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Integration of water and wastewater utilities

USING EXAMPLES FROM FINLAND AND SWEDEN, THIS ARTICLE HIGHLIGHTS THE POTENTIAL ADVANTAGES OF INTEGRATING URBAN WATER AND SEWAGE UTILITIES BUT NOTES THAT THE PREPARATION FOR SUCH MERGERS AND THE DEVELOPMENT OF JOINT MANAGEMENT CULTURES AFTER THEY OCCUR TAKE TIME.

Integrated Water Resources Management (IWRM) is an idea for international water management and policy that has been strongly advocated for the past decade. Global Water Partnership (2000) defined IWRM as “a process which promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.” However, the concept isn’t new. Grigg (2008) dates the beginning of IWRM to as early as 1917, when the US Flood Control Act called for “a comprehensive study of the watershed.” According to Biswas (2004), the concept of IWRM has been around for as long as 60 years, and it was rediscovered in the 1990s. In the 1970s Finland, Sweden, the United States, and other western countries introduced so-called multipurpose water use and comprehensive water resource planning that were based on many similar ideas.

Although the concepts comprising IWRM are familiar, the idea as a whole has not been fully embraced. This may in part be caused by the abstract language and nature of IWRM as well as its similarities to concepts such as total water management (TWM). Biswas (2004) noted that there were as many as 35 different ways to interpret IWRM. Grigg (2008) observed that “. . . while *integrated* emphasizes blending together, *total* sweeps in the concept of

comprehensive as well as integrated.” He further argues that “. . . unless we use precise terms, each group goes back to the drawing board to create another definition,” and therefore there is confusion among IWRM and related concepts.

Saravanan (2006) called attention to the important combination of formal and informal mechanisms of IWRM. A comparative study on the evolution of water and sewage services in 29 cities of 13 European countries demonstrated the variety of administrative and legal traditions. One of the key findings was that merging water and sewage utilities is uncommon in Europe. Of the 13 European countries studied, IWRM is only practiced in Finland and Sweden. Today there is renewed interest in understanding how the integration of service is actually implemented (Juuti & Katko, 2005).

MAKING THE CASE FOR INTEGRATION

This article highlights one aspect of IWRM—the integration of urban water and sewage utilities—that has received little attention. A comprehensive overview is given of the issues that need to be considered in a potential merger of these two services by (1) exploring some of the definitions and interpretations of IWRM in the literature, (2) describing how the idea of IWRM was introduced to Finland in the 1970s in the form of comprehensive and multipurpose planning and use of water resources, (3) describing how the idea of integration was incorporated into the management philosophy of community water supply and sanitation services in the 1950s and then in the 1970s was promoted through legislation, and (4) exploring a case study based on the experiences of 14 experts who were involved in the integration of one Finnish city’s water and wastewater utilities. It is on the basis of this case study that the authors make some general conclusions (Flyvbjerg, 2004).

A schematic of the integration of water supply and sewage systems is shown in Figure 1. The authors have not included stormwater management in this study, although it also is a rising issue in Finland. Finally, the article discusses some of the experiences and drawbacks related to such integration of water and sewage utilities in Finland and other countries.

INTEGRATION OF WATER AND WASTEWATER UTILITIES IN FINLAND

Viewed internationally, Finnish water and sewage utilities are small, a reflection of the country’s population of 5.3 million (The World Bank, 2010). About 90% of Finland’s population is served by public water supply, and nearly 80% is served by

result, later that year a book on water supply and sanitation was published—the first of its kind. Since its publication, the single Finnish word “vesihuolto” has referred to both community water supply and sanitation. The shift in thinking that this word represents was likely a precursor to later mergers (Mussalo, 1989). In contrast, most other languages use at least two terms to describe water and sanitation services, e.g., “vatten och avloppsvatten” in Swedish, “Wasser und Abwasser” in German, and “servicios de agua y saneamiento comunitarios” in Spanish.

In Finland, the concept of modern community water supply caught hold after World War II, particularly in the 1960s, whereas the concepts associated with modern water pollution control and wastewater treatment

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public sewage systems. Public water service in the country’s sparsely populated areas is rather limited compared with many other European countries because of long distances and the abundance of water. However, the number of people receiving public water services has continuously increased, with nearly 100% of the people in densely populated areas receiving services (Hukka & Seppälä, 2004).

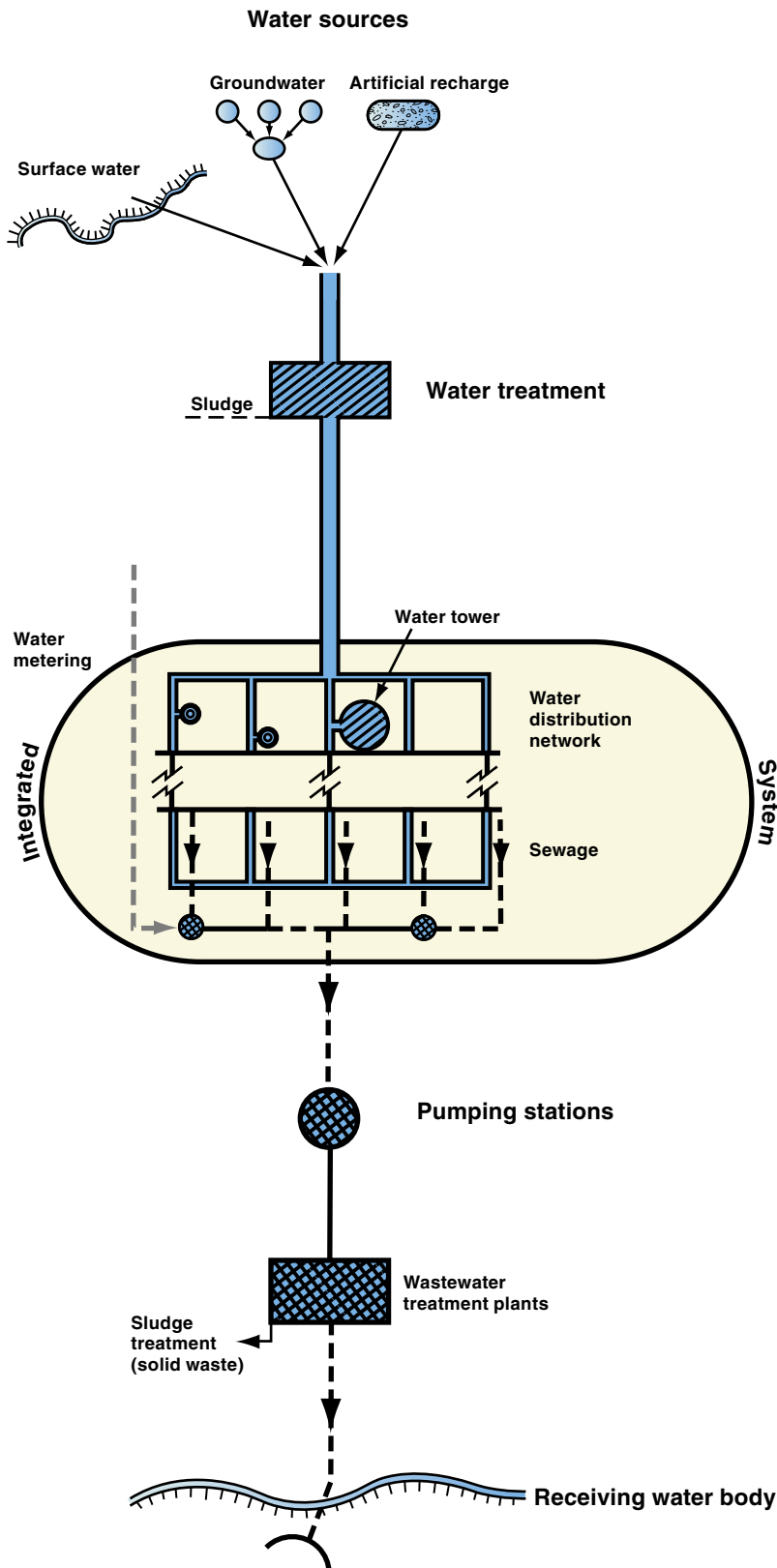
Early signs of institutional framework development to come. One early sign of the trend toward merging water and wastewater utilities dates back to 1953. That year, the Union of Finnish Cities requested comments on a proposal regarding a special sewage handbook. The Association of Soil and Water Construction Engineers (now the Association of Finnish Civil Engineers) suggested that the handbook also contain information about water utilities. As a

expanded most rapidly in the 1970s. In Finland, several administrative and legislative reforms promoted these activities and paved the way for later integration of water supply and sewage utilities in urban centers.

In the 1960s, Finland’s National Board of Roads and Waterways was assigned the task of planning a regional water supply system for the Helsinki metropolitan area and for the Turku Region on Finland’s southwestern coast. At about the same time, Finland’s National Board of Agriculture began preparing regional master plans for water supply and water pollution control in various parts of the country (Katko, 1996; Erävuori, 1976).

The Finnish Water Administration and the National Board of Waters were established in 1970. Their key duties were promoting the use of, protection of, and research about water resources. Emphasis was placed

FIGURE 1 Schematic of integrated water supply and sewage systems



on comprehensive planning that takes into account the multiple uses of water resources, water pollution control, water supply and sanitation, recreational use of watersheds, the use of hydropower, and flood control (Vesihallinto, 1980). Water supply and sanitation were among the top priorities, as detailed in the comprehensive water resources development master plans put forth by the Finnish administration (Peltokangas, 1996).

For the purpose of comprehensive water planning, the country was divided into 19 areas that corresponded largely with catchment areas, as opposed to water districts that primarily follow administrative boundaries. Regional master plans had previously been prepared for water supply and sanitation, particularly in Ostrobothnia on the western coast where the need for such plans was considered high. Similar master plans were later prepared by consulting companies that were supervised by water and environmental authorities (Katko, 1996). Thus, sectoral master plans were prepared for the most important use—water supply—concurrently with comprehensive water resources development.

Water resources master plans have also served as guides for government support of water supply and sanitation. Individual municipalities were previously quite reluctant to accept these plans, but because of financial trouble that occurred in the 1980s and 1990s, they became more interested in such regional efforts (Katko, 1996).

Water pollution control policies have traditionally been based on long-term strategies. In 1974 the first water protection program—a national strategy plan for the coming decade—was completed. It was revised in 1985 and again in 1995. These programs identified targets, measures, and instruments. The last one covered the period up to 2005. It also set certain targets for water pollution control by the forest industries as well as all other major polluters (MOE, 1989, 1998).

In 2006 the government adopted a new set of national water protection policy outlines that defined the measures needed to improve water quality. These outlines are in effect until 2015 (Finnish Government, 2006) and define the needs and objectives aimed at

- reducing the nutrient loads that cause eutrophication,
- reducing the risks caused by hazardous substances,
- protecting groundwater,
- protecting aquatic biodiversity, and
- restoring ecologically damaged water bodies.

In 1995 Finland became a member of the European Union, and thus the European Union Water Framework Directive, enacted in 2000, set additional guidelines for future water management policy. Related to this, in 2004 Finland adopted an to the organize river basin management planning. The objective of river basin management plans is to improve the quality of surface water and groundwater by the end of 2015. The first river basin management plans were completed earlier this year.

The integration of water and sewage utilities is to be viewed in the context of the wider institutional framework previously described. It covers regional master plans for water resources use, master plans for water supply and sanitation, and water protection programs.

A look at integration-related legislation. The Water Rights Act of 1902 emphasized economic water use and, in particular, promoted hydro-power construction. Although the act contained some prohibitions against damming, diverting, and polluting of water courses, water pollution control remained voluntary (Hallberg, 2002).

A few cities started wastewater treatment as early as 1910, but the real boom in modern wastewater treatment facility construction occurred in the 1960s and 1970s. This intensification of construction activity was the result of the water

act that went into effect in 1962. It was the first law that introduced discharge permits and had the authority to require communities and industries to begin modern wastewater treatment. Separate sewers began to be introduced at this time, gradually making it technically feasible to treat wastewater.

Two major acts have been of particular importance with regard to the integration of water supply and sewage works. The Wastewater Surcharge Act (WSA) of 1974 more than doubled water rates and replaced earlier systems funded by municipal taxes. This started the debate about which type of utility should operate sewage services (Korhonen, 2010). The WSA and the energy crisis that arrived a short time earlier affected water companies, technology developers, and consumers, led to a decrease in the use of water per capita and in communities, and resulted in more sustainable water use.

The 1977 Act on Public Water and Sewerage Systems in Finland stated that “a Public Water and Waste Water Works is one owned by a municipality or a federation of municipalities accepted by a municipality as such, which has been assigned the task of taking care of a community’s water supply and sewerage.” This act promoted the integration of water supply and sewage services because they were considered to be naturally linked through the hydrologic cycle. Stormwater was already considered the responsibility of the sewage works, although the appropriateness of this and the ways in which related costs are covered have been debated ever since. Water use and wastewater production can be metered, but stormwater cannot (Korhonen, 2010). The WSA of 2007 currently under revision is expected to recognize stormwater as the responsibility of municipalities, which could buy related services, for example, from integrated water and wastewater utilities. It is hoped that such an arrangement would also solve the problem of how to pay for stormwater management.

Mergers of water and wastewater utilities 1970–2009. Table 1 summarizes the mergers of Finland’s 20 largest water and wastewater utilities and their related institutional arrangements. Sixteen of them (80%) were citywide water and wastewater utilities, two were regional water and wastewater companies providing both services in their area, and the remaining two had other separate arrangements.

In some cases, as in Jyväskylä, two wholesale systems operated in slightly different areas. In Lahti, again, the citywide water and wastewater utility was divided into two municipally owned companies. The motivation in the latter case was to lower or avoid taxes paid by utilities. The energy company in Jyväskylä resorted to “creative accounting” by buying the water utility, not primarily to develop water services, but rather to lower its own taxes (Vinnari & Näsi, 2008).

The numerous mergers of municipalities in Finland in the early 2000s often resulted in only one integrated utility providing water supply and sewage services for the new entity. The three biggest utilities in the Helsinki metropolitan area were merged into a regional environmental services authority for water, sewage, and solid wastes at the beginning of 2010. Although changes occur continuously in organizational arrangements and the trend toward larger systems is not stable, the principle of merged water and wastewater services is largely adhered to in water sales and service distribution.

In the latter part of 1999 through the beginning of 2001, the names of municipal water and sewage utilities were shortened in many cases. From the practical and promotional points of view, this was justified. However, there is the risk that citizens will not understand the integrated nature of water and wastewater, as was the case previously when the combined term “vesihuolto”—meaning both of these services—or the term “water and wastewater works” was used.

The Pori merger experience. In 1987 the water and sewage utilities of Pori, a city on the western coast of Finland, were merged. The two entities had operated under the governance of two boards. Starting in 1987, the integrated water and wastewater utilities operated under the Board of Construction and Real Estate. In 1998, the utility was turned into an autonomous municipal utility. In 2009, 14 of the utility's staff members were interviewed about the effects of the merger and their related experiences. Their stories are presented in the following sections (Juuti et al, 2010). Although the annual utility reports mention the merger in 1987, there is no discussion of the integration process in subsequent years.

Before the merger, working groups for planning, construction,

networks, treatment plants, customer service, technical support service, and administration and management were established for planning the integration and related actions (Soukki, 2010). The groups were divided further into teams to look into more specific issues, e.g., the teams of the customer service group studied issues related to supervision, home connections and metering, and customer agreements (Hedberg, 2010).

The first water/wastewater integration proposal had actually been presented in 1974. It took 12 years to finally implement the merger after four failed attempts with slightly different setups (Soukki, 2010). When the new director of the water utility was hired in August 1984, the merger became one of his major responsibilities. Because he had not

previously been employed by either the water or sewer utilities, he was able to operate quite independently.

The water utility strongly opposed becoming merged under the Board of Construction and Real Estate, and the staff did not want to be merged with the wastewater staff—something they regarded as a demotion. After the merger, the work climate at first deteriorated because it was commonly felt that the integration had been forced. A clear conflict between the working cultures existed: the water utility staff was unwilling to work with the sewage utility staff. Those who considered themselves water utility experts claimed that they would have nothing to do with sewers. The water utility employees had adjusted to the idea that costs were paid for by consumer fees, but the older practice of funding sewers

TABLE 1 Mergers of water and wastewater utilities in Finland's 20 largest cities according to population from 1970 to 1993

Utility*	Year of Merger	Notes
Helsinki Water †	1984	Joint regional authority established in 2010 in Helsinki, Espoo, and Vantaa
Espoo Water†	1974	
Vantaa Water†	M	Established in 1957
Tampere Water†	1981	
Turku Water Works	1989	Wholesale company for raw water; regional wholesale company for WWT since 2002
Oulu Water†	1993	
Jyväskylä	N	Water under energy since 2006; wholesale company for WWT since 1971
Lahti Aqua Oy	1970	Divided into two companies in 2007
Kuopio Water†	M	A modified merger in the 1980s, though separate annual reports are produced
Kouvola Water†	1978	Expanded, merger of municipalities in 2009
Pori Water†	1987	
Joensuu Water†	M	Established in 1927
Lappeenranta Water Ltd.	1974	Limited since 2007
Hämeenlinna Regional Water and Sewage Company	1992	Regional company as of 2001; merged with utilities of six neighboring municipalities
Arctic Water†, Rovaniemi	1974	
Vaasa Water†	1975	*
Seinäjoki Water†	M	*
Kymi Water Ltd.	2007	Regional water and sewage company serving three municipalities since 2007
Kotka Water and Sewage Dept.	1977	
Mikkeli Water Works‡	1976	*
Porvoo Water†	1975	

M—merged to some extent in 1970, N—not merged, WWT—wastewater treatment

*Names as of 2009

†Name shortened to [name of city] followed by "Water" in approximately 2000, although also treats wastewater

‡Also treats wastewater

with taxes, which had been in place before the 1974 Wastewater Charge Act, was also still in use. Various opinions were expressed about the amount of time that would be needed to integrate these two work cultures—in reality, it took a decade.

On the positive side, it was noted that assistance from the sewage utility was available to the water utility when needed. After the merger, pipe laying and other related activities were planned and implemented jointly. Operations became more logical and efficient and often two pipe layers could do the work of four. In many respects, the integration was one of the biggest changes in water services management in Pori—although the change was resisted, advantages were realized and accepted over time.

Other findings from Finland. According to Korhonen (2010), the following economic advantages in particular can be reached by merging water supply and sewage services:

- at least part of the staff can work for both services, and
- cost savings from laying water and wastewater pipe in the same trench—as done in Finland—can easily be allocated according to actual expenses.

A recent study on the options for and experiences with managing intermunicipal water supply and sewage systems in Finland (Pietilä & Katko, 2010) implies that the raw water sources and natural and artificial groundwater intake areas are often geographically distant from larger wastewater collection and treatment points. This favors the principle of flexibility and need to take into account local conditions, including various options for wholesale arrangements, if needed.

Korhonen (2010) refers to the oldest wholesale company for regional water supply that was established in the Kalajoki River Valley in 1968 (Hannula, 2008). Since 2008, the company has also provided wholesale wastewater treatment—thus it is an integrated wholesale company.

According to Korhonen, in the case of the 110-km long Kalajoki valley it would not be wise to merge all the municipal water distribution and sewage utilities into a large, comprehensive regional company, but local offices would be needed for on-call services.

In Finland's capital, Helsinki, water and wastewater utilities were merged in 1984. According to

ing to the public works department, was that both utilities could lay pipes in the same excavation. Besides, in areas that had combined sewer systems, the sewers were an integral part of street construction (Herranen, 2002).

Findings from several case studies indicate that staff members of water supply utilities often looked down

A few cities started wastewater treatment as early as 1910, but the real boom in modern wastewater treatment facility construction occurred in the 1960s and 1970s.

Tiainen (2009), before the merger the water utility employed 450 people and the sewage works employed 270. The merger resulted in a reassessment of the activities of the new utility. For example, the water utility had its own engineering works, employing 30 people who manufactured equipment such as water hydrants, which at the time could have been purchased externally for less. This practice was unique in Finland. The old utility also had an office that employed more than 30 people who built water connections for other city-owned utilities, hospitals, and homes for the elderly. This activity, commonly practiced by many urban utilities, ended in 1988 in Helsinki. By 1995 the staff of the merged utility had fallen to fewer than 400 employees (Herranen, 2002) and by 2008 it was closer to 300 (Helsinki Water, 2008).

In the case of Helsinki, the merger of the water and sewage utilities was initiated in 1975 when the city technical works committee proposed studying it. At that time the water utility was in favor of integration because it considered the chain of operations comprising both services to be both a technical and economic entity. But the public works department, which was in charge of sewage, held the opposite view. The only advantage from integration, accord-

on staff members of sewage utilities—they were considered to be involved in something dirty and less valuable. However, among members of the general public attitudes seem to be changing. Because of public relations activities, people have recently started showing interest in understanding how their wastewater is treated and managed.

THE IWRM EXPERIENCE IN OTHER COUNTRIES

According to Persson (2010), the Swedish Public Water and Wastewater Plant Act of 1970 determined the responsibilities of the water and sanitation supplier and customer, but it did not specifically side with larger supply systems. The Danish Water and Waste Water Association has 152 utility companies as members. Of these, 43 (29%) provide water and wastewater services, 63 (41%) provide water only, and 46 (30%) provide only wastewater services. According to Fischer (2010), it is likely that some mergers of water and wastewater services will take place in five to 10 years. To a degree this has already begun. In connection with Denmark's latest reform there has been a consolidation of the sector, corresponding with a reduction of municipalities from 270 to 98.

In the mid-1800s most western nations began developing urban



In Finland it is common practice to lay pipes for water and wastewater utility services in the same trench, which reduces the disruption to the public as well as costs in terms of excavation and labor.

water and sewage services based on private concessions or operators, but fairly soon the operations were taken over by municipalities. Only in France have private operators survived and expanded considerably. This is largely because France has so many municipalities—36,000 in 2000. It is difficult to imagine so many municipally owned utilities all managing their own water services (Juuti et al, 2005).

With regard to municipal hierarchy, some interesting traditions exist in Europe. For example, the

“Stadtwerke” in Germany operates both water and gas, but not sewage systems. A special feature of the Dutch water sector is the water boards—independent decentralized governmental entities with elected members. These boards oversee wastewater treatment, whereas water supply and sewage are typically separate utilities or bodies under municipalities (Pietilä, 2006).

Merged water and wastewater utilities certainly also exist in other countries, but it is difficult to find reliable statistics about them.

Because water and sanitation services are typically managed at the local level, the role of local governments and legal and administrative traditions largely determine how these services are managed in each country (Juuti & Katko, 2005).

In 1996 AWWA surveyed 898 US utilities serving from 2,000 to 5 million people. Of the 881 utilities that responded, 351 (40%) had merged their wastewater treatment and water supply. In a subsequent survey of distribution systems, AWWA (2003) received data from 339 utilities serving from 3,000 to 4 million people; of these, 151 (45%) also provided wastewater treatment. It appears that the number of utilities providing both water supply and sewage service is increasing. Additional studies are needed to verify this speculation.

A case study by Isbell and Lee (2006) examined the integration of water supply and sewage utilities in Charlotte, N.C., in 2005. The approach taken by the utilities was to focus on managing individual strengths and placing the right people in the right roles. A pilot program indicated that costs could be reduced by

- creating crews of mixed skills,
- consolidating headquarters,
- cross-training drinking water and wastewater personnel,
- increasing the responsibilities of team leaders,
- sizing crews properly, and
- enhancing communication.

Isbell and Lee concluded that integration is an ongoing process and the management challenge is to determine individuals’ unique talents and then bring them together.

In countries with developing economies (e.g., Accra in Ghana), it is not uncommon that international financial bodies have promoted the idea of private operators developing water supply services, whereas sewage and wastewater treatment are provided by other organizations. Before the water sector reform during 1993–94, the water supply and sanitation services were inte-

grated under one national entity, the Ghana Water and Sewerage Corporation, and served approximately 370,000 water connections and 6–8 million people in the country's 10 political regions. Although water supply remained centralized, the responsibility for sanitation and wastewater management was decentralized (Suleiman & Cars, 2010). With this organizational model, there is the risk that the lack of integration will make it difficult to implement effective water pollution controls and ensure that the system is financially sound—an acute challenge for many developing and transitioning economies.

Moriarty and colleagues (2010) suggest that in Middle Eastern countries instead of the typical top-down IWRM structure, these countries should instead apply so-called light IWRM; in other words, focus on delivering water-based services to people. However, according to Moriarty et al, a major limitation of this approach is the lack of appropriately decentralized finance. Local authorities typically rely on financing from the national government, which is often earmarked and over which they usually have little control.

WHAT EXPERIENCE CAN TEACH US

When considering integration of water supply and sewage utilities in the context of Finland, it is important to recognize the four major system types. At the lowest level, there are onsite water and sanitation systems. These typically serve one or a few households and are not connected to networks. The next level is small rural systems that serve villages or a slightly larger area. These systems are commonly managed by cooperatives and increasingly are becoming involved with sewage services. The third level of systems is those serving townships and cities and surrounding population centers that form a single municipality. Fourth, there are a variety of intermunicipal sys-

tems, most of which operate on a wholesale basis both in water supply and sewage service. Integration of water supply and sewage utilities in Finland occurs mainly on the third level. However, the small water cooperatives of rural areas are also increasingly expanding to include sewage services because of the decree that requires adequate water pollution control in the case of permanent and secondary housing in rural areas by 2014. Some water cooperatives are also likely to merge with larger

nization seems to have several advantages, at least for larger urban areas and retail activities.

(2) In a wider regional and intermunicipal context, merging is probably more complicated and less feasible.

(3) In the case of small systems, more mergers between piped water and wastewater services and with bigger systems can be expected.

(4) Preparation of mergers as well as the development of joint management cultures after integra-

Merging water and wastewater utilities under one utility or organization seems to have several advantages, at least for larger urban areas and retail activities.

municipal or other types of systems. The overall structure is close to that of Sweden except that their municipally owned systems are responsible for smaller systems.

As for the Pori case, through extensive interviews Sandelin (2006) found that although the two utilities had merged in 1987, almost two decades later several cultures still prevailed within the utility because of geographical distance. This is another possible drawback when considering the ever-expanding size of water and sewage utilities that is now somewhat indiscriminately promoted by authorities in Finland.

In one recent case, there was strong opposition to merging the on-call duties of water and wastewater system operators. It is true that any possible contamination risks must be considered carefully. However, as Rontu (2010) points out, it is probably more a question of performing the duties in the right order; water supply should get preference.

The following conclusions were drawn concerning the merging of water and wastewater utilities in Finland.

(1) Merging water and wastewater utilities under one utility or orga-

nization will take time, easily a decade in each case.

Yet, integration of water supply and sewage services is logical based on the experiences of Finland and several other countries. From the perspective of people—the primary users of water—ensuring adequate cooperation between water and sewage utilities could be the first natural step toward more integrated water resources management. More studies on the experiences of integration of water supply and sewage services, including their advantages and limitations in various conditions, would be useful in moving the field forward.

ACKNOWLEDGMENT

The authors thank Jorma Tiainen for assistance with language, Neil S. Grigg for his advice, as well as Kaj W. Hedberg and Ilkka Mikkola for additional assistance. Additionally, the comments by the editor and the three peer reviewers are highly appreciated. The views of the 14 experts from Pori, Finland, are also greatly appreciated, and the financial support from Pori Water and Academy of Finland (decision number 135843) is gratefully acknowledged.

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