

An international comparison of the institutional governance of water utility asset management and its implications for Finland

E. M. Vinnari^a and J. J. Hukka^b

^a*Corresponding author. Dept. of Accounting and Finance, Turku School of Economics, Rehtorinpellonkatu 3, Turku, FI-20500, Finland. Tel: + 358400743973. E-mail: eija.vinnari@tse.fi*

^b*Tampere University of Technology, Salhojankatu 3 A 6, Tampere, FI-33500, Finland*

Abstract

Concerns over the condition of water and sewerage networks and their facilities are especially topical as several countries, including Finland, are approaching a stage where their aging and deteriorating pipelines will demand extensive repair, renewal and replacement. Solving the problems related to the construction and, in particular, the maintenance of water service infrastructures requires the methods of long-term planning and strategic decision-making, which are often referred to as water utility asset management. Since maintaining the operational capacity of water service systems has a crucial role in preventing hazards to human health and to the environment, the policy-level consideration of issues related to asset management planning seems well justified. A review of the institutional governance of asset management and investment planning in countries that are facing similar challenges provides several replicable principles for the water sector in Finland. A combination of legal requirements and professionally established norms could be expected to set an appropriate balance between securing adequate service levels and allowing utilities to decide autonomously on additional improvements.

Keywords: Asset management; Long-term planning; Policy; Regulation; Water utility

1. Introduction

The 1980s saw the inception of New Public Management (NPM) principles, which sought, through the application of market-oriented principles and practices, to enhance the cost efficiency of public sector operations, including water supply and sewerage services. The movement was initiated in Great Britain, but soon spread especially to the United States, Australasia and the Pacific Rim (McLaughlin & Osborne, 2001). In addition to those countries, institutional or public management reforms affecting the water sector have also been implemented elsewhere in Europe (e.g. Schedler, 2003; Groot & Budding, 2004; Danesi *et al.*, 2007) as well as in several countries in Latin America (Hall & Lobina, 2002; Hearnea & Donoso, 2005) and Africa (Hall *et al.*, 2002; Seppälä, 2002; Backeberg, 2005; Doukkali,

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2005). Eventually, the movement towards commercializing public sector services spread to Finland, where business management and accounting principles were imposed upon public service industries such as energy and water services production. The water and wastewater works, which were previously organized as municipal departments, were transformed into municipality-owned companies, enterprises or other separate accounting entities, with the requirements of financial autonomy from the owner municipality and full cost recovery through customer charges.

On a global scale, NPM has also increased business-like management of water services infrastructure assets. The adoption of business accounting principles in the public sector has conveyed the need to include in financial statements the value and the costs of using public infrastructure assets, including those used for water services delivery. In addition, the increased focus on cost recovery and production efficiency has extended to future costs, including the large cash outflows caused by repairing, renewing and replacing the aging, deteriorating water infrastructures. These influences can be discerned especially in the reformed public sector and/or water sector policies of England and Wales, the United States, New Zealand, and Australia—the countries that were the most thorough in embracing NPM. Each of these countries has implemented legislation that requires public sector organizations to adopt business accounting as well as to adhere to prudent, long-term investment planning and/or other asset management practices.

In Finland, it was generally recognized already some years ago that the bulk of the water infrastructure was approaching the end of its technical lifespan and would need to be replaced or renewed fairly soon. Despite this realization, no corresponding straightforward stipulations were included in the new water services legislation that was introduced in connection with NPM reforms in the latter half of the 1990s. This omission and other instances of loose economic regulation in the Finnish water sector have been justified by the public ownership of the infrastructure assets. Yet, the current state of the water infrastructure, combined with the increasing market orientation of service provision as well as indications of municipal asset stripping and hidden taxation through water services charges (Vinnari, 2006a; Vinnari & Näsi, 2008), has raised concerns about the appropriateness of the current regulatory system and especially the need to address issues related to capital asset maintenance and renewal.

The aim of this paper is to compare and evaluate the institutional governance and regulation of water utility asset management and investment planning practices in the countries listed above. Although the assessment will be conducted from the point of view of applicability to Finland, the results will also be of benefit to other countries, both developed and developing, that are considering similar issues. The paper therefore contributes to and complements the existing body of knowledge on the institutional governance and regulation of water utilities, with specific emphasis on the management of infrastructure assets. The structure of the paper is as follows: The second section reviews contemporary literature on water utility asset management and its regulation; the third section describes the current state of the water sector in Finland; the fourth section presents an overview of the existing institutional frameworks in the selected countries, while the fifth section estimates the suitability of the options for Finland and other countries in similar circumstances; the final chapter presents the conclusions of the authors.

2. Water utility asset management

Like other infrastructure services, water supply and wastewater treatment is extremely capital-intensive: fixed costs are generally perceived to account for 80% of the total costs of a water supply and/or a wastewater utility. The construction of networks and treatment plants requires a large one-time

investment, while maintaining the operability of the system demands constant repair, renewal and replacement. Attaining and maintaining appropriate investment levels is challenging because of the inherent characteristics of water utility assets: long asset life, the laboriousness of the condition assessment of the physical infrastructure, especially in the case of underground locations, differences between book value and fair value, and the difficulty of assessing the costs of deferred investments (Westerhoff *et al.*, 2005). Yet, failing to maintain the good condition of a water utility's infrastructure can result in serious hazards for both human health and the environment. Research suggests that a substantial proportion of waterborne disease outbreaks, both microbial and chemical, are attributable to problems within distribution systems (National Research Council, 2006). Functioning water services infrastructure is also crucial to economic development and maintaining social stability.

Concerns over the soundness of water services networks and facilities are especially topical as several countries are approaching a stage where their aging and deteriorating pipelines will demand extensive repair, renewal and replacement. In the United States, for example, estimates of the capital system investments needed in the following two to three decades range from \$276.8 billion (10^9) to \$1 trillion (10^{12}) (WIN, 2000; AWWA, 2001; EPA, 2005). Such massive renewal needs often coincide with a backlog of investments and other pressures on the utilities' limited funds. Considerable financial input is also required because of tighter environmental and/or quality regulations requiring advanced technology; customer demands for a higher level of service, and security and vulnerability considerations. At the same time, utilities are being pressured to reduce long-term costs, and in certain areas they may also be losing revenue due to population decline or diminished government support. (InfraGuide, 2005; Rogers & Louis, 2005; Gleick, 2006).

In developing countries, the major complication related to the water service infrastructure is insufficient investment in the construction of new networks aimed at extending service coverage. Estimates of the investment needed to achieve the Millennium Development Goals range from \$51 to \$102 billion (10^9) for water, and from \$24 to \$42 billion (10^9) for sanitation (Hall & Lobina, 2006). Yet, although there is pressure to create new services for the growing populations, the policy must be "get more from what you have already" (UN-Habitat, 2004). This implies shifting more resources to the renewal and maintenance of existing water services systems to ensure that its infrastructure continues to support the productivity of developing economies, as well as the environment and health (Hukka & Seppälä, 2007). The main challenge in these cases is the renewing of systems that have already deteriorated due to long-lasting conflicts or a lack of funds (World Bank, 2000). In India, for example, the water infrastructure is disintegrating due to past neglect and the lack of funds for repairs and maintenance, and much of what is currently called 'investment' in water supply is a belated attempt to renew and repair the crumbling infrastructure (Briscoe & Malik, 2006).

Solving the problems related to the construction and especially maintenance of a water service infrastructure requires not only technological solutions and related capacity building but also methods of long-term planning and strategic decision-making that can be referred to as water utility asset management. The definitions given for the term are numerous and depend on the approach assumed. From an operations point of view, the aim of asset management is to maximize asset life, while the engineering viewpoint emphasizes the development of a comprehensive evaluation and life-cycle strategy across the physical assets (Sklar, 2005). From a business point of view, water utility asset management can be described as managing the total cost of owning and operating infrastructure assets while delivering the service levels customers desire (AMSA, 2001). Finally, a financial research focus sees asset management as a way of ensuring an adequate funding base for the operations, maintenance,

and renewal of a water utility's assets (Grigg, 2003). A definition that captures these four facets is given by Paralez & Muto (2002, p. 16): “a philosophy of business that is reflected in a strategy of operating, maintaining, refurbishing and replacing infrastructure and system assets based on customer service standards (such as pressures, quality, reliability, response) and economic standards (such as life cycle costing, debt servicing) and capital management”.

The application of water utility asset management has been credited with delivering various benefits (GAO, 2002; Matichich & Schwarzwald, 2002; Grigg, 2003; Westerhoff *et al.*, 2005). It is claimed that comprehensive asset management allows utility managers to obtain better information on the age and condition of existing assets, determine the level of maintenance needed to optimize asset performance and its useful life, assess the risks associated with the failure of various assets, set priorities for their maintenance and replacement, and understand the trade-offs and implications of management decisions about the assets. Informed decision-making in turn decreases the probability of catastrophic system failures, major budget surprises and claims from system non-performance, thus reducing the long-term costs of operations. Being able to provide exact data on the assets also facilitates responding to customers' value-for-money demands and providing justification for infrastructure improvements and resulting rate increases. Especially in transition and developing economies, well-managed infrastructure also provides improved opportunities for economic development.

Research on water utility asset management has concentrated mainly on utility-level decision-making, and consequently several tools have been developed for data gathering, infrastructure condition assessment, network performance modelling, and investment prioritization (see e.g. Saegrov *et al.*, 1999; Dandy & Engelhardt, 2001; Scarf & Martin, 2001; Deb, 2002; Wood *et al.*, 2007). More general frameworks, such as those for implementing a comprehensive utility asset management system, have also been devised (e.g. Mays, 2002; Ashley *et al.*, 2004; Grigg, 2005; Matichich *et al.*, 2006). Nevertheless, related policy-level issues have merited very little discussion, and the few who have broached the subject seem somewhat divided in their views. It has, for example, been recommended that the regulation of capital investment should focus on outputs such as service levels instead of inputs such as capital expenditures (Burns & Riechmann, 2004). Some feel that policy should put less emphasis on investment strategies than on defining and implementing regulatory approaches (Von Hirschhausen *et al.*, 2004), while others recommend that instead of focusing only on prescriptive expenditure regulation and efficiency comparisons, the regulator should encourage water companies to draft robust and realistic business plans (Ballance, 2006). Those against formal regulation argue that national directives that are too specific have the potential to overshoot or over-simplify the asset management process, and recommend instead the “professionally established norms” of a non-governmental professionally centred entity (Allbee, 2005). This paper will contribute to the discussion by reviewing existing options for regulating water utility asset management and investment planning and evaluating their suitability for responding to the challenges presented by the water sector in Finland.

3. The current state of the water sector in Finland

3.1. Institutional governance and regulation

Finland is a Nordic country with 5.3 million inhabitants, of whom 65% live in towns or urban areas and 35% in rural areas. The average population density is 16 persons/km² but the population is very

unevenly distributed with the majority living in the southern parts of the country. As concerns state structure, Finland is a Unitarian, decentralized state where the independence of local governments (municipalities) from central government is guaranteed by the constitution. Legislation is formulated and approved on the central government level but the local governments' opinions on legislative matters are taken into account by consulting their interest organization, the Association of Finnish Local and Regional Authorities, and the Minister of Interior Affairs.

The water sector in Finland is governed at its highest level by European Union legislation, and these stipulations are embedded in national legislation. The key Acts and Decrees affecting the water sector can be divided into the following categories: water and wastewater services, human health protection, environmental protection and land use, consumer protection, and others (Table 1).

The public sector management reform in Finland was initiated with the implementation of the Local Government Act of 1995 and the reference in this act to the application of the Accounting Act of 1973, reformed in 1997. Taken together, these two Acts denoted that the public sector adopted accrual accounting methods, which had up to then only been used in business companies while national and local government(s) had used a more cash flow based method. Some years later, the reform proceeded with the reorganization of municipality-owned natural monopoly industries—electricity and natural gas, and water—into financially independent units such as public companies and public enterprises.

Three main aims were presented for the separation (Myllyntaus, 2001), the first of which was to prevent the misuse of the monopoly position by making the principles for determining customer charges for the services transparent and comparable across various service providers to both customers and relevant authorities. The second objective was to enable the reasonable pricing of services, and in this context reference was made to the Act on Competition Restrictions (1992), which states that the customer charges from monopoly services should not notably exceed the costs of providing those services. This stipulation had been designed, on one hand, to prevent the formation of large excess profits that could be used to finance other municipal activities as hidden taxation and, on the other hand, to secure sufficient income for funding operations and maintaining good financial standing. The last aim of granting water and energy production units more autonomy was to increase the efficiency of operations by clarifying the principles of profit calculation, business viability assessments and accountability, by increasing cost-consciousness, and by facilitating the monitoring of internal financial transactions.

The second significant piece of legislation implemented as a result of the public sector reform is the Water Services Act of 2001, which includes provisions on the organization and finances of water service provision, the rights and obligations of the different stakeholders, and customer charges. The ultimate responsibility for organizing water and wastewater services lies with the municipality but their production can be delegated to a public or private entity. The municipality is also responsible for the overall development of water services by formulating and regularly updating a water service development plan that describes and schedules construction activities for the near future, and by participating in regional planning and cooperation regarding joint networks or other means of securing service delivery in exceptional circumstances. The duty of the utility is to take care of the construction and maintenance of the infrastructure and the delivery of services within an operational area defined by the municipality. The utility also needs to monitor and ensure that drinking water meets the quality standards set out in the Decree of the Ministry of Social Affairs and Health Relating to the Quality and Monitoring of Water Intended for Human Consumption. The customer in turn has the obligation to connect his property to the network if it is located within a utility's service area, and to maintain the pipelines and fixtures on that property in functioning order. The authorities monitoring adherence to

Table 1. Key legislation affecting the water sector in Finland (modified from Hukka & Seppälä 2004). The stipulations of EU directives are embedded in national legislation.

Field of application	Law/Act	Content
Water supply and sewerage services	Water Services Act (119/2001)	Development and organization of water and sewerage services, rates, customer protection
	Act and Decree on Assistance for the Community Water Supply Measures (Act 56/1980, amendment 123/2001; Decree 97/1995)	Preconditions for obtaining financial assistance from the Government for planning and construction of water supply, sewerage or wastewater treatment systems
Health protection	Health Protection Act (763/1994)	Responsibilities for the monitoring of drinking water quality
	Decree of the Ministry of Social Affairs and Health Relating to the Quality and Monitoring of Water Intended for Human Consumption (461/2000)	Drinking water quality standards and their monitoring
Environmental protection and land use	Water Act (264/1961, amendment 121/2001)	Control of altering and damming of water bodies by subjecting to permit any activity likely to damage these
	Environmental Protection Act (86/2000) and Decree (169/2000)	Prevention of pollution of soil, air and water, applied to all activities that cause or may cause environmental damage
	Act on the Environmental Administration (55/1995)	Mandate of the Finnish Environment Institute and the Regional Environment Centers
	Land Use and Building Act (132/1999, amendment 22/2001)	Land use planning, municipal building regulations, building permits
Consumer protection	Treatment of Household Wastewaters in the Areas outside Sewerage Networks of Water and Wastewater Undertakings (542/2003)	Reduction of the untreated effluent from households and facilities not connected to common sewerage systems
	Consumer Protection Act (38/1978) Act on Competition Restrictions (480/1992)	Protection of consumer rights Ensuring sound economic competition
Others	Local Government Act (365/1995)	Organization and duties of local governments and councils, regulations on municipal finances
	Public Procurement Act (1505/1992)	Mandatory tendering for public sector purchases
	Co-operatives Act (1488/2001)	Organization and functioning of consumer-owned co-operatives
	Emergency Powers Act (1080/1991)	Obligating municipalities to prepare plans for ensuring service delivery in situations of national emergency

the Act are specified as being the Regional Environment Centres, the municipal health inspection authority and the environmental protection authority.

The Water Services Act orders the full cost recovery of a water services utility's operation and maintenance costs as well as investment costs through customer charges. The charges should be fair,

reasonable, and based on the true cost of producing the services. They can also include a “reasonable rate of return” for the capital investment of the owner. The Act provides no further definition for the term “reasonable”, even though the government proposal that preceded the Act referred to the average effective interest rate of the government’s long-term loan obligations as a possible benchmark level. According to the Water Services Act, the general grounds for the pricing of water and wastewater and the tariff structure must be approved by the local council. The council also approves the water service utility’s budget for the following year and in that context decides on the rate of return to be paid by the utility to the municipality. The customer charges are subject to ex post, on complaint regulation¹ by the Competition Authority, whose mandate is limited to deciding on the overall reasonability of the charges. An exception to the requirement of full cost recovery is provided by the Act and Decree on Assistance for the Community Water Supply Measures, which allows government support for activities aimed at enabling regional cooperation, arranging water services in rural areas, securing service delivery in exceptional circumstances, or the protection of the environment.

3.2. *Infrastructure investment planning and asset management*

Because of the even distribution of rain- and snowfall, large number of lakes, and abundant groundwater resources, Finland does not have problems with the availability of water. Due to the abundance of naturally clean water as well as the long distances in sparsely populated areas, the (%) of public water service coverage in Finland is rather low compared to many other European countries. About 89% (4.6 million people) of the population are connected to a public water distribution network, and public sewerage utilities serve about 4.2 million people (81%). Practically all wastewater receives at least secondary treatment. (Finnish Environment Institute, 2002a and b; FIWA, 2002).

The very first piped water and wastewater systems in Finland were built in the 1870s and centralized systems have been operated by municipalities ever since (Katko, 1997). These municipal utilities have served mainly urban population centers, whereas smaller communities in rural areas have traditionally organized their water services in the form of small-scale user-operated cooperatives or more or less informal partnership arrangements. Currently there are four main institutional options for water and sanitation services in Finland: individual on-site systems in sparsely populated rural areas, small private water associations (partnerships, water cooperatives) serving rural communities, municipality-owned public utilities in urban and rural centres, and regional publicly-owned systems organized as joint-stock companies or associations of several municipalities. Over 90% of all water is distributed through municipality-owned utilities (Seppälä, 2003).

The first centralized water supply systems relied mainly on surface water but since the 1960s the share of groundwater has steadily increased and is currently about 60% of all water supplied (Ministry of the Environment, 2006). The specific consumption of water increased until the 1970s, then decreased due to the energy crisis and the introduction of wastewater fees, and is now estimated as 240 l/c/d (Finnish Environment Institute, 2002a). The first wastewater treatment plants were based on either biological or chemical treatment but now the prevailing technology is biological-chemical activated sludge treatment.

¹ The Competition Authority reviews a water utility’s charges only if a customer or other concerned party files a formal complaint claiming that the charges are too high.

The systematic construction of the infrastructure and facilities begun in the 1930s and a veritable construction boom was experienced in the 1960s–1970s in connection with the industrialization of agriculture and the economic recession which drove people from the country side to urban centres. Total investment into the construction of water service systems was at its highest in the mid-1970s (Figure 1) after the treatment of domestic wastewater had been made obligatory.

The total length of the water pipelines in Finland is approximately 84,000 km, while the corresponding figure for sewer pipelines is 41,000 km (FIWA, 2002). The average age of the water and wastewater networks are 28 years and 32 years, respectively (Finnish Environment Institute, 2002b). As the technical lifespan of pipelines varies from 30 to 60 years, the considerable renewal requirements of the networks will materialize within the next few decades, resulting in the need to raise the current level of repair, renewal and replacement investment. It has been estimated that 10% of the water and wastewater networks are already in need of urgent repair or replacement (Oulasvirta, 2004). The current pace of renewal is approximately 150 km per year, even though the actual need is at least four times as much (Tompuri, 2005). In financial terms, the accumulated investment backlog has been estimated as €1,000 million, the addressing of which will require the additional investment of €50 to €100 million annually until 2020 (ROTI, 2007). It has been suggested that one reason for the deferred investments, at least in the largest utilities, is the owner municipalities' rate of return requirements, which do not leave the utilities with enough funds for infrastructure renewal (Vinnari, 2006a).

Network condition assessments and renewal planning, aimed at preventing pipe breaks, have a crucial role in securing drinking water delivery and quality. Yet, the condition and renewal requirements of the pipelines and related physical infrastructure are difficult and expensive to assess due to differing soil and load conditions, water quality parameters, pipe materials and construction methods. Thus, it is not surprising that many water and wastewater utilities in Finland lack up-to-date

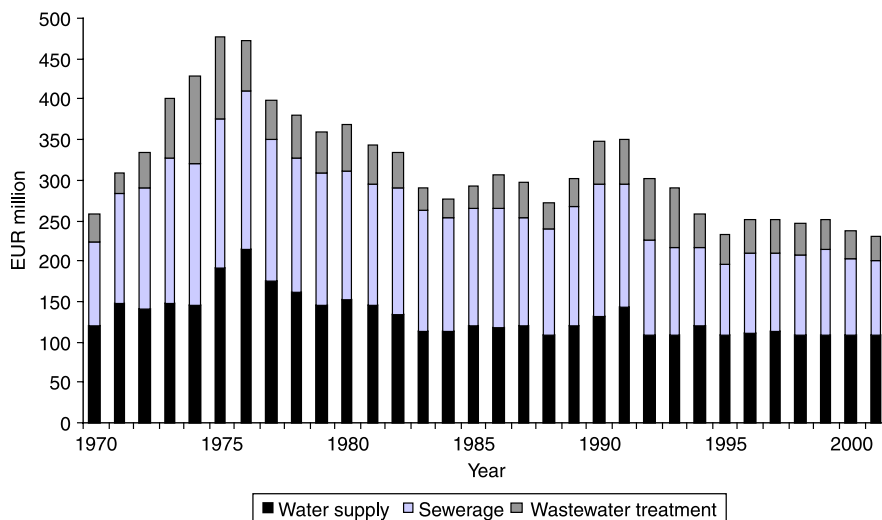


Fig. 1. Total investments in public water services, 1970–2001 (Finnish Environment Institute, 2002a).

and accurate information on the condition of their networks (Vaattovaara & Sipilä, 2005). Network information systems are ubiquitous, especially in large and mid-size utilities, but their usage is mostly limited to recording the age, location, and technical details of the pipelines, even though the systems could also include information on network maintenance operation and planning. Furthermore, many water utilities' maintenance and renewal investment plans are often insufficient and do not span an adequately long period of time. The most problematic in this sense are the smallest utilities, which do not collect enough user charges for maintenance investments or possess the adequate expertise for assessing maintenance needs (Ministry of Agriculture and Forestry, 2005). Yet, neither can large water service utilities be considered exemplary in this sense. A recent survey revealed that only two of the largest fifteen utilities have actual long-term investment plans (20 to 30 years), while as many as a quarter of the utilities only made plans for a maximum of four years into the future (Vinnari, 2006b).

The statutory water services development plans devised by the municipalities are not being utilized to their full potential with regard to long-term infrastructure maintenance and investment. The existing plans concentrate mostly on the construction of new networks, even though a guidance document on how to draft such plans includes a separate section on maintenance needs and suggests a time horizon of up to 10 years as suitable for long-term planning. This document also suggests checking if the average amount spent on renewal investments during the last five years corresponds to the recommended 2–3% of the value of the fixed assets. Some reasons for the lack of long-term planning can be found in the results of a recent survey (Poijärvi, 2006) of municipal authorities' views. Many of these considered investments into network renewal and the reduction of unaccounted for water fairly important but there were also some who saw these as natural activities that do not need to be scheduled and specified, and others who felt these issues should only be addressed if problems occur.

In addition to the above mentioned factors, the need to develop water infrastructure planning and management is also influenced by expected future developments. The water sector in Finland is currently undergoing a transition, stemming from reconstruction, consolidation and mergers in the municipal sector and leading towards the joint production of public services through large regional public companies rather than small local utilities. This development can be expected to emphasize the business-oriented nature of service production and pave the way for increased private sector participation in the form of outsourcing, contracting, and possibly even full divestitures. Consequently, it would seem that securing consumer service levels and standards regardless of the organizational form of the service provider necessitate that investment plans and asset management be addressed more explicitly in the national water services policy. For these purposes, an evaluation of related legislation and guidelines in other countries should provide useful lessons.

4. International options for regulating asset management

4.1. England and Wales

The United Kingdom comprises four constituent countries and consequently three distinct legal systems, which operate in England and Wales, Scotland, and Northern Ireland. The current regulatory framework for the water sector in England and Wales was set out by the Water Industry Act of 1991,

which requires all water and sewerage companies to provide and maintain an efficient and economical system of water supply; to improve and extend their networks; and to meet certain standards of service. The privatized water services companies of England and Wales are monitored through an extensive regulatory system. Environmental regulation is taken care of by two bodies, the Drinking Water Inspectorate, which sets the quality standards for drinking water, and the Environment Agency, which regulates water abstraction consents and quality standards in water courses (Summerton, 1998). The availability of water in England and Wales does not normally present problems, but instances of severe water stress in the past few years have caused the need for these authorities to advise the water services companies in how to cope with drought.

With regard to financial affairs, the responsibility for economic regulation lies with the Water Services Regulation Authority (Ofwat). This authority's duties include protecting the interests of consumers by promoting effective competition and securing that the water services companies are able to finance their functions, in particular by securing a reasonable rate of return on their capital. For these purposes, Ofwat conducts five-yearly price reviews using the price cap method, aiming to minimize customer prices and to allow water companies to make an adequate return on capital, thus permitting investment into the water infrastructure while encouraging efficiency savings. For each price review, the water companies are required to submit business plans, devised according to Ofwat's guidelines, in which they propose the capital expenditures needed during the next five-year period. The costs of above ground assets are recognized through depreciation charges over the period in which the asset is used, and these charges should roughly equal the future levels of expenditure required to maintain and replace those assets. Underground assets such as networks are not depreciated but an annual infrastructure renewals charge is made against the companies' profits to cover the average forecast costs of maintaining the system in a steady condition over the following 15–20 years (Ofwat, 2004).

As the regulatory system is fairly young, the approaches utilized by Ofwat are constantly developed according to feedback from external evaluators and the regulated companies. In the latest price review in 2004, Ofwat assessed the water companies' business plan with a four-stage approach that included estimating both historical and future expenditure required to maintain serviceability, using econometric methods for determining required efficiency improvements, and ranking the plans on the basis of 18 different indicators. Recently Ofwat (2006) announced that as they prepare for the next price review in 2009, they will consider developing companies' capital programs beyond the normal five-year period, alongside the requirement for companies to produce 25-year business plans. Additionally, they will also develop their own guidelines for drafting the plans, so that the companies will be able to submit "total asset management plans", integrated across all aspects of the companies' business.

4.2. New Zealand

As regards water resources, New Zealand has an extensive lake and river system fed by substantial yearly rainfall but freshwater distribution across the country is very uneven, resulting in some regions experiencing occasional shortages. The nation's water resources are managed by central government devised legislation, as is also the organization of water services. Most of the entities providing water services are in public ownership.

Since 1984, all levels of government in New Zealand have undergone fundamental philosophical and structural changes, the key objectives of which have been the better management of publicly owned resources and a higher standard of accountability to the public for the use of those resources

(Pallot, 1997). A significant change was presented by the Local Government Amendment Act of 1989, which ordered local governments to adopt accrual accounting, establish a fair valuation of the existing assets, and make financial provisions for maintaining and replacing assets. A somewhat contrary amendment was made to the Act in 2002, obligating a local government organization that provides water services to continue that service and maintain its capacity to meet its obligations. With regard to infrastructure assets, the amended Act prohibits a local government water service organization from using the assets of its water service as security, divesting its ownership of those assets except to another local government organization, and from disposing of the significant water service infrastructure in its region or district, unless it retains the capacity to meet its obligations.

The Local Government Act also orders every local authority in New Zealand to have a long-term financial strategy relating to a period of at least ten years. The contents of the strategy plan should identify, *inter alia*, the local government's assets; how the local authority will manage the implications of changes in demand for relevant services; what additional asset capacity is estimated to be required to match the change in demand; how the provision and funding of additional asset capacity will be undertaken; how the maintenance, renewal, and replacement of assets will be undertaken; and how the costs of those actions will be met. The Act requires the plan to include detailed cost information for the first three years of the plan and an outline of costs for the following years. In practice, many water service utilities craft their own plans, which then inform the local government's plan. At least three water utilities in New Zealand have twenty-year plans and one has a forty-year plan (IPWEA, 2006).

Fairly soon after the implementation of the public sector reforms, local governments in New Zealand realized they needed assistance in adopting the business-oriented mode of thinking and methods. In 1995, several organizations established the National Asset Management Steering (NAMS) Group, a non-profit industry organization, to promote asset management in public infrastructure services through the development of best practice guidelines and training. Together with the corresponding association in Australia, NAMS has produced comprehensive handbooks and manuals that have also been distributed internationally. Despite the achievements of NAMS, the New Zealand government has requested the development of more consistent practices in the water sector. In late 2006, a member organization of NAMS established the Water Information Management Steering Group, the purpose of which is to lead, promote and develop a best practice in water information management and the use of computerized systems and tools that advance asset management in the water sector.

4.3. Australia

In terms of water resources, Australia is marked by recurrent droughts and extreme floods, leading to extremely variations in the availability of water. Solving problems related to water scarcity on national level is challenging because Australia is a Federalist nation, meaning that the legislative power over water resources and water services is vested largely with the eight independent states or regions that make up the federation (see e.g. McKay, 2005). Similarly, state or local governments own all water utilities, although most of the larger utilities have been restructured and transformed from public sector departments to corporations with clear commercial objectives (Srivastava, 2004).

The driver behind asset management planning in Australia is the Accounting Standard 27 of 1996, which requires all local government assets, including infrastructure assets, to be reported in a statement

of their financial position and depreciated. Yet, there is no national regulation or guidance relating to long term financial planning for infrastructure assets. On a state level, the South Australian Local Government Act 1999 (as amended) requires local councils to develop a long-term financial plan and an infrastructure and asset management plan, both for a period of at least 10 years. No other states have such formal stipulations, but independent local government inquiries in New South Wales and Western Australia have concluded with a recommendation for long-term strategic and financial plans that take into account infrastructure renewal (Howard & Champion, 2006). Informal asset management guidelines are provided by NAMS Australia, but as the organization was established only in 2004, it has thus far relied heavily on the work of its New Zealand counterpart.

With specific regard to the water sector, the Council of Australian Governments (CoAG) has set guidelines that provide the framework for water and wastewater prices. The guidelines establish upper and lower cost recovery limits, between which the customer charges should fall. The lower limit is the minimum level for business viability at which all operating costs are met, including a provision for asset renewal or replacement, but without allowing a return on capital other than interest costs incurred and dividends paid. The upper limit is the maximum revenue that allows for an appropriate return on assets, above which any excess returns are considered to be monopoly rents. The provision for asset replacement and/or renewal is calculated as the annual amount of funds that needs to be set aside in order to maintain service levels in the medium to long term (NCC 1998 Part 2). State-level independent regulatory bodies oversee compliance with these limits, or at least advise a government entity in this task. Specific requirements for systematic asset management have been introduced by the regulator of New South Wales into the operating licences of water utilities. According to these license conditions, the utilities should have an asset management system that is audited at least once during every five-year licence period (IPART, 2006).

4.4. United States

The United States is a heterogeneous country in terms of both water resources and related legislation. Arid regions in the Southern and Western parts of the country suffer periodically from water scarcity, while the Eastern parts receive plenty of rainfall year round. Similarly to Australia, the United States is also a Federalist country and as such characterized by strong state sovereignty in legislative matters, also in those associated with the use of water resources and the organization of water services. The provision of water services is taken care of mostly by publicly owned utilities, which serve about 85% of the population.

In the United States, the immense amount of aging water and wastewater infrastructure has resulted in much consideration of the role of asset management in water service operations. There is no explicit national requirement for creating asset management plans in public water utilities, but such an option is embedded in the Governmental Accounting Standards Board Statement 34 (GASB 34), issued in 2000. The Statement obligates the water service utilities to report the depreciation of infrastructure assets by using one of the following methods: either conventional straight-line depreciation, or the modified approach, which permits the utility to depreciate the assets on the basis of preserving their condition at or above a predetermined level. Using the latter approach requires that a utility maintains an up-to-date asset inventory; establishes a target condition for the assets and reserves enough funds for maintaining that condition; conducts a condition assessment at least every three years; implements a formal asset

management system; reviews the effectiveness of maintenance procedures; and compares the actual preservation expenditures with those budgeted for (AMSA, 2001).

Due to the lack of federal or state requirements, the state of asset management in US water utilities varies. Certain utilities' voluntary investments in business capabilities, and in particular information technology, have developed sophisticated asset management tools that are being used globally (Urquhart, 2006). On the other hand, the General Accounting Office (GAO) has reported that approximately a third of the water and wastewater utilities in the US deferred maintenance because of insufficient funding, had 20% or more of their pipelines nearing the end of their useful life, and lacked basic asset management plans (GAO, 2002). To respond to the problems caused by deteriorating drinking water and wastewater systems and other public works, the US Senate has tried several times to introduce a National Infrastructure Improvement Act for establishing a National Commission on the Infrastructure of the United States. The Commission would be charged with completing a report that details infrastructure legislation and administrative actions deemed necessary for the future. The report would include the capacity, age, and condition of the public infrastructure; repair and maintenance needs; financing methods; and investment requirements. Thus far², the Act has not been passed by the House of Representatives.

Water utility asset management is also actively promoted by a partnership of several professional organizations, led by the US Environmental Protection Agency (EPA). The partnership will strive to ensure the long-term viability of the nation's water systems and improved water and wastewater utility performance through education, management tools and performance measures (EPA, 2006). As a result of these collaborations, the American Water Works Association (AWWA) has updated the asset management section of its Policy Statement to recommend that water utilities implement a comprehensive asset management plan that describes each existing component, its function, a method of assessment used to determine the end of the life cycle for that component, and the corresponding action to renew the asset. The plan should also describe funding mechanisms to meet renewal and replacement costs based upon the expected life of each asset (AWWA, 2007).

5. Discussion

Several factors influence the current state of the water and wastewater infrastructure in Finland. On the utility level, the main problems preventing the sustainable management of assets seem to be, on the one hand, an underestimation of the significance of long-term maintenance and renewal planning, and on the other hand, the lack of necessary knowledge and skills. At the highest policy level, the vague wording in relevant legislation allows too much room for interpretation. Pertinent examples are the requirement for the recovery of all costs without further specifications, and the allowing of a reasonable rate of return for the owner of a water service utility without determining any limits. On the local government level, municipal decision-makers' planning horizons often extend only as far as the next election, which makes them prone to favouring visible rather than invisible investments and hidden taxation instead of raising municipal income tax. These issues reflect a fundamental dilemma in maintaining public infrastructure assets: none of the people involved in the related decision-making bear all the costs or receive all the benefits of maintenance and renewal, and thus they are not motivated to

² February 2008.

contribute as many resources as they would if they were the sole contributors and beneficiaries (Ostrom *et al.*, 1993). This problem might intensify along with the anticipated commercialization of the service production, resulting from the consolidations and mergers that are becoming more ubiquitous in the Finnish water sector. Thus, taking into account the above mentioned factors and considering the critical function that the water and wastewater infrastructure has in protecting human and environmental health, it can be argued that explicit institutional guidance on water infrastructure investment, maintenance and renewal planning is well justified.

The regulatory approaches adopted in the countries examined in this paper vary according to the institutional setup as well as the structure and organization of water service production (Table 2). The completely private ownership of drinking water companies in England and Wales has resulted in an elaborate and detailed system directed by a strong national economic regulator. For the purposes of a significantly smaller industry with publicly owned assets, the Ofwat approach as a whole is most likely to be too complex, burdensome and costly. Yet, certain aspects of the system are worth replicating, including the practice of regularly reviewing the business and asset management plans, the likely extension of the planning period to 25 years, and the at least theoretical willingness of the regulator to develop practices by consulting all stakeholders and independent experts. Also the infrastructure renewals accounting approach would be worth further consideration as it seems to better reflect the aging and investment profile of underground assets than regular depreciation accounting.

In the case of New Zealand, the procedures for managing water service assets are included in the 10-year financial plan required of all local governments. In Australia, water and wastewater utilities are expected to make annual provision for medium to long term asset renewal, and in some states to implement asset management systems. The formal guidance in both Australia and New Zealand is complemented by the comprehensive asset management handbooks produced by the prominent industry associations that display international best practices. With regard to the situation in Finland, the specific timeframe indicated in New Zealand's legislation would provide a good starting point for introducing long-term planning into the water service sector. This practice could later on be developed along the lines of the New South Wales requirement of asset management systems and their regular auditing. A national asset management organization, embedded with industry specific subgroups, would be responsible for helping the utilities in the practical realization of these stipulations.

Table 2. Comparison of international asset management policies.

	Fixed asset ownership	Policy driver	Main organizations involved	Asset management planning
England and Wales	Private	Water Industry Act 1989	National regulator	Required by regulator. Currently five-year plans, anticipated future requirement 25 years.
Australia	Public	Accounting Standard 27, CoAG principles	State regulators, professional associations	Required by some of the regulators. Length varies according to state.
New Zealand	Public	Local Government Act 1989; 2002	Local governments, professional associations	Statutory minimum requirement 10 years; in practice up to 40 years.
United States	Mostly public	GASB 34	EPA, professional associations	Not specified.

In the United States, water utility asset management practices have so far been promoted mostly by professional entities. Legislation has not yet caught up with the recognized needs: the GASB 34 will not require utilities to adopt asset management practices unless they choose the non-conventional method of depreciation. Even if the special committee suggested to the Senate is established, it will take several years before the possible new statutes are implemented. In the meantime, asset management practices in the US will most likely be introduced and adopted mostly as informal professional norms and practical applications. These can then be utilized as examples for developing utility-level capacity in the Finnish water service industry, especially in the form of information technology solutions designed to support and facilitate decision making.

6. Conclusions

The current state of the maintenance and infrastructure investment planning in the Finnish water sector seems to require improvement. First of all, the pace of repair, renewal and replacement investment is slower than optimal considering the aging and deterioration of the infrastructure. Secondly, even the largest water service utilities that could be expected to possess the competence and skills for implementing progressive practices, do not engage in long-term investment planning or utilize comprehensive asset management systems. As maintaining the operational capacity of the water service systems has a crucial role in preventing hazards to human health and to the environment, the policy-level consideration of the issues related especially to maintenance and renewal investment planning seems well justified.

A review of asset management regulation in England and Wales, New Zealand, Australia and the United States provided several applicable principles for the water sector in Finland. One option worth further consideration would be to amend legislation to include the requirement for all water service utilities to devise a long-term (20 to 30 years) capital investment plan, including infrastructure renewal to maintain the service levels of the assets. In this task, the utilities should be duly assisted by practically oriented and fairly detailed guidance documents devised by a professional interest organization on the basis of international best practices. An essential consideration would be the regular updating of the plan, for example every five years, to enable timely preparation for future investment costs. The plan should also be filed with the relevant authorities who would comment on the adequacy of the plans from the point of view of maintaining and improving service levels and standards. After the implementation of long-term planning, a natural next step would be to encourage the water utilities to adopt comprehensive asset management systems, tailored to suit each utility's size and organizational arrangements. If felt necessary, these systems could also be audited, for example, simultaneously with the updating of the long-term investment plan. This type of combination of legal requirements and professionally established norms could be expected to set an appropriate balance between securing service levels and retaining the autonomy of the utilities.

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