	Local economy discourse	Environmental discourse
Storylines	Local rights (also Tavase)	Environmental changes (also Tavase)
	Water stress	Health risk
		Water stress

Geographical positioning also affected the local rights storyline. As Jarvis (2014) argues, the urban-rural divide is the most noteworthy in large-scale water transfer projects. In the case TRW, the spatial distance between Turku Region and Loimaa Region – where the MAR plant was constructed – exacerbated the juxtaposition between urban and rural, between those who benefit and those who bear the costs. Indeed, Alasuutari (2011) states that the dichotomy between city and countryside has been strongly visible in public debate in the Finnish media during the 21st Century. Indeed, in the newspaper articles concerning the case TRW, the local residents used strong emotional argumentation referring to immorality and injustice towards the underdog. Instead, the case Tavase has a more uniform geographical setting; the municipality of Pälkäne belongs to the very same region with the shareholder municipalities. Juxtaposition occurred, however, between the city center and surrounding municipalities, although it was not as strong as it was in the case TRW.

In both cases, the local residents were concerned about the environmental changes that MAR would cause on the esker which mainly consists of forest, also including a natural conservation area. Especially in case Tavase, they emphasized that the local esker would not be suitable for MAR. They did not oppose MAR in general, they opposed the project that would be established *in their backyard*[13]. However, the project planners emphasized the minority of the environmental impacts that an MAR plant would have, especially compared with those that local land use activities – for example gravel mining and car racing circuit – already had. The environmental changes storyline was the strongest one in both cases, supporting the hegemonic position of the environmental discourse.

A health risk storyline was formed inside the environmental discourse. In the case TRW, this storyline culminated around the mercury debate, which was formed around the assumption that the mercury from the sediments of the River Kokemäenjoki would pollute the natural groundwater, thus ending up not only to the drinking water of local residents but also to people from Turku Region. In the case Tavase, the local residents also feared surface water blending with the natural groundwater but this was not seen as a potential health risk; rather, as an environmental threat. Instead, the local residents were afraid that the MAR project would cause a safety risk: since the planned MAR plant would be situated very close to dwellings, they thought that infiltrated water would flood into their basements. Thus, in both cases, the opponents questioned the functionality and controllability of MAR technology.

In summary, two of the four storylines in the case TRW – local rights and environmental changes storylines – could be clearly distinguished in the case Tavase as well. Furthermore, both cases involved a contradiction between the two discourses: the hegemonic environmental discourse and latent local economy discourse. The latter indicates economic competition between jurisdictions as well as tensions between rural and urban areas, which should be acknowledged in concrete policy-making. However, the policy decisions were mostly colored by the environmental discourse, especially those aiming at the opposition of the projects.

4.1.3 Coalition formation

This research addresses the coalition formation process through discursive order and knowledge production. In both cases, the environmental argumentation formed the main construction material for the opposing discourse coalition. The project proponents used environmental argumentation as

[13] The two cases fall into the so-called NIMBY category (Not In My Backyard) (e.g., Dear 1992, Devine-Wright 2009, Kopomaa et al. 2008); however, this perspective was not particularly used in the analysis of the case studies.

well, thus giving support to environmental discourse; however, their coalition was formed around rational argumentation, which emphasized the expert knowledge. They strengthened the dichotomy between the discourse coalitions by positioning the opponents as scaremongers and lay people with unreliable and emotional argumentation.

Despite of this positioning, these conflicts were not formed between experts and lay people. Instead, in both cases, the project opponents also included highly educated actors, and they utilized expert-based factual arguments to support their cause. Furthermore, the local residents included only few local resources in their knowledge claims; instead, they used research results published by outside experts, and individual groundwater experts also gave their personal support to the opponents. Thus, the formed discourse coalitions can also be called knowledge coalitions (van Buuren and Edelenbos 2004), which moves the focus from between the policy and knowledge worlds themselves to between the coalitions that include actors from both worlds.

In terms of spatial dimensions, in both cases, the opposing coalitions first remained at local level, but they started to expand in the course of time. In the case TRW, where the geographical distance between Turku Region and Loimaa Region was rather long, this expansion remained rather feeble, reaching only some individuals from Turku Region. Instead, in the case Tavase, the opposition gradually spread to two municipalities, Kangasala and Valkeakoski, which were also the shareholders of Tavase Ltd. The opposition increased and finally led to the disintegration of the company, and resulted in decisions made by two owner municipalities to resign from Tavase Ltd. This gave strong support to the project opposition, albeit that the municipalities have not yet been able to execute these decisions.

4.2 Why did this happen?

Evidently, this research cannot comprehensively explain the reasons for these two conflicts. However, it can give guidelines to wherein the answers can be searched for. These signposts indicate four directions. First, there is a wider framework of a planning paradigm where reductionist approaches are still commonly used in complex management problems. Second, groundwater planning and management concentrate on the visible tip of an iceberg, instead of managing the whole. Third, drawing from negotiation theory, the interaction of stakeholders concentrate on zero-sum game and distributive bargaining instead of integrative negotiation where mutual gains are searched for. Fourth, the issue of legitimacy is not adequately recognized in groundwater planning and management.

4.2.1 Reductionist approach to a complex problem

These case studies illustrate how instrumental rationality still prevails in planning practices. Rational expert knowledge is emphasized as a basis for goal-directed planning as well as in argumentation of lay people, who are obliged to participate in the discussion on terms of the same rationality. As discussed in chapter 4.1.3, this was visible in both case studies where the local residents deployed similar expert-based argumentation as did the project planners and managers; furthermore, the local features had only minor role in the argumentation.

However, scientific knowledge alone is not sufficient. For example, hydrology reduces water to its material composition (Linton 2010), although it is a highly social issue as well. Indeed, a complex system is sensitive to changes in social orders, which is often disregarded in planning deriving from instrumental rationality. Both cases illustrate how the changes in social orders unbalanced the projects. First, the municipalities reached an agreement and a water company was established in order to implement the project. However, when the opposition emerged among the local residents, this agreement was strongly questioned. This became as a surprise to the project planners, and they were not prepared to respond to these changes in social orders.

The assumption of perfect and objective information is one of the significant weaknesses of comprehensive rationalistic planning. In a conflict situation, political debates may overshadow rational analysis, and planning based on instrumental rationality cannot respond to the situation (Bäcklund and Mäntysalo 2010, Nolon et al. 2013, Sotarauta 1996, 154). As the two case studies show, the expert-based arguments of the project planners did not calm down the opposition; instead, it worked as a fuel for even stronger counter-argumentation. Therefore, this research supports the argument presented, for example, by Nelkin (1979), Pellizzoni (2003), and van Buuren (2009): increasing the amount of expert knowledge does not necessarily solve the problem.

As the MAR projects represent complex management problems, there are no short-cuts or right solutions available. An idea of a single best solution is a mirage since complex problems do not follow the linear model of causality, and the system is subject to constant and unpredictable change (Innes and Booher 2010, 9). Nevertheless, many actors try to compress complex problems to fit into simple models. The planners, probably based on their education and earlier experience, make the assumption that the problem follows the linear model, thus being predictable, controllable, and knowable. The cases revealed that these assumptions were clearly made in various sectors of project planning, including water experts, project managers, as well as municipal authorities. This can led to a DAD syndrome (Decide-Announce-Defend), where public officials make their own autonomous decisions,

which are announced to public and later defended when opposition occurs (see Innes and Booher 2010).

Accordingly, the base for conflicts which emerged around the two MAR projects is in the planning approaches based on instrumental rationality that could not successfully operate in the field of complex water management.

4.2.2 Concentrating on the tip of the iceberg

The integrative negotiation model emphasizes that actors should concentrate on interests instead of positions (Nolon et al. 2013, Susskind and Field 1996). As discussed in chapter 2, while the positions of actors can be seen as the tip of the iceberg, the interests constitute the rest 90% of it. Thus, the argument here is that actors put most of their efforts and energy into a minor fraction of a problem while the major and most important part is left without attention.

Water conflicts often are, as discussed by Islam and Susskind (2013), formed as parties protect their own economic and political interests. Accordingly, although in both cases the environmental argumentation acted as the main discursive cement inside the opposing coalitions, the latent local economy discourse revealed some profound concerns and interests of the local residents. Whereas protecting groundwater and the environment was of particular relevance to local actors, the local economy formed one of the main concerns related to the MAR projects. This was fueled with emotional value-based arguments concerning local rights.

The project planners acknowledged these concerns to some extent. However, it is natural that eyes are fixed upon those parts that are visible. Since the local economy discourse was overshadowed by the environmental one, it did not draw so much attention. At this point, the planners' professional skills, which leaned on instrumental rationality, did not support a more comprehensive analysis of the case and acknowledging the interests of the opponents.

Thus, instead of acknowledging the interests of other sides, the parties aimed towards their own goals with a competitive mindset. The project planners were locked up into their own positions defined by the water companies, and the opposing coalitions could not see any other way out than trying to stop the whole projects.

4.2.3 Zero-sum game

In negotiating with each other, the parties adopted a mental model of distributive bargaining. This refers to a tendency for zero-sum game (Islam and Susskind 2013) where the ground-rule is that the amount of benefit is fixed and the parties need to compete for those benefits, since any concession

for one would mean less benefits for the other. Thus, a competitive atmosphere was formed around the projects: the local residents feared economic losses and environmental impacts that the MAR projects would cause to their municipality and they were not willing to negotiate about any concessions. In both cases, project planners tried to indicate some benefits that local residents would gain from the project and to offer compensations if some unintended effects would occur, but these were not acknowledged in this competitive atmosphere. Indeed, mutual trust was already lost and the opponents claimed that these concessions were false or inadequate.

Accordingly, there was no place for alternative or creative solutions, which would satisfy the underlying interests of both parties. The only aim for the opponents was to stop the whole project and this left no place for negotiations. Parties were locked into their positions and instead of searching for a common ground, they concentrated on arguing about the facts as they saw them in order to win the zero-sum game. Indeed, this course of action did not help the parties to define common interests or finding mutual gains.

Distributive bargaining model easily ends up to a deadlock or only creates winners and losers; thus, it often destroys relationships and fosters mistrust and hostility (Nolon et al. 2013). As in the case TRW, the project was implemented and the opponents lost the game. Currently, they continue to present counter arguments towards the already constructed MAR plant; however, these arguments are much less frequent than during the planning process. In the case Tavase, the parties are still waiting for the response from the Supreme Administrative Court.

4.2.4 Lack of legitimacy

Legitimacy in this study is understood as tacit approval (Häikiö 2007) where actors recognize, approve, and support the process, practices, and outcomes. According to Suchman (1995) legitimacy is generalized, thus it cannot be bound to a particular event, although it is dependent on a historical context of the events. Furthermore, "legitimacy is possessed objectively, yet created subjectively (Suchman 1995, 547)". This means that it is formed through perceptions or assumptions of observers but can be maintained if those observers do not recognize divergences from social norms. The social constructionist aspect on legitimacy emphasizes a congruence between the behaviors of the legitimated entity and the collective beliefs of a social group.

In the field of public policy, the power balance always changes along with new elections. Therefore, there is a risk that a system based on power will not produce durable outcomes, since decisions can be overturned as a consequence of shifting power balance (Nolon et al. 2013). This was clearly visible in both case studies. First, the early phase of the case TRW showed how a water acquisition project,

which gained a political approval and was planned for more than two decades, was voted down by the city council of Turku in 1993, right after municipal elections. Second, in the case Tavase, the establishment of Tavase Ltd can be seen as an initial agreement between municipalities in order to implement the MAR project. However, the later decisions of two shareholder municipalities to resign from the company indicate that power balance in their local governments had shifted. Thus, the legitimacy among various actors was not reached.

The policy followed by the decisions of the two shareholder municipalities was strongly criticized by some water managers and authorities. They saw this problem as lack of commitment, which could be probably fixed by using stricter charters. In addition, although the water companies already are quite autonomous organizations, their representatives emphasized that the companies should be even more decoupled from political decision-making in order to be more effective in planning and implementation (see article I). Thus, they did not recognize tradeoffs between legitimacy, efficiency, and effectiveness (see Lieberherr 2011).

The issue of legitimacy cannot, however, be solved through sanctions or more autonomous organizations with as little influence of party politics as possible. Accordingly, if the process does not gain legitimacy, it is probable that it will be contested by some actors, and this, in the long run, may lead to the collapse of political will inside and between the municipalities. Indeed, as the two case studies indicate, the decision-makers are not the sole power-holders.[14]

Accordingly, complex projects that require long-term planning and implementation need to gain legitimacy through interest-based collaborative process, which tries to satisfy the needs, concerns, and fears of multiple stakeholders involved. In this legitimation process, stakeholders should be seen as partners, not adversaries.

4.3 MAR as an arena for conflicts

Although the MAR conflicts escalated around the environmental debate, they were, however, symptoms of larger regional policy tensions and legitimacy problematics. In addition, neither of the cases had a definitive problem formulation, but rather they involved various interpretations which strengthened separate knowledge coalitions and the gap between them. Thus, they can be seen as

[14] Burr (2003, 67), who emphasizes some Foucauldian elements of power, states that power is something that does not reside in institutions, nor is it in some form of possessions. Instead, as Hannigan (2006) presents, power is embedded in social relationships and is thus present in the discursive construction of our everyday lives.

highly complex management problems. The cases included multiple stakeholders and interactions, emergent properties, and non-linearity, as well as operation inside various domains, sectors, and levels. Nevertheless, these are also the characteristics of various other contentious water management cases. Thus, one aim of this study was to recognize the special features related especially to MAR projects in the field of conflicts.

Groundwater, in short term, is easy and economically feasible to abstract and it is a driving force for socio-economic development. However, as discussed in chapter 1, a long-term effect may be groundwater overexploitation and problems such as groundwater pollution and social inequalities (van der Gun 2012). As in several disputes concerning surface water, this may lead to a multiple-use groundwater conflict where various actors compete for the shares of water allocation; for example, the actors from the fields of energy, agriculture, industry, and domestic use. According to Islam and Susskind (2013, 131), "[f]ear about water scarcity makes value creation difficult." However, parties could abandon the zero-sum assumption that there is a fixed amount of water to be allocated, and view water as a flexible instead of a scarce resource. New ways to expand the usable quantity of water should be searched for, e.g., through new water management techniques (ibid.; see also Burkhard et al. 2000).

Indeed, in case of MAR, one objective of aquifer recharge is to increase the amount of usable water, and balance the short-term and long-term effects of groundwater use, and thus the multiple-use issues become less relevant. However, the two case studies showed that this opportunity for value creation did not offer any solutions to the contradictions between multiple parties. Conversely, the problem culminated around the MAR technique itself. Thus, the emphasis in MAR conflicts is rather on the process of water production than on water allocation.

As well as groundwater management in general, MAR processes are strongly connected with land use and spatial planning. They have indirect impacts on land use because of possible restrictions for other land use activities such as gravel mining, nursery, or agriculture. In addition, MAR processes involve physical land use requirements for different recharge methods, such as recharge basins, sprinkling, and recharge wells.

Connection to land use has a more mental feature as well. In Finland, as well as in many other countries in the world, groundwater cannot be owned by anyone and it can be classified as common-pool resource (Madani and Dinar 2012). However, since groundwater is situated underground, it is often regarded as a private property of the landowner. In both cases, it was referred as a local property. Accordingly, MAR conflicts have some features of land use conflicts as well. Thus, in groundwater

conflicts, features from common-pool and non-common-pool resource conflicts are present and cause mental confusion which forwards the problem of legitimacy.

Aquifers form an underground network which, depending on the geological conditions, may connect various places with each other[15]. Consequently, inputs in one particular place have an effect in various other places, which may spread fear and uncertainty among local residents. Thus, the invisibility of aquifers raises several questions and doubts related to expert knowledge among lay people, but also among experts themselves. This may foster a duelling experts' syndrome, which emerges among complex management problems where no right answers are available. The disputing parties tend to invoke the experts who are the most probable to favor the preferred outcome. The experts themselves do not necessarily consult with each other and they tell their client what they want to hear. In addition, long and incoherent reports are produced, which fosters the confusion and enhances contradictory interpretations among disputants. (Wade 2004.)

Groundwater conflicts generally encounter a duelling experts' syndrome, since the water practitioners lack consensus regarding some fundamental aspects of groundwater hydrology and sustainable groundwater use (Jarvis 2014). Since MAR systems require more engineering skills than mere groundwater abstraction systems, they form even a more fruitful ground for duelling experts' syndrome, as well as for legitimacy issues concerning expert knowledge in general.

Finally, in an MAR system, the built environment transcends strongly to the natural environment. In the two case studies, this nested structure of built and natural environments strengthened the mistrust among the project opponents towards engineering: several arguments emphasized the unpredictability of nature and the limited capability of engineers in front of the power of nature. Thus, the assumed constraints related to built and natural environments were strongly felt in the social environment. Although the opponents questioned the engineering capacity of the projects, they also used factual, expert-based argumentation by themselves and water experts, and engineers were involved in the knowledge coalition. Thus, the expressed distrust implies the problem of legitimacy in the knowledge production process rather than ultimate distrust towards an engineering system and expert knowledge.

4.4 What could have been done otherwise?

The analysis of the two MAR projects raised several challenges in planning and implementing complex groundwater projects. In order to answer those challenges, this chapter presents some

[15] If compared with other European countries, the aquifers in Finland are, however, more local and concentrated on ice marginal delta formations due to geological conditions (see article II, Figure 2).

suggestions drawn from two sources: on the one hand from literature on collaborative governance, including multiple case studies, theoretical considerations, and pragmatic guidebooks; and on the other hand from those lessons that we can take out from the pitfalls of the two case studies.

4.4.1 Knowledge production

Knowledge is one of the fundamental elements for building legitimacy in complex processes. It is, however, also a medium for clashing claims. In the two case studies, both project opponents and proponents used various sources of knowledge in order to defend their argumentation. Occasionally, they even used the same source of knowledge, but their interpretations were different. In the case Tavase, the main investigators were private consulting companies hired by Tavase Ltd, whereas in the case TRW, the company had its own experts and therefore could keep hold of the reins itself. Yet, neither knowledge production strategy gained legitimacy among the opponents. Accordingly, the main question here is: how can we harness different ways of knowing to serve a collaborative process?

Collaborative processes are argued to address effectively the dichotomy between science and policy worlds (e.g., Singleton 2002, Innes and Booher 2010, Taylor et al. 2012, Islam and Susskind 2013). In order to find sustainable solutions to complex water problems, we need negotiated and joint problem-solving approaches which transcend boundaries of science, policy, and politics (Islam and Susskind 2013). However, as the two case studies indicate, the boundary management should not be directed towards this dichotomy; instead, new links should be established between different knowledge coalitions, including actors from both worlds (see van Buuren and Edelenbos 2004). The case studies showed that a knowledge coalition included actors from the field of science as well as policy, e.g. local residents, politicians and scientists. Thus, inside this coalition, joint learning occurred, but the contradiction emerged between the knowledge coalitions.

Therefore, the main task is to create a knowledge base that can be approved by every stakeholder, in order that knowledge coalitions would not be formed or the boundary between them could be transcended. One approach is a process called *joint fact-finding*, which is generally presented as an essential part of consensus-building process (Susskind et al. 1999). Joint fact-finding is a collaborative process, where instead of finding the best solution, a rich terrain of options is established through dialogue of various stakeholders with differing viewpoints and interests (Ehrmann and Stinson 1999). The dialogue brings a wide variety of experience and knowledge to the process. The process does not, however, eliminate disagreement; instead, it clarifies the road map in terms of locating the possible places for agreement and disagreement (Islam and Susskind 2013). The result of this process is negotiated knowledge, which is constructed from co-produced facts in interaction

between divergent actors. The aim is that produced knowledge *is accepted as* convincing and reliable by every party and can then be used as a base for reaching decisions together.

Here the emphasis is on the words *is accepted as*, since, as both cases illustrate, the reliability of knowledge is not gained through the status of expert knowledge. The local residents did not consider the knowledge produced by the water professionals from consulting companies or from TRW Ltd as reliable, and neither did the representatives of TRW Ltd and Tavase Ltd consider the knowledge produced by the outside experts, who supported the arguments of the case opponents, as reliable.

When the diversity of different ways of knowing as well as the provisional nature of knowledge is seen as a basic characteristic of development, it can be seen as a strength instead of it being an obstacle for planning. However, knowledge generation in itself is not sufficient for a collaborative process. Instead, from the perspective of practitioners and water managers, it requires adaptiveness: continuous observations, learning, and adapting to changing circumstances (Islam and Susskind 2013, 97). Furthermore, from a more collective perspective, several scholars have emphasized the importance of social learning (e.g., Bos and Brown 2012, Dempster 1998, Pahl-Wostl 2007), which is closely connected to joint knowledge production and takes place through social networks. It enhances adaptive capacity and can lead to attitudinal and behavioral change in individuals but also in a social entity as a whole (Pahl-Wostl 2007).

4.4.2 Searching for the invisible

Similarly to groundwater that lies beneath the ground, away from our sight, the critical components for successful project planning and implementation can be found from beneath the surface. Here hidden components concerning three aspects of collaborative approaches are searched for: case history, interests, and creative alternative solutions.

First, some elements are hidden behind temporal layers, and they need to be searched for from the case history. As Järvilehto (1995) states: history does not mean describing the past but explaining the current reality. In this study, case histories had a relevant role in the analysing process; thus, the research approach is more longitudinal than transverse. Accordingly, the analysis revealed strong historical baggage that overshadowed both cases. Especially the opponents remembered actions and statements from several years or even decades ago. As the case studies show, historical load may, together with positional thinking and competitive framing, form an insurmountable barrier to successful negotiation (see also Islam and Susskind 2013, 132). Therefore, proper management of complex groundwater systems requires an analysis of historical context of the case.

Second, as discussed earlier, the parties' interests need to be searched for from behind their positions. In the analysis of the case Tavase, two main conflicting interests were revealed. First, protection of natural values and cultural heritage of the esker against the construction of the MAR plant, which represents common good as it would produce good quality drinking water for several municipalities. Second, the economic competitive strength of the City of Tampere against that of the surrounding municipalities. The latter emphasizes the tensions between municipalities, thus revealing the context of dispute around local economies, which was also made visible through discourse analysis in the case TRW. On the other hand, while the divergent interests were more profoundly analysed, also common ones could be found: groundwater protection, economic and reliable water supply for all parties, and the need for independent and reliable knowledge. Accordingly, proper identification of interests can turn them into building blocks for options that would satisfy the needs of all parties (Nolon et al. 2013, 14).

Third, creative solutions and potential for enlarging the fixed pie can be hidden behind competitive mindsets of stakeholders. Multiple arguments presented in newspaper articles concerning the case TRW, raised the alternative solutions to MAR. However, these options were presented from the perspective to stop the MAR project, whereas the TRW Ltd was established in order to implement the project in question. Thus, there were no place for creating alternative options collaboratively.

Therefore, it would be important to launch a collaborative process before engaging in a certain solution through an agreement, which in these cases was the establishment of a water company. These agreements were established in consensus with the authorities of the owner municipalities. However, they were not produced collaboratively with politicians and local residents, especially from the municipalities outside the company. Consequently, the agreements did not gain legitimacy in the long term among those stakeholders.

In a collaborative process, acknowledging the concerns of the other side and clarifying the interests of each party would help them to see outside the box (Fisher et al. 1991). Thus, parties would start to realize that instead of having a fixed amount of benefit, they have several other options, and it is worth investigating those options before committing to particular solutions. The integrative negotiation model is used in order to produce an agreement between the parties. However, the aim is not that everyone wins (it would be unrealistic); instead, the aim is to enter into an agreement that meets parties' interests better than if they could not reach an agreement at all (Islam and Susskind 2013).

4.4.3 Comprehensive approach to groundwater management

In addition to the previous suggestions for complex groundwater management, i.e., to search for the invisible and to build on interests, not on positions (Nolon et al. 2013, Susskind and Field 1996), it is also necessary to analyse the visible tip of the iceberg where stakeholder positions are discoverable. This research indicates that the analysis of those positions was useful in order to clarify the whole picture of the case as well as the ways actors have constructed the problem. For example, the two cases were strongly constructed around environmental argumentation, and especially in the case TRW even an atmosphere of an environmental crisis was built through different narratives. The discourse analysis showed how the environmental discourse was constructed and maintained by several stakeholders, including those of project proponents.

Article II presented a holistic framework for MAR projects, which was developed further in chapter 3 by bridging the three domains: natural, built, and socio-economic environments. Accordingly, the complexity of groundwater management issues requires a comprehensive approach. Therefore, it is time to replace the machine metaphor with the idea of complexity, which suggests that the systems should be considered as a whole rather than as components (see Islam and Susskind 2013). Some scholars (e.g., Innes and Booher 2010, Sotarauta 1996) argue that we need to answer to complexity with complexity. Instead of trying to control the system, we should adopt to complexity and exploit it. Indeed, collaborative approaches can be seen as complex adaptive systems (Innes and Booher 2010, 33) with their self-organizing nature, diverse agents, and interactions, as well as nonlinear dynamics. Applying these features of collaboration results in creative and adaptive outcomes in a constantly changing environment.

In order to establish a collaborative process, many practical tools can be exploited, such as charrettes, public workshops, and stakeholder committees. In addition, a neutral third party intervention is often seen as an important part of a collaborative process (Raiffa 1983, Susskind and Ozawa 1984, Susskind et al. 1999). Jarvis (2014) argues that a mediator's technical background and understanding of the substance is critical, especially in groundwater conflicts. In the case Tavase, although a workshop with invited stakeholders and external facilitators was organized, it was initiated by the researchers, thus being a part of the research project as opposed to an attempt by parties to start a consensus-building process.

After all, conflicts cannot be automatically seen as a bad thing. Disagreements are a fundamental part of our society and the only challenge is to make them productive (van Buuren and Edelencos 2004). In an organization or in society, planning and management need to have tensions in order to be effective: extreme incoherence leads to disintegration of a system, whereas extreme coherence leads

to inflexibility and rigidness (Sotarauta 1996, 33). Accordingly, conflict and consensus form two sides of a paradox, which is an essential fuel for development.

Finally, Table 4 illustrates the conventional way to manage groundwater issues and compares them with collaborative groundwater governance, which forms a suggested framework for future projects. Whereas MAR is one possible water *management* solution to produce good-quality fresh water for domestic and industrial use, *governance* here refers to the whole process where various solutions are considered, knowledge is gathered, stakeholders are convened, and options are negotiated. The suggested framework is drawn from the lessons learned while analysing the two case studies as well as from literature on collaborative governance. In addition, Table 5 presents a summary of the groundwater management characteristics in the two case studies. Although both cases included some collaborative features, they were not sufficient in governing complex MAR issues. Instead, these cases involved conventional way of thinking and management of groundwater, which was based more on instrumental than collaborative rationality.

Table 4. Conventional management versus collaborative governance concerning groundwater issues

	Conventional groundwater management	**Collaborative groundwater governance**
Paradigm	Instrumental rationality	Collaborative rationality
Goal	An outcome that fulfills technical, legislative, and environmental requirements.	Process and outcome that are legitimate from technical, environmental, and socio-economic perspective.
Problem definition	Technical issue that involves multiple part issues that can be dealt with separately.	Complex, unpredictable, uncontrollable, non-linear
Managing target	Tip of the iceberg (positions)	Whole iceberg (positions and interests)
Interaction	Zero-sum game and distributive bargaining	Integrative negotiation
Knowledge production	Expert-based analysis from the object	Joint knowledge production (e.g., joint fact finding)
Role of water managers	Provide expert knowledge	Provide expert knowledge, convene stakeholders, facilitate and/or mediate the process
Role of stakeholders	Informants and/or adversaries	Allies and partners
Question of legitimacy	Not recognized as a base for the process	Gaining legitimation is a starting point for the whole process
Special features of MAR	Technical solution to the problems of water quality and quantity	One option among others in order to ensure enough good quality water supply
	No contradictory interpretations among experts	Duelling experts' syndrome is acknowledged
		Connection to land use: features from common-pool and non-common-pool resource conflicts
		Legitimation of the water production process is required

Table 5. Groundwater management in the case studies

	Characteristics of groundwater management in the case studies
Paradigm	Instrumental rationality
Goal	To implement the MAR project in order to produce enough good-quality fresh water for domestic and industrial use in efficient, economic, and ecologically sustainable manner
Problem definition	MAR was seen as an technical issue Complexity of the MAR project was not acknowledged Opposition and emerged conflicts came as a surprise
Managing target	Parties concentrated on the visible tip of the iceberg Environmental discourse became hegemonic and overshadowed the parties' interests Strong positions were formed
Interaction	Negotiation based mainly on the zero-sum game Project managers attempted to find some mutual gains but these attempts were overshadowed by the competitive atmosphere where mutual trust was not generated
Knowledge production	Analyses conducted by water experts from consulting- or the water companies
Role of managers	Provide expert knowledge and be responsible for the operative management of the project
Role of stakeholders	Informants and adversaries
Question of legitimacy	Was not recognized as a base for the process
MAR	MAR was seen as a mere technical water production process, which does not require legitimation Duelling experts' syndrome was recognized to some extent

4.4.4 Practical challenges

Evidently, collaborative approaches have their challenges as well, and it is evident that these approaches cannot be implemented everywhere. The case studies illustrated, for example, the challenge of the authenticity of collaboration. Although there was intention for cooperation, and inter-municipal cooperation was the starting point for both cases, authentic collaboration did not occur. A general comment from opponents of the case Tavase was that the project planners hear them only to the extent that the law obliges them to. Thus, collaboration should be authentic, not an obligation by law or other external force. If it is window-dressing to decisions that have already been made, it is a waste of time and money (Innes and Booher 2010, 41) and easily reduces actual collaboration to the level of information sharing. The case studies illustrate this well: water managers argued that all the information is available, but the distribution of it had failed. From their perspective, this failure could have been corrected if they had early enough hired a publicist, who could have responded actively to the counter arguments of the opponents. Thus, the challenge here is that instead of being partners, stakeholders are viewed only an active audience in front of planners and managers.

Furthermore, collaboration requires commitment of every stakeholder group and it might be difficult to motivate all parties for collaboration. For example, in conflicts already escalated, it might be difficult to find motivation. On the one hand, the situation may be already so blocked and exacerbated that it is difficult to persuade parties to the negotiation table. On the other hand, one of the parties may have an assumption that it is already winning the case and thus it would be useless or even harmful to start negotiations; in other words, they may use the power of not collaborating (Margerum 2002). Accordingly, as article IV concludes, the emphasis should be transferred from conflict resolution to anticipatory work: it is more useful to prevent pollution upstream than try to clean polluted water downstream. Early engagement is often emphasized as essential in order to achieve durable outcomes (e.g., Chess and Purcell 1999, Cuadrado-Quesada 2014, Nolon et al. 2013, Reed et al. 2006).

Collaborative approaches might be, however, unattractive to many water professionals since the process is likely to be more complex with multiple parties involved. Furthermore, while some professionals fear the loss of authority in informal problem-solving, elected officials may view consensus-based process as giving up power. (Islam and Susskind 2013, 150.) Thus, prevailing power relations may curtail collaborative governance processes (Häikiö 2007). Conventional, expert-based planning and water management are rooted deep in practices and structures, thus setting the standard of acting for multiple parties. These standards may be difficult to break in individual cases, unless a larger paradigm shift occurs.

4.5 Paradigm shift

The need for more holistic approaches in scientific inquiries has been acknowledged for decades. While mechanistic worldview assumes that by using continuously increasing amount of cumulative knowledge humans can control nature and society, complexity science reminds us about the nonlinear, unpredictable, and uncontrollable nature of many problems concerning urban planning as well as NRM. Indeed, complexity and policy sciences have generated an understanding that complex management problems, which must be addressed in a public policy context, cannot be tackled with the tools obtained from systems engineering or optimization (Islam and Susskind 2013). However, although rational planning has given way to more collaborative approaches, the two case studies showed that instrumental rationality still has a strong grip on the current water planning and management in Finland.

From historical perspective water services has rather stable and predictable operating environment. Therefore, reductionist approaches leaning on instrumental rationality have rather successfully developed the water systems to their present existence. However, the world has become more complex and it is constantly changing, but most of the institutions of government still operate as if it would be predictable and controllable (Innes and Booher 2010, 8, Sundarasaradula and Hasan 2005). Thus, conflicts can be seen as anomalies that challenge the prevailing paradigm. Since current ways of thinking and practices of operation no longer provide satisfactory results, the problems need to be redefined. Accordingly, conflicts around the two MAR projects can also be seen as a criticism towards the expert system and prevailing planning paradigm.

Conventional habits are rooted deep and rational planning persists as a dominant model in the education of water professionals as well as appointed and elected officials, thus supporting the conventional logic of decision-making (Innes and Booher 2010). In the case studies, the paradigm of instrumental rationality was strongly conveyed by the water managers; however, expert-based factual argumentation had significance in the argumentation of every stakeholder group. Indeed, knowledge was generated and transformed inside the framework of instrumental rationality, which obfuscated values and social power. In a larger context, these cases reflect a historical success story of technocratic discourse, which can be seen as a means for control and exclusion (Swyndedouw 2004, 176) and which is maintained through a powerful discourse of neutral expert knowledge (Budds 2009, 428).

Innes and Booher (2010, 4) argue that legitimacy gained through formal expertise is no longer as persuasive as it was some decades ago, and actors are searching for new forms of legitimacy from

collaborative action. In both cases, collaborative knowledge production was visible to some extent, but only inside knowledge coalitions. Thus, instead of bringing some mutual understanding of the case as a whole, this collaborative knowledge production only widened the gap between coalitions. It seems that the world of water planning and management is balancing between two paradigms: instrumental and collaborative rationality.

While acknowledging the ambivalence between the two paradigms of instrumental and collaborative rationality in the constantly changing world of water governance, this research emphasizes the idea of a paradox in order to find better ways to proceed in contentious large-scale groundwater projects. As the definition of a paradox indicates, in paradox two opposite phenomena are simultaneously present, and neither of them can be left aside. Thus, instead of emphasizing only one, the two sides of the coin should be acknowledged and ways of dissipating the dichotomous character of a paradox sought (see Sotarauta 1996).

Accordingly, the new paradigm neither discards the old one totally nor offers direct solutions to old problems. Approaches framed by the old paradigm are still usable in some cases. For example, constructing a water pipeline network to a new residential area is not as complex nor as unpredictable management problem as is an inter-municipal MAR project. Thus, its' construction would probably not require a collaborative planning and implementation process. Furthermore, some aspects from the old paradigm may be useful in a situation, which requires new way of thinking in a large context. Accordingly, new paradigm can be seen as an addition to the coexisting theoretical sources and practices from the old paradigm (Bäcklund and Mäntysalo 2010). For example, collaborative groundwater governance should include both rational expertise and collaborative approaches: expert knowledge analyses the question of *what* we are processing, whereas collaborative approaches can answer the question of *how* we should proceed in terms of interaction and legitimation of the process (see article IV).

4.6 Assessment and self-evaluation

In qualitative, problem-driven research, concepts like validity and reliability are not applicable in the same manner as in quantitative research. However, this does not mean that qualitative research can be left without evaluation; on the contrary, evaluation is extremely important when there are no clear tools for proving the accuracy of the results and the concept of objectivity is questioned or at least seen from different perspective as in positivistic research tradition.

As discussed in chapter 2.1, from the social constructionist point of view a researcher is not an objective observer of a measurable and predictable phenomenon. Instead, every research includes

implicitly the researcher's world of experience and values, which influence the interpretations made of the phenomenon. When the world is viewed as socially constructed through social practices and interactions, this acknowledges the performative nature of phenomena, which means that a description of the phenomenon also modifies it. Therefore, a researcher participates in the construction and transformation of the phenomenon. On the other hand, the influence of our environment on our thinking is evident. Therefore, the relationship between a researcher and his or her research object is bidirectional.

Accordingly, in non-positivistic research tradition, the truth-value of the findings are evaluated by addressing the credibility of the researcher's interpretations (Lincoln and Cuba 1984). Therefore, the researcher needs to provide sufficient description of the theoretical framework, methods and materials used, as well as their interrelations. An accurate description of the whole analysing process is necessary and the trustworthiness of every step should be scrutinized (Elo et al. 2014). In this research, the description is provided mainly in chapter 1.4 and chapter 2. The path of this research has not been linear; instead, the dialogue between empirical material and theory has evolved in non-linear cycles during the process. Chosen methodology is considered to be a kind of unitive glue in this dialogue. Accordingly, the conflict analysis and discourse analysis bound the case material through discursive framework and negotiation theory to social constructionism, the epistemological foundation of this study. Furthermore, these two perspectives supported each other and enhanced the methodological variety of the study.

An important question in the process analysis is the applicability of the research: to what extent the research results are applicable in other contexts? This question has been tackled especially concerning case studies. Flyvbjerg (2006, 228) argues that formal generalization is overvalued at the expense of case studies: "case study may be central to scientific development via generalization as supplement or alternative to other methods." Since every situation is different, we cannot draw any universal principles from a single case study nor transfer conclusions directly from one context to another (Innes and Booher 2010, 22). However, we can increase our understanding of a certain phenomenon and use this understanding while analysing new cases with the cumulated knowledge base that we have obtained by studying earlier cases.

The applicability of qualitative research is often examined through the concept of transferability (Lincoln and Cuba 1984). In this study, the first part of the research problem addressed the major constraints concerning contentious groundwater projects, and this was the foundation for the choice of case studies. However, the contextual framework of this study lies in the larger context of urban planning as well as NRM, and the findings echo the earlier research on collaborative governance in

these fields. Thus, although the specific context here is in groundwater management and MAR as well as geographical context in boreal regions, the results are most probably transferable to other settings also. As the results indicate, context needs to be considered in every analysing process, but the most profound reasons for conflict does not necessarily depend on context. Thus, this research offers signposts which indicate from which directions answers can be searched for, but the journey for the search varies in different terrains.

The other side of research problem was shaped later during the research process when the discussion between case material and theoretical consideration had taken several steps forward. The framework of collaborative rationality not only offered guidance for searching for major constraints but also for lessons and suggestions for future groundwater projects. Since the two case studies did not offer direct examples of collaborative action, and it was too late for including new cases to the ensemble, these recommendations and policy implications are drawn from the existing literature as well as from those constraints perceived in case studies. This can be seen as a limitation of this research, which does, however, generate interesting considerations for further research.

There are many wise men and women around these days, each of whom is an expert regarding some particular anatomical part of the great elephant. What we sorely need are more people with expertise in the contours of the beast as a whole.

(Rubin 1983, sited by Crump and Glendon 2003, 222)

This chapter clarifies the meaning of the results obtained in this research. It first lists the major conclusions drawn from the results and then illustrates the scientific contribution of the study as well as reflects the results with their theoretical base. Third, more practical outcomes of the research are introduced by suggesting some recommendations and introducing policy implications to the field. Finally, some suggestions for further research are presented.

5.1 Conclusions

The objective of this study was to find new perspectives for groundwater governance from the water services point of view, which spans two often separately examined fields: urban planning and natural resources management (NRM). Both fields widely acknowledge the contribution of collaborative governance in complex planning and management problems. Thus, this was the perspective from which this research analysed major constraints of groundwater governance in a contentious framework and suggests better practices for future projects.

This research derives from two case studies: large-scale, regional MAR projects that have faced contentious issues. The first interest was to examine groundwater conflicts, which are less frequently analysed than surface conflicts (Jarvis 2014), and the reasons why those conflicts occur in a country with rather abundant water resources. Although the case TRW fulfills the requirements for water-scarce conditions, these are, however, not extreme conditions in global context. Furthermore, groundwater abstraction in Finland in general seems to evoke contradictory issues. Thus, water scarcity loses its power in counter-argumentation, especially in cases of MAR, where the intention is to augment water quantity by using artificial recharge methods. As stated earlier, contradictions in water management employ strong public governance features rather than water scarcity or other technical perspectives.

Major conclusions about the constraints in groundwater management are:

i) Instrumental rationality still prevails in water management sector. Socio-economic environment is not adequately acknowledged. In the case studies, the projects were managed merely from technical perspective and the influence of social orders to water management was underestimated. Although collaborative efforts were implemented, these were used only as casual tools without really relying on collaborative rationality.

ii) The actors concentrate on the tip of the iceberg, the visible part of the conflict, instead of managing the whole: positional thinking and arguing about facts dominate the discussion. In the case studies, this led to a deadlock where increasing the amount of expert knowledge could not solve the problems.

iii) The interaction is based on zero-sum game, and the underlying interests and the complexity of the problem are not acknowledged. The interests and values are hidden under those positions; for example, environmental argumentation overshadowed a latent but important local economy discourse in the case studies.

iv) The situation is defined in various ways depending on the position that an actor takes. For example, the local residents in both cases saw the MAR project as an environmental threat, whereas the project planners saw it as an environmentally friendly solution to water management problem.

v) Solely expert knowledge is accepted as a legitimate source of information. In the case studies, knowledge coalitions were formed, which leaned on expert-based argumentation. However, the coalitions did not approve the arguments presented by the experts from the other coalition. Thus, dueling experts' syndrome was visible.

The second interest of this research was to outline lessons for future groundwater governance based on collaborative rationality and the constraints encountered during the two case studies. These lessons are outlined in chapter 5.3 where recommendations and policy implications are presented.

5.2 Scientific contributions

It is evident that neither conflict research nor research on collaborative planning is a new phenomenon. Collaborative approaches to conflict resolution are commonly acknowledged in the field of urban planning as well as NRM. However, to my knowledge, this kind of collaborative governance framework has not been presented in relation to MAR, which has globally evoked a large amount of research in terms of technical, economic, and legislative considerations. Furthermore, this

research contributes to the discussion on collaborative governance from three perspectives. First, this study combines usually separately studied fields of urban planning and NRM. Second, the thematics of knowledge production is strongly bound to the collaborative governance framework. Third, the research problem is viewed from two different perspective: negotiation theory and discourse analysis.

While urban planning and NRM are considered as separate fields of inquiry, they both are an intrinsic part of societal development. Furthermore, these fields have similar features from the perspective of governance: they both involve complex issues of planning as well as various interactions inside natural, built, and socio-economic environments. In this context, water services provide an excellent example since they are strongly bound to both fields through their multiple connections with aquatic environment, immense built pipeline networks, and other technical facilities in cities and rural areas, as well as through the influence of good quality and sufficient quantity of fresh water to the socio-economic development.

Although collaborative rationality has a strong position in academic discussion as well as in practice, its core has still rudiments from instrumental rationality. The literature shows that collaborative water management is still strongly bound to rationalistic and technocratic ideas of management frameworks, tools, and methods that are not sufficient in shaping a collaborative decision-making process (van Buuren 2013). Especially the idea of socially constructed knowledge is easily forgotten when expert-driven rationalistic choice dominates. Accordingly, this study has addressed the question of knowledge production from the perspective of knowledge coalitions (see van Buuren and Edelenbos 2004) which perform joint knowledge production inside the coalition but widen the gap between coalitions. While knowledge can be seen as a source for fragmentation as well as integration, it is essential to locate the existing boundaries and try to concentrate on those, instead of putting efforts to the assumed dichotomy between policy and knowledge worlds. In this boundary-management process, integrative negotiation model provides applicable perspectives.

The two approaches, negotiation theory and discourse analysis, enabled diverse observation of the two MAR projects. Indeed, unambiguous view of case studies was abandoned, and the analysis revealed multiple perspectives from which parties evaluated the iceberg. The storylines around the environmental discourse crisscrossed on the surface and were constructed in the argumentation of various parties. Furthermore, discourse analysis revealed something from beneath the surface as parties interests started to uncover along with the regional policy discourse. Together with discourse analysis negotiation theory led to a comprehensive analysis of the iceberg: visible discourses, hidden interests as well as main constraints were revealed. Thus, this research clarified the governance failure

in the two case studies and, in a larger context, accounted for the problems of conventional groundwater management.

5.3 Recommendations and policy implications

Like negotiation theory, this research is strongly practice-oriented. Nevertheless, it is difficult to integrate scientific learning with a contextual reality of complex, unpredictable, and non-linear water conflicts. Complex problems do not fit into any single governance model, which often offer too simplified a picture of the world. Every situation is different; thus, practitioners need to translate solutions derived from scientific findings into the confused context of the policy world. This study indicates some directions towards collaborative groundwater governance.

Whereas the goal of conventional groundwater management is to achieve outcomes that fulfill technical, legislative, and environmental requirements, in collaborative groundwater governance the basis should be in legitimation process. Legitimacy needs to be gained from the perspective of three domains that are ultimately present in groundwater processes: natural, built, and socio-economic environments. For example, an MAR project has to fulfill the environmental requirements not only from the perspective of an environmental authority; rather, every stakeholder needs to accept the presented justifications.

In the legitimation process two major aspects needs to be considered: interaction and knowledge production. Before that, it is necessary to acknowledge that problem definition from the conventional management perspective derives from a mechanistic worldview where a system can be taken apart, the details of individual parts analysed, solutions for those parts found, and the parts then combined into a whole again. Instead, when causal effects cannot form the base of the analysis, governance framework acknowledges the complexity of groundwater management problems and their uncontrollable and unpredictable nature. Here, the complex nature of the system is seen as source of adaptation rather than control.

As the two case studies illustrated, failed interaction is one of the fundamental constraints for complex groundwater projects. Failed interaction can form an insurmountable barrier between parties, but when successful it can form a bridge even between contentious interests of various parties. In the case studies, interaction was based on zero-sum game with an idea of fixed amount of benefit that needs to be allocated among the stakeholders. Thus, there were no possibilities for enlarging the pie, in other words, the parties could not find a solutions that would have offered benefits for all parties. This was difficult because parties negotiated from the perspective of their positions rather than of their

interests. However, integrative approach emphasizes interest-based negotiations. While interests of every party are on the negotiation table, parties come out from behind their positions when transparent and more trustworthy negotiations are allowed to begin. Without a competitive mindset, creative solutions and new potential options can be searched for.

Thus, instead of concentrating on the tip of the iceberg, the whole iceberg should be acknowledged: positions should also be recognized in order to clarify the comprehensive understanding of the problem and how it was constructed. As the two case studies showed, this clarification may reveal underlying interests as well. Furthermore, a historical perspective helps us to define the current interactions and practices. In contentious cases, a historical load may overshadow fluent and transparent interaction, and thus explain many controversies. The importance of the case history cannot be neglected, rather it should be emphasized in all practical work in the field.

Knowledge production in conventional groundwater management is driven by an assumption of perfect and objective information that can be obtained by expert analysis. However, in complex cases this assumption leads to a deadlock. Disagreement about the facts prevails also among the experts themselves. Indeed, MAR projects form fruitful ground for duelling experts' syndrome. In the case studies, also the opponents invoked authorities who were considered to be experts in the field at issue. This was possible, since, among the experts, MAR was not unambiguously approved as the best water management solution to the areas in question.

Thus, the main task is to create a legitimate knowledge base together with experts and stakeholders. In this joint knowledge production process, expertise is exploited as a fundamental source of knowledge but it is complemented with local, experiential, and other forms of non-scientific knowledge. However, the most important question is to find legitimate ways to gather this knowledge base, which then forms a cornerstone for the collectively produced truth about the problem.

In a collaborative process MAR should be seen as one option among others. However, after the goal for MAR is fixed, the negotiations become more challenging. Fixed goal narrows the space of creative alternative options and may form stronger contentious positions among involved parties. For example, in both case studies, water companies were launched and their official goal was to implement an MAR project. This kind of fixed position determines the perspective of project managers and binds their possibilities for collaborative action. This led to the DAD syndrome (Decide-Announce-Defend), where public officials made their own autonomous decisions about the implementation of the MAR project, which was announced to public and later defended when

opposition started to occur. However, if the goal is already fixed to MAR, the options should be collectively created inside this framework, although it is much more challenging.

Some special features of MAR increase the complexity of groundwater management in MAR cases. For example, a strong connection to land use should be acknowledged. Although groundwater is not a private property as the land above it might be, the landowner may have the image of groundwater as a private property. Thus, the groundwater conflicts may involve features from common-pool and non-common-pool resource conflicts (see Ostrom 1993), which causes mental confusion and forwards the problem of legitimacy. In addition, it should be acknowledged that as MAR technology itself reduces water scarcity, the emphasis of conflict is probably not in water allocation but rather in the process itself. This aspect needs to be considered especially while negotiating about the benefits that different parties would gain from the project. The negotiation is not about allocating scarce water resources among various parties, but about finding legitimacy to a process which is contested.

In these settings, the role of a water manager changes from the holder of the only legitimate source of knowledge to a facilitator or even a mediator who has the key to expert-based knowledge as well as to the sources of collective knowledge production. Jarvis (2014) argues that especially in groundwater conflicts the technical background and understanding of the substance is critical for a mediator. Furthermore, a water manager could also be a conveyor, whose main task is to construct and maintain collaborative process and to ensure that every relevant stakeholder is gathered around the negotiation table. This is extremely important since in order to reach durable and feasible outcomes in processes, instead of just *allowing* stakeholders to participate, we really *need* them to participate. Thus, the stakeholders should be viewed as partners or allies who are an invaluable asset for dealing with current groundwater management problems that are inherently complex in nature.

Finally, if we use new tools in an old manner, the result will probably remain the same. Thus, the *core* of groundwater governance should be in collaborative rationality while some of the tools can be obtained from rationalistic expert-based planning, not vice versa, as the examples derived from the two case studies show.

5.4 Suggestions for further research

The two case studies in this research are elaborated with a metaphor of an iceberg, including the visible tip of the iceberg as well as the hidden 90% below the surface of water. Now the iceberg have been analysed from the tip to the bottom. However, not all the aspects of the iceberg have been included in this research. Although contentious groundwater projects have been analysed in the

Finnish context from various perspectives, one emphasis for future research could be proactive conflict management, which corresponds to collaborative approaches. As mentioned in article IV, it would be interesting to study the mechanisms that facilitate recognizing emergent contradictions before an actual conflict will occurs.

Furthermore, there are several other icebergs in the ocean waiting for a researcher. A suggestion for further research would be to study the inter-municipal large scale projects that have proceeded without delays or strong contradictions: do they employ collaborative elements in their management strategies? And if so, what are those elements, and which are those institutional and practical settings that best allow collaborative groundwater governance to occur? And if not? Evidently, there are several cases where complex water projects have been successfully implemented with rationalistic planning approaches. Thus, the interesting questions are, when and how do the models based on instrumental rationality work well in complex settings. What about in the historical context: what is the role of rationalistic planning in the evolution of water sector? When and why water sector became more complex?

As discussed in chapter 2.2, one of the major challenges in the field of collaborative governance is in the dissemination of the general principles in the field. Although there are evidence of changes in planning practices, the paradigm shift from instrumental towards collaborative rationality may remain a paradigm shift in theory only (see Bäcklund and Mäntysalo 2010). Therefore, more practically oriented research is needed in order to narrow the gap between theory and practice. For example, which are those mechanisms that enhance collaborative practices in the field? If collaborative approaches are difficult to adopt among water managers with their educational and professional background based on instrumental rationality, which are the tools and mechanisms, which would support this adaptation?

Finally, a common problem in case studies, as well as in planning in general, is the issue of fixed goal. Negotiations become much more challenging after the goal is fixed to a certain option. Thus, for further research interesting questions are: why are the decision options so restricted from the beginning and what process features explain this?

Thus, this dissertation has evoked several ideas for further research. Several questions remain without an answer. In the end, questions, not the answers, open up possibilities for formation of a broader world view, which will be tested in future studies where again new questions are developed. Therefore, concerning the overall contribution of this research, more important than the destination itself, was the journey during which relevant questions were formed.

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Assessing Regional Cooperation in Water Services: Finnish Lessons Compared With International Findings

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Abstract

Water services, that is, water supply and wastewater disposal, are traditionally the responsibility of local governments. Many municipalities have joined forces to meet the challenges of increasing water quality requirements, aging infrastructures, and decreasing fiscal resources. Regional cooperation is claimed to generate benefits in various ways, but there are challenges to this assumption. This article assesses the benefits and challenges of regional cooperation through the following categories: economies of scale, socioeconomic and spatial disparities, autonomy and legitimacy, by comparing Finnish experiences with previous research findings. Our assessment concludes that the benefits and challenges of regional cooperation are not straightforward, not only dependent on the local context but also on the level and tradition of cooperation, especially on the degree of organizational autonomy.

Keywords

bilateral agreement, Finland, inter-municipal cooperation, municipal federation, water wholesale

Introduction

Water can be seen as a natural element for enhancing regionalization processes as it crosses jurisdictional boundaries all over the world. Indeed, regional context plays a central role in the water governance of Western Europe (Fürst, 2007). Regional governance

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involves various characteristics including horizontal coordination of various actors; cooperation between governmental, municipal, and private organizations; as well as multilevel features, which means that in addition to organizational policies, local, regional, and national policies need to be considered (Benz, 2001). Furthermore, horizontal, network-based decision-making structures have replaced hierarchical and vertical model of government (Benz & Papadopoulos, 2006; Michels & Meijer, 2008).

A practical example of regional collaboration[1] is a joint organization established by two or more local authorities in geographic proximity to enhance a single local government function. Typically, horizontal character of regional collaboration leads to a high degree of organizational autonomy, which means that a joint organization is no longer embedded within the public administration (Lieberherr, 2016). However, regional cooperation is not limited to joint organizations, it can also be a joint effort undertaken by many independently owned public utilities (American Water Works Association [AWWA], 1981). Thus, it is notable that the organizational autonomy within regional collaboration varies: The lowest degree of autonomy occurs when public authorities offer services to each other through bilateral contracts (Kurki, 2010), whereas the highest degree of autonomy is gained through a joint organization operating under private law (Lieberherr, 2016). Our study analyzes inter-municipal water services as one manifestation of regionalization.

In the Western world, organizing water supply and wastewater disposal is traditionally a responsibility of local governments (Pietilä, 2006). However, during the last few decades, some municipalities have faced increasing challenges in fulfilling this duty. Major challenges are institutional fragmentation (OECD, 2011) and several changes in the operating environment of water services: augmented statutory requirements in drinking water quality as well as in the quality of wastewater discharged to water bodies, expectations of more profound risk management, and of more enhanced communications to consumers and decision makers. Furthermore, aging infrastructure increases economic pressures all over the world; old drinking water and wastewater networks in particular require renovation (Hukka & Katko, 2015). In addition, many experienced workers are about to be retired during the next few years, which raises the fear of losing tacit knowledge concerning water services. Consequently, these challenges and limited capacity at the local level to address them have furthered collaboration between single municipalities.

Inter-municipal cooperation in water services occurs in several European countries, as well as in the United States, Middle East, and North Africa. Yet, the subject has generated research only to a limited extent, drawing on case studies of inter-municipal collaboration in urban wastewater treatment (Hophmayer-Tokich & Kliot, 2008; Lieberherr, 2011, 2016) and water supply (Schmidt, 2014; Stenroos & Katko, 2011), as well as regionalization of community water systems in rural areas (Hansen, 2011). In addition, some nationwide analyses have been conducted on the regionalization of the water and wastewater sector (Frone, 2008; Grigg, 1996; Mullin, 2009; Okun, 1977; Raucher et al., 2006).

Previous research emphasizes the benefits gained from inter-municipal collaboration in addressing problems that extend beyond the municipal boundaries. For

example, Schmidt (2014) argues that regional approaches should be systematically established and developed to enhance the sustainable development of urban water management. Furthermore, Grigg (1996) considers regional cooperation, with its several advantages, the most powerful tool that water managers can use. This is also recognized by the AWWA (2015), which highlights the benefits gained from regional cooperation: knowledge sharing, increasing efficiency, minimizing capital expenditure, and enhancing source protection. These benefits are commonly recognized; however, the researchers do acknowledge some disadvantages as well.

In assessing benefits and challenges of inter-municipal cooperation, this article compares Finnish experiences with previous research in water sector through an analytical framework, which includes three categories: economies of scale, socioeconomic and spatial disparities, and autonomy and legitimacy. However, most of the existing research concern the performance of regional cooperation based on single or multiple case studies without recognizing that collaboration actually occurs at various levels. The degree of organizational autonomy especially affects the performance of a particular cooperation model. Therefore, our nationwide analysis aims at contributing to the knowledge base for this particular subject by exploring the following research questions:

Research Question 1: What are the benefits and challenges of inter-municipal water collaboration in the Finnish context, and how do these correlate with international experiences?
Research Question 2: How do the different levels of collaboration affect the performance of regional cooperation?

This study is organized as follows: The material and methods used in this study is described in the next section, and the analytical framework is introduced in section "Analytical Framework." The section titled "Background of Inter-Municipal Water Services in Finland" introduces the background, and the section "Three Levels of Inter-Municipal Collaboration" discusses the levels of regional water services cooperation in Finland. Section "Analyzing Benefits and Challenges of Regional Collaboration" outlines the benefits and challenges of regional water cooperation in the Finnish context, and compares the findings with international experiences. This assessment indicates that neither benefits nor challenges invariably occur but are strongly dependent on the context as well as the level of cooperation. The section titled "Concluding Remarks" discusses the results and suggests that in the future, not only the contextual influence but also the various levels of cooperation within the nation in question should be recognized as an important part of the evaluation of inter-municipal cooperation in the water sector.

Research Design

The material for this article was obtained from research conducted during the years 2008 to 2015. Three separate studies were carried out, from which Study 1 had the

Table 1. Material Collected During the Three Studies.

Study 1 (2008-2010)	Inquiries to 11 water utilities
	Semi-structured interviews (utility managers and politicians; *n* = 13)
	Two seminars (first in December 2008, second in February 2010)
Study 2 (2009-2010)	Inquiry to 264 water utilities (*n* = 233, including 50 largest municipalities of Finland)
	Semi-structured interviews (utility managers; *n* = 9)
Study 3 (2012-2015)	Semi-structured interviews (utility managers, authority, water experts, politicians, and citizens; *n* = 28)

major relevance to this article, whereas Studies 2 and 3 offered complementary material:

- Study 1: Research on the inter-municipal collaboration in the Finnish water sector.
- Study 2: Research on the bilateral collaboration in water services in Finland.
- Study 3: Two case studies on contentious inter-municipal groundwater projects.

Details on the individual surveys are shown in Table 1.

The first study explored the inter-municipal cooperation in the Finnish water sector; particularly, cases where two or more municipalities had established a joint organization, either a company or a federation of municipalities. Empirical data were gathered from water utilities by inquiries and interviews. Ten cases representing various kinds of cooperation between municipalities were chosen for closer examination. The focus was on their experiences with different cooperation models, including possible constraints and opportunities. The information collected was complemented by two seminars which convened water experts from various organizations including water utilities, regional water companies, the Environmental Center of Tampere Region, the Association of Finnish Local and Regional Authorities, and the Finnish Water Utilities Association. The purpose of the seminars was to gain a deeper understanding of the reasons why joint organizations were established, what is critical to a well-functioning organization, and what is needed for successful collaboration in the future. (See Pietilä, Katko, & Kurki, 2010 for more on the research approach and results).

The second study provided complementary insights for this article about bilateral collaboration in water sector. It collected quantitative data on the extent of bilateral, agreement-based collaboration. An inquiry was sent to 264 utilities of which 233 responded (88%). In addition, nine semi-structured interviews were conducted to gather qualitative data about operational experiences and future cooperative plans. The qualitative data were analyzed through a strength, weaknesses, opportunities, and threats (SWOT) analysis. (See Kurki, Katko, & Pietilä, 2010 for more on the research approach and results).

Whereas the first two studies were nationwide analyses, the ongoing[2] third study is a case study that analyzes two contentious inter-municipal groundwater projects with an emphasis on water conflicts. Accordingly, the actual focus of the study is not on the regional water cooperation as such; thus, it is used only as a complementary material for this article. However, the interviews revealed interesting aspects about the operation of wholesale companies, the most used organization model in regional water services in Finland. Altogether, the interviewees included utility managers, water experts, authorities, politicians, citizens, and representatives of an environmental non-governmental organization (NGO).

This study followed a dialogical process where material collection and theoretical observations overlap. Our analysis is based on the analytical framework, which enabled us to assess benefits and challenges of inter-municipal cooperation in water sector in Finland, as well as to compare our findings with the case studies from other countries. It is established on the basis of the academic literature of regional governance as well as case studies from the water sector in Finland and other countries such as the United States, Sweden, Israel, Germany, and Switzerland. First two case countries were observed through literature review as well as personal communications. In addition, material was collected during a professional visit in 2008 to the United States. Other cases were observed solely based on the literature.

Analytical Framework

To assess the regional cooperation in water services, we established an analytical framework for analyzing benefits and challenges of inter-municipal cooperation. It includes three categories: (a) economies of scale, (b) socioeconomic and spatial differences, and (c) autonomy and legitimacy.

Economies of scale refer to the idea that the production costs per unit are lower as the volume of production increases. In addition to product-specific approach, overall economies of scale are recognized in association with increases in all organization's outputs (J. A. Clark, 1988), such as knowledge sharing, complementary resources and capabilities, and more effective governance (Dyer & Singh, 1998). Economies of scale are recognized in several fields, especially in industries, such as electricity (Christensen & Greene, 1976), machinery, and high-tech industries (Henderson, 2003), as well as in banking (Adams, Bauer, & Sickles, 2004) and education (Cohn, Rhine, & Santos, 1989).

In terms of regional cooperation, economies of scale occur when small public organizations are merged into larger, inter-municipal units. This may bring economies of scale in capital facilities and operational costs (Frone, 2008; Grigg, 1996), which usually means efficient use of limited financial resources when high-cost advanced systems can be constructed with a lower per capita cost (Hophmayer-Tokich & Kliot, 2008). However, the economies of scale do not increase endlessly while the size of organization grows. The optimal size of an organization is hard to determine, because specific circumstances vary with each case and have an influence on the relative efficiency (Frone, 2008).

Closely related to the economies of scale, regional collaboration may enhance uniform regional development even more in terms of balancing socioeconomic and spatial differences between municipalities. This refers, for example, to differences in the geographical situation, fiscal strength, and sufficiency of professional capacity for performing public services. In general, small municipalities benefit from the fiscal and human resources capacity of larger municipalities (e.g., Hophmayer-Tokich & Kliot, 2008); however, in terms of common pool resources, such as water, in many cases city centers benefit from the resources obtained from surrounding municipalities.

The third category analyzes the organizational autonomy and related legitimacy. Autonomization is related to the horizontalization of government where vertical government structures are gradually replaced by horizontal ones. In meso-level, this means that the government bodies are no longer central actors but rather partners with NGOs and private enterprises (Michels & Meijer, 2008). Thus, many public organizations are no longer embedded within administrative bodies, and they have a higher degree of organizational autonomy: Political decision making is separated from operational and management decisions (Lieberherr, 2016).

In this context, legitimacy can be defined as something that converts power into authority: Those who have the decision-making power are expected to follow the preestablished norms (Schmitter, 2001). However, problems of legitimacy occur when political sphere has no longer influence on the decision-making process (Benz, 2001). Strong autonomization generally weakens democratic structures: As the degree of autonomy increases, the transparency of decision making decreases, as the public sphere has less opportunity for control. Thus, the question of legitimacy is closely related to the organizational autonomy (Lieberherr, 2011, 2016).

Background of Inter-Municipal Water Services in Finland

According to Finnish legislation, municipalities are in charge of arranging water services, but they are free to decide how these services are actually provided (Katko & Hukka, 2015). Municipalities can provide the services as a section within technical services, as an independent water department, as a municipal water utility or company, or jointly with other municipalities in different organizational forms. In addition, water services can be provided by cooperatives owned by the water users.

Finland is a rather sparsely populated country with its five and a half million inhabitants occupying more than 300,000 km^2. Furthermore, the country has abundant water resources with more than 180,000 lakes as well as groundwater, mainly in alluvial eskers. However, settlement is concentrated in the coastal areas of southern and western Finland where geological conditions contribute to water quantity and quality problems that are more serious than elsewhere in Finland. In these parts of the country, only a few large groundwater areas exist, and the surface water consists mainly of river water that is of low quality due to acid sulfate soils which (Figure 1), together with human activities such as agriculture and draining, impose high loads of acidity, metals, humus, and suspended matter (Edén, Weppling, & Jokela, 1999).

Figure 1. Deposits of acid sulfate soils in Finland, formed during the Litorina stage of the Baltic Sea about 7500-1500 BC.
Source. Adapted from Weppling, Innanen, and Jokela (1999).

Consequently, to gain adequate fresh water resources, inter-municipal cooperation concerning water supply started to develop in the coastal areas as early as in the 1950s. Currently, most of joint organizations are located in those areas (Figure 2). For example, the two largest coastal regions,[3] the Helsinki metropolitan area and the Turku Region, currently receive their drinking water from inland water sources through a 120-kilometer-long tunnel and a 70-kilometer-long water transfer pipeline, respectively.

In terms of wastewater treatment, although the first regional wastewater company was established as early as in 1961, the process of centralization emerged much later. This can be observed from the number of urban wastewater treatment plants, which gradually increased up to the 1990s: Local needs were satisfied with local solutions. However, economics and stricter quality requirements for treated wastewater justified larger, more centralized systems, and the total number of wastewater treatment plants started to decrease. For example, the City of Helsinki, the capital of Finland, had 11 wastewater treatment plants at the beginning of the 1970s, but currently, there is only

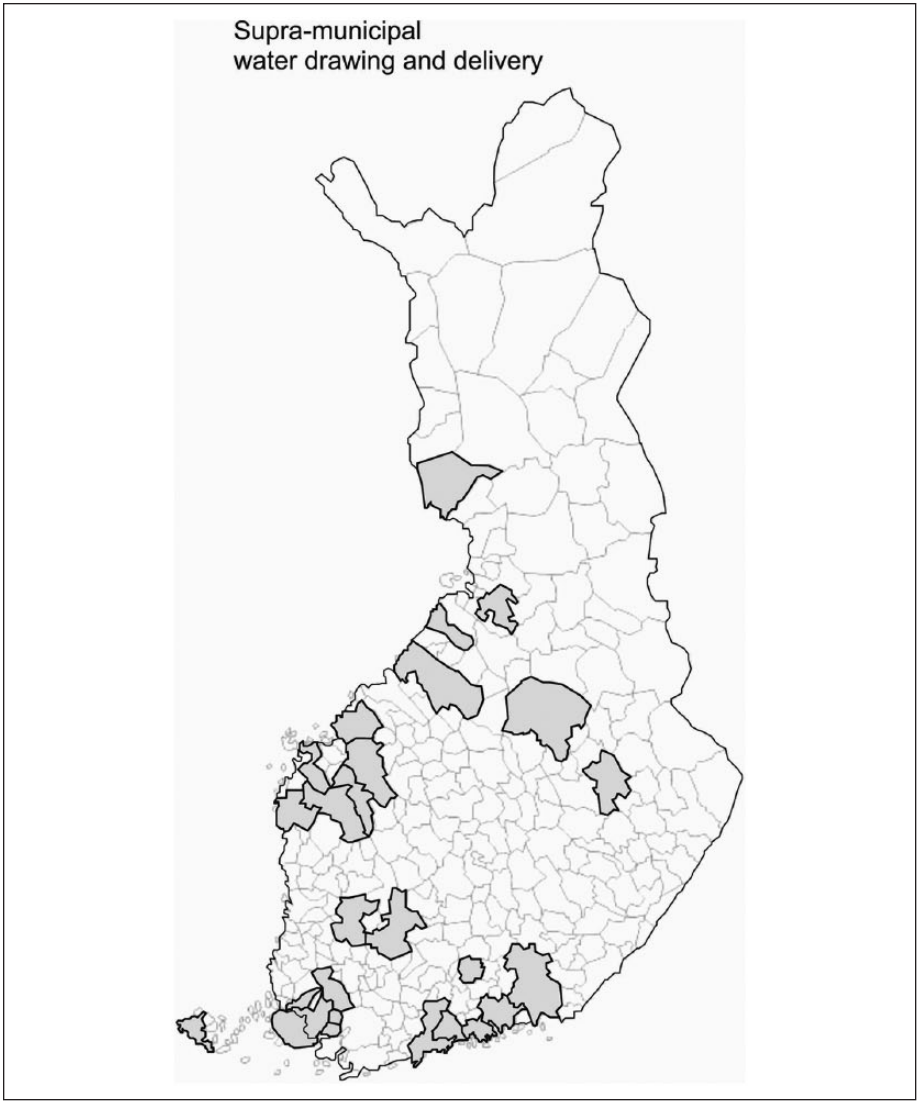

Figure 2. Locations of joint organizations for regional water drawing and delivery.
Source. Adapted from Pietilä, Katko, & Kurki, 2010.

one, which receives wastewater from several neighboring municipalities as well (Kurki, 2010).

Regional cooperation in water services has been promoted strongly by government authorities as well. Official policy has provided financial incentives, for example, for construction of water transfer pipelines from one municipality to another. Figure 3

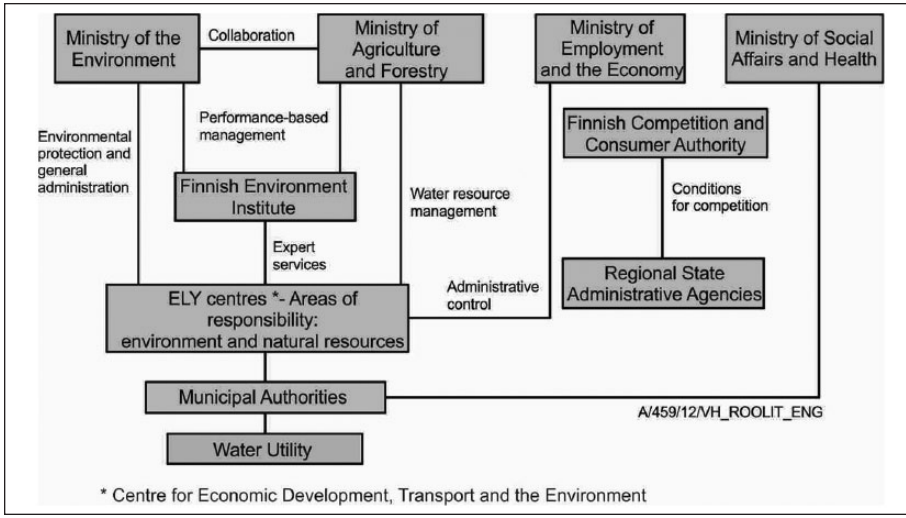

Figure 3. Institutional framework of Finnish water and sanitation services (Katko, 2016).

illustrates the role of various administrative bodies in water services in Finland. The Center for Economic Development, Transport, and the Environment (ELY Center) acts as environmental authority and is guided by three ministries. Regional ELY Centers coordinate *regional development plans for water services* which aim at developing inter-municipal collaboration.

The first plans were established in the 1970s when water supply challenges started to emerge, especially on the coastal areas of southern and western Finland (KUVENE, 1975). Consequently, several regional water utilities were founded. Water supply was their main concern until the mid-1990s, when regional plans also started to consider regional sewerage systems. From the beginning of the 21st century, planning has addressed water supply and wastewater treatment comprehensively.

Three Levels of Inter-Municipal Collaboration

In this section, we will illustrate the specific design of regional cooperation in water services in Finland. However, it is important to note that regional cooperation can be performed through various arrangements depending on the nation's history and related political and administrative traditions. For example, in the United States, the most commonly used arrangement is the so-called *special district*, which can be traced back to the 1880s. These are autonomous governmental bodies that can perform almost any local government functions but usually only one function per district: water, sewerages, irrigation, parks, transit, libraries, fire protection, health care, and so on. Furthermore, a special district reduces the financial risk of municipality, because unlike in Finland these districts have the ability to issue debt in the form of bonds

which is underwritten by the taxing power of the special district not the municipality. As special districts perform a single function, they can customize the service area according to its needs instead of jurisdictions (Mullin, 2009). In addition, inter-municipal cooperation in the United States is performed through regional agreements and authorities. Here, we can find several similarities to Finnish systems.

In Finland (as well as in Sweden), we can distinguish three main levels of inter-municipal cooperation in water services:

1. Bilateral agreements
2. Wholesale water or wastewater company (or federation)
3. Regional water and wastewater company (or federation)

First level is rather light form of inter-municipal collaboration because no joint organization is established; municipal water utilities collaborate through bilateral agreements, which are rather easy to negotiate. A water utility can either sell or buy drinking water at an approved price, and the contract can be either continuous, as in cases of inadequate water resources, or provisional, to secure water supply at times of crises. In addition, there are an increasing number of contracts for transferring wastewaters to the treatment plant of a neighboring municipality. As the contracts are bilateral, water utilities commonly have several contracts with neighbor municipalities, for both supplying water and receiving wastewater. When the number of bilateral contracts increases, it causes additional challenges in managing the ensemble. In many cases, cooperation based on contracts has been the first step toward a joint inter-municipal organization (Kurki, Katko, & Pietilä, 2010).

In general, in the second level of cooperation, a wholesale company (or federation) typically concentrates on water supply and/or treatment only, while the municipalities are responsible for water distribution to the users or wastewater collection from the users. Consequently, the ownership of water distribution networks or sewers stays with the municipalities except for the trunk mains and sewers. However, in case of a regional water and wastewater company (third level), the organization is in charge of the whole chain of water services and owns the entire infrastructure it operates with. Thus, the third cooperation level integrates water supply and wastewater management sectors, which has also been a common practice in municipal-level organizations in Finland since the 1970s (Katko, Kurki, Juuti, Rajala, & Seppälä, 2010).

In terms of organizational autonomy, the first level of cooperation has the lowest degree of autonomy because it is operated through municipal utilities, which are embedded within administrative structures and political decision making (see Lieberherr, 2016). Concerning Levels 2 and 3, a new organizational entity is formed and the degree of autonomy increases. However, organizational structuring also has an influence on this. The legal form of a joint organization in the water sector in Finland is either a company owned by municipalities or a federation of municipalities. They both have legal personality, but a company has a higher degree of autonomy than a federation.

Wholesale companies and regional water and wastewater companies in Finland are regulated by the Limited Liability Companies Act (624/2006). They follow the

Table 2. Characteristics of the Three Cooperation Levels.

	First established	Number of organizations	Integration of water supply and wastewater treatment	Degree of autonomy	Owner of water and wastewater networks
Category 1: Bilateral agreement	1959	Hundreds of agreements	No	Low	Municipality
Category 2: Wholesale organization					
Federation	1954	5 WS 1 WW	No	Medium	Municipality
Company	1965	19 WS 10 WW	No	High	Municipality
Category 3: Regional water and wastewater company					
Federation	2010	1	Yes	Medium	Federation
Company	1965	4	Yes	High	Company

Note. WS = water supply; WW = wastewater disposal.

principles of private sector, and their decision making is decoupled from municipal structures. However, municipalities are the shareholders, and they use the right of decision at the General Meeting, which is the supreme decision-making body. In addition, they choose the members to the Board of Directors, who are personally responsible for administration and operational management. Thus, the municipalities cannot direct their action but they can give instructions to supervise owner interests (Metsälä, 2001). Furthermore, the decision-making process of companies is not public: The Board of Directors can decide which information will be published and decisions can be enforced immediately. As for municipal federations, although they form a legal entity, they operate under the Local Government Act (365/1995) and are more connected to the municipal decision-making structures than companies. For example, the decisions are subordinates to appeals and demands for rectification.

Inter-municipal collaboration in water sector began in the 1950s, and it has increased and developed in its all forms. In comparison, in Sweden the current trend is also to increase inter-municipal collaboration in water sector (Thomasson, 2013). Currently in Finland, altogether 40 joint regional organizations (Levels 2 and 3) operate in the field of water services and serve close to 35% of the country's population (Stenroos & Katko, 2011; percentage value updated by the authors). However, the most commonly used form is bilateral contracts (Level 1). The number of contracts has more than tripled since the 1970s, and it appears that the number will continue to increase in the future (Kurki et al., 2010). Table 2 summarizes the characteristics of each cooperation level.

Initially, joint inter-municipal organizations were mainly municipal federations for wholesale water sales, whereas in the 1960s, water companies started to emerge. Currently, nearly half of the joint organizations are water wholesale companies. The emphasis on water supply can be explained by geography because most of the

companies are established in the water-scarce coastal areas. However, the popularity of companies over federations is a more complicated phenomenon. Interviewees emphasized the bad reputation of federations in terms of organizational flexibility and decision making. However, good experiences of federations were reported as well. Accordingly, in most cases, planning of inter-municipal cooperation did not precede any profound analysis of different organization models, rather the decisions were made based on minnow and general trends.

Analyzing Benefits and Challenges of Regional Collaboration

In general, the reasons for inter-municipal cooperation are very clear: sufficiently good-quality raw water is not available in certain regions, or the capacity of old wastewater treatment plants has been exceeded, and neighbor municipalities decide to join forces and construct a larger, common one. Accordingly, collaboration between municipalities aims at bringing benefits for all parties. However, in practice, it may face several challenges as well. In this section, we analyze the benefits and challenges of inter-municipal collaboration by using an analytical framework, which includes the following categories: economies of scale, socioeconomic and spatial differences, autonomy and legitimacy. The Finnish experiences are compared with the research findings in other countries.

Economies of Scale

Economies of scale are generally referred to as indicators for benefits, which emerge from larger units followed by lower per capita costs. In terms of water services, this may entail a possibility to gain improved water quality; for example, through more advanced treatment processes, the ability to use better laboratories or resources for source protection programs (Grigg, 1996), as well as reduction of spillover effects in case of wastewater treatment (Hophmayer-Tokich & Kliot, 2008). As the regulatory challenges increase, concerning, for example, safe drinking water, small utilities may benefit from consolidations to reduce their regulatory burden (Shih, Harrington, Pizer, & Gillingham, 2006). In the case of Finland, these benefits were identified by the water experts and authorities as well. Furthermore, in case of wholesale companies and federations, the actors can concentrate on a specific operational area instead of managing the entire water sector. In addition, the interviewees emphasized better risk management as well as synergies in electricity, automatization and process management competence. Indeed, "economies of scale" have become a hegemonic discourse around the regionalization phenomenon in Finland—only few dare to question it. However, both large and small units most likely are needed, as F. E. Schumacher (1973/2010) notes in his book *Small Is Beautiful*,

> For different purposes man needs many different structures, both small ones and large ones, some exclusive and some comprehensive. Yet people find it most difficult to keep two seemingly opposite necessities of truth in their minds at the same time. (p. 58)

The concept of economies of scale is critically reviewed in the literature; for example, R. M. Clark (1979) questioned it in connection with water supply and regionalization. According to Grigg (1996), larger units do not necessarily provide additional reliability for water services: For example, a large, single facility might have greater vulnerability in case of failure than several small units where the risk is far more diffuse (Lieberherr, 2011). In our study, a causality to a financial risk was introduced as well, as insurances do not cover all damages. Moreover, Bakir (2001) has studied sparsely populated small communities in the Middle East and North Africa, where centralized wastewater treatment may become economically infeasible due to the high cost of the wastewater transfer network. This is relevant also in Finland, which is a sparsely populated country. Accordingly, population density has an influence on the relative efficiency and the benefits obtained through large units. Furthermore, our interviewees argued that local knowledge can become invisible inside large joint organizations. Here, the concept of local knowledge not only refers to the knowledge that local residents have—for example, concerning the local aquatic environment or locations of old wells and pipelines—but also to the tacit knowledge that employees have inside their company.

In addition, Schmidt (2014) argues that regional collaboration may be inefficient when the economies of scale are hindered by spatial and institutional fragmentation. In a German case study, she presents the situation of inter-municipal collaboration in the region of Frankfurt and Rhine-Main: There are altogether 17 associations for water supply, as well as 85 providers and 19 associations responsible for wastewater disposal serving 2.2 million inhabitants in 75 municipalities. Conversely, a positive example can be found from the Ruhr urban region, where highly integrated regional governance processes recognized the intersection of spatial development and regional water management as well (Schmidt, 2014). Accordingly, as regionalization may involve complex double structures and fragmentation, an adequate institutional platform for a higher level coordination is needed (see also OECD, 2011).

In terms of three different cooperation levels in Finland, presented in the previous section, assessing the challenges and benefits under the category of economies of scale has only minor variation. The size of an organization grows from the first to third level of cooperation, but economies of scale are evident in all three levels. However, the size of an organization may affect its operational flexibility. The interviewees stated that wholesale companies are usually quite small organizations when compared with regional water and wastewater companies, and thus more flexible in their decision-making processes. Furthermore, a weakness of the third level of cooperation is that the regional monopoly becomes stronger than in the first and second levels of cooperation.

Socioeconomic and Spatial Differences

Regional collaboration may balance socioeconomic and spatial differences between municipalities. In terms of water supply, this means, for example, more equal access to water resources (Frone, 2008). As discussed earlier in this article, in Finland this

was the main motivator for the establishment of regional wholesale water companies in the water-scarce coastal regions. In addition, collaboration may bring more expertise inside an organization and therefore enable better service to the customers.

Hophmayer-Tokich and Kliot (2008) present an example of regional wastewater treatment, and how cooperation can efficiently balance socioeconomic as well as spatial disparities between local authorities. In their case study from Israel, there were several small municipalities in the Karmiel region, which were not able to establish an advanced wastewater treatment plant by themselves. However, cooperation with a stronger local municipality enabled them to overcome the fiscal as well as political, organizational, and human-resources-related challenges, and establish a centralized wastewater treatment plant. Consequently, regional collaboration solved many sewage pollution problems in the drainage basin by enabling small towns to upgrade their wastewater to a higher standard, thus bringing environmental advantages to the whole area.

According to Hophmayer-Tokich and Kliot (2008), small municipalities may benefit from the capacities of stronger municipalities, as well as from the authority of a joint organization which has greater political strength to promote their interests. However, in the Finnish context, also contradictory observations were made. Commonly in joint organizations in Finland, smaller municipalities are afraid that they will not have enough power to drive their own interests because the central municipality will have the largest number of shares. Thus, they fear they would lose their autonomy if they collaborated with larger city (see also Lieberherr, 2011). For this reason, some small municipalities preferred agreement-based collaboration rather than participating in a large joint organization. However, various organizational examples from Finland show that there are several ways to balance power between shareholders. In some organizations, decisions require 80% endorsement or alternatively, the largest owner cannot have more than 50% of the seats on the Board of Directors. Another example suggests that each member municipality may have an equal number of members on the board, regardless of the size of the municipality. Nevertheless, concerning the distribution of dividends, the largest shareholders generally have more substantial shares of ownership.

Another problem, introduced by the interviewees, concerned already-existing old infrastructure. A regional water and wastewater company will possess and sustain the entirety of the water infrastructure. This may raise issues with value and share determination. Representation of each municipality on the board is determined according to the value of assigned infrastructure or to the volume of business. Agreement may be hard to reach because the capital value in proportion to the volume of business may vary between different municipalities: In a sparsely populated area, the length of network is often greater compared with densely populated municipalities where the capital value may be higher because of the volume of delivered water. In addition, the condition of infrastructure may vary greatly between municipalities; thus, the potential partner municipality may not want to inherit a poorly maintained infrastructure system (Schmidt, 2014). These issues may even prevent the establishment of a joint organization.

In terms of finance and large capital investments, accessing long-term finance is crucial in the water sector. Frone (2008) argues that regional cooperation is a suitable tool to address this, because large long-term loans to a single entity are considered to be more efficient than providing small loans to a large number of entities. Within a single structure, small units can guarantee each other in the event of default. In case of Finland, wholesale companies and municipal federations have the whole responsibility of finance, although municipalities may act as lenders or guarantee for the loans. In addition, they do not have to earn profit to the shareholding municipalities—any possible profit will be used to improve the service. Shareholders pay for the services according to the use; consequently, the operating and investment costs are covered with the payments. This allows long-term development of the operations, and the company can concentrate on its own activity.

Autonomy and Legitimacy

The degree of organizational autonomy varies within the three levels of inter-municipal collaboration as well as within organizational models. A general view among the interviewees of our study was that decision-making process is generally more efficient and less bureaucratic in more autonomous organizations (joint companies) than in those with lower degree of autonomy (municipal water utilities or federations; see also Lieberherr, 2011).

In the case of Finland, in joint companies, there is an embedded structural need for the members to pursue the company's interests together (Stenroos & Katko, 2011). The organization is not embedded within municipal administration, and although the Board of Directors is typically a mixture of technical experts and politicians, the party politics stays away from the negotiation tables. The board can be seen as a team which shares common knowledge on possibilities, threats, and limiting factors concerning water works; leaving, however, the leading role in matters concerning technological solutions to the managing director. Stability and commitment of the board members are important to build a functioning management structure of the company. Furthermore, interviewees emphasized that in a joint company decisions can be made without publicity, and thus without political pressures.

Thus, the high degree of autonomization may increase organizational competencies by decoupling the decision-making process from the political system as it was also shown in a Swiss case study (Lieberherr, 2011). The decision making becomes more resilient and efficient, and instead of party politics, professionalism determines the strategic directions. However, this leads to the question of legitimacy (Lieberherr, 2011, 2016), which is highly relevant when dealing with something falling under the public good, such as water.

Lieberherr (2011) emphasizes the importance of acknowledging the tradeoffs between legitimacy, efficiency, and effectiveness: As the degree of autonomy increases, the transparency of decision making decreases. Sometimes this tradeoff is difficult to see or accept. Accordingly, one of our interviewees stated, "They [politicians] would like to have both; flexible decision making and the ability to control it through the political system, but it is impossible" (a representative of the Board of Directors of a wholesale company).

Among the interviewees, citizens especially recognized the problem of legitimacy. They were afraid that a municipal water company, regulated by the Limited Liability Companies Act, slides too far away from the democratic decision making. The most extreme scenarios predicted that this would eventually lead to privatization of water services. Nevertheless, water professionals, managers, and authorities were not as concerned with the consequences of autonomization. Conversely, they desired even more autonomy to avoid political debates inside a decision-making process.

However, prior to the establishment of an autonomous joint organization, a common political will needs to be developed within all stakeholder municipalities. According to Grigg (1996), divergent interests and tensions in policy arenas may hinder launching a collaboration project, and regionalization may be a hot topic at the local political level. As Schmidt (2014) argues, "[. . .] the logics of action driven by local egoisms work against regional activities" (p. 836). Nevertheless, several examples from Finland show that once political approval has been obtained, it is easier to negotiate the general terms of collaboration before establishing a joint organization. Subsequently, basic principles can be negotiated, such as value estimation of infrastructure and share distribution, and to gain final agreement about the form of collaboration.

However, in some cases, political will has collapsed after the establishment of a joint organization. The deteriorating influence of autonomization on democratic input may cause conflict between citizens and a water company. For example, there may be opposition against a large wastewater treatment plant in the host community, which falls into the "NIMBY" syndrome (Not In My Backyard; see Hophmayer-Tokich & Kliot, 2008). Furthermore, opposition may spread among the other stakeholder municipalities. In Finland, some contested inter-municipal groundwater projects have been delayed for several years, even decades, due to the collapse of a common political will after the local inhabitants intensively opposed the projects (Kurki & Katko, 2015; Kurki, Takala, & Vinnari, 2015). Indeed, Nolon, Ferguson, and Field (2013) argue that collaboration based only on political power cannot last because the power balance often changes with new elections.

Consequently, more profound engagement of each municipality is needed. During the interviews of our study, some representatives of wholesale companies proposed that this engagement should be done by more strict charters. However, this would not probably solve the issue of legitimacy. On the contrary, many authors suggest various collaborative methods to gain a higher level of commitment and legitimacy in the beginning of the project or even at the state of conflict (Innes & Booher, 1999; Islam & Susskind, 2013; Nolon et al., 2013). The basic idea is to find new and creative possibilities together with key stakeholders to create mutual gains and find solutions, which can be approved by each party.

Concluding Remarks

In the context of regionalization, our study utilizes water services as an example to illustrate the benefits and challenges of inter-municipal collaboration in the Finnish

context, and it also compares these observations with international research. Various levels of cooperation are emphasized.

The normative guidance concerning regional water cooperation in Finland is restricted to the municipal responsibility: Municipalities are in charge of arranging water services that are actually provided by water utilities or cooperatives (Katko & Hukka, 2015). State authorities can provide financial incentives or set requirements but cannot control decisions of local governments. For example, since 2010 large cities have been required to have more than one raw water source available. Municipalities can decide how they arrange this; however, in many cases it can be seen as promotion for inter-municipal collaboration. The collaboration has evolved during the last six decades, and it now represents a significant aspect of water services. Nevertheless, the subject has not previously evoked any comprehensive research in Finland. Moreover, at global level, earlier studies have addressed inter-municipal collaboration in water sector mainly through case studies, without acknowledging various cooperation levels and the diversity of collaboration within single nation. Thus, the current study offers valuable insights for practitioners and authorities who are planning inter-municipal cooperation.

Regional collaboration in water sector began in the 1950s. Bilateral collaboration was first established in the Helsinki region and expanded from there to other regions. Frequently, bilateral collaboration has been the first step toward a joint organization. Especially in the 1970s and 1980s, wholesale water companies emerged in the Ostrobothnia region, in the western coast of Finland. Coastal areas especially have long experience with regional collaboration in water supply and demonstrate its importance because the lack of good fresh water resource is evident. Furthermore, regional authorities have strongly promoted inter-municipal cooperation in water sector through financial incentives and regional development plans. Currently, some 40 joint organizations operate in the field, and the number of bilateral contracts has more than tripled since the 1970s. However, regional cooperation may encounter several challenges. Therefore, successful implementation always requires thorough contextual consideration of multiple aspects, including analysis of technological capacity, the socioeconomic situation, as well as the political atmosphere.

Returning to our first research question, what are the benefits and challenges of inter-municipal water collaboration in the Finnish context, and how do these correlate with international experiences, we conducted our evaluation under three categories. First, economies of scale are widely acknowledged as a benefit of regional cooperation. The main argument is that financial, human, and technological resources are more efficiently used in larger and joint units. In Finland, the main argumentation to support inter-municipal cooperation in water services is based on economies of scale, and only few dare to question it. However, these benefits are strongly dependent on context and should not be taken as self-evident.

Second, regional collaboration is argued to balance *socioeconomic and spatial differences* between municipalities. The question is particularly relevant in the case of a large central city compared with smaller surrounding municipalities. This raised divergent remarks in two different contexts. In the case of Israel, small municipalities

acknowledged fiscal, authoritative, and political benefits when they established a joint wastewater treatment organization with a stronger municipality (Hophmayer-Tokich & Kliot, 2008). However, in the case of Finland, although these benefits are also visible, inter-municipal collaboration raises the issue of unbalanced power between the central city and surrounding municipalities; for example, in the decision-making process inside a joint organization (see also Hytönen et al., 2016).

An intrinsic question related to inter-municipal cooperation, and our third category, is *autonomy and legitimacy*. Regional cooperation may increase the degree of autonomy in the water sector, which means that the decision-making process is more or less decoupled from municipal structures (Lieberherr, 2016). Autonomization brings benefits, especially in terms of effective decision making. However, the tradeoff between effectiveness and legitimacy needs to be recognized and addressed (Lieberherr, 2011). Accordingly, as the degree of autonomy increases, the legitimacy in terms of democratic decision making decreases. Our conclusion is that the problem of legitimacy in large regional projects may lead to opposition among citizens, which may lead to the collapse of common political will inside and between the municipalities. Therefore, the issue of legitimacy should be acknowledged among decision makers, authorities, as well as water managers in early stages of regional cooperation.

Our second research question, *how do the different levels of collaboration affect the performance of regional cooperation*, deepened our analysis in terms of diversity of regional collaboration. Excluding Lieberherr (2016), previous literature has not considered this question. In the Finnish case, we identified three levels of regional collaboration: bilateral agreements, a wholesale water or wastewater company (or federation), and a regional water and wastewater company (or federation). These levels and collaboration models vary especially in terms of organizational autonomy, which is closely related to the question of legitimacy. We found that regional collaboration cannot be viewed only through one kind of collaboration model. Instead, various forms of collaboration should be recognized and studied by the practitioners and planners considering collaboration with neighboring municipalities, as well as by scholars assessing the performance of inter-municipal collaboration.

The benefits and drawbacks of the three collaboration levels are strongly dependent on context. This study distinguishes, however, some general insights. Bilateral contracts are rather easy to negotiate, and the decision-making process stays inside the municipal organization as no joint organization is established. However, if the number of contracts increases, managing the ensemble may become challenging.

From joint organizations, a wholesale water company is the most used model of collaboration in Finland. It is usually quite small and flexible organization when compared with a regional water and wastewater company. However, the large operating area and concentration only on water supply or wastewater treatment enables persistent long-term planning inside the company. Rather, autonomous decision-making process outside the public sphere and policy-making guarantees flexible process but raises the issue of legitimacy. This may, for example, lead to the collapse of common political will inside and between municipalities.

The third level of collaboration—a regional water and wastewater company—is in charge of the whole chain of water services. Thus, the whole process is in the hands of one organization, and the economies of scale become more evident than in the first two levels of collaboration. However, a weakness of this model of collaboration is that the regional monopoly and the issue of legitimacy become stronger. Finally, we conclude that organization model does not explicitly determine the success of cooperation, but other features, such as leadership and political atmosphere as well as prevailing norms, are relevant as well.

The presented collaboration models and their performance can be considered in global context as an example of the diversity of organizing regional collaboration in water sector. Diversity in inter-municipal collaboration has proved valuable for water cooperation, at least in the Finnish context. Thus, in accordance with previous studies (Grigg, 1996; Hophmayer-Tokich & Kliot, 2008), the findings suggest that inter-municipal collaboration must be considered on a case-by-case basis, and suitable alternatives should be compared to find the most feasible solution. The danger of a single management structure is that collaboration is performed in different regions and the same pattern may not be suitable for all regional contexts. Thus, in each case, the most appropriate solution should be carefully considered, bearing in mind that cooperation between municipalities can also be achieved through varying levels of commitment and autonomy.

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Notes

1. Although terms of collaboration and cooperation have different nuances, we use them as synonyms.
2. This separate research project is about to be finalized during the spring 2016. More information about the project can be found from two articles authored by Kurki, Takala and Vinnari (2015) and by Kurki and Katko (2015).
3. In the context of this research, the term *region* refers to a functional urban region which consists of a large city center and its surrounding municipalities that jointly constitute a daily commuting area.

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Author Biographies

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Article II

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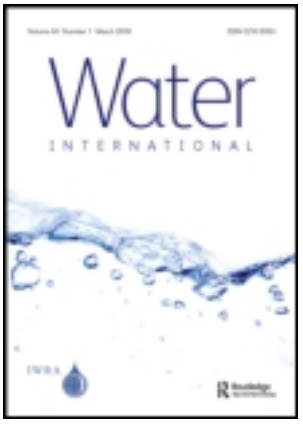

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Managed aquifer recharge in community water supply: the Finnish experience and some international comparisons

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Managed aquifer recharge in community water supply: the Finnish experience and some international comparisons

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This paper analyzes the use of managed aquifer recharge (MAR) in community water supply in Finland and presents some international experiences for comparison. The framework of MAR consists of the natural environment and physical infrastructure, as well as socio-economic aspects, all of which are interrelated. Local conditions form the basis of an MAR system and to a large degree determine infiltration options and the most suitable methods. Finnish hydrogeology, climate and local conditions are highly comparable to those in Sweden but differ from those of other parts of Europe, Australia, the USA and Asia. This article provides a holistic view of MAR not only as a technical means of resource enhancement for water supply but also as an element interacting with the natural environment and society.

Keywords: managed aquifer recharge; groundwater; infiltration methods; local conditions

Introduction

In Finland, groundwater plays a very important role as the source of community water supply. The share of groundwater, including groundwater produced through managed aquifer recharge, has increased continuously since the 1930s (Katko, Lipponen, & Rönkä, 2006). In 2011, it was approximately 66% of the total water supplied by utilities, estimates senior researcher Jari Rintala of the Finnish Environment Institute (personal communication, 13 February 2012). Managed aquifer recharge (MAR) refers to intentional infiltration of surface water or harvested rainwater into aquifers. The term "artificial groundwater recharge" is also well known and widely used. As the word "artificial" carries a negative connotation, implying that the water is somehow unnatural, "managed" has been adopted, as pointed out by Dillon (2005).

MAR is an internationally known concept that has different applications. In Finland and Sweden, most MAR plants are designed particularly for drinking-water treatment. Globally, MAR is also used for other purposes, such as storing water during dry seasons (e.g. Karimov et al., 2012; Keller, Sakthivadivel, & Seckler, 2000), treating wastewater

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The views expressed in this article are those of the authors and do not necessarily reflect the views of the United Nations Economic Commission for Europe.

(e.g. Barnett, Howles, Martin, & Serges, 2000; Bouwer, 2002), and raising the level of the groundwater where it has been over-exploited (e.g. Ong'or & Long-Cang, 2009).

MAR has been practised, since the nineteenth century at least, in England, France, Germany, Scotland, Sweden and the USA. Based on the Swedish experiences in Gothenburg, where the first MAR operation started in 1902, J.G. Richert carried out experiments and surveys for MAR in Vasa, on the western coast of Finland, from 1901 into the 1910s. Starting in 1929, some sort of MAR was used till the early 1950s (Juuti & Katko, 2006). However, the method did not gain wider use until the 1970s, when the great majority of Finnish MAR plants were built (Hatva, 1996). Currently, there are 25 MAR plants, covering 16% of the country's total drinking-water production, with infiltration rates varying from 100 to 25,000 m^3 per day (see Table 1). In 2010 the largest MAR plant in Finland was established having a water recovery permission for 105,000 m^3.

Recently, there has been a growing interest in MAR techniques in developing countries as well, especially in arid and semi-arid regions, mainly because of over-exploitation and quality problems with groundwater (e.g. Jain, Singh, & Soni, 2013; Jebamalar, Ravikumar, & Meiyappan, 2012; Wang et al., 2011). However, for example in South West Africa, the underground storage of surface water has been practised since the 1950s; only the technique has been called "sand storage dams" rather than "managed aquifer recharge" (Wipplinger, 1958).

Table 1. MAR plants in Finland.

Province	Municipality	Maximum volume of recovered water, 1999–2009 (m^3 per day)	Infiltration methods (as of 2005)
Southern Finland	Porvoo	5,890	Recharge basin
	Tuusula × 2	6,900 and 12,300	Recharge basin, sprinkling and well injection
	Hyvinkää	4,700	Recharge basin
	Hämeenlinna × 2	500 and 8,100	Recharge basin and sprinkling
	Lappeenranta × 2	1,800 and 12,500	Recharge basin
	Kouvola × 2	7,200 and 24,600	Recharge basin and sprinkling
Western Finland	Pori	22,300	Recharge basin
	Eura	2,630	Sprinkling
	Loimaa, Oripää	9,600 in 2011; water recovery permission for 105,000	Recharge basin
	Nokia	5,200	Well injection
	Ikaalinen	180	Recharge basin
	Laukaa × 2	7,200 and 15,000	Sprinkling
	Saarijärvi	90	Sprinkling
	Evijärvi	467	Recharge basin and sprinkling
Eastern Finland	Enonkoski	200	Recharge basin
	Juva	300	Recharge basin
	Mikkeli	6,500	Recharge basin and sprinkling
	Pieksämäki	2,800	Sprinkling
	Kangasniemi	200	Sprinkling
	Iisalmi	2,224	Recharge basin

Source: adapted from Isomäki et al. (2007).

In Finland, the use of MAR is highly topical because certain MAR schemes have provoked controversy among different stakeholders. The public interest requires reviewing the standard of knowledge on the application of MAR (globally) and its sufficiency with regard to conditions in Finland. Understanding the wider framework is also important, especially in cases of conflicting interests with respect to the natural environment. In Finland, the biotechnical aspects of MAR have been studied recently by Kolehmainen (2008), Kolehmainen, Crochet, Kortelainen, Langwaldt, and Puhakka (2010) and Ojala, Wakeman, and Puhakka (2012), and the geological aspects especially by Artimo, Mäkinen, Berg, Abert, and Salonen (2003) and Artimo, Saraperä, and Ylander (2008). Yet, many projects which are technically sound and economically feasible are at risk of being cancelled or delayed because of governance problems.

The main objective of this paper is to draw an overall picture of the use of MAR in community water supply in Finland and its prevalence internationally. This analysis consists of a literature review and interviews with one Swedish and three Finnish water experts. This paper presents a framework of MAR that covers the natural environment and the physical infrastructure, as well as the socio-economic aspects. It is important to understand that all the elements of the MAR framework are interrelated. The role of local conditions, the purposes of MAR, and infiltration options (including the main technical methods) are discussed here.

The framework of MAR

An MAR system is a combination of natural and engineered processes. Surface water (usually from a lake or river) or harvested rainwater is pumped to the infiltration area, pretreated if necessary, and infiltrated to the aquifer by suitable methods. Recharge can happen by surface infiltration through a basin or sprinkling, or by subsurface infiltration through wells. Water percolates through different layers down to the groundwater table. The percolating water adds to the groundwater flow in the aquifer down the hydraulic gradient, as determined by the geological structure, hydraulic properties and pressure conditions. Eventually, water is abstracted through recovery wells, treated according to the requirements of use if necessary and finally distributed to end users.

Some of the key requirements in applying MAR are basically the same regardless of the country or area where it takes place. Raw water of suitable quality in sufficient quantities, an infiltration area of sufficient size, good permeability of the soil and the possibility of regulating the groundwater table are a must (Hatva, 1996). However, many parameters vary from case to case. Furthermore, the information from which the three-dimensional structure of the aquifer and the spatial distribution of its hydrogeological properties have to be inferred is typically limited (based on point observations from drilling, geophysical profiles, etc.). Therefore, MAR projects are rather complex to implement. They require sufficiently detailed studies of the physical system and feasibility, and the scheme must be tailored to the particular setting.

The framework of MAR systems can be viewed through three major components: local conditions, the purpose of MAR and infiltration options (Figure 1). Local conditions can be considered the base: the purpose of MAR arises from the needs of the community and depends on local conditions. Both purpose and local conditions influence the selection of infiltration options. In addition to natural environment and physical infrastructure, several other factors play an important role in MAR project planning: economic considerations (cost-effectiveness and total investment required); social impacts; and legislation with respect to the socio-economic part of the MAR framework.

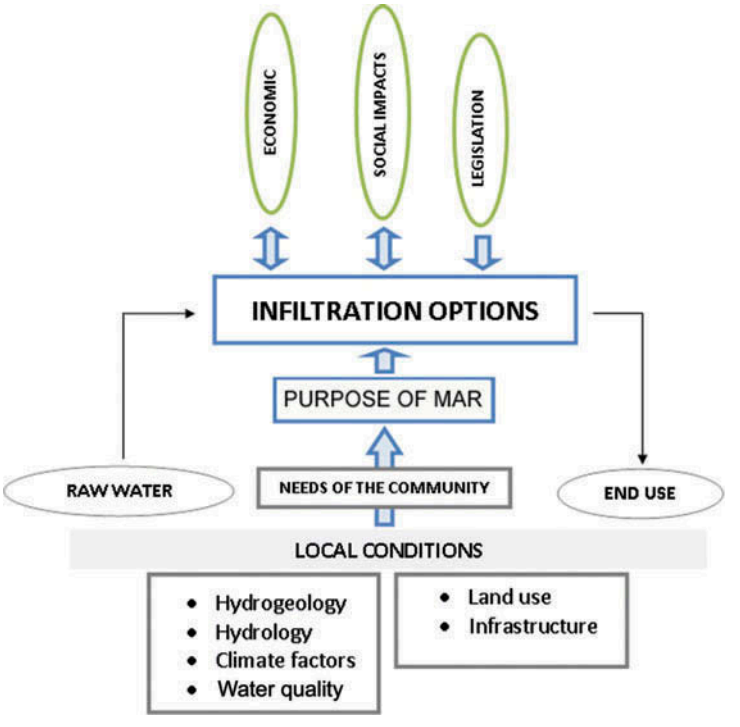

Figure 1. The framework of an MAR project.

The purpose of MAR

The purpose of MAR varies from case to case. The British Geological Survey (2006) presented the following list of the purposes for MAR:

- improving water quality
- storing freshwater
- managing saline intrusion or land subsidence
- stabilizing or raising groundwater levels where over-exploited
- disposal or reuse of wastewater and stormwater
- impeding storm runoff and soil erosion

In Finland and Sweden, MAR is primarily a water-treatment method. According to Kolehmainen (2008), the main objective of MAR in boreal regions is the removal of natural organic matter (NOM). The high concentration of NOM is a key problem in surface-water treatment in Finland. NOM is a nutrient source for micro-organisms in the water-distribution system, and when disinfection chemicals react with NOM, they produce disinfection by-products, some of which may be carcinogenic.

An MAR project can have several simultaneous purposes. In Finland, for example, groundwater is valued more than surface water as a source of domestic water for its more stable quality and temperature, and better protection from contamination (Katko et al., 2006). Therefore, MAR is used to increase the capacity to extract groundwater and to improve water quality. At the same time, the aquifer works as storage, even though this is not the main purpose of MAR as it is in arid and semi-arid countries. The sporadic spatial

and temporal distribution of precipitation, droughts, and increasing concerns about climate change favour the use of underground storage in managing water supply to match demand. The major advantages of underground storage of water are that water can be stored, often in substantial quantities in favourable geological settings, for long time periods with little or no evaporation (Keller et al., 2000). In Finland and other boreal regions this is not necessary because of the high precipitation and low evaporation.

MAR can also be used to protect aquifers from salinization or to restore fallen groundwater levels. The former is common in the case of coastal aquifers, and the latter in arid and semi-arid areas where groundwater may be over-exploited or groundwater storage occasionally needs to be tapped into because of the variable natural recharge (Dillon, 2005). For example, in Jining City in China, groundwater overdraft has caused a cone of depression. According to the research of Ong'or and Long-Cang (2009), MAR should be an imperative part of the wider groundwater management programme for Jining City in order to reverse this serious environmental problem. The over-exploitation of groundwater causes serious problems of land subsidence in many metropolitan areas, such as Mexico City, Bangkok and Shanghai (Keller et al., 2000; Wang et al., 2011). Fortunately, good results have been gained, for example in Chennai City, India, where implementation of rainwater harvesting has increased the groundwater storage considerably. In addition, groundwater quality has increased in some parts of the studied area (Jebamalar et al., 2012).

Stormwater and treated wastewater can also be injected into underground storage systems, thereby turning a waste product into a resource (Barnett et al., 2000). This may be considered a future technique in areas that suffer from serious water shortages. Some experiments with stormwater and treated-wastewater recharge have been made, at least in Australia and the USA (Barnett et al., 2000; Bouwer, 2002).

Local conditions

Any MAR scheme has to be built on the basis of local conditions. Firstly, the need for MAR can arise from insufficient raw water quality, scarcity of water (in some cases only during the dry season), or high salinity of aquifers, which are all local problems. Secondly, when the decision to launch a project has been made, local conditions determine how it can be implemented.

Several technical parameters of an MAR system depend on hydrogeological conditions. Therefore, the understanding and characterization of the hydrogeological conditions of the aquifer is a critical part of an MAR project. This requires adequate investigation of aquifer properties, including determining the stratigraphy and measuring the hydraulic properties affecting recharge, for example groundwater flow directions (Nonner, 2012). Three-dimensional modelling has proven to significantly help the characterization of aquifers (Artimo et al., 2008; National Research Council, 2008). This tool can provide better understanding of the structure and groundwater-flow paths of an aquifer and create a framework for planning the placement of infiltration basins and recovery wells, as well as the management of those systems. The fact that the proper positioning of wells can notably increase their yield underlines the importance of this aspect in planning. The visual results also provide a useful communication tool for different stakeholders: researchers, engineers and decision-makers (Artimo et al., 2008).

When Finland and Sweden are compared with other parts of Europe in the context of MAR systems, three notable differences in local conditions emerge. Firstly, Finland and Sweden lie on the Fennoscandian Shield (Figure 2), a bedrock area where shallow

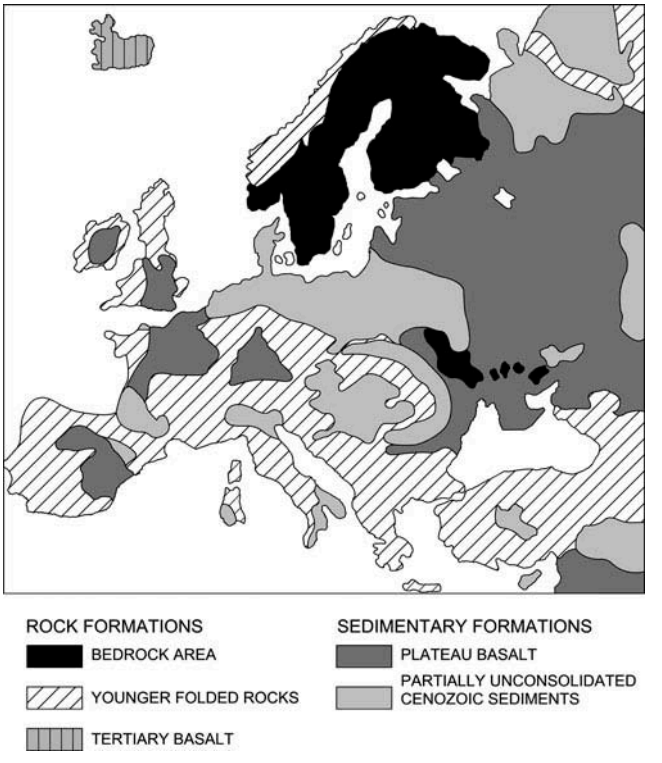

Figure 2. The hydrogeological environment in Europe.
Source: Mälkki (1999).

aquifers in superficial (Quaternary) deposits are the most important in terms of the potential for water supply. Small quantities of groundwater are also available from fractured bedrock; these are commonly abstracted for the needs of individual households or small villages (Mäkelä, 2012). Infiltration happens mainly in eskers and in ice marginal delta formations which are potential areas for recharging groundwater but are sparsely situated (Hatva, 1996). These hydrogeological conditions differ greatly from those in the other parts of Europe. For example, Northern Germany, Denmark and Poland are part of the sedimentary-rock area of the kind which commonly hosts major groundwater basins globally (International Groundwater Resources Assessment Centre [IGRAC], 2009; Mälkki, 1999).

Secondly, due to climate factors – high precipitation and low evaporation –fresh water is quite abundant and the use of irrigation is very limited. Aquifers are rarely over-exploited, and surface water is available almost everywhere. (An exception is the western coast of Finland, where lack of fresh water can occur.) Therefore, in Finland and Sweden, MAR systems are used mainly for water treatment, not storage as in arid and semi-arid countries.

Thirdly, the population density in Finland is rather low, at 16 inhabitants per km^2, compared with other parts of Europe; e.g. Germany has 231 inhabitants per km^2 (United Nations, 2011). The limited availability of land can be a crucial factor in countries with high population density and thus dense infrastructure.

Infiltration options

Local conditions and the purpose of MAR provide a starting point for the planning of an MAR system. The key issue is the feasibility of infiltrating water into the aquifer and recovering it for use (National Research Council, 2008). Infiltration options (see Figure 1) refer not only to infiltration methods but also to all the technical design parameters needed for an MAR system, e.g. the desired distance between the infiltration site and the abstraction point; residence time; the volume of infiltrated water; and the quality required of raw water and recovered water.

With direct infiltration methods, the yield of the aquifer is increased by spreading surface water over permeable soil deposits. The most common methods are basin filtration and recharge wells (National Research Council, 2008). Sprinkling is used especially in Finland (Figure 3).

Selection of the infiltration method

The method to be chosen depends mainly on the aquifer's type (confined or unconfined) and depth, aquifer characteristics such as structure and stratigraphy, surface soil permeability, and the hydraulic conductivity of the aquifer media. Basin filtration, sprinkling and vadose-zone wells are restricted to unconfined aquifers, while recharge wells may be used with both unconfined and deeper confined aquifers (Figure 3).

Basin infiltration has been the most common infiltration method in Finland. It has been used since the early 1970s. However, basins have to be excavated, which destroys the natural vegetation on the topsoil (Figure 4). Since most MAR plants are situated on eskers where land use may be restricted for nature-conservation purposes, a new method, sprinkling, was introduced in the 1990s (Nöjd et al., 2009). Sprinkling resembles natural rainfall. Raw water is sprinkled directly on the forest floor from a network of pipes (Figure 5). Significant land modifications are not required, and pipes can be moved from one place to another. Therefore, sprinkling is easy to use during experimental recharge when trying to determine the optimal location for an infiltration site (Mälkki, 1999). On the other hand, the input of water may be thousands of times larger than annual precipitation, and the chemical

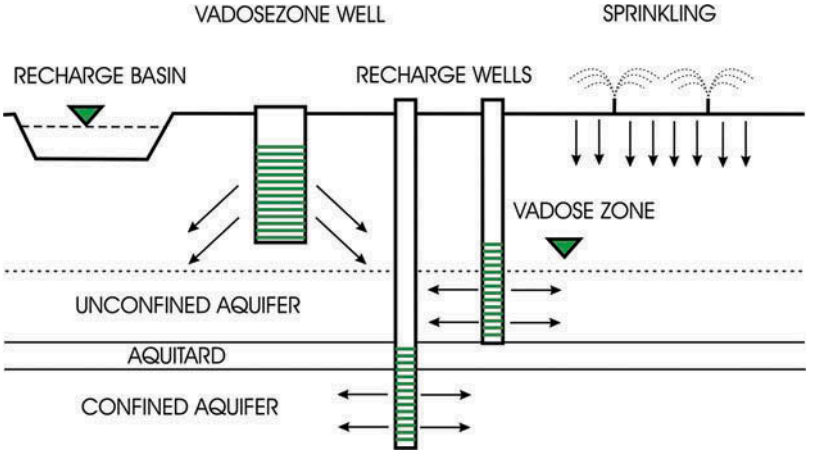

Figure 3. Methods of aquifer recharge.
Source: adapted from National Research Council (2008).

Figure 4. Basin recharge on top of an esker.

Figure 5. The sprinkler system consists of perforated pipes.

composition of the raw water differs from natural rainfall (Nöjd et al., 2009). Therefore, sprinkling has multifaceted impacts on soil and vegetation (Helmisaari et al., 1999).

On the other hand, Kenneth Persson, of Lund University, states that in Sweden, over 90% of the 141 MAR plants use basin infiltration, and the rest use bank infiltration;[1] sprinkling is not in use (personal communication, 24 October 2012). Eskers are also used for infiltration there, but gravel extraction is a strong competitor. Landowners dislike control and restrictions on land use. In that context, a basin that takes up less space is more suitable than sprinkling.

Basin infiltration and sprinkling are used when the purpose of MAR is water treatment. This is because of the perception that the purification process takes place mainly in the top layer. Yet, contradictory research results have been presented (e.g. Helmisaari & Mäenpää, 2003). Well injection is used more for the other purposes. It is particularly suitable when there is the need to prevent water losses due to evaporation or surface contamination. In addition, well injection requires a smaller surface area, which makes it more suitable in situations where surface infiltration is impossible due to lack of land ownership, paved land surface or other land uses (National Research Council, 2008). In any case, the impact of land use on groundwater quality needs to be considered. In areas where an impermeable layer does not allow natural recharge of ground water, recharge pits can be used. For example Jain et al. (2013) have studied the use of recharge pits in Madhya Pradesh, India. Thanks to the simple construction and the fact that locally and readily available material can be used, such packed-sand-and-gravel recharge pits can provide appropriate, cost-effective infiltration solutions in developing countries.

Examples from Finland

The currently operating MAR plants in Finland are presented in Table 1.There are 25, and they provide 16% of the country's total drinking-water production. During 1999–2009, infiltration volumes varied from 100 to 24,600 m^3 per day. Basin recharge and sprinkling are the most commonly used methods in Finland; there is only a little experience with injection wells, in the municipalities of Nokia and Tuusula (Figure 6), even though well injection is in wide use internationally. Usually, the main aquifers are unconfined and the water quality of the confined parts of aquifers covered by, for example, clayey soils is generally not very good due to their low oxygen content. Furthermore, because of an impermeable layer the infiltration through surface soil is not an option and the use of wells could be considered.

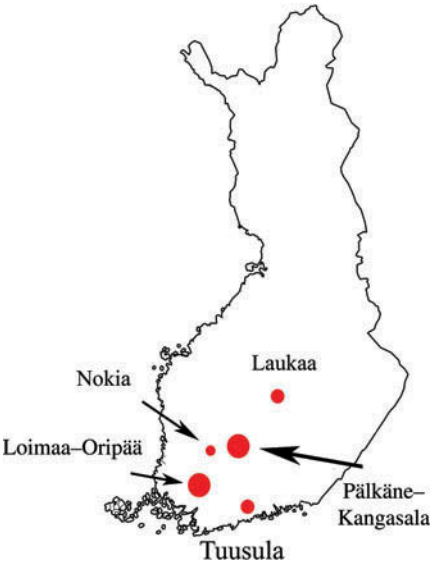

Figure 6. MAR plants used as examples in this paper. The relative size of the marker indicates the capacity of the plant.

One example of an MAR plant using only sprinkling is found in Laukaa, in central Finland (Figure 6). The plant was put into use in 1999, following a research period of a few years. It is situated on an esker which is mainly not cultivated and is without infrastructure. Markku Järvenpää, a developer at Jyväskylä Energy Group, says that the sprinkling system is easy to build and maintain (personal communication, 18 June 2012). All the pipes and other parts can be removed manually without leaving tractor tracks in the forest. The infiltration site must be chosen so that the water percolates straight into ground and puddles are not formed. In addition, the water jets of the sprinkling system have to be rather low, at most 30 centimetres, to prevent erosion. Every second year the pipes are moved to another site to allow the vegetation in the sprinkled area to recover for four to five years. In Laukaa the total infiltration area is about 30 hectares, but only 1.5–2.5 hectares is at use at a given time.

In 2011, water production began in the biggest MAR plant in Finland, situated in the municipalities of Loimaa and Oripää (Figure 6). The plant has permission to recover 105,000 m^3 of artificially infiltrated groundwater per day. This plant uses basin recharge. The sprinkling method was used only during the experimental phase, prior to the river-water infiltrations. The plant is located in an area of Quaternary esker complex which is especially suitable for artificial recharge. The main aquifer used in MAR is an esker aquifer deposited in a bedrock valley. The water that flows through the coarse-grained sand and gravel deposits filling the bedrock valley mixes easily throughout and is well oxidized (Artimo et al., 2003). In addition, the bedrock valley confines the groundwater flow field, which makes water production easier to manage.

As mentioned earlier, local conditions define the planning of an MAR system. A good example of the application of MAR to diverse local conditions is the planned MAR plant in Kangasala and Pälkäne (Figure 6). It is planned to be the country's second-largest MAR plant, with a capacity of 70,000 m^3 per day. It will employ three different recharge methods: basin recharge, sprinkling and well injection. The basin is situated in a former gravel pit, where excavation can be done with a lesser impact on the landscape. Sprinkling and well injection will be performed in a wooded esker area partly protected by the Natura 2000 programme (Pöyry Finland Oy, 2011). Natura 2000 is an EU-wide network of nature-protection areas established under the 1992 Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). The use of the sprinkling and well-injection methods in this area is well founded since they have little impact on the landscape.

The use of three different methods is justified by the company as a means to ensure flexibility and reliability of operation. The managing director, Petri Jokela (personal communication, 18 November 2012), states that sprinkling and well injection can be used simultaneously or in rotation, especially during spring and autumn, when the raw water may contain diatoms, which increases the risk of clogging in well injection. Both methods have already been tested successfully in the infiltration area (Pöyry Finland Oy, 2011). Yet, there is much less experience with well injection in Finnish conditions than with sprinkling.

Technical challenges

The most common problem with MAR systems is clogging, an issue of maintenance need and hence cost. Clogging can be caused by physical, biological and chemical processes (Bouwer, 2002) and is affected by raw water quality (especially colloids and pH), grain size distribution and mineral composition of the aquifer material, as well as infiltration rate (Helmisaari & Mäenpää, 2003).

Clogging can be partly prevented by the pretreatment of raw water to reduce the amount of suspended solids, nutrients and organic carbon (Bouwer, 2002). However, pretreatment does not prevent clogging completely, because microbial growth on the infiltrating surface is likely to occur in any case. Therefore, physical removal of the clogging layer may be necessary. With recharge wells, a better option is to prevent serious clogging by frequent backwashing of the clogging layer. However, vadose-zone wells cannot be remediated in this way, and the emphasis must be on preventing clogging by careful pretreatment of the raw water (Bouwer, 2002; National Research Council, 2008).

Sprinkling affects topsoil and vegetation. According to Helmisaari et al. (1999), the impact varies as a function both of the quantity and of the quality of infiltrated water. Based on their research at several MAR plants in Finland during and after a two-year infiltration period, increases in pH and humidity of the soil caused noticeable changes in the nitrogen cycle and increased nutrient content. Furthermore, during sprinkling, vegetation started to change from typical dry-habitat species to ones that prefer a moist seed-bed. Erosion also increased. On the other hand, sprinkling either had no effect on tree stands or was positive in relation to tree growth. Because of these side effects, it is important that sprinkling be intermittent. The location of sprinkling needs to be changed after a year or two to give the soil and vegetation time to recover.

Since the main purpose of the MAR systems in Finland is water treatment, various studies concerning the purification process of filtrated water have been conducted (Helmisaari & Mäenpää, 2003; Kolehmainen, 2008; Ojala, Wakeman, & Puhakka, 2012). During the above-mentioned three-year research period (Helmisaari et al., 1999), the quality of groundwater remained very high. However, in the long term, the essential question is how the capacity of the esker to filter organic matter will evolve. A special issue related to the clogging problem and the purification process in Finland is the high NOM concentration in raw water. Knowledge of NOM purification mechanisms is particularly relevant when designing and implementing new large-scale MAR plants, especially for drinking-water production, because of the water-quality implications as well as for minimizing adverse environmental impacts.

The pioneering research by Helmisaari and Mäenpää (2003) showed that the essential part of the purification process takes place in the vadose and saturated zone instead of the top soil layer. There was no difference in the quality of abstracted water between sprinkling and basin recharge. Research showed that biodegradation has a substantial role in NOM removal. The share of NOM removed through biodegradation (compared to total NOM) ranged from 30% to 50%. However, Kolehmainen (2008) argued that despite the long history of MAR, the scientific basis concerning NOM purification mechanisms and the microbial communities involved is insufficient. Ojala et al. (2012) continued research to increase the understanding of the biological processes occurring during MAR.

The complexity of the purification process arises from the highly complex environment, where several biotic and abiotic processes vary in time and space (Kolehmainen, 2008). Several factors affect NOM removal in an aquifer, such as water chemistry, aquifer material, temperature, hydraulic load and retention time, infiltration distance and the microbial communities involved (Helmisaari & Mäenpää, 2003; Kolehmainen, 2008). Every aquifer is different, and therefore experimental work and piloting are important in identifying the key processes. These should also cover a sufficient time period for a reliable assessment of the key processes and the system's dynamics.

Legal and socio-economic aspects of MAR

The long history of MAR provides adequate experience for drawing some general conclusions about MAR projects and their goals, challenges and difficulties. In the previous sections, aspects of the natural environment and physical infrastructure of the MAR framework were described. Yet, it is important to notice the other, often less recognized, aspects as well: the legal, economic and social issues linked to MAR (see Figure 1). The US National Research Council (2008) concluded that as technical challenges become more tractable, institutional issues might become even more relevant in the implementation of MAR. Dillon (2007) stated that ad hoc and arbitrary governance arrangements are the major barrier to effective MAR adoption. These arise from the new challenges that MAR technologies present to existing policy approaches in many jurisdictions, especially when stormwater or reclaimed water is used as a source of recharge. A detailed discussion of these aspects is outside the scope of this paper, but some considerations can be highlighted.

Legislation, regulatory requirements and institutional set-up significantly influence the planning, development and approval processes of MAR schemes; they also vary significantly between countries. In the USA, underground storage of water is among the most complex undertakings to implement due to the range of regulatory requirements at the federal, state and sometimes local levels. According to Dillon (2007), "MAR is an acid test of integrated water resources management in any jurisdiction because it involves management of quantity and quality of water in surface water and groundwater." However, some states (e.g. Oregon and Arizona) have addressed these issues in a statutory scheme created specifically for the regulation of underground-storage projects. In some states, these projects accelerated rapidly after new regulatory programmes were introduced (National Research Council, 2008).

The general public are interested in and have concerns about the reliability of community water supplies, including MAR projects. In Finland, two large-scale MAR projects, in the regions of Turku and Tampere, have been delayed for years due to strong criticism and generally opposing public opinion (Jokela & Valtonen, 2010). MAR projects are regulated by four different acts: the Land Use and Building Act (132/1999), the Water Act (587/2011), the Environmental Protection Act (86/2000) and the Act on Environmental Impact Assessment Procedure (468/1994). Each of them provides for a right of appeal, which is one reason for the delayed processes.

Finnish water management in general has been made consistent with the European Union's Water Framework Directive (2000/60/EC), which emphasizes collaborative planning and active involvement of the public (e.g. Hansen & Mäenpää, 2008). Specific parts of the national legislation highlight the aspect of public participation. The aim of the Land Use and Building Act (132/1999) is to allow the public to participate in open planning processes. Engaging the public at an early stage of project planning can be vital to the development of an MAR project, as it ensures that the concerns of the public are heard and taken into consideration. It is important that accurate, reliable and adequate information is provided.

In addition to the social and regulatory side, there are always economic assessments to be made. They may include the cost of land, treatment and operation; access to capital; availability of grants, loans and subsidies; and ability to collect revenue from water users (National Research Council, 2008). The economic benefits of MAR have been pointed out by several researchers (e.g. Balke & Zhu, 2008; Barnett et al., 2000; Bouwer, 2002; Dillon, 2005; Shahbaz, Shahbaz, Munir, & Jürgen, 2008), but they are largely dependent on local conditions. In Finland, MAR plants are justified partly by their economic benefits. In at

least some cases when an old water-treatment plant is in need of reconstruction it may be cheaper to build an MAR plant instead.

Institutional constraints and the interaction of multiple stakeholders with diverse interests and responsibilities are challenges to MAR projects. It is essential to identify and take into account the beneficiaries of planned schemes and those who bear the costs. If a scheme is meant to serve a larger area, conveyance costs may also become important. This complexity requires interdisciplinary knowledge of many aspects of science, technology and institutional issues (Artimo et al., 2008; National Research Council, 2008). Therefore, professionals from many fields are needed, and their work should be integrated at an early stage of the project.

Summary and conclusions

The purpose of this paper was to review the use of MAR in Finland, with emphasis on technical issues, and to compare them with other international experiences with the help of the holistic framework of MAR. With respect to the climatic and hydrogeological environment, Finnish and Swedish conditions are fairly similar, but quite different in comparison to other parts of Europe and the rest of the world. That became clear in Finland already in the middle of the 1960s, when studies of MAR plants began to proliferate. Field trips were made to Sweden, where MAR plants had already been in use for several decades and were serving almost a million people (Tanhuala, 1994).

Local conditions form the base of an MAR project: planning, implementation and operation are dependent on local hydrogeology, climate factors and existing land use regulations and infrastructure. These conditions determine the possibilities of augmenting water resources with MAR in terms of quantity and quality. In Finland and Sweden, MAR is used primarily as a water-treatment method. Due to the boreal climate conditions, there is no lack of water, unlike in arid or semi-arid areas, where the main purpose of MAR is generally underground storage.

Finding a proper place for the MAR plant is the key issue. In Finland and Sweden, hydrogeological conditions form a limiting factor. Infiltration can happen mainly in glaciofluvial formations, eskers in particular, which are far apart and often used for other purposes, such as for gravel extraction or in recreation areas. Availability of a suitable raw water source is also a precondition. Elsewhere, the limiting factor can be high population density and intensive land use for other purposes. This affects the infiltration methods which can be applied, as well. Finland and Sweden use mainly basin infiltration, but in the USA, for example, well injection is gaining popularity due to restrictions on the available land.

However, the entire focus should not be on local conditions. MAR has to been seen in the overall context of community water supply (proximity of uses, etc.). MAR should also be considered in water resources planning at the river basin district level (according to the requirements of the Water Framework Directive) and in overall water management strategies. The socio-economic and legislative issues in general may become even more relevant in the implementation of MAR than the technical and physical details, which are already quite well known.

The two MAR cases in Finland that have met with extensive public opposition (Jokela & Valtonen, 2010) show that research on the technical and natural-scientific issues is not enough. The MAR projects have been studied thoroughly from those perspectives; it seems that lack of technical or natural-scientific knowledge cannot explain the projects' difficulties and prolongation. Commonly, the subsurface is poorly understood by laymen, and

communicating to the general public about physical, chemical and biological processes and other complex technical issues in an accessible away is a real challenge. Research on the legal and socio-economic issues, and application of its findings, is needed, in addition to the technical ones.

MAR has been used on different continents in developed and developing countries, but the purpose of MAR, the suitability of different infiltration options and the attitudes towards it vary from place to place. Interdisciplinary approaches and the use of the holistic framework presented in this paper are highly recommended to achieve successful implementation of an MAR system, whether it is used for the treatment of water, underground storage or groundwater protection.

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Note

1. Bank infiltration is an indirect infiltration method by which the yield of an aquifer is increased by lowering the water level in wells when water from the nearby surface water source infiltrates the aquifer.

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Article III

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Clashing coalitions: a discourse analysis of an artificial groundwater recharge project in Finland

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ABSTRACT

The purpose of this paper is to increase understanding of the dynamics of knowledge production in the context of large-scale environmental projects causing local conflict. In particular, the paper analyses the discourse coalitions that formed around an artificial groundwater recharge project for the Turku Region in Finland. The material for this study consists of over 400 articles and opinion pieces which were collected from local and regional newspapers between 1999 and 2010. The articles were analysed by using Hajer's [1995. *The politics of environmental discourse. Ecological modernisation and the policy process*. Oxford, UK: Clarendon] discursive framework, and the analysis was complemented with the concept of knowledge coalition by Van Buuren and Edelenbos [2004. Conflicting knowledge. Why is joint knowledge production such a problem? *Science and Public Policy*, 31 (4), 289–299]. Results of the study indicate that knowledge coalitions were formed among the researchers, lay residents, and policy-makers, and they all utilised similar expertise-based factual arguments to support their cause. Thus, the paper participates in the academic discussion on the use and interpretation of expert knowledge in environmental policy-making by reshaping the division between experts and lay residents.

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Introduction

Knowledge, used in public policy processes, is increasingly more contested and includes counterevidence from various sides (Nowotny *et al.* 2001, Van Buuren and Edelenbos 2004). Indeed, knowledge has multiple manifestations, and it can no more be considered a univocal asset (Van Buuren 2009). Thus, the production, possession, and use of knowledge are some of the key questions in environmental conflicts and their discursive construction (Peuhkuri 2002). Traditionally, two fields of knowledge, scientific and lay knowledge, have been kept separate (Nowotny *et al.* 2001, Jasanoff and Martello 2004, Yearley 2005). However, the transformation in their relationship started around the 1960s and 1970s along with society becoming more complex and more uncertain, including distrust and critical discussion over scientific knowledge among ordinary citizens (Beck 1992, Nowotny *et al*. 2001). Nowotny *et al.* (2001) describe the phenomenon as transgression of science and society: each has invaded to other's domain.

The transgression of science and society has many dimensions. First, scientific claims need to be legitimised through recognition from groups outside the scientific practice, such as the media, the government, and the public (Hannigan 2006). The media especially has a significant role in

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popularising science, legitimising claims, and making them comprehensible to a wider public. Thus, through the influence of media and public education, knowledge has become public property (Nowotny *et al.* 2001, Van Buuren and Edelenbos 2004)

Second, beside the academic knowledge, local, experiential, and other forms of non-scientific knowledge have emerged in the policy arenas as relevant forms of knowledge. This refers to hybridisation, where produced knowledge is a kind of mixture of different kinds of knowledge (Jasanoff and Martello 2004, Delvaux and Shoenaers 2012). Thus, scientific knowledge has become more and more contextualised: interaction with interested parties in order to produce more socially robust knowledge has become increasingly necessary (Nowotny *et al.* 2001).

However, the question "what is relevant knowledge?" still arises around controversial policy processes. Environmental debates are dependent on scientific facts; simultaneously, those facts work as a medium of clashing claims (Peuhkuri 2002). A relevant fact to one actor may seem irrelevant to another. Underlying values and different belief systems determine the way actors see the world, how they interpret the problem, and shape possible solutions (Wynne 1996, Van Buuren 2009). Thus, generating new facts does not solve the problems (Pellizzoni 2003, Van Buuren 2009). Concurrently, contested policy processes generate *knowledge fights*, where knowledge is produced from different perspectives and actors fire from one trench at the other (Van Buuren and Edelenbos 2004).

Accordingly, Van Buuren (2009, p. 231) argues: "[…] knowledge is one of the most important sources of fragmentation, discordance, and interdependency in governance networks and conflicting knowledge components must therefore be dealt with if societal controversies are ever to be diminished." Research on the dynamics of expert and lay knowledge in connection with uncertain situations like environmental conflicts has progressed (Aitken 2009). However, this paper contributes to the ongoing discussion by investigating a situation where juxtaposition between experts and lay people does not hold such a strong position; instead, knowledge coalitions (see Van Buuren and Edelenbos 2004) are formed from the actors from both groups, and the main contradiction lies in between those coalitions.

In this article, by using Hajer's (1995) discursive framework, we will examine how this kind of knowledge fight develops inside an environmental conflict, by using an example of an artificial groundwater recharge[1] (AGR) project for the Turku Region in Finland. More precisely, the study aims at finding answers to the following questions: How do different stakeholders represent themselves and others when constructing a local environmental problem? How are different sorts of knowledge claims used? How do different stakeholders mobilise scientific arguments to fit their purpose? Towards this end, the paper analyses the formation of discourse coalitions (Hajer 1995) around the AGR project, and complements the analysis with the idea of knowledge coalitions (Van Buuren and Edelenbos 2004).

The paper consists of six sections. After introduction, the second section presents the theoretical framework of the study. Case description and the material used are presented in the third section. The results are elaborated in the following two sections: the fourth one analyses the formation of storylines and discourse coalitions around the AGR project, and the fifth one analyses the use of expert knowledge in the discursive construction of the problem and how the coalitions are constructed from the perspective of knowledge production. The sixth section elaborates the discussion and the main conclusions of the study.

Hajer's discursive framework

A discourse analysis can be seen as an umbrella designation for a field of research covering a wide range of theoretical approaches and analytical emphases (Nikander 2008). In this paper, we will use Hajer's (1995) discursive framework, which suggests that environmental conflicts are dependent on discursive dynamics. The conflicts can be seen as complex struggles about the definition and meaning of an environmental problem. This symbolic struggle about the ownership of the problem is bound to the concrete struggle about proprietary rights and the right to use natural

resources. The actors try to ensure that the discourse representing their definition of reality is taken as the basis of decision-making. They construct and defend their reality by mobilising their own policy-relevant knowledge in a policy process (Van Buuren and Edelenbos 2004).

According to Nikander (2008), the discourse analysis examines the construction of actions and meanings in and through a text and talk. Hajer's (1995) argumentative approach presents that the political power of a text comes from its multi-interpretability rather than its consistency. Actors see problems according to their own views, but they also try to position other actors in a specific way.

To be able to analyse the maintenance and transformation of the discursive orders, the argumentative approach puts forward the concepts of storyline and discourse coalition. The storyline is a generative sort of narrative which gives a uniform meaning to a complex problem or phenomenon by combining and simplifying elements from various sectors. This mechanism creates, maintains, and transforms the discursive order by positioning subjects and structures. Through storylines, knowledge is clustered and actors are positioned so that coalitions are formed amongst the actors of a given domain. The storylines can be considered as discursive cement that keeps a discourse coalition together (Hajer 1995).

In addition, storylines create a social and moral order in a given domain. In this context, actors can be positioned as, for example, victims of pollution, problem solvers, perpetrators, top scientists, or scaremongers. Through the storylines and their socio-political resonance, the discursive construction of reality can be seen as an important realm of power (Hajer 1995).

Hajer (1995) summarises the functioning of a storyline as follows: First of all, it reduces the discursive complexity around a certain phenomenon and creates possibilities for problem closure. Secondly, as it starts to gain more attention, it is accepted and used by more actors. At this stage, the storyline gives some permanence to the debate. Thirdly, it affects the actors in their own production of knowledge. Scientist, environmentalist, politician, or whoever, now has a chance to illustrate how his or her expertise or experience fits into the jigsaw puzzle. Thus, the production of knowledge is one of the mechanisms to construct, maintain and transform a storyline.

The concept of discourse coalition helps us to analyse the social dynamics of the problem construction. The actors of a discourse coalition can define a certain storyline in different ways and they might have different interests, but all of them maintain or transform the same storyline in their own specific manner. Here, the difference from a traditional political coalition can be seen: storylines, not interests, form the basis of a discourse coalition (Hajer 1995, p. 66).

Since knowledge production is one of the key elements inside environmental conflicts and their discursive construction (Peuhkuri 2002) as well as in constructing storylines, we see the clear connection between the concepts of discourse coalition and knowledge coalition presented by Van Buuren and Edelenbos (2004, see also the concept of advocacy coalition presented by Sabatier and Jenkins Smith 1993). Thus, in this article, we will combine the two theoretical perspectives in analysing the coalition formation inside an environmental conflict. In addition, in order to have some practical tools for conducting a rhetorical discourse analysis, we complement Hajer's approach with the ideas of Michael Billig (1987) and Jonathan Potter (1996), who are the key influencers inside the rhetorical analysis movement, and Chaïm Perelman (1982), who was one of the most important developers of the new rhetoric analysis.

Case description and material

In Finland, artificial groundwater recharge (AGR) is used as a water treatment method in community water supply, covering 16% of the country's total drinking water production. Having an AGR system means that surface water is pumped to an infiltration area and infiltrated to the underlying aquifer by suitable methods, mainly through an infiltration basin or by sprinkling (see Kurki *et al.* 2013). Water percolates through different earth layers down to the groundwater table and adds to the groundwater flow in the aquifer. Finally, water, purified through this process, is abstracted through recovery wells and distributed to end users. This system, depending on the local conditions, might require pre-

or post-treatment in order to ensure that the water distributed meets the strict quality standards set in legislation.

This paper analyses the second phase of the water acquisition project for the Turku Region, situated in the southwestern coast, which is one of the few regions in Finland having water scarcity problems. First, long-distance water acquisition project started already in 1969, when the aim was to extract water from Lake Pyhäjärvi, situated some 70 kilometres to the northeast from Turku (Figure 1). The project fell down in 1993 because of strong opposition from the local residents. Consequently, the second phase of the project began in 1999. The raw water source had been changed to the River Kokemäenjoki, where the water quality had improved during three decades, and the aim was to infiltrate it through the esker of Virttaankangas. After a struggle lasting more than 10 years, the production of artificial groundwater finally began in 2011.

During a period of four decades, a dynamic and diverse group of stakeholders have been involved in the process. Primary stakeholders were Turku Region Water Ltd (TRW), founded already in 1974, and the local residents from the municipalities around the esker Virttaankangas, where the AGR plant is situated. The company, owned by nine surrounding municipalities, has been in charge of

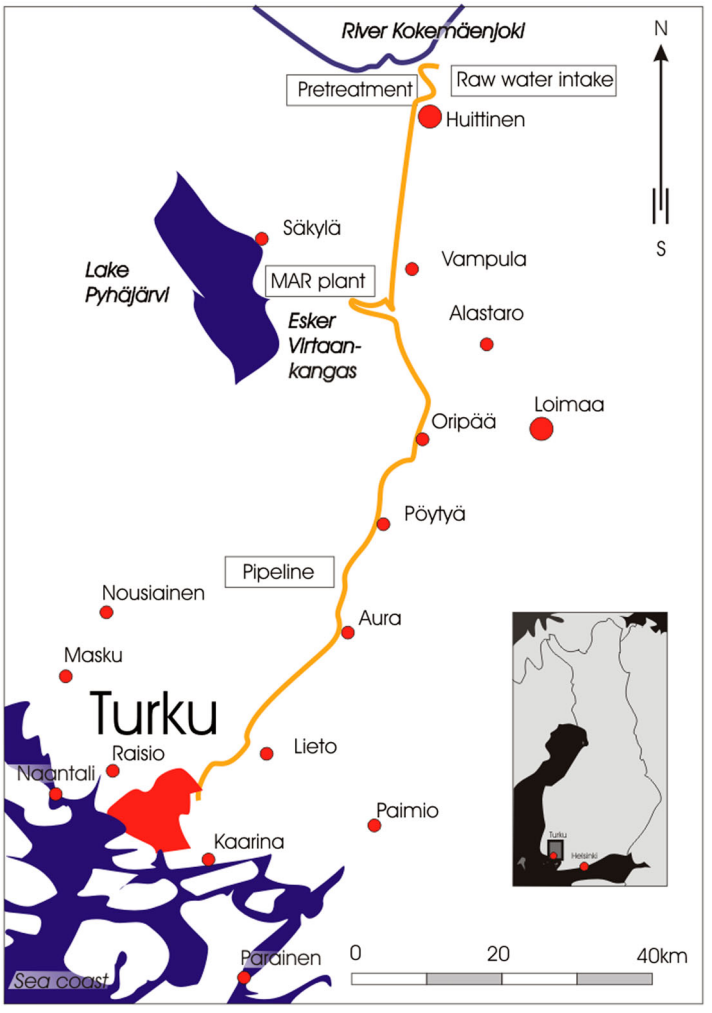

Figure 1. The AGR project in the Turku Region.
Source: Turku Region Water Ltd, modified by the author.

both phases of the water acquisition project. Other stakeholders, appearing prominently in written media, were municipal decision-makers, authorities, and researchers.

In 2001, TRW partners wrote a contract about the execution of the AGR project. After the environmental impact assessment (EIA), the inspection record incited several comments from local residents. However, the project was authorised in 2005, followed by several appeals. The project went through all the court instances and the final permit was given in 2008. The Supreme Administrative Court rejected all appeals and claims, but at the same time, it tightened the permit conditions.

The material for this study consists of about 400 newspaper articles and opinion pieces, collected from local and regional daily newspapers between 1999 and 2010. The circulation of the local newspapers varied from 4000 to 8800, whereas the circulation of the two analysed daily newspapers were approximately 55,000 and 99,000. All citations from newspaper writings used in this paper have been translated from Finnish by the authors.

According to Hajer (2009), the media form a central arena where storylines are co-produced and different interpretations of reality are contested. Although we focus on the newspaper writings, the wider societal perspectives are also considered, as rhetoric is always connected to the wider linguistic and cultural context (Perelman 1982). Furthermore, the long history of the case has a certain effect to the process (see Kurki and Juuti 2013).

Four storylines around two discourses

This analysis focused on the formation of storylines and discourse coalitions (Hajer 1995) complemented with the idea of knowledge coalitions (Van Buuren and Edelenbos 2004) around the AGR project for the Turku Region. We will present here the four most relevant storylines: *environmental changes* and *health risk* storylines were chosen because of their most frequent appearance in the analysed material; the *water stress* and *local rights* storylines did not emerge as often, but they had latent relevance in this case (Figure 2).

The storylines were formed around two discourses: the environmental discourse and the regional policy discourse (Table 1). These two discourses were strongly bound to each other and they brought

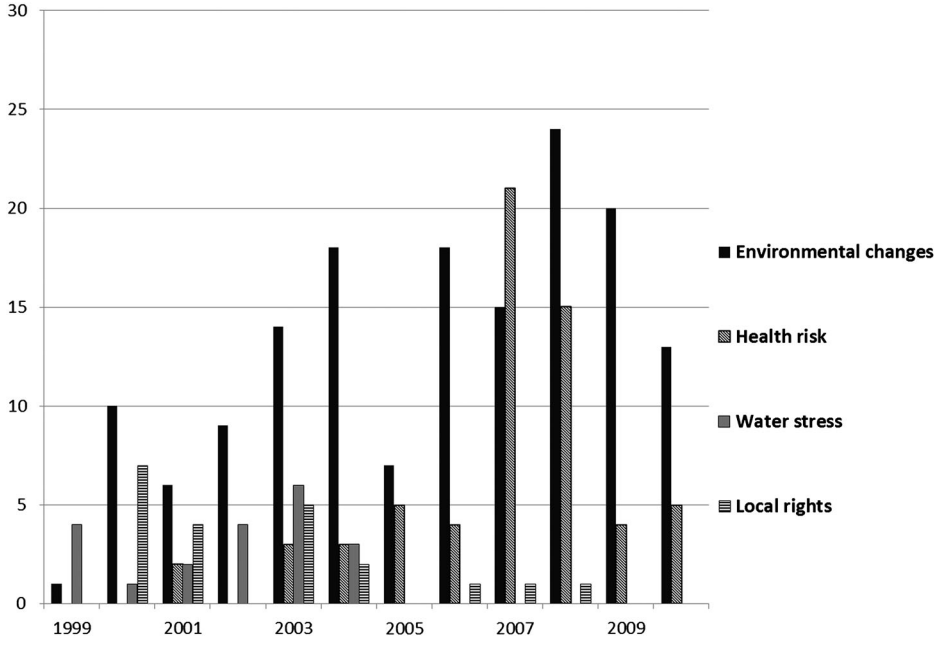

Figure 2. The frequency of different storylines among the newspaper articles.

out an interesting contradiction already at the beginning of the project. The local residents were frightened by the potentially tightening land-use requirements that the AGR project would bring about as well as the subsequent financial losses. Thus, the local economic life was considered under threat by the project. Simultaneously, an environmental concern started to arise about the threats related to the environmental effects of the AGR project itself.

In this context, it is useful to note that arguments opposing the project were the most frequent and they dominated the media field as the discourses formed. In addition, arguments defending the project contained a tautological feature: they repeated the same arguments without really increasing information (Perelman 1982). This attitude was criticised in the opposing arguments. However, the defending arguments got represented mainly in the articles, and the opposing arguments in opinion pieces. Local newspapers presented mainly the opposing views, whereas the major daily newspaper from the Turku Region gave space for the views from both sides.

In the following subsections, we will describe the formation of the storylines; beginning with the two latent ones, as they provide background information, and continuing with those two that appeared most frequently. Storylines are linked with each other, but for increased readability, we have made certain distinctions between them.

Water stress storyline

The water stress storyline is part of the environmental discourse and is also linked to the regional policy discourse. Water stress has caused notable problems on the southwestern coast, even though it is a quite rare phenomenon in Finland – a land of abundant water resources. Only few lakes exist in the coastal area, and the water quality in the River Aurajoki, which is the only raw water source in the region, is poor when compared with the quality of groundwater or lake water. The exceptionally dry summer of 1999 highlighted the need for water acquisition plans which had been more or less on the agenda since the 1970s.

The newspaper writings about the problems related to water quality and quantity, caused by water stress during 1999–2002, may be considered as the foundation of the water stress storyline. In 2003, the managing director of Turku Water Utility wrote about the situation in order to legitimise the AGR project.

> The exceptional weather conditions of recent times have posed a true challenge to the water acquisition of South-Western Finland. A permanent improvement will not be achieved until the completion of the Virttaa artificial groundwater recharge project, managed by Turku Region Water Ltd. (Trade journal, article 1, February 2003)

Better water quality was also presented as a precondition for the economic development of the Turku Region. Particularly, the image of the region was considered important in attracting companies that need good-quality water for their production processes.

After 2003, the water stress storyline was no longer used to support the project. Instead, infrequently appearing opposing arguments vaguely sustained the storyline by questioning both water quantity- and water quality-based arguments (see Figure 2).

> The Green Party reminds us that the aim of the water project was the sufficient quantity and quality of household water as the water in the River Aurajoki did not fulfil the associated criteria a few decades ago. Since then, water consumption has decreased notably, the amount of rain has increased, and the water in the River Aurajoki fulfils the drinking water norms set by the EU. (Local newspaper, article 2, March 2008)

Table 1. Four storylines inside two discourses.

Discourses	Regional policy discourse	Environmental discourse
Storylines	Local rights Water stress	Environmental changes Health risk Water stress

Local rights storyline

The local rights storyline is part of the regional policy discourse. Already at the beginning of the project, local residents began to defend their region. Local residents referred to groundwater as a local property, even though according to Finnish legislation, groundwater cannot be owned by anyone, and such is the case in many other countries of the world.

Similar to the water stress storyline, the local rights storyline was particularly visible during the first half of the project (see Figure 2). It concentrated on the economic losses that the AGR project would inflict upon the region. The local residents considered that a powerful city gained at the expense of local people.

> The artificial groundwater project is already causing harm to the business life of the Virttaa Region and its development. The losses will only increase in the future. (Chairman of Municipal Board in local newspaper, article 3, April 2000)

In some writings, a strong moral argumentation was presented: local residents refer to colonial policy and the project is seen to represent immorality and injustice towards the underdog.

> Turku seems to consider the Loimaa Region as a northern colony which it can freely oppress in the favor of Turku and the Turku Region. (Opinion piece in a local newspaper, article 4, January 2008)

One theme recurring throughout the project was the division between the city and the countryside. We interpreted it as a remarkable but latent theme. It can be seen as a part of regional policy debate, but it was visible inside both discourses and in several storylines, even though it is not clear and dominant.

> There has been dismissive talk about country hicks who don't understand anything. But we don't care, rather it makes us more enthusiastic. (Daily newspaper, article 6, May 2005)

The local rights storyline stayed alive during the whole project, but after the early stages, it was overshadowed by the environmental discourse and changed to a latent storyline. Accordingly, in 2007, the managing director of the Centre for Developing the Loimaa Region denied the juxtaposition between the city and its surrounding regions and invoked environmental discourse.

> [The managing director] denies that there would be two opposing regions, and that the Loimaa Region would incur all the downsides of the project whereas the Turku Region would get to enjoy better drinking water. Virttaankangas is a recreational area for the residents of Turku. They have also protested against water extraction, they are dubious about the possible dangerous substances in the drinking water. (Trade journal, article 5, April 2007)

Environmental changes storyline

The environmental effects of the project were contested within this storyline, which appeared to be the most dominant one inside the environmental discourse and, in this case, in general (see Figure 2). The opposing arguments refer to the possible environmental threat concerning the esker Virttaankangas, where the AGR plant would be situated. Moreover, they question the reliability of the AGR technique. However, to support the project, defending arguments emphasised the minor dimension of the environmental effects of the project. At an early stage, the project manager stated about the raw water source:

> High concentrations of mercury could be found in some places in the sediment, but the total amount is so small that even if they all came off at the same time, the concentration would not even approach the limit of what is considered harmful. (Local newspaper, article 7, September 2001)

In 2002, the project was approved by the provincial federations. They emphasised that the project needed to be implemented in an environmentally friendly way, also taking into account the cultural values of the esker Virttaankangas. The provincial federation presented the conservation of the esker

as a common need for all sides in the debate. Subsequently, in 2003, a record of an inspection approved the project but set strict limits regarding the mercury risk.

However, some years later, the local residents argued that the 100-year-old cultural landscape cannot be destroyed. They used factual rhetoric to posit that the bad-quality surface water will pollute the precious groundwater and the vegetation on the esker will be destroyed.

> TRW is going to pump 110,000 cubic metres of water per day from the River Kokemäenjoki to the pristine esker Virttaankangas, and in newspaper writings TRW has mentioned that the total size of the infiltration field is 15 hectares, of which 5 hectares at a time are being treated with infiltration. This means about a 2.2-metre water mattress every day. This amount equals that which would come from natural sources to the same area in a thousand years. Now, what ingredients for a natural disaster do we have here? (Opinion piece in local newspaper, article 8, January 2005)

Environmental arguments were also used to defend the project, however. The representatives of TRW presented the AGR system as an environmentally friendly and natural option for conventional water treatment.

> The method of artificial groundwater formation is simple and natural […] We help Mother Nature by increasing the amount of groundwater with the raw water from the River Kokemäenjoki. (Representative of TRW in trade journal, article 9, January 2004)

However, subsequently, the representatives of TRW changed the direction of their argumentation from the defensive to the offensive (Potter 1996): instead of a conciliatory tone, they tried to weaken the opposing arguments with recrimination. They presented the local forms of land use as worse environmental problems than the AGR system. This became one of the most frequently used arguments by the representatives of TRW.

> This [infiltration basins 3.5 ha] is considered a too significant environmental sacrifice while the environmental influence of the already existing activities have been ignored (gravel mining, car racing circuit, golf course, transferable lawn plot, together ca. 260 ha). (Managing director of TRW in daily newspaper, article 10, November 2006)

The local residents did not respond to this argument; instead, they tried to increase the opposition by positioning the people from the Turku Region inside this storyline. In 2006, they appealed to the people of the City of Turku, pointing out that they also benefit from the esker of Virttaankangas as a recreational area. Furthermore, the parliamentary elections in 2003 and 2007 and the municipal election in 2008 sped up the conversation among local politicians. For example, some candidates of the municipalities of Naantali and Lieto, which are part owners of the TRW, began to oppose the project by appealing to environmental arguments.

> It is clear that the enormous amounts of water to be pumped from the River Kokemäenjoki to the esker Virttaankangas (80,000–100,000 cubic metres per day) will change and, in the long run, destroy nature on the esker and pollute the groundwater permanently. (Council member candidate in local newspaper, article 11, January 2007)

Within both discourses, opposing arguments appealed to morality and legality. Even though these do not always coincide, such arguments were often presented together. The opponents presented the project planners as immoral actors; even suspicions of environmental crime were presented.

Legislation was appealed but also questioned. In 2004, a Finnish Member of Parliament and Member of the European Parliament suggested that the Finnish Water Act should be revised. She invoked the Water Framework Directive of the European Union. Consequently, the local residents started to invoke the European Union, stating that it will prevent the destruction of nature. The Water Act was also criticised by a local environmental NGO which argued that it was outdated and promoted the dichotomy between urban districts and the countryside.

Despite the strong and spreading opposition to the project, local residents did not seem to form a unitary party against the project. In 2002, some of them wrote in the newspapers about local irresponsibility, such as littering, reckless use of motor vehicles on the esker, and immoderate fussing and forgetting the facts. In 2004 and 2008, the local residents blamed the mayor of the municipality

of Alastaro for acting against the benefits of the municipality. Moreover, at this stage, the environmental changes storyline gives way to the health risk storyline.

Health risk storyline

The health risk storyline formed a strong storyline inside the environmental discourse; however, it appeared frequently only some years (see Figure 2). The health risk was bound to the assumption that the AGR project would pollute the natural groundwater. The local residents compared the River Kokemäenjoki, which was designated as the raw water source for the AGR system, to a sewer. After all, the wastewater from the Tampere Region, situated some 150 kilometres to northeast, is discharged, albeit after extensive treatment, to the river.

This storyline culminated in the mercury debate. The representatives of TRW brought up the existence of mercury in the sediments of the River Kokemäenjoki already at the beginning of the project, and argued that it posed no risk. However, the mercury argument was not used to oppose the project until in 2003. The actual mercury debate was initiated by an engineer from the municipality of Loimaa in 2006 (Local newspaper, article 11, November 2006), and the debate escalated during years 2007–2008. One rhetorical method was to enhance the radical uncertainty by comparing local figures with international ones:

> In Minamata, 27 tons [of mercury] was enough to kill over 1000 people, now we'll see what damage will be caused by the 40 tons from the municipality of Äetsä! (Opinion piece in local newspaper, article 13, January 2008)

Through this storyline, the opposition expanded from the local level to the neighbouring municipalities. The local residents emphasised the risk of pollution of the natural groundwater which is used as a raw water resource in all the neighbouring municipalities. Such an expansion occurred to some extent in the Turku Region as well. In 2003, 34 aldermen from the municipality of Kaarina, a part owner of the TRW, signed a water initiative, which stated:

> It is not in the interests of Kaarina that our raw water source will be polluted. That is why all residents of Kaarina should take as their aim that the Virttaa artificial groundwater treatment plant will not be built, unless it can be shown that the artificial groundwater plant will not cause the risk of polluting groundwater, even in the long term. (Local newspaper, article 14, November 2003)

The municipal council considered the initiative, but the conclusion was that the AGR project would not cause a pollution threat to the groundwater.

In 2007, the local residents stated that along with the artificial groundwater, the mercury would spread also to the Turku Region. Thus, the opposition of the project is for common good and the issue also concerns everyone living in the Turku Region. In an opinion piece urging all mothers to unite for safe water, an opponent writes that:

> Suddenly information began to trickle to the media; terrifying, new information about poisons that will be infiltrated in the esker during the water purification process. And not all poisons will be infiltrated but they will happily continue their journey towards Turku and the water glass of a thirsty person. (Opinion piece in daily newspaper, article 15, August 2007)

Scrutinising the construction of the four storylines clarified the discursive order of the conflict, and the positioning of different actors inside the environmental struggle. The local rights storyline describes strong emotions and values of the local residents. However, they were overshadowed by the more dominant argumentation linked to the environmental discourse. Thus, this storyline cannot be seen as discursive cement that keeps a discourse coalition together, especially not in terms of knowledge production. Instead, the coalitions are formed around the environmental changes and health risk storylines. In the next chapter, we will illustrate how knowledge production is bound to storyline construction by using the idea of knowledge coalition presented by Van Buuren and Edelenbos (2004).

Formation of knowledge coalitions

If the existing planning rationality emphasises the factual descriptions in the planning process, it is understandable that the stakeholders use the same weapon in order to construct their own reality. This leads to disappearance of the dimension of experimental knowledge (Bäcklund 2007). Gustafsson (2011) emphasises that lay people try to construct a discursive space that allows them to participate in the discussion alongside experts and politicians, partly on similar terms. Indeed, in our case, the project planners and authorities as well as the local residents deployed similar expert-based argumentation; furthermore, the local features were absent from the main argumentative arenas.

According to Ehrman and Stinson (1999), in a complex process, it is always possible to find an expert to support one's view. Thus, the parties produce knowledge in order to deconstruct each other's argumentation and to prove the suppositions of the other side as contestable. This leads to *knowledge fights* between knowledge coalitions, which consists of both knowledge providers (researchers, consultants, and advisors) and knowledge users (policy-makers, interest groups, and citizens). Thus, knowledge is produced in parallel and then strategically directed towards other knowledge coalition (Van Buuren and Edelenbos 2004).

Accordingly, in rhetoric, unlike in logic, opposing arguments may both be reasonable. The objective in argumentation is to persuade the audience to support the speaker's own argumentation position by strengthening that position and weakening the opposite one (Billig 1987). A factual description is a kind of extreme form, which tries to describe how things really are. Attempts are made in order to make controversial claims look like undeniable facts (Potter 1996). The means of argumentation are always chosen and applied according to the audience (Perelman 1982). We will use the mercury dispute to illustrate how the various participants construct their knowledge claims as factual inside the storyline formation process, and how the knowledge coalitions are formed around the health risk storyline.

Mercury dispute

The project planners emphasised expert knowledge and presented it as factual and neutral. Consequently, they questioned the local residents' knowledge base and denounced the opposing arguments as imagination, and the project opponents as scaremongers. Research manager of TRW noted:

> It clearly seems that they are fanning the flames of fear with false evidence and limited facts in a matter in which there really is nothing to be afraid of. (Local newspaper, article 17, January 2007)

However, the local residents used expert knowledge in their argumentation as well. Nevertheless, they tried to weaken the position of the project planners by questioning expert knowledge and emphasising the unpredictability of nature.

> When nature's own systems are artificially changed, there is always the risk that nature behaves in a manner other than that calculated by engineers on paper. (Local newspaper, article 24, September 2003)
> Engineers have spoken. Now it's nature's turn to show whether they are right or wrong. (Opinion piece in daily newspaper, article 25, September 2010)

According to Peuhkuri (2002), the expressed distrust towards expert knowledge may also imply an experienced outside threat to local identity and user rights of natural resources, which became visible inside the local rights storyline. However, these arguments were overshadowed by the competing factual descriptions constructed by both parties. Indeed, parties used various rhetorical devices in the process of constructing a factual knowledge base in order to support their own arguments, as well as to deconstruct the other side's views. During the furious struggle concerning mercury, the representatives of TRW referred to the leading researcher of hazardous substances from the Finnish Environment Institute, who claimed:

> You ingest the same amount of mercury when you eat a meal made of fish as when you drink a million glasses of untreated water from the River Kokemäenjoki. (Trade journal, article 18, April 2007)
> "If the leading institution on environmental poison research is of this opinion, there is no need to fear the risks of mercury", Artimo [research manager of TRW] trusts. (Local newspaper, article 19, January 2007)

Here, we can distinguish three rhetorical devices used (Perelman 1982): first, the representatives of TRW invoked an authority who was considered to be an expert in the field at issue. This device was often used in the opposing arguments as well. Second, in this argument, the researcher invoked an example, and the conclusion about the low risk of mercury is based on the truthfulness of the chosen example. Third, the analogical comparison between two objects: the amount of mercury in the water is compared to the amount of mercury in the fish, which is more familiar to the public.

In addition, the representatives of TRW used the consensus and corroboration to construct factual descriptions (Potter 1996): they invoked several authorities and researchers in order to prove the arguments. This was strengthened by using *we-rhetoric* (Billig 1987).

> We have examined the river water in collaboration with, for instance, the Water Protection Association of the River Kokemäenjoki. The samples have been analysed in state-of-the-art laboratories and it is a fact that in the 2000s, the mercury concentration has not exceeded the drinking water level as stipulated in the Act set by the Ministry of Social Affairs and Health. (Research Manager of TRW in local newspaper, article 20, January 2007)

The local residents produced counter knowledge by appealing to authorities and research studies as well. In the following arguments, they also use extremisation (Potter 1996). This was a common rhetorical device used to oppose the project, especially when the mercury dispute escalated during the years 2007–2008 (see Figure 2). Several extreme expressions can be found from the newspaper articles and opinion pieces: *extremely dangerous*, *super-poison*, *ecocatastrophe*.

> Doctor Tarja Toimela considered it a risk to use the water from the River Kokemäenjoki as the raw material for the artificial groundwater project … bacteria will enrich, i.e., change surprisingly and unpredictably the inorganic mercury into extremely dangerous methyl mercury in the water. (Local newspaper, article 21, May 2007)

Furthermore, the local residents used category entitlement, which is connected to the invoking authority, but it can be used in one's own arguments as well (Potter 1996). They used specific titles in their opinion pieces; for example, some mentioned their education in engineering. In addition, Jarl Ahlbeck, an adjunct professor of environmental engineering at Åbo Akademi University, Finland, gave his support to the local residents, as did the Doctor of Agronomy and Forestry, Risto Lauhanen. Obviously, in this case, the battle was not waged between experts and lay residents; instead, we can distinguish formation of a knowledge coalition in which experts, local residents and policy-makers work together in producing knowledge (see Van Buuren and Edelenbos 2004).

The local residents continue with questioning the research contracted out by TRW. On the one hand, they claimed that the presented facts were false, and on the other hand, they claimed that the company had bought the desired results from the consultants. These arguments use ironising descriptions, including notions of lies, delusions, mistakes and misrepresentations which are effective devices to undermine the inadequacy of the defending arguments (Potter 1996).

> [a]s far as I understand, TRW does not possess any reality-based, neutral, fact-based information. […] Apparently the factual information presented in the writing has been obtained by looking into a crystal ball, if they really claim that this river water mixture would under no circumstances mix with the drinking water in [municipalities of] Loimaa, Huittinen, Alastaro or Vampula … Because I can vouch for it that the groundwater in these areas move fairly freely and no one has built or will build any walls along municipality borders. (Opinion piece in daily newspaper, article 23, November 2006)

However, the representatives of TRW tried to undermine the extending opposition by highlighting the existence of a divide between two watercourses, and by highlighting the contradiction in the opposing environmental argumentation.

> Research manager Aki Artimo wants to emphasize to the residents of Loimaa that the waters from esker Virttaankankaa are in no contact with the water that is pumped to the town of Loimaa. "This is a fact which is apparently

> consciously waved aside so that opponents to our project could be attracted from further away than in the core area of Virttaa." (Local newspaper, article 22, January 2007)

The representatives of TRW formed a knowledge coalition with the researchers and consultants, whereas the visible contribution from the policy world remained rather feeble. However, Van Buuren and Edelenbos (2004) argue that mutual social influences are always present, even though a boundary between policy world and knowledge world might exist. Our written material enables us to investigate only few sporadic occurrences of these interactions. For example, some politicians and individuals from the Turku Region gave their public support to the project; furthermore, the Green Party of the Turku Region approved of some of the arguments of TRW, even though they did not give unreserved support to the project in itself. However, even though these examples occurred only in a few among hundreds of articles on the matter, they do indicate that more profound interaction inside the coalition probably exists beyond the written media.

Finally, our analysis of the mercury dispute illustrates that knowledge production is a strong mechanism through which coalitions are constructed. Furthermore, this is strongly bound to the creation, maintenance and transformation of storylines. In the discussion part, we will conclude our analysis of the discursive construction of an environmental conflict by drawing together the elements form Hajer's (1995) discursive framework and the concept of knowledge coalition presented by Van Buuren and Edelenbos (2004).

Discussion and conclusions

Within Hajer's discursive framework, this research has explored the coalition formation and knowledge production process around the contentious AGR project. Various storylines and the contradictory field of expert knowledge intertwine and participate in the discursive construction of an environmental conflict. Concurrently, the issue is characterised by a concrete struggle about the right to use natural resources.

Both the opposing and defensive coalitions include engineering professionals, and they utilise similar expert-based factual arguments to support their cause. In addition, the local residents included only few local resources in their knowledge claims. Therefore, the case does not represent the traditional dichotomy between expert and lay knowledge. On the contrary, we complement our discourse analysis with the idea of knowledge coalitions (Van Buuren and Edelenbos 2004), which moves the focus from between the policy and knowledge worlds themselves to between the coalitions that include actors from both worlds. Thus, the paper contributes to the discussion of the transgression of science and society (Nowotny *et al* 2001, Jasanoff and Martello 2004, Delvaux and Shoenaers 2012) by combining the elements from discourse analysis and knowledge production.

In our case, inside the discursive construction of the problem, the environmental discourse may be seen as hegemonic. According to Hajer (1995), a discourse can be said to be hegemonic if both discourse structuration and institutionalisation occur. In our case, the discourse structuration is visible while observing the number of given environmentally based arguments which are clearly the most used ones to oppose the project, but are also used to defend it. Accordingly, one rhetorical device, used by the representatives of TRW, was to draw a picture of an environmentally friendly method of water treatment and to accuse the local residents about contamination of esker by their land-use activities (cf. political "use" of environment, Dalby and Mackenzie 1997, p. 99). Through our case study, we can see that hegemonic discourse can overshadow a latent but important one. Even though the regional policy discourse preceded the environmental one and was rather strong in the early stage of the project, the actors had to use the language of the hegemonic environmental discourse in the main argumentation.

Furthermore, the institutionalisation of environmental discourse took its first steps already at the beginning of the 1970s, when ideological and political expansion of environmental issues emerged in Finland. Environmental discourse gradually translated into institutional arrangements through

concrete policies; for example, a number of environmental laws were enacted during the 1970s and 1980s, and the Ministry of the Environment was established in 1983 in order to centralise the fragmented environmental administration (Sairinen 2000).

Inside the two discourses, we defined four storylines; *water stress*, *local rights*, *environmental changes*, and *health risk* storylines; they may be seen as simplified descriptions of a very complex phenomenon (Hajer 1995). An atmosphere of environmental crisis was built through these narratives. For example, the health risk storyline portrayed a very simple and clear message: the AGR project will destroy the esker and pollute the natural groundwater. The environmental arguments became self-evident and the counterarguments of the other side were ignored. Hence, this case can be seen as a struggle about the definition and meaning of an environmental problem (see Hajer 1995).

Through the storylines, the knowledge was produced and actors were positioned so that coalitions were formed amongst the knowledge producers and users. To push various interests, especially during the mercury debate, both sides used specific research results to support their view. In addition, some figures appeared to be a target of divergent interpretations and conclusions.

Some experts gave their support to the local residents directly, thus contributing to the coalition formation. Typically to knowledge fights (Van Buuren and Edelenbos 2004), this coalition produced knowledge to support their own perspectives, and then strategically used it against the other coalition. In addition, they tried to unbalance the other coalition by positioning the TRW as the main perpetrator and their experts as marionettes whose views could be bought.

The opposing coalition stayed first at the local level. The local people living close to the esker began to defend their region and refer to the rights of local people. Later, the coalition spread to the neighbouring municipalities along with the health risk storyline, which acted as the main discursive cement inside the opposing coalition. The local residents referred to the risk of mercury poisoning trying to position the people from the Turku Region as the victims of the project as well. However, the expansion of the coalition remained a rather feeble attempt.

The representatives of TRW positioned consultants and other experts who supported their views as reliable top scientists. In addition, they positioned the local residents, especially in the context of the mercury debate, as scaremongers and lay people, even though many of them were highly educated. Their argumentation was presented as unreliable and based on emotions, whereas the knowledge used by the project planners (experts) was presented as reliable and based on expert knowledge (see Blok *et al.* 2008). Accordingly, the representatives of TRW, the consultants and other experts formed a coalition which supported the implementation of the AGR project. However, the role of policy actors inside this coalition remained somewhat unclear, because of the scarcity of appearances of the defenders' views in the written media. Thus, we were not able to conduct a more profound analysis of the coalition formation among the defenders of the project..

Regarding the other limitations of the study, Hajer (1995) defines the discourse coalition as an ensemble of (1) a set of storylines; (2) the actors who utter these storylines; and (3) the practices in which this discursive activity is based. Our written material enabled us to focus only on the storylines and actors, while the observation of the practice was considered as a topic worthy of a separate piece of research.

Instead of being two separate worlds, the world of policy-making and the world of research intertwine; therefore, the production of knowledge is a social and collective process (Nowotny *et al.* 2001, Jasanoff and Martello 2004, Van Buuren and Edelenbos 2004). However, even though the social orders of knowledge production have been gradually recognised (Jasanoff and Martello 2004), there are still assumptions in our society that the knowledge used in policy processes needs to be apolitical; that is, knowledge must be devoid of interests and emotions, and expert knowledge is seen as independent from its producer (Bäcklund 2007, Delvaux and Shoenaers 2012). Consequently, as our case study indicates, inside the process of the transgression of science and society, the actors from the policy world are pressured to use the means acknowledged inside the academic argumentation.

This study shows that inside an environmental conflict, the contestable knowledge plays a significant role, and the knowledge production is intertwined with the discursive construction of reality. The experts, policy-makers and citizens produce knowledge and construct storylines inside the contested policy process. The coalitions are formed among the actors who utter those storylines. The case supports greatly the argument presented by Van Buuren and Edelenbos (2004) that in managing knowledge fights, the emphasis must be put on the establishing links between different knowledge coalitions rather than between knowledge and policy worlds.

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Note

1. The term *managed aquifer recharge* has begun to be used as a substitute, as the word *artificial* carries a negative connotation implying that the water is somehow unnatural (Dillon 2005). However, in this article, we will utilise the concept *artificial groundwater recharge*, because it corresponds better with the Finnish translation, and because the word *artificial* often appeared in the rhetoric of those opposing the project.

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Article IV

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Groundwater as a Source of Conflict and Cooperation: Towards Creating Mutual Gains in a Finnish Water Supply Project

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ABSTRACT: Community planners, decision-makers and authorities frequently encounter conflicts revolving around natural resource management as well as around urban planning. Since the 1970s, the dynamics of conflict resolution have evolved from conventional expert-based rational solutions towards collaborative ones. Against this background, our research investigates one contentious groundwater project in the Tampere Region in Finland. Conflict assessment clarified the divergent interests of the multiple parties. Drawing on negotiation theory, this study illustrates how polarised positions and competitive framing, as well as the influence of historical baggage, may form an insurmountable barrier to successful negotiation. While the acknowledgement of various interests should form the heart of the integrative negotiation process, excessive energy is used for argumentation to protect predefined goals with as minor concessions as possible. Addressing the collaborative approach, we suggest multiple ways towards creating mutual gains and cooperation in future water supply projects.

KEYWORDS: Conflict assessment, case-study, groundwater, integrative negotiation, mutual gains approach, Finland

INTRODUCTION

During the last few decades, Finnish community water supply has increasingly relied on groundwater as the source of water, thus replacing surface water in many communities (Katko et al., 2004). However, several inter-municipal groundwater projects have faced contentious issues in Finland (Myyrä, 2007; Kurki et al., submitted; Lauhava, 2013). Globally, management and governance of groundwater constitute a significant challenge, which has become an increasingly conflictive issue (Jarvis, 2014). The more and more complex environment cannot be controlled through conventional expert-based rational solutions. The decisions are often contested in the court, leading to a time-consuming and costly judicial dispute resolution, which does not encourage joint problem-solving or good relationships between parties (Susskind and Ozawa, 1984).

In the field of conflict research, especially in Australia and the USA, scholars and practitioners have increasingly emphasised negotiation-based, collaborative practices in conflict resolution. Some researchers present these approaches as a dominant paradigm inside the planning discipline and natural resources management (NRM) (Singleton, 2002; Margerum, 2002b, 2011; Margerum and Whitall, 2004). However, even though in Finland scholars and practitioners have strongly emphasised that though public participation in public policy (see Puustinen, 2008) and public participation are also an integral part of integrated water resources management (IWRM), mediation and negotiation theory have gained less attention. Some examples can be found from Edelman (2007), concerning integrative

negotiation in the field of urban planning, and from Peltonen et al. (2012), concerning investigating mediation of environmental disputes.

According to the definition by Susskind et al. (1999), consensus-building – which is a collaborative approach to problem solving – addresses stakeholder interests, enables wide participation, and consumes less time and money than more conventional approaches, which may lead to lengthy litigation processes. In addition, collaboration can build trust among parties, and is particularly useful for complex NRM processes (Innes and Booher, 1999). However, collaborative planning has evoked both critical reviews in terms of institutions, practices and procedures (Moote et al., 1997; Margerum, 2002a; Walker and Hurley, 2004; Margerum, 2007), and success stories among multiple case studies and in comparison with various planning styles (Innes and Booher, 1999; Innes and Gruber, 2005; McKinney and Field, 2008; Nolon et al., 2013; Moore, 2013; Clarke and Peterson, 2015).

Collaborative planning emerged in the USA from an interest in finding an effective alternative to traditional litigation in order to resolve disputes regarding development and use of natural resources (Susskind and Weinstein, 1980; McDonnel, 1988). In these complex disputes, a board or a judge may be incapable of finding common ground (Nolon et al., 2013). As one pioneer in alternative dispute resolution (ADR), Denver metropolitan water roundtable represents a successful collaborative process in the 1980s, after decades of dispute and litigation about regional water supply (Carpenter and Kennedy, 1988). Subsequently, studies on collaborative NRM have addressed several cases of watershed planning (Singleton, 2002; Margerum and Whitall, 2004; Bidwell and Ryan, 2006; Bonnel and Koontz, 2007) and water resources management (Lach et al., 2005; Baldwin and Ross, 2012; Taylor et al., 2012). However, few studies have concentrated directly on water services, which is community water supply and wastewater disposal. Furthermore, the research on water conflicts predominantly concentrates on surface water, even though most of the world's freshwater resources are underground (Jarvis, 2014).

Accordingly, this paper contributes to the growing literature of conflict research by analysing a contentious groundwater project in the context of Finnish community water supply. Water supply, as part of water services, is connected with the two major fields: NRM and urban planning, which are generally studied separately. Our analysis combines the elements of conflict assessment and conflict resolution. Accordingly, the aim is to analyse the central elements of the conflict as well as to find better practices for future large-scale water projects. Furthermore, by drawing on negotiation theory (Walton and McKersie, 1965; Fisher et al., 1991; Bartos, 1995) the paper analyses the interaction between the involved parties. This will be elaborated by using the principles of the Mutual Gains Approach (MGA) (Susskind and Field, 1996; Nolon et al., 2013).

CONFLICT ASSESSMENT AND NEGOTIATION THEORY

The general aim of conflict assessment is to recognise the basic elements of a conflict: central issues, main parties involved and their interests, as well as possibilities for conflict resolution (Nolon et al., 2013). Parties' interests, which form one of the key concepts of negotiation theory, should be distinguished from their goals (Wehr, 1998). Susskind (1999: 6) clarifies the distinction: "[d]emands and positions are what people say they must have, but interests are the underlying reasons, needs, or values that explain why they take the positions they do". Interests often form around deep beliefs, but may also change when new information is obtained and the understanding of the problem becomes deeper.

Two main models of negotiation, distributive and integrative, were first formulated by Walton and McKersie (1965). These approaches may be seen as opposites: while distributive bargaining emphasises the parties' interest to maximise their share of the fixed amount of benefits in a *zero-sum* negotiation, the integrative style focuses on the *win-win* negotiation in order to increase the size of the mutual gain (Susskind, 1999). A broader scope of issues, potential benefits or resources subject to negotiation may

provide more opportunities for increasing the mutual gain. A negotiation situation may, however, include elements from both bargaining styles (Walton and McKersie, 1965).

The distributive negotiation model includes an aspect of positional thinking. This means that parties have already defined their goals, and the main purpose of the negotiation is to defend them with as minor concessions as possible, thus devoting less attention to defining the interests of other parties (Fisher et al., 1991). Contending positions prevent the creative search for new solutions (Poirier Elliot, 1999), and participants are locked to their positions which they consider the only acceptable solution that would satisfy their underlying interests. This leads to exclusion of the information outside the box, as well as other possible solutions which might also satisfy their interests (Fisher et al., 1991). Consequently, the distributive approach ignores an important aspect of the negotiation process: "the fact that stalemates can be broken by making new and imaginative proposals" (Bartos, 1995: 51).

The integrative negotiation model, on the other hand, searches for alternative solutions and benefits for all parties in a joint process (Walton and McKersie, 1965). Value creation or enlarging the fixed amount of benefits requires a shift from positions to interests (Islam and Susskind, 2013). This is emphasised in a mutual gains approach, whose principles (Susskind and Field, 1996; Nolon et al., 2013) are applied in this study:

- acknowledge the interests of the other side
- build on interests, not positions
- encourage joint fact-finding
- compensate for losses
- build mutual trust

These principles will be explored more carefully through our case study. Finally, according to Jarvis (2014), in a collaborative process, it is important to blur the fixed boundaries between parties by emphasising that we are all in this together.

RESEARCH DESIGN

This in-depth case study analyses a conflict around an inter-municipal groundwater project in Finland, while drawing on conflict assessment and negotiation theory. The conflict assessment process included altogether 28 semi-structured interviews including all the primary parties except the Council of Tampere Region; their representatives related to this case were already retired and did not respond to interview requests. The interviewees included politicians, officials, local inhabitants, landowners, and representatives of a local NGO. Some interviewees represent two different primary parties; however, only one party is mentioned in the quotes in order to protect identities. The interviews were recorded and transcribed, with the exception of two phone-interviews, where only notes were taken. The material was analysed by using different categories of conflict assessment: history, parties, interests, context, and process dynamics (Peltonen and Kangasoja, 2009). Additional material of the analysis included official documents, newspaper articles, appeals in court, and court decisions.

After the interviews, the conflict assessment included three steps. First, the researchers outlined a *conflict map* based on the analysed material, including a timeline of the project, describing the main events and the main issues of the conflict. In this case, the term conflict map is symbolic, and refers to a written summary including the components mentioned above. Second, a draft conflict map was sent to ten representatives, from which eight were interviewees, and two were actively involved in the project but were not interviewed. They were encouraged to give feedback and four representatives provided comments. The aim was to include a representative from each primary party; however, the representatives from ELY Centre (defined later in this article) could not participate.

The third step of the conflict assessment was to present the conflict map in a workshop organised in March 2014. All ten representatives and four researchers participated in the workshop and it was facilitated by two external facilitators. The workshop was initiated by the researchers and it was part of the research project. Finally, a written summary of the workshop was sent to all participants, along with a request for feedback; three comments were received.

Even though the workshop did not aim for the mediation of the conflict, the parties had a unique opportunity to hear each other in a positive and cooperative atmosphere. This confidential conversation was included in the overall research analysis; the interaction between the parties was analysed on the basis of negotiation theory.

CASE HISTORY AND STAKEHOLDERS

The case analysed in this study is the inter-municipal groundwater project of seven[1] municipalities situated in the Tampere Region, south-western Finland. Since the 1980s, the municipalities have practised inter-municipal cooperation in water services, such as bilateral contracts in water sales and wastewater treatment (Kurki, 2010). The population of the region, currently some 300,000 inhabitants, has continuously grown during four decades, and the growth is estimated to continue in the future. The region is characterised by its several lakes, thus having abundant surface water resources. However, in the 1990s, the national recommendation was to increase the amount of natural and artificially recharged groundwater in domestic water supply in order to improve raw water quality and water-crisis management.

Consequently, in 1993, the Tampere Region established a Water Supply Plan for Tampere and Valkeakoski Region, with an aim to increase the use of groundwater in the region. Since natural groundwater resources were insufficient, the plans proceeded towards artificial groundwater recharge (AGR),[2] which means intentional surface water recharge through the soil to the underlying aquifer in order to augment the amount of natural groundwater. The planned AGR plant would serve as a water supply for six municipalities, excluding Pälkäne, which is self-sufficient with its natural groundwater resources. However, the plant would be constructed on top of an esker, on the municipal border between Pälkäne and Kangasala as shown in Figure 1.

In Finland, the main groundwater areas are situated in eskers and other glaciofluvial formations with thick sand and gravel deposits, which have mainly formed during the ice age by subglacial streams. In this case, the planned infiltration area would cover approximately two percent of the 700 ha of the esker, which is mainly composed of forest and other vegetation, serving local inhabitants as a recreational area. The area includes a conservation area restricted by the EU-wide network called Natura Programme (Council Directive 92/43/EEC). In addition, there are some settlements, farms, a shooting range, a nursery, and some gravel mining. Furthermore, an old industrial area of Pälkäne is situated next to the esker.

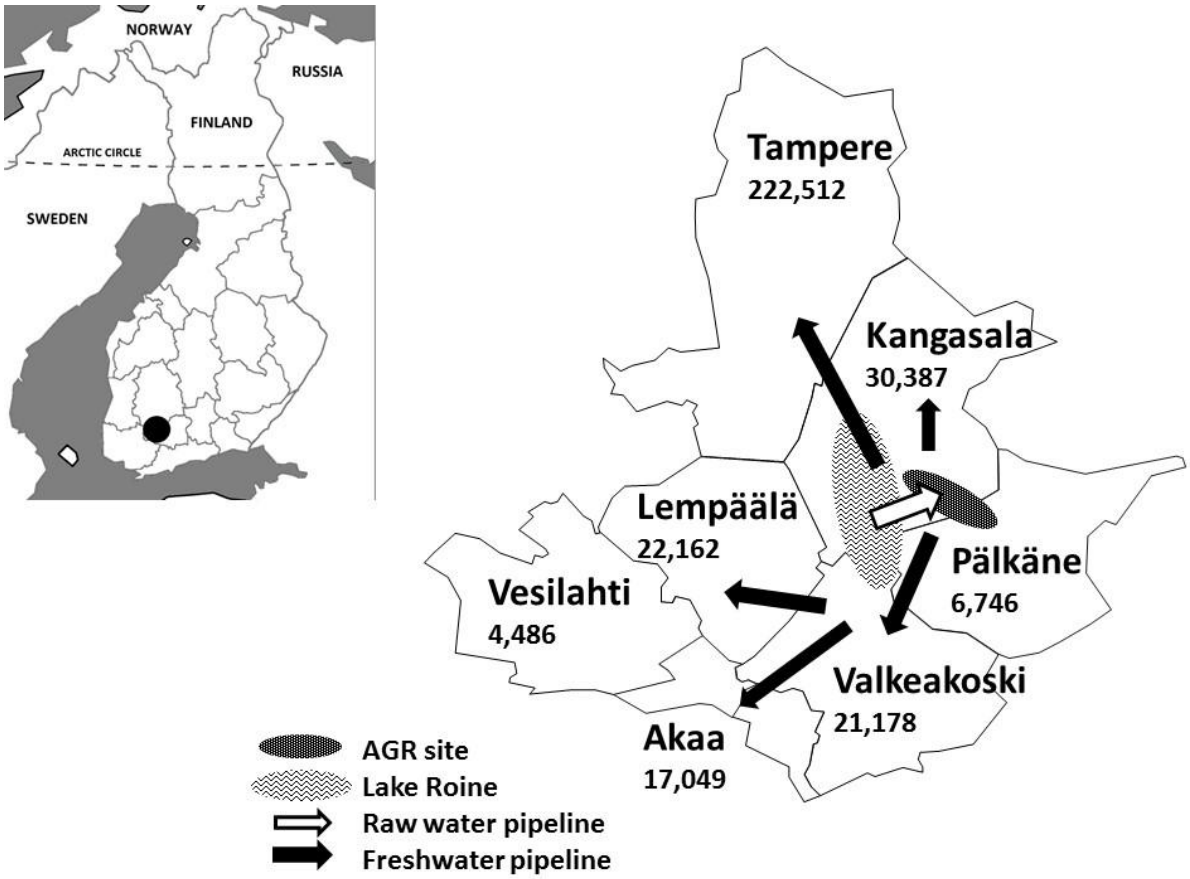
Originally, the groundwater project was initiated by the municipality of Valkeakoski in the beginning of the 1990s. Their old water utility relies on surface water and requires renovation, and they had observed positive experiences of AGR from other parts of Finland (Interview, Official, City of Valkeakoski). Other stakeholders having a crucial role in initiating the project are the other municipalities, Council of Tampere Region, and the ELY Centre (Centre for Economic Development,

[1] In the beginning, the project involved nine municipalities; however, after the consolidation of municipalities the number has decreased to seven.

[2] The term *managed aquifer recharge* is also widely used as a substitute. However, in this article, we will utilise the concept *artificial groundwater recharge*, because it corresponds better with the Finnish translation *tekopohjavesi.*

Transport and the Environment[3]) of the Tampere Region. These stakeholders were responsible for the Water Supply Plan and they formed a planning committee, which started to enhance the project. In this case, the initial stakeholders can also be seen as primary parties of the groundwater project, having a direct stake in the outcome of the conflict (Wehr, 1998).

Figure 1. Planned AGR plant and the municipalities involved, including the numbers of inhabitants of the municipalities.



Although all seven municipalities are considered as primary parties, this study concentrates on the four most active ones: Tampere, Valkeakoski, Kangasala and Pälkäne. Each municipality has internal groupings, such as decision-makers, authority, water utilities and individuals. Thus, a municipality cannot be seen as a unitary group, but rather the degree of internal cohesion may vary and also be quite low, with internal disagreements and divergent interests.

The municipality of Pälkäne represents the main opponent. It filed appeals against the AGR investigations on the esker, and went through all the court instances. At the early stage, however, Pälkäne participated in the meetings of the planning committee and the opposition was not totally uniform. In 2002, the other municipalities made a final agreement about the implementation of the

[3] ELY Centre, including 15 regional centres, operate under the central government, being responsible for regional implementation and development–related tasks, e.g. to industry, transport, infrastructure, environment and natural resources. The centre name has been changed several times during the project. However, it is referred to as ELY Centre throughout this article.

AGR plans and founded a municipality owned company called *Tavase Ltd*. Subsequently, Pälkäne municipal council decided almost unanimously to abandon the project. Furthermore, the opposition gradually spread to Kangasala and Valkeakoski as well. Inside those municipalities, the argumentation between opponents and supporters gradually evolved, and finally resulted in internal agreements, though not unanimous, to resign from the company in 2011 and 2012.

The municipality of Pälkäne and the opponents from Kangasala and Valkeakoski formed a coalition, called *opposing coalition* later in this article. The interviews revealed their relatively consistent perspectives on the project. Consequently, the conflict culminated between the opposing coalition and Tavase Ltd.

While opponents have challenged the decisions through appeals, Tavase Ltd. has gradually enhanced the groundwater project. After the EIA process, in 2003, Tavase Ltd. submitted a licence application to the Regional State Administrative Agency (AVI, *Aluehallintovirasto*). In 2012, an updated application was submitted after intensive investigations on the esker. In the course of writing this article, the final decision on whether the project will have a licence is still open and, if so, there is still the matter of it being approved by the municipalities.

INTERESTS AND ISSUES

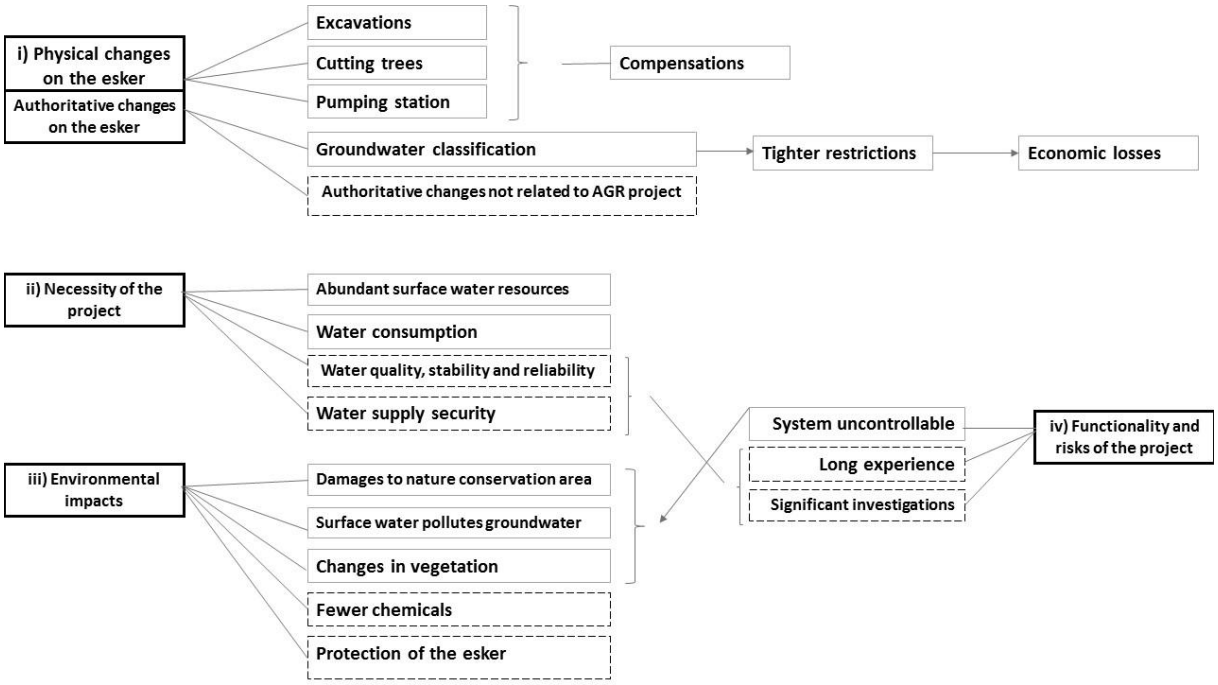
While the interviews revealed various issues around the conflict, this article focuses on the four major issues appearing most frequently in the argumentation and, in the course, revealing the most profound information about the interests of the parties. Distinction between the issues is inevitably rather vague, since they are closely linked to each other. However, to enhance the readability of the paper, we formed the following categorisation of the issues: (i) physical and authoritative changes on the esker, (ii) necessity of the project, (iii) environmental impacts, and (iv) functionality and risks of the project. Figure 2 illustrates the content and relations of these issues.

The first issue is about the physical and authoritative changes on the esker. The physical changes, like excavation for pipelines and cutting trees, would likely happen during the construction of the AGR plant. In addition, a pumping station would be constructed on the waterfront of Lake Roine in the Vehoniemi Village. The local landowners state that the promised compensations are not enough, whereas some think that money cannot compensate for future damages.

> The landscape of Vehoniemi, cultural values, history, natural values (…) and the identity of local inhabitants are attached to those, and money cannot compensate for them (Landowner, Municipality of Kangasala).

Furthermore, the authoritative changes refer to the classification of groundwater area, planned and supervised by the ELY Centre. In Finland, all groundwater areas are classified according to their usability and the need of protection as follows: class one refers to an important groundwater area for water supply, areas in class two are suitable but for the present have not been used for water supply, and class three refers to those groundwater areas of which the potential for water supply requires more investigations. Consequently, change from class two to class one would cause tighter restrictions in the use of fertilisers and pesticides on the fields and in the nursery area in horticultural operations. In addition, the restrictions would affect the 40-year-old industrial area, in which millions of euros have been invested, in terms of environmental restoration efforts. The municipality of Pälkäne claims that the change in the classification would cause huge economic losses to the municipality. Entrepreneurs are already unwilling to make investments because of the threat of future restrictions (Interview, Official, Municipality of Pälkäne). However, there is no consensus among the parties about the relation between authoritative changes and the AGR project.

Figure 2. Four major issues, their content and relations.



Note: The boxes with dashed lines refer to defenders' argumentation, and other boxes refer to the opponents' argumentation.

The second issue is the necessity of the groundwater project. The need is questioned because of the abundant surface water resources in the Tampere Region. Moreover, total water consumption will not increase according to population growth, because of the decrease in per capita water consumption as well as improved water-saving technologies. In addition, the surface water quality as well as water treatment technologies have improved during the last few decades. The opponents claim that the current situation is totally different from that of the initial stage.

According to Tavase Ltd.; the groundwater project is necessary because it improves domestic water quality, stability and reliability. With the growing population it is important to have different water sources and AGR would be one among others. This would increase the security of water supply. In addition, water crisis management will be improved at least from three aspects: groundwater is relatively safe from air pollution (although this is presently less of a concern than some decades ago), water is stored inside the esker in case of water shortage, and the AGR plant will include three independent production areas.

The third issue concerns possible environmental impacts. AGR is partly a natural and partly an engineered system. Furthermore, the plant is planned to operate for a 100 years, thus the local changes cannot be predicted precisely. This causes guesswork and fears among the local inhabitants: the black alder woodland situated in the conservation area will be in danger due to changes in water flows and water levels, infiltrated surface water can mix with the natural groundwater thus polluting it, and the infiltration through sprinkling[4] will change the vegetation of the esker. An environmental NGO group from Kangasala states:

[4] Sprinkling refers to a recharge system where water spurts out from a perforated pipeline network and percolates through the soil.

> The AGR plant can be constructed in the commercial forest, but not on the esker which has cultural, environmental, and economic values (Local NGO, Municipality of Kangasala).

The main interest of the group is to protect the vulnerable environment, especially the conservation area and the quality of natural groundwater. This can be considered an important interest of the local inhabitants of Pälkäne as well.

Interestingly enough, environmental argumentation is also used by the project proponents. Tavase Ltd. states that AGR is a natural and environmental-friendly way to produce domestic water since it requires fewer chemicals than conventional water purification methods. Furthermore, the company sees the environmental argumentation of the opponents as unsustainable because of local gravel mining and industrial area beside the esker. The AGR plant could even protect the esker from these damages.

The fourth issue is closely related to the third one. Central questions are: will the planned AGR plant function properly or not, and what are the risks of the project? The local inhabitants are afraid that the system cannot be totally controlled; that water will flood their basements and that the project will cause significant environmental effects on the esker area. They claim that there is not enough reliable knowledge to guarantee the functioning of the AGR plant. The interests of local inhabitants of Pälkäne and Kangasala could be summarised as follows: protection of people, their property, environment, and cultural heritage.

However, the representatives of Tavase Ltd. emphasise long AGR experience in Finland and other countries: the first Finnish AGR plants were completed already by the beginning of the 20th century and in many other European countries in the 19th century. Furthermore, Tavase Ltd. claimed that they strongly trust the research concerning this case, conducted by internationally acknowledged consultants.

In summary, the four identified issues also revealed the parties' interests. The main conflicting interests can be summarised as follows: first, protection of natural values and cultural heritage of the esker against the construction of the AGR plant; second, the economic competitive strength of the City of Tampere against that of the surrounding municipalities. This division will gain further support from the analyses presented in the following section.

Despite the disagreements and differences in observations and conflicting interests, the negotiation table became clearer during the workshop organised in March 2014, and the divergent interests of parties were clarified. Among conflicting interests, we did recognise common interests as well, such as, groundwater protection, economic and reliable water supply, and the need for independent and reliable knowledge, which were interests that all parties emphasised.

TAKING POSITIONS OR CREATING MUTUAL GAINS?

This section analyses the interaction of parties within negotiation theory and by using an integrative negotiation-related Mutual Gains Approach (MGA). The MGA emphasises the importance of understanding the concerns of the other sides (Susskind and Field, 1996). As Nolon et al. (2013: 14) argue: "parties have the best chance of success if they understand from the start what their counterparts care about and why". Thus, the negotiation should be built on interests, not on positions.

However, in our case, instead of acknowledging the interests of other sides, the parties aimed towards their own goals with a competitive mindset illustrated by the environmental impact assessment (EIA) process, which became an arena of discursive and political struggle. A public hearing related to the EIA, held in 2002, serves as an example of the formation of strong positions and the use of a distributive bargaining style. An official described the atmosphere as hostile and that "violence hung in the air" (Interview, Representative of Tavase Ltd.). On the other side of the fence, local inhabitants described the attitude of project planners as very arrogant. Furthermore, they assumed

that the gathering was organised only because of the EIA obligation. Several interviewees remembered the expression of an official:

> [He said that] Water Act is such a powerful law that you can do nothing to stop us (Local inhabitant, Municipality of Pälkäne).

The EIA was reviewed by the ELY Centre of Central Finland, it being an external reviewer of the project. It addressed several environmental impacts; however, it was the functionality of the project that drew the major attention of the public. A hydrogeologist from the ELY Centre reported, for example, that the planned water purification will not be realised according to the plans, since calculated retention times were incorrect (Mäkelä, 2002). Instead of taking the critical evaluation as a source for improvements, a public debate between the parties emerged: the project planners launched an active counter-argumentation, and the local inhabitants of Pälkäne started to promote the opposition of the project even more actively.

Another critical event was the establishment of the company, Tavase Ltd. The responsibility of the project was given to the company and its aim was clear: implementation of the groundwater project on the esker situated in Pälkäne and Kangasala. This created a significant position against the municipality of Pälkäne, which did not acknowledge any benefits from the project. The company representatives are legitimated but also obliged by the partnership agreement, and they are working only towards the goal set by the company. Moreover, the opponents of the project argue that the representatives hide behind that position and real interaction is blocked.

> (…) a managing director cannot do anything else than execute the goals of the company, set by its shareholders (Representative of Tavase Ltd.).

> (…) no information was given, they always hid behind the Companies Act (Politician, City of Valkeakoski).

Another MGA principle encourages joint fact-finding, which emphasises that gathering data, analysing them, and drawing conclusions should be done in consensus with all parties (Susskind and Field, 1996; Nolon et al., 2013). Instead of using different experts to support each side's point of view, the parties should jointly define the issues of concern and choose the expert to be used (see Ehrmann and Stinson, 1999). Thus, information becomes part of a shared knowledge base and is legitimate and credible to each party.

Legitimate and shared information was not reached in our case. Instead, the consulting companies hired by Tavase Ltd. conducted most of the investigations on the esker, concerning mainly hydrogeological conditions, technical design and the suitability of the area to the groundwater recharge. However, the opponents claimed that the results were unreliable and only supported the views of the payer. In addition, opponents used the arguments of external experts to support their views such as those concerning the negative environmental impacts. According to Jarvis (2014), a duelling experts' syndrome is typical in groundwater-related conflicts since the water practitioners lack consensus regarding some of the fundamentals of groundwater hydrology and sustainability of groundwater use. Thus, Ehrmann and Stinson's (1999: 376-377) assumption that "there are always experts available to provide the answers that support each side's point of view" is more than likely to pertain in cases related to groundwater. Also, inevitably, in the case of groundwater conditions and flow – since the understanding is typically based on limited, commonly indirect information – there is frequently room for multi-interpretations. However, Ehrmann and Stinson continue that this does not make technical expertise less valuable, rather it emphasises the relevance of *how* the information is gathered.

Positional thinking and dispute orientation are likely to result in poor communication which can be considered as one of the constraints of successful negotiations. The parties are not talking to each other, and they are probably trying to convince the possible third party with rhetoric argumentation

and blacken the other side (Fisher et al., 1991). A representative from Tavase Ltd. argues that they attempted to acknowledge, for example, the fears of local inhabitants of Pälkäne:

> I realised that they, older people, really were scared that water erodes the gravel [beneath the houses] and their house collapses, and who will pay then. [We promised that] if the court states that it is caused by Tavase Ltd. and if the company is not solvent, the owner municipalities will compensate (Representative of Tavase Ltd.).

The above demonstrates that groundwater dynamics was not well understood among laymen. However, the representatives of Tavase Ltd. followed the MGA principle, which suggests to "offer contingent commitments to minimise impacts if they do occur; and promise to compensate unintended but knowable effects" (Susskind and Field, 1996). Nevertheless, the promise of Tavase Ltd. did not convince local inhabitants of Pälkäne; instead, it caused a public commotion:

> The opponents started to claim that Tavase Ltd. had already spent all the money and for wrong purposes (Representative of Tavase Ltd.).

Obviously, mutual trust, which is a prerequisite to cooperation, was already lost between the stakeholders. Indeed, another MGA principle emphasises the importance of trustworthiness in carrying out every phase of the project (Susskind and Field, 1996). However, the early phases of planning are the most crucial ones. Prior to establishment of Tavase Ltd.; Pälkäne joined in the meetings of the planning committee. According to the interviewees, they had to participate in order to gain information; however, they did not feel like being an equal party of the planning process (Interview, Official, Municipality of Pälkäne). After taking an unambiguous opposing stand they left the planning committee.

Subsequently, the active opposition by the local inhabitants of Pälkäne spread to neighbouring municipalities as well: while the unifying stand of Pälkäne strengthened, the internal cohesion of the Kangasala and Valkeakoski started to weaken. This led to the disintegration of Tavase Ltd, and resulted in decisions made by two owner municipalities to resign from the company. This policy was strongly criticised by some of the representatives of Tavase Ltd.

> [N]ow that we have municipal elections (…) the new council members feel that the old decisions do not bind them. (…) I think that citizens should be able to trust the decisions that are made (Representative of Tavase Ltd.).

In local communities, as a consequence of new elections, the power balance is always shifting. Thus, in systems based on power and rights, the probability of durable outcomes becomes lower since decisions can be overturned when the power balance changes (Nolon et al., 2013).

In a larger context, inter-municipal cooperation – in particular between a central city and its surrounding municipalities – has faced difficulties in Finland in terms of economic competition, political conflicts, and distrust between the municipalities (Hytönen et al., 2013). On the other hand, a tighter economic situation can create incentives for inter-municipal cooperation, and reduced funding to municipalities from the State has driven municipal mergers, in recent years. According to Jarvis (2014), the urban-rural divide is probably most noteworthy in cases of large-scale water transfer projects. In our case, the tension between rural and urban areas can be seen in the attitude of the opposing coalition:

> The city of Tampere wants to seize the surrounding municipalities. They fear that the surrounding municipalities become more attractive. (…)This is probably related to the municipal reform.[5] (…) the units

[5] During the past years, consolidations of municipalities have caused a national public debate.

> become larger and larger all the time, and the profits go to the urban centre (Local inhabitant, Municipality of Kangasala).

Thus, the contentious groundwater project can be seen as an arena for tension between the municipalities. This illustrates the complex nature of water management problems: they involve unknowable, unpredictable and uncontrollable interaction of natural, societal and political processes (Islam and Susskind, 2013).

The distributive bargaining methods may leave gains on the negotiation table: while negotiating parties are locked into their predefined goals they do not use the potential for creating alternative solutions. Accordingly, our case contains unrealised potential for mutual gains. The workshop held in March 2014 concluded that collaboration in future would require an analysis covering the current situation of the costs, different options, and possible compensation to Pälkäne. The proposed analysis made by an external expert should be approved by each party as the MGA principle of joint fact finding suggests (Nolon et al., 2013). Interests, common and conflicting ones, are now on the negotiating table and they form a common ground to the continuation of the project.

Indeed, a critical component of the consensus-building approach is the role of a neutral third party (Susskind et al., 1999). Since the workshop initiated by this research represents the only third party intervention in our case, it is difficult to profoundly analyse the influence of it. Thus, we can conclude that only first steps have been taken, and the tight overhand knots are still waiting for ways to be opened. Thus it remains to be seen whether groundwater will be a source of conflict or collaboration for the Tampere region in the future.

DISCUSSION

This case-study analyses the conflict around a groundwater project in Finland. The article presents neither a success story, nor failure of a collaborative process; rather, it critically reviews an ongoing contentious project and the potential for collaborative planning. It combines the elements from two branches of conflict research; i.e. conflict assessment and conflict resolution (see Lewicki et al., 1992), in order to understand the concurrent process of conflict dynamics and the attempts for resolution. The main conflicting issues and related interests of each party were defined via conflict assessment, whereas negotiation theory was applied to investigate the interaction between the parties. Both approaches draw from interest-based, collaborative planning, thus bringing the collaborative rationality in the centre of the analysis.

The conflict assessment process clarified the central issues related to the case. Among those issues the parties' interests were identified. Two conflicting interests are of particular relevance: first, protection of natural values and cultural heritage of the esker against the construction of the AGR plant; second, the economic competitive strength of the City of Tampere against that of the surrounding municipalities. These questions reach beyond pure expert knowledge, thus emphasising the tension between technical and political arenas, which is particularly high when concerning the hidden resource of groundwater (Jarvis, 2014). In addition, especially the second pair of conflicting interests indicates that there are other sources of tension between municipalities, thus revealing the context of regional policy dispute in this case. Though Nolon et al. (2013) suggest that long-term decisions should be based on interest-based processes, beyond the current elected officials, we cannot avoid politics influencing the process. Thus, this analysis supports the view of Walker and Hurley (2004) that while examining collaborative efforts, the political context should be analysed at least as carefully as the procedures and institutional requirements for collaboration.

The analysis of the parties' interaction illustrates how a mindset filled with positional thinking and competitive framing and the influence of historical load can together form an insurmountable barrier to successful negotiation. The stakeholder groups adopted a mental model of distributive negotiation,

which refers to a tendency to approach negotiations with a zero-sum mindset (Islam and Susskind, 2013). The goals were defined and positions taken at the early phase of the project. Thus, the interests of the other parties were not genuinely acknowledged or even recognised. Instead of searching for common ground, the parties concentrated on arguing about the facts, while the interests, including the common ones, were hidden under the contentious positions as profoundly as is the groundwater hidden under the surface.

However, the hidden interests were slightly revealed from behind the visible goals, and they were communicated together with the party representatives in the workshop organised in March 2014. In addition, common interests began to unveil: groundwater protection, economic and reliable water supply, and the need for independent and reliable knowledge were highlighted by all parties. Accordingly, an integrative solution could be found by following the principles of the MGA: build on interests (not on positions), encourage joint fact finding, and build mutual trust between the parties. This requires a perspective shift from negative opposition to positive and collaborative problem solving (McDonnel, 1988), and in particular, the willingness and commitment of each party to continue (Islam and Susskind, 2013).

The context of this study is tremendously complex. The hidden resource is tackled inside the framework of water services which operate in two practical fields: natural resources management and urban planning. In addition, water services projects often involve transboundary elements, which may evoke political challenges. Water policy issues typically involve several agencies or jurisdictions; they concern multiple stakeholders with divergent interests, power and resources; and they are characterised by uncertainty and controversial interpretation of technical issues (Carpenter and Kennedy, 1988; Jarvis, 2014). Furthermore, allocation of burdens in a mutually acceptable manner is challenging (Freeman, 2010). Therefore, the use of MGA for negotiation is particularly appropriate in a large-scale regional water project. This article supports the view of Baldwin and Ross (2012): applying consensus-based techniques into the water planning processes can facilitate exploration of hidden interests and values, prepare parties for negotiation and identify common ground, as well as decrease the likelihood of escalated conflicts. Yet, forums for collaborative planning do not work as a panacea for resolution of deeply escalated conflicts (Moote et al., 1997).

Lach et al. (2005) state that management approaches in the water sector have turned towards social interaction-intensive strategies instead of just managing the uncertainty of physical structures and organised routines. However, even though the rational planning paradigm has taken steps towards collaborative planning for more than four decades, distributive bargaining has remained a conventional practice in public-sector disputes (remark by Edelman, 2013; see also Innes and Booher, 2010), as our case study also illustrates.

Accordingly, practical as well as institutional changes are needed to achieve a more consensus-oriented water-planning culture, drawing from an integrative negotiation approach (see also Margerum, 2007; Baldwin and Ross, 2012). Nevertheless, distributive and integrative negotiation approaches are not mutually exclusive (Bartos, 1995), and methods related to rational planning remain part of the collaborative process (Shmueli et al., 2008). Thus, we suggest that rational expertise should be emphasised in order to answer the question of *what* we are processing. Instead, in terms of interaction, we should find better practices as well as institutional arrangements from collaborative approaches to answer the question of *how* we should proceed.

CONCLUSIONS

Analysing the ways in which the inter-municipal water supply cooperation developed to an escalated conflict provides lessons for the application of negotiation theory in conflict assessment and resolution. In addition, the paper contributes to the fields of urban planning and NRM, which are generally studied separately. Based on this case study we outline four conclusions.

First, the emphasis on interests is essential in conflict assessment as well as in resolution processes. Disputes over facts or blind orientation towards predefined goals may hide common interests of both parties, as was evident in our case. Even if common interests could not be found, clarifying the negotiation table in terms of interests may facilitate to build mutual trust and to find joint solutions to the problems. Although joint solutions were not yet found in our case, the case illustrates how even a single third-party intervention can help in revealing the potential for consensus building.

However, our second conclusion is that in an already escalated conflict, a historical load may hinder the search for mutual trust and joint gains. As illustrated in our case, most of the opponents strongly emphasised the statements provided by the project planners several years, even two decades, ago. Together with positional thinking and competitive framing a historical load may form an insurmountable barrier to successful negotiation. Thus, the third conclusion is that an analysis of the larger, both historical and political, context of the conflict is essential to conflict assessment as well as for conflict resolution. In our case, the contextual framework was analysed throughout the project, and this helped us in conducting interviews, organising the workshop and in communicating with each party during the workshop.

Our fourth conclusion is that complex environments, such as the water sector, call for anticipatory work, comprising analyses of interests of each party, with intention to avoid conflict. Referring to our second conclusion, it is evident that the more prolonged a conflict becomes the more difficult it is to solve. Thus, the emphasis should be removed from conflict resolution to an anticipatory work. Accordingly, one recommendation to future conflict research would be to concentrate on those mechanisms that facilitate in recognising emergent contradictions before actual conflict will occur.

This article calls for applying negotiation theory and lessons from practice to enhance conflict assessment and resolution. It proposes that lessons from integrative negotiation should be applied at all institutional levels in order to enhance the interaction between individuals as well as between organisations; however, it should not be forgotten that rational features are a vital part of the ensemble.

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