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Performance assessment of water and wastewater services

– survey of best practice

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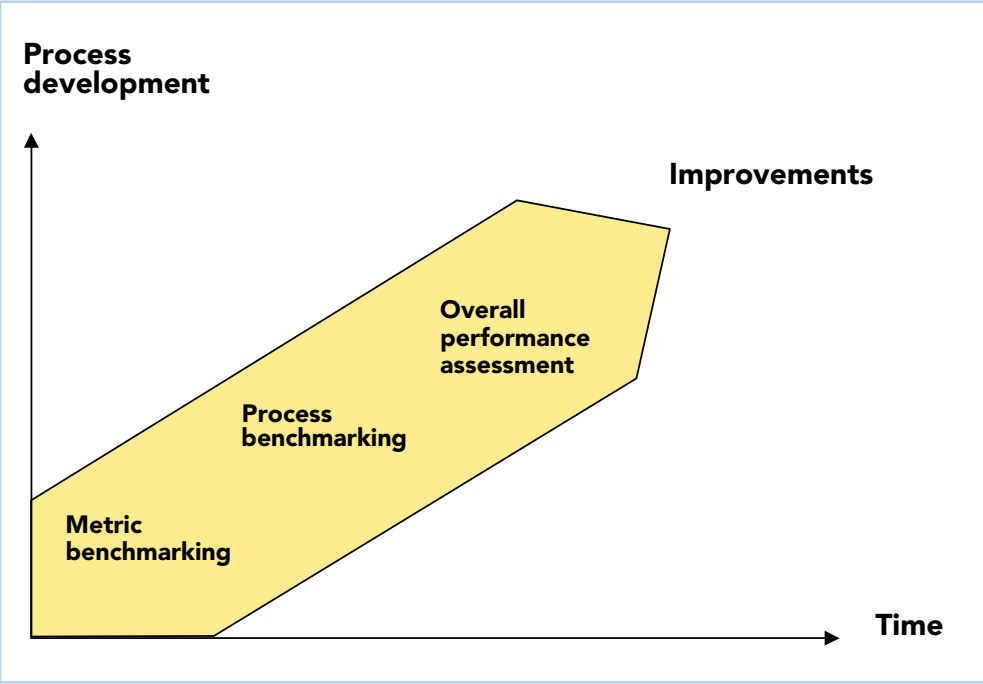

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Foreword

In 1996 the Scandinavian 6-cities group – Copenhagen, Oslo, Helsinki, Stockholm, Gothenburg and Malmo – started a benchmarking co-operation for comparing the performance of their water and wastewater services. In the group, metric benchmarking has since then been carried out yearly. These studies are followed up by various process benchmarking projects. The benchmarking activities indicate differences in performance in selected areas. It does however not give an assessment of the overall performance.

One objective with the co-operation in the 6-cities group is to find a way of assessing the overall performance of the water and wastewater services. Among others the assessment must consider service levels, important cost drivers and the actual status of the infrastructure. With a limited number of input data the assessment model shall give a picture of the performance and the long term potential for improvements. As a base for developing such a model it has been decided to make a survey of what is going on in Europe with regard to performance assessment in the water and wastewater sector.

In this report the result of the survey of the situation in Europe is presented. The survey includes organisational structure of water and wastewater services, forms for ownership and operation and forms for regulating the utilities. Ongoing benchmarking initiatives and existing approaches for assessment of the quality of service as well as the economic efficiency are described. In addition a number of benchmarking initiatives and assessment approaches outside Europe are presented. We hope the findings presented in this study will increase the interest for performance assessment as a management tool in the strategic planning.

This report was worked out by Jan Adamsson, Aqua-Tech Consult in Gothenburg. The 6-cities performance indicator group has served as reference group for the study. The framework developed in the IWA Task Forces for Performance Indicators has been of great value as a base for the study.

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Summary

Ownership and operation

The inquiry shows that public ownership of the water supply and wastewater infrastructure is dominating in Europe. Only in England and Wales the infrastructure is fully privatised. There is no general trend for increased private ownership, but in some countries, especially in the eastern part of Europe, public/private companies will increase. In most cases the communities are keeping a controlling position.

The pressure on the water and wastewater monopolies to increase efficiency has lead to that the existing structures have been questioned and alternatives discussed. In Europe two trends for development of the organisation of the water and wastewater services are appearing:

- Increasing scale of management of the services by regional cooperation
- Increasing use of private operators

Examples of large-scale regional co-operation in the past are the re-organisation of the water and wastewater services in England and Wales and the water services in the Netherlands.

In France private operation of water and wastewater services has a long tradition. Today private operation is increasing in many European countries and is seen as a way of increasing competition in the sector. However French experiences show that delegated management of operation is difficult to control and that it is necessary to introduce a legal system for regulation of the services.

Regulation

Almost all of the contacted water and wastewater associations and national regulators stress the importance of performance indicators on a market where the lack of competition sets special demands on a reliable and transparent documentation of results and costs.

Regulation of water and wastewater services should cover the following areas:

- Customer services
- Drinking water quality
- Environmental duties
- Cost efficiency

In all European countries the drinking water quality and the environmental duties are regulated either on national level or locally. However regulation of customer service and cost efficiency on national level using a performance assessment model is very scare. Only England, Wales and Scotland have institutions for regulation of the price and are assessing the performance on a national level. In most other countries the city councils decide upon tariffs and service levels.

Metric and benchmarking initiatives

Many water and wastewater utilities, water associations and regulators in Europe are working with or are in the process of introducing performance indicators and benchmarking as a management tool. The Office of Water Service (Ofwat) in England is the pioneer in benchmarking in the water sector. The work done by the World Bank and the International Water Association is in many countries acting as a catalyser.

Models for performance assessment

The survey has identified nine models for performance assessment of interest for further evaluation. Three of these are used by regulators or governments. Six models are initiated by branch organisations or by networks of service providers. Most of the models have an overall performance assessment approach but some only focus on quality of service or on cost efficiency. Besides England, Wales and Scotland there are no countries in Europe that have developed models for regulation of prices and control of cost efficiency as sophisticated as the Ofwat model. However there are discussions and developments in this direction going on in a number of countries.

In England and Wales Ofwat together with the Drinking Water Inspectorate and the Environment Agency every year apply performance assessment with help of performance indicators and a number of econometric models. The methodology is scientifically based and also acknowledged by the water industry. The Ofwat model presuppose that a number of big companies take part in the comparison and that a lot of work is spent on collecting the necessary input data and on analysing the results. In Scotland the Water Industry Commissioner for Scotland carries out the economic regulation. The Ofwat model with slight modifications for adapting it to the public ownership and operation is used.

In France the subject of performance indicators and efficiency assessment has attracted increasing interest from the authorities. Performance criteria have been defined and a list of core indicators has been established with the objective to give a view of overall performance to the public – the ENGREF model.

In the Dutch VEWIN-model the performance of the water companies is evaluated focusing four themes – water quality, service, environment, and finance & efficiency. All the water companies in the Netherlands are included in the performance assessment.

In Germany a group of water utilities are testing the IWA PI framework in order to refine and adapt it to German standards. The ambition is to develop the system to a management tool. A structure with 93 performance indicators has been developed allowing a balanced interpretation of quality, reliability, service, sustainability and economic efficiency of a water supplier.

The Danish Competition Board has in their yearly report for 2002 highlighted the lack of competition in the water and wastewater sector. To illustrate the efficiency potential they have conducted two benchmarking studies and evaluated the results with the so-called DEA-method (Data Envelopment Analysis).

The Norwegian Association of Water and Wastewater works, NORVAR, is running a test project on performance assessment using an assessment system based on the experiences from a Norwegian metric benchmarking project. 11 municipalities take part in the test. The main goal for the project is to get the utilities to focus more on efficiency.

In Sweden 23 municipalities are using the management tool, WUMP 2050. The model assess the utility's performance in five areas with respect to defined standards. Based on the results, the performance is graded in four classes.

Outside Europe the model used by the Government of Western Australia is interesting in its simplicity. Customer inquiries showed that drinking water quality and interruption of water supply turned out to be the most important issues for the customers. The assessment model is based on two performance indicators for drinking water quality and two indicators for continuity in water supply.

In Canada, the National Water and Wastewater Benchmarking Initiative is translating the results of metric benchmarking into actions that are stimulating performance improvement. One action is the development of a "Utility Management Model" that provides the framework for performance assessment of water, wastewater and stormwater.

1 Introduktion

1.1 Background

The organisational structure of the municipal water and wastewater infrastructure is under constant change all over the world. Traditionally the infrastructure has been owned and operated by municipalities. Looking at the water sector today you find both public and privately owned and operated water and wastewater utilities.

Sweden has a long tradition of public ownership and operation. In the mid 1990's the market-liberal pressure for increased competition initiated discussions of alternative forms for ownership and operation. The politicians were faced with very difficult decision situations. Will private alternatives really result in decreased tariffs or is public ownership and operation the best solution in a long-term perspective?

During the intense debate about privatisation it was obvious that the utilities in Sweden to great extent were lacking hard facts about the actual cost efficiency of the water and wastewater services. The managing directors were of course convinced that their utilities were efficiently operated, but they had no means of proving this to their political boards. The Scandinavian 6-cities group – Copenhagen, Oslo, Helsinki, Stockholm, Gothenburg and Malmo – took the decision to develop and implement a benchmarking system for a more systematic assessment of the performance of their utilities. Yearly metric benchmarking studies were carried out, which were followed up by a number of process benchmarking projects. The benchmarking indicates differences in performance in selected areas. It does however not give an assessment of the overall efficiency.

1.2 Project idea

One objective with the co-operation in the 6-cities group is to find a model for assessing the overall performance of water and wastewater services. Such a model must among others take service levels, important cost drivers and the actual status of the infrastructure into account. The model should with a limited number of input data give a picture of the performance and the long term potential for improvements.

This first phase of the project is limited to a survey of best practice of performance assessment in Europe. Examples from Australia, South and Central America and Canada have been included in order to illustrate what is going on outside Europe.

The survey includes organisational structure of water and wastewater services – forms for ownership and operation on national level and forms for regulation of the utilities. Ongoing benchmarking projects and existing models for assessment of performance are described.

The next phase of the project, which is not yet decided upon, will focus on identification of factors of importance for the assessment of a utility's performance and on analysis of existing models for performance assessment. The most interesting model elements will be evaluated and tested with data from a number of Scandinavian water and wastewater utilities. The findings of this next phase of the project will form the base for the design of practical performance assessment models suited for Scandinavian conditions.

2 Organisation of water and wastewater services

An inquiry was sent to water and wastewater organisations representing 30 countries in Europe – Appendix 1. Answers were received from 22 of these. Outside Europe contacts have been taken with water and wastewater organisations in Canada, Australia, Japan, Central and South America. Other sources of information that were used in this study are listed in the reference list.

2.1 Ownership and operation

Dominating forms for ownership of water and wastewater utilities in the European countries are illustrated in Figure 1 (next page) and in Appendix 2.

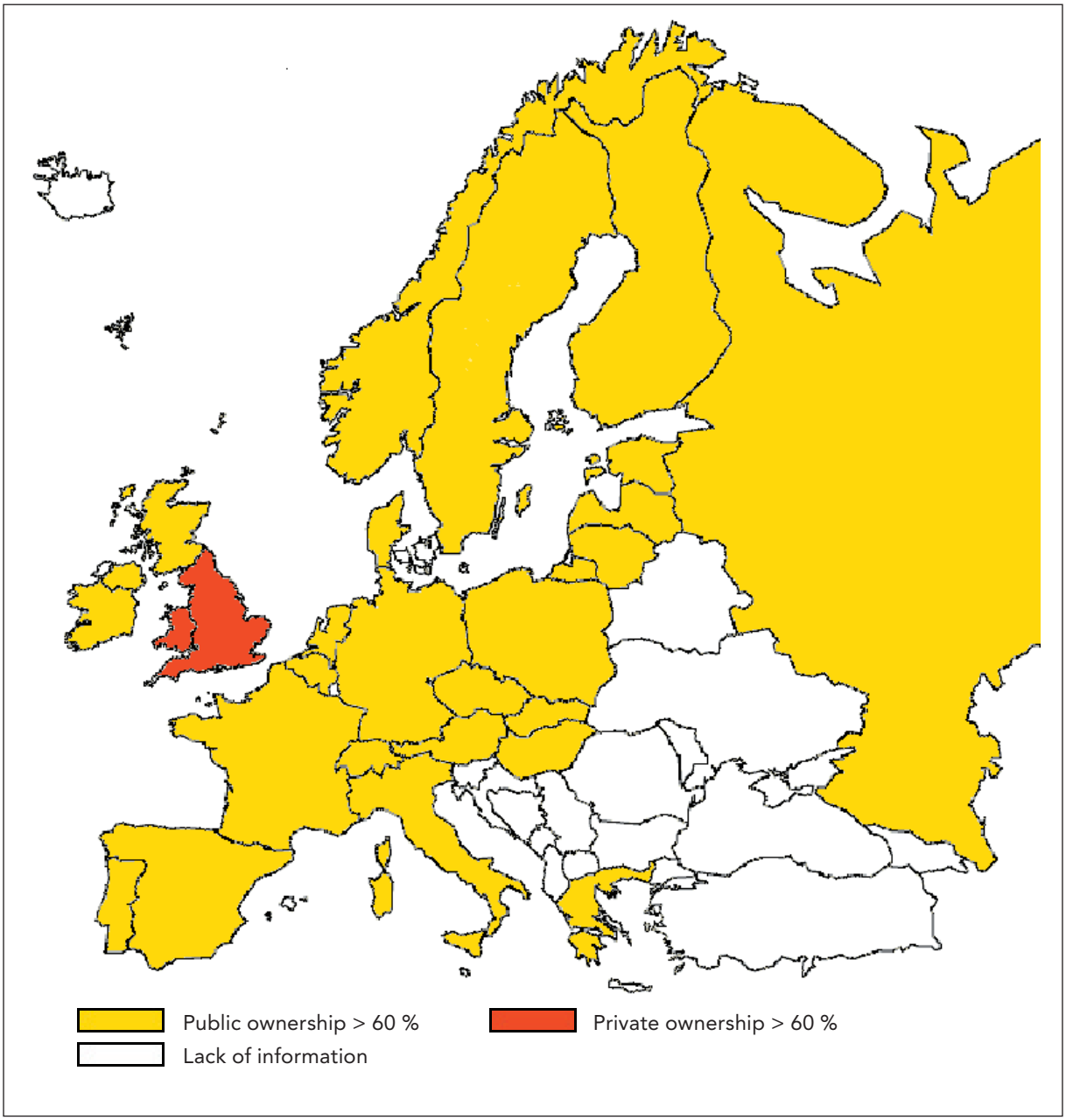

Figure 1. Ownership of water and wastewater services in Europe.

Dominating forms for operation of water and wastewater utilities in the European countries are illustrated in Figure 2 (next page) and in Appendix 2.

In Europe two trends for organisation of water and wastewater services are appearing:

- Increasing scale of management of the services by regional cooperation
- Increasing use of private operators

The identified trends can be illustrated with the following models:

- The British model used both in England and Wales with large scale regional management and fully privatisation and in Scotland with public ownership
- The French model where ownership and responsibility is at the public municipal level with a high degree of private operators especially regarding water supply
- The Scandinavian model with public ownership and mostly also public operation

2.1.1 The British model and the Scottish exception

Before 1974 England and Wales had over 1 600 separate, often municipally run, water suppliers. The 1973 Water Act changed the organisational structure of the water industry. Instead of the many small locally based water undertakings, 10 large regional public water

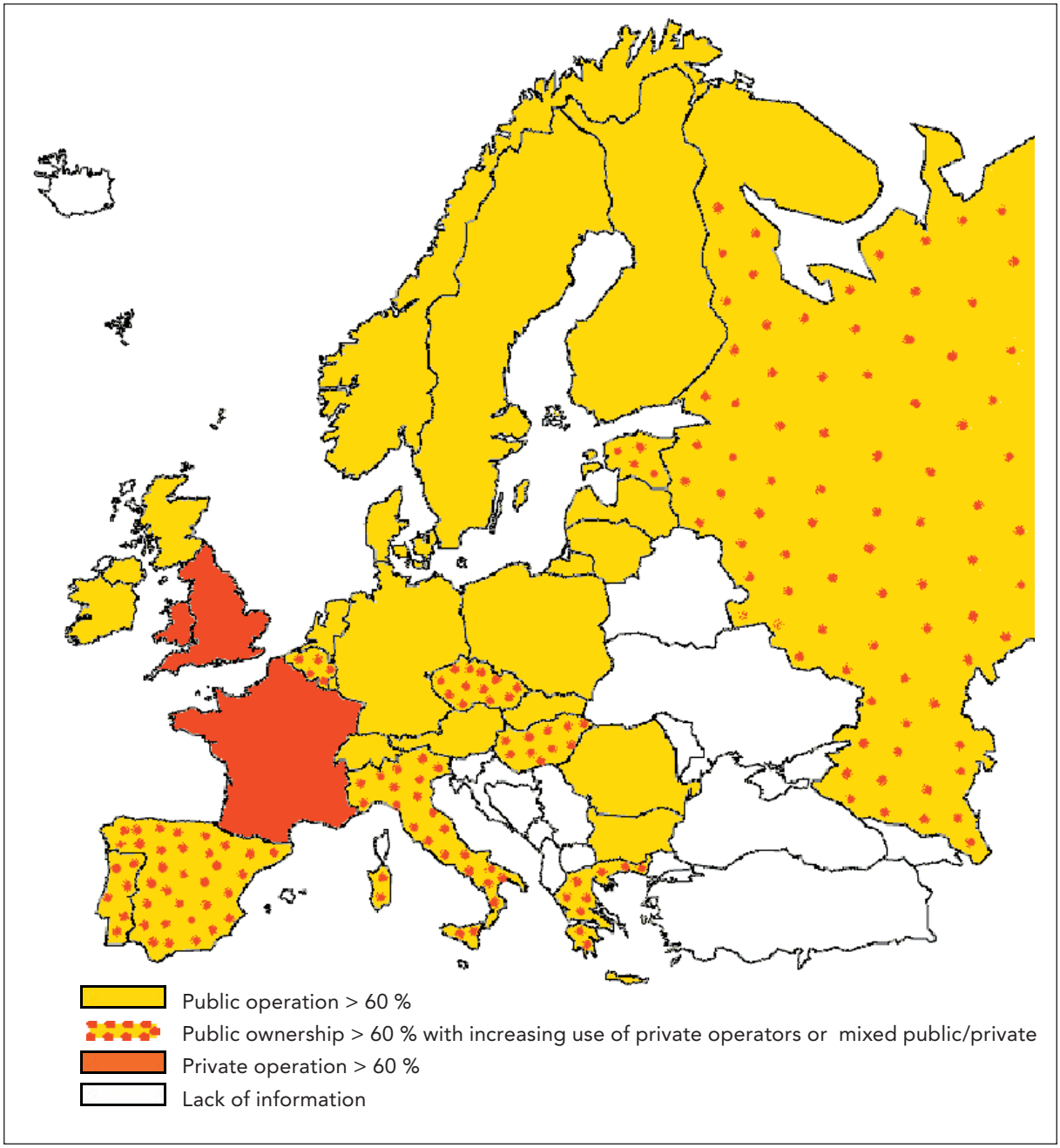

Figure 2. Operation of water and wastewater services in Europe.

authorities emerged, each based on river catchment areas. In addition there were 29 statutory water companies, many of which had been in existence for over 100 years. In 1989 there was a further reorganisation. The water authorities in England and Wales were fully privatised. At the same time a centralised regulation of customer services, cost efficiency, drinking water quality and environmental duties was introduced. Today there are 10 private companies with water and wastewater services and 12 companies with water service only.

In Scotland water and wastewater services are publicly owned and operated. In April 1996 the responsibilities for the water and wastewater services were taken away from the existing 12 regional and islands councils and transferred to 3 regional publicly owned water authorities. At the same time The Scottish Water and Sewerage Customers Council was formed and acted as financial regulator until the Water Industry Commissioner for Scotland was established in 1999. The Commissioner started benchmarking with England and Wales using the Ofwat model, which was modified to suit the particular situation in Scotland. Compared with the water industry in England, the Scottish authorities were less efficient than the medium company in England

and there were demands for greater efficiency in the sector. In 2002 the Scottish Parliament decided that the water and wastewater services should remain publicly owned and managed. However, in order to be able to meet increasing quality demands and to improve the efficiency the three regional authorities were merged into one authority, Scottish Water. Scottish Water is in operation since April 2002.

2.1.2 The French model

In France there are 36700 municipalities of which 95 % have less than 5000 inhabitants (70 % less than 700 inhabitants). The 16000 water utilities and 18000 wastewater utilities (municipalities or groups of municipalities responsible for the organsation of the services) comprise both small rural municipalities of some hundred inhabitants and large cities of several hundred thousand inhabitants. The diversity of the systems is reflected in the mode of management. A water and wastewater utility can either be operated by the local authority itself (régie) or be subcontracted to the private sector (delegation). For municipalities less than 5000 inhabitants about half of the utilities operate the utilities directly. For municipalities with more than 10000 inhabitants only 20 % operate the services themselves. The local authority (single municipality or associations of municipalities) is the sole legal authority responsible for the management and performance of the water utilities.

2.1.3 The Scandinavian model

In Scandinavia ownership of water and wastewater utilities is almost 100 % public and also operation is normally organised as a public utility, either as part of the municipal organisation or as a publicly owned company. An overview of the water and wastewater services in Scandinavia is presented below (Table 1).

2.2 Regulation

2.2.1 Motives for regulation

Infrastructure utility systems are necessary for providing technical services such as telecommunication, electricity, gas, district heating, drinking water and wastewater to individual households. All of these infrastructure systems therefore represent natural monopolies and need regulation. The possibilities and advantages for free competition depend on the specific type of service that is provided.

Public services such as telecommunication, electricity and gas have for historic reasons been monopolistic, generally a state monopoly. The state was the owner of the entire infrastructure including the network. The market liberalisation has in many European countries led to that the old monopolies were opened up for competition. Competition is not impossible from a technical point of view but newcomers must have a chance to take a place on a market with a dominant operator. Here the regulation is the transition from a monopoly to a competitive situation. The regulators role is to create the conditions for balanced competition and to arbitrate disagreements between operators in this competition and if necessary to take sanctions for the case of abuse. The regulator should also check the quality of the services.

For a number of reasons the water and wastewater sector presents a particular regulatory challenge. First, water and wastewater is the utility sector with the least scope for competition, necessitating a more labour intensive form of natural monopoly regulation,

Table 1. Overview of water and wastewater services in Scandinavia.

Country	Population supplied	Drinking water production	Surface/ Ground water [1]	Length of water mains	Number of Water & Wastewater utilities		
	M inhabitants	Mm3	%	km	Managed by the municipality	Inter-municipal companies	Other Forms [3]
Denmark	5.3	424	1 / 99/0	42000	166	1	2626
Finland	4.7	408	39/61 [2]	83600	400	30	1500
Norway	4.0	789	90/10/0	48000	434	24	485
Sweden	7.7	937	51/26/23	67000	279	7	7

[1 Surface water/Groundwater/Artificial groundwater
[2 Groundwater and artificial groundwater
[3 Consumer-managed co-operatives, Private companies, Management contracts

without the possibility of relying on the market to reveal information about costs. Second, the water and wastewater services present a particularly complex and multi-dimensional array of quality issues that complicate the regulatory process. Third, in many countries, water and wastewater services have been completely decentralized and there has been comparatively little private sector participation in the water sector. Another factor is the capital intense nature of the sector, where huge investments are needed to supply all of the population with the services and at the same time protecting the environment from pollution.

2.2.2 The regulatory mechanism

In the price-cap model the price level is fixed and defines the income to the operator. The operator can work on the costs. It is a great incentive to increase productivity, but we do not know what the profit will be.

In the cost-plus model the price is not fixed but the margin for the operator. He will communicate his costs and the price will be adapted to the margin. So the costs are known, but there is not much incentive to reduce costs.

The pseudo-competition model is based on comparison. Most common is to compare costs between different operators. You can also compare the qualitative performances, which is done with a number of indicators, which are collected every year and give rise to benchmarking and classifications between the operators.

2.2.3 Regulation forms in Europe

Regulation of water and wastewater services can cover the following areas.

Customer services: Customer services and company performance can be measured as responses to customers, adequacy of water resources, reliability of water supply services and secure sewerage services.

Drinking water quality: Drinking water quality is measured against European standards.

Environmental duties: Environmental duties are measured against the limits set by national environmental authorities. The limits are normally based on European standards.

Cost efficiency: Cost efficiency measures the cost for supplying adequate services.

Forms for regulation of water and wastewater services in European countries are presented in Appendix 3.

2.2.4 Regulation of the water industry in England, Wales and Scotland

England, Wales and Scotland have the most developed regulation organisation covering customer services, drinking water quality, environmental duties and cost efficiency.

Standards concerning the quality of drinking water are primarily set by European standards. The Drinking Water Inspectorate (DWI) in England and Wales and the Drinking Water Quality Regulator (DWQR) in Scotland is responsible for monitoring the quality of the water supplied to the customers. DWI can and has prosecuted companies for failing to meet water quality standards. DWQR has similar powers and has taken action against Scottish Water for failures to comply with the standards.

The Environment Agency in England and Wales and the Scottish Environment Protection Agency (SEPA) regulates and enforces national environmental water quality standards in rivers, estuaries and coastal waters.

The Office of Water Services (Ofwat) is the economic regulator in England and Wales and has four key responsibilities:

- Facilitating competition
- Protecting customers
- Promoting economy and efficiency by the companies
- Setting price limits

Ofwat uses the price-cap model to set efficiency targets and control the tariff levels. These caps set maximum revenues for each water company in five-year cycles. Through performance comparisons Ofwat derives yardsticks that are used to assess the relative efficiency of the water companies. Less efficient companies are given more demanding efficiency targets and are expected to come up to the standard set by the best performers.

Comparative competition is a strong regulating tool. Water companies are keenly aware of the importance attached to being able to report good performance levels for several reasons:

- The media, national and local, are only too ready to use information produced by Ofwat and the other regulators
- Customers want to see “their” company doing well
- Shareholders are no longer just taking a view on the level of profits generated. They are questioning

why the company they are investing in is not at the forefront of Ofwats´ performance rankings
- Management are increasingly taking performance indicators seriously

For the first 5 years after the privatisation in England and Wales in 1989, the Government set the price limits and Ofwat only had the role of monitoring them. Companies made huge profits in those first 5 years. In 1994 Ofwat addressed the problem by setting own price limits but companies were still making quite high profits. First in 1999 Ofwat succeeded in reducing the profits. Despite the difficulties in the beginning the system now has a good reputation and is accepted of all parts in the industry.

Ofwat also insure that companies deliver their services at right level and monitor the performance through a whole range of different performance indicators. Ofwat also insure that the networks are maintained at an appropriate level and settle disputes between customers and companies.

One limitation of the system for assessing efficiency is that a fairly large number of utilities must be included in the comparison. This is necessary as the best performers set the standards. A problem with the Ofwat model is that so much input data is needed. This makes the system very "heavy" and time-consuming for the utilities.

In Scotland, economic regulation is carried out by the Water Industry Commissioner for Scotland (WIC) who operates in a similar fashion to that of Ofwat for England and Wales. The WIC uses Ofwat´s model for assessment of service and efficiency with only slight modifications for adapting to the public ownership and operation.

2.2.5 Regulation in other European countries

In all European countries the drinking water quality and the environmental duties are regulated either on national level or locally. However, use of performance assessment models in the regulation of customer service and efficiency on national level is very scarce.

Only England, Wales and Scotland have institutions for regulation of the price and are assessing the performance on a national level. In most countries the municipality councils decide upon tariffs and service levels. Many countries are in the process of developing tools for price setting and performance assessment.

In for example France the problems with regulation often mentioned are:
- lack of real competition
- lack of symmetry in the information
- lack of details about tariffs and quality of service
- vagueness of the missions and obligations of the licenses

In France a new law on water policy was under way in 2002 focusing on ways to insure the competition and on methods and tools for regulating the sector. A national regulation authority was proposed. The main task of this authority was to define common performance indicators, to bring together price and performance data and to prepare statistics and apply them on local level. After the last election the enforcement of the regulation has been postponed due to political disagreements.

In the Netherlands there are three different types of organisations for water and wastewater services.
- Regional water companies are responsible for water supply and distribution
- The municipalities are responsible for waste water collection
- Regional wastewater companies are responsible for treatment of wastewater and discharge to recipients

Due to legislation from the 1970-ies the municipalities were forced to organise the water supply in regional organisations. Local municipalities and provincial governments own the new regional Dutch Water companies. The company boards report to the shareholders, but in practice each company operates with relative autonomy. There are government departments, which regulate certain aspects of the water service, but the investment plans and subsequent effects on water tariffs are agreed between the companies and the shareholders. There is currently no economic regulation of the water industry in the Netherlands.

Historically the shareholders´ main focus has been on the reliability of the water supply, both in terms of quantity and quality. Cost savings has been a secondary consideration. The Netherlands Waterworks Association, VEWIN, has in recent years undertaken benchmarking exercises that have highlighted the differences in costs between the various companies. As a result all the companies are now examining proposed expenditure more critical.

In Denmark the Danish Board of Competition has done a benchmarking analysis of waterworks and wastewater treatment plants. Based on this analysis they concluded that the sector is not efficient enough and proposed a number of actions in order to increase the efficiency. In Norway the Government has initiated a study for assessing the need of improvements in the municipalities' operation of the water and wastewater services. The study, which was presented in 2003, proposes a national system for benchmarking, development of legislation and establishment of a regulation authority.

3 Performance assessment

Irrespective of whether it is a private or a public service supplier, any undertaking should strive for high degree of efficiency. In this process benchmarking has proved to be a powerful management tool. A benchmarking project often starts with metric benchmarking and via process benchmarking ends up in overall performance assessment.

As a general base for the development of a benchmarking system a set of relevant performance indicators has to be identified. The indicators are used to describe the characteristics and the performance of individual features of the systems. It must be emphasised that the numeric value of an individual indicator is not enough for assessing the system performance. In principle the performance indicators shall be looked upon as a standardised reference language, which is necessary for making consistent system comparisons.

3.1 Metric benchmarking

Metric benchmarking is a quantitative comparative analysis that enables a utility to follow the performance of their system over time and to compare its performance against the performance of other similar utilities. Areas of good performance as well as areas where there is a need for improvement can be identified.

3.2 Process benchmarking

Process benchmarking focuses on selected processes in the business. The aim with process benchmarking is to improve the processes and to increase the efficiency by "learning from others". As a base for process benchmarking one has to analyse the work processes in more detail. The use of process charts can be of great help in this connection. By comparing performance indicators and work processes in different

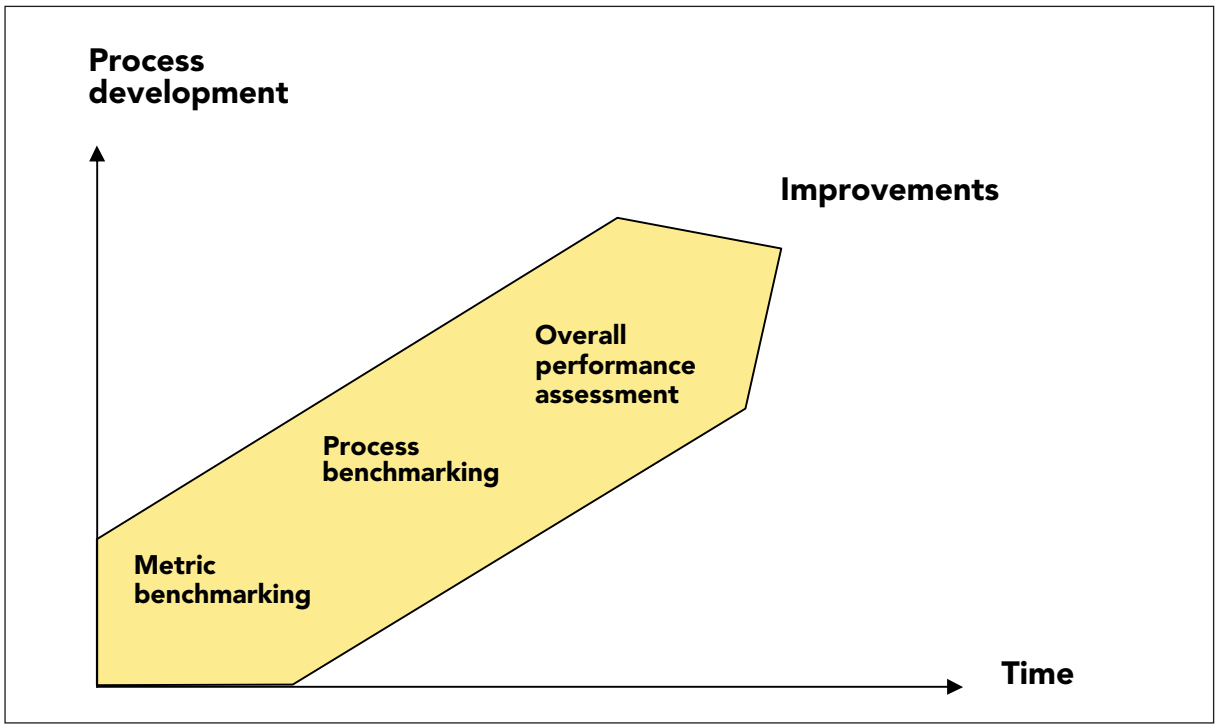

Figure 3. Different levels of performance assessment.

utilities the best practice can be identified. Process benchmarking is also used for explaining observed differences in the metric benchmarking.

3.3 Overall performance assessment

To be able to assess the overall performance of a utility in quantifiable terms it is necessary to carry out an integrated analysis of a variety of factors. Such an analysis includes performance in terms of quality, service reliability and environmental aspects as well as the economic dimensions of the performance.

4 Metric and process benchmarking initiatives

Many water and wastewater utilities, water associations and regulators in Europe are working with or are in the process of introducing performance indicators and benchmarking as a management tool. The Office of Water Service (Ofwat) in England is the pioneer in benchmarking in the water sector. The work done by the World Bank and by the International Water Association have in many countries become important sources of inspiration.

4.1 International initiatives

4.1.1 The International Water Association, IWA

The International Water Association, IWA, has produced guidelines and definitions for the use of performance indicators. IWA's manuals of Best Practice for Performance Indicators for Water Supply Services and Wastewater Services can be looked upon as a reference system from which the utility can choose suitable indicators. Important features of the IWA PI-framework are the data quality grading system, the identification of three priority levels for PIs, and the use of context information to allow context-specific interpretation of PI-values. A software tool named SIGMA is available for implementation of the IWA PI System.

IWA's Performance Indicators for Water Supply Services was introduced in July 2000. There is an on-going coordinated field-testing of the PI-system including 69 undertakings in 19 countries.

The indicators for Water Supply Services are divided into three levels (Table 2).

The experiences from the IWA field-testing of PI's for water supply services have been used in the development of the PI Manual for Wastewater Services that was introduced in November 2003. The PI Wastewater manual has a structure similar to that for Water Supply Services and the number of indicators is totally 182, of which 25 have been ranked as top priority.

4.1.2 The World Bank

Another example of a PI System is the World Bank's Start-Up Kit for utility performance and benchmarking. The kit is available to partners interested in compiling cost and performance data for water and wastewater utilities. The system is based on 47 data and 27 performance indicators are calculated (Table 3, next page).

4.1.3 The International Organization for Standardization, ISO

A clear signal of the worldwide relevance of a comprehensive framework for performance indicators in

Table 2. Number of performance indicators in the IWA framework.

Group of indicators	Level 1	Level 2	Level 3	Total
Water resources indicators	1	1	0	2
Personnel indicators	1	4	17	22
Physical indicators	1	4	7	12
Operational indicators	8	17	11	36
Quality of service indicators	7	17	1	25
Financial indicators	8	13	15	36
Total numbers of indicators	**26**	**56**	**51**	**133**

the field of water supply and wastewater services is the recent developments of international standards ISO/TC 224. Standards are expected to be published by 2006.

Table 3. Number of performance indicators in the World Bank's Start-Up Kit.

Core indicator group	Number of indicators
Coverage	2
Water Consumption and Production	3
Unaccounted-for water	1
Metering Practices	2
Pipe Network Performance	2
Cost and Staffing	4
Quality of Service	3
Billings and Collections	6
Financial Performance	2
Capital Investment	2
Total number of indicators	**27**

4.2 Benchmarking initiatives in Europe

4.2.1 England and Wales

In England and Wales a systematic benchmarking system was introduced 1989 for the privatised water and wastewater companies as a regulation tool. The Ofwat model is described in the following chapter "Models for Performance Assessment".

4.2.2 Scotland

In Scotland the water and wastewater services are publicly owned and operated. The regulator – the Water Industry Commissioner for Scotland – is using a slightly modified version of the Ofwat model as a tool for performance assessment. Scottish Water is benchmarked against the private water companies in England.

4.2.3 France

In France performance indicators and performance assessment has attracted an increasing interest from the authorities. The Association of Public Local Authorities (FNCCR) has initiated a benchmarking project. In addition IGD (Institut de la gestion déléguée), which organization is promoting the French model of delegated management, has introduced a benchmarking model in order to constitute a national observatory. Both groups have worked together with Laboratory GEA at the the National School of Water and Forestry Engineering (ENGREF).

At the initiative of ENGREF, criteria for performance and a list of indicators have been proposed for regulation by the local authorities. Field testing of the suggested model has been carried out in five municipalities of different size and different management modes. The ENGREF indicators are already beginning to be used in new management contracts. The ENGREF model is described in following chapter "Models for Performance Assessment".

4.2.4 The Netherlands

The Netherlands Waterworks Association (VEWIN) performed their first benchmarking study in the water industry in 1997. The methodology was refined in the second study in 2000. The study was performed at 15 water companies representing 90 % of the water sector in the Netherlands. The VEWIN system is described in the chapter "Models for Performance Assessment".

4.2.5 Germany

The acceptance of performance indicator concepts in the German water industry can be characterized as follows:

- The German water industry has a long-established tradition of self-organization and self-regulation. PI concepts are regarded ambiguously – useful for the undertakings on one side (but not particularly missed in the past) and threatening in the hand of a potential supervisor or regulator.
- In the context of the discussion on the liberalization of the water market, PI concepts were handled with some reluctance and skepticism, but have gained increasing interest recently.
- A multi-dimensional approach in order to equally cover quality, reliability, customer service, sustainability and economic efficiency is favoured.

In the international field test of the IWA PI-system, 14 water undertakings took part from Germany. The German group has worked together on the translation, refinement and adaptation of the IWA performance indicator system to German conditions. Between 2001 and 2003, the group achieved substantial results in terms of methodological development and

numerical results. Independently from the international group, the German group gathered data, calculated indicators and interpreted the results with respect to detailed conclusions for each individual company. The methodology of the PI concepts was improved on the aspects of context information, multidimensional assessment of performance and interpretation of PI results.

In parallel to the IWA field test in Germany, a benchmarking project in the German federal state Bavaria was conducted based on the IWA framework and in close co-operation to the field test. 95 utilities took part in the first cycle of the benchmarking exercise from 2001 to 2003.

There are also other initiatives mainly on the process benchmarking level in both water supply and wastewater.

4.2.6 Denmark

The Danish Water Association (DANVA) has 2000–2001 worked with a metric benchmarking project including 15 water and 16 wastewater utilities. The objective with this study was to focus the use of metric benchmarking as part of a management system. In total the number of performance indicators in the Danish system is approximately 170 within water supply services and about 160 within wastewater services.

The project confirmed that Danish water and wastewater utilities are ready to use benchmarking as one of more tools in their development. There is a demand for further development of the data to make it more reliable and to make the performance indictors more useful to the utilities. The project will continue with a yearly reporting, assessment and justification especially within the customer service area.

4.2.7 Norway

The Norwegian Water and Wastewater Works Association (NORVAR) performed in 1999–2000 a project focusing performance indicators as a tool for management of municipal water and wastewater services.

The PI-project led to a metric benchmarking project in which 21 utilities participated. The project was carried out in 2002. The project focused on use of performance indicators based on data already available from the Central Bureau of Statistics and from the Water Works Register.

4.2.8 Sweden

The Swedish Water and Wastewater Association, Swedish Water, has since it was established 1962 compiled facts about the water and wastewater industry yearly. As a tool for effective management of the operation and maintenance of networks a computer-based system, VABAS/DUF, was developed in the 1980-ies. Also a model for network benchmarking, DRIVA, was developed.

The system for compilation of statistics from the water and wastewater sector in Sweden was revised in 2001 and a new national system, VASS, was introduced. In addition to traditional data on the assets the new system also cover tariffs and data on economy, quality and service.

With the VASS system it is possible for the utilities themselves to conduct analysis and benchmarking studies. The system meets the demands on water and wastewater statistics from utilities, authorities and media. Data on tariffs are divided into two groups – connection fees (9 data) and consumption fees (11 data). Entry of data is compulsory for all municipalities in Sweden. Data on operation has a compulsory level (27 basic data) and four voluntary levels with more detailed data (69–467 basic data). In the future data will be classified with respect to accuracy in three groups. In January 2003 the web-based on-line system was successfully put into operation.

1995 a number of utilities in a region in middle Sweden started a benchmarking project with the ambition of developing a management tool – WUMP 2050. This system was developed together with a Swedish Consultancy firm, SWECO. The planning includes the following steps: Formulation of a vision and a business concept – key success factors – overall strategy. Objectives with measurable targets are set for operation, environmental protection, staff and organisation, customers and economy. Yearly benchmarking studies are carried out with in total 48 indicators. The data collection system is web-based and all data and indicators are stored in a central data bank available for the participating utilities. Today 23 Swedish municipalities are using WUMP 2050.

4.2.9 The Scandinavian 6-cities group

The 6-cities Group consists of Copenhagen, Gothenburg, Helsinki, Malmo, Oslo and Stockholm – cities with 800 000–250 000 inhabitants. In the 6-cities Group the water and wastewater utilities are all under public control.

In 1995 the 6-Cities Group initiated the development of a coherent performance benchmarking system for water and wastewater services. The group has developed a set of performance indicators for making consistent system comparisons. Annual benchmarking exercises are carried out and the comparative performance between the six undertakings and trends looking back five years are highlighted. The metric benchmarking processes have also been supplemented by process benchmarking whereby differences in performance between the organisations are identified and explanation factors are analysed.

4.3 Benchmarking initiatives outside Europe

4.3.1 Latin America

During the last decade, most countries in the Latin American region have introduced regulatory frameworks for the water and wastewater sector and created regulatory entities to control and enforce them. In October 2001, representatives of 10 Latin American regulatory entities formed a regional association of water regulators: ADERASA (Asociación de Entes Reguladores de Agua y Saneamiento de las Américas – America's Water and Sanitation Regulatory Bodies Association).

ADERASA brings together countries at very different stages in their development of a regulatory framework. Many of the regulatory tools that need to be developed, such as financial models, regulatory accounting guidelines, benchmarking performance indicators or customer's complaints methodologies, are generic in nature. This means that they can more cost-effectively be developed on a regional level, saving on the costs of 'reinventing the wheel' in each specific country, and accelerating the process of regulatory development in the countries that have reformed more recently.

ADERASA has established itself as a lively and supportive forum for the discussion of regulatory challenges, and the development of regulatory solutions. Although regulators in Latin America have been promoting the adoption of cost based tariffs, in most cases they have no real tools at their disposal for assessing whether these costs are efficient. The creation of a consistent and accurate regional database on utility performance parameters would greatly assist regulators in detecting and eliminating inefficiencies, thereby ensuring that customers do not pay higher tariffs than are really necessary.

The first challenge of ADERASA was to establish a common set of Performance Indicators (PIs). The intention was to facilitate comparisons of the performance of different companies. A PI manual was developed inspired by the IWA manuals, the WB toolkit, Ofwat, the 6-city Group, the Western Australia experience and other initiatives. Necessary adjustments were made to adapt it to the Latin American reality.

A starting set of indicators with aggregate information has been proposed with the intention of making a soft start. This starting set includes 80 PIs and 144 data entries. The number of indicators can later be increased according to the member's requests.

4.3.2 Western Australia

In 1996 the Office of Regulation (OWR) for Western Australia was formed to support the licensing of water services under the Water Services Coordination Act 1995. Licences usually run for 25 years and prescribe an operating area within which the service can be provided. The licence sets a range of minimum service standards, reporting requirements and customer service conditions. The functions of OWR are to ensure the administration of licensing system, to assist the Minister in planning and coordinating the provision of water services across the state and to coordinate and advise on water service policies. OWR also provides advice to the Minister on annual prices and charges on submissions made by Water utilities and provides a complaint resolution service to utility customers. The Health department sets the drinking water standards. Department of Environmental Protection licenses wastewater treatment plants.

In 1999 OWR set about defining and securing the essential information that would enable the assessment and reporting of the Western Australian water industry's performance and that of its major service providers.

The objectives of the benchmarking initiative are to:

- summarise pertinent facts and figures on the general business and operational environments of western Australia's three main licensed water providers
- discuss related performance achievements of the different towns/providers against statistical and performance indicators

- provide a comparative view of performance by benchmarking achievements in the crucial areas of water quality and supply continuity and rating the 31 towns (averaging 10 500 inhabitants) and the city of Perth (1 274 000 inhabitants) relative to each other

OWR publish the results from their benchmarking activities in yearly reports.

4.3.3 Canada

In Canada, the National Water and Wastewater Benchmarking Initiative is aiming at translating the results of metric benchmarking into actions that stimulate continuous improvement. The initiative, which started with four wastewater utility participants in 1997, is currently entering its sixth year of wastewater utility benchmarking, the fourth year for water utility benchmarking and the second year for stormwater benchmarking. The 2003/2004 benchmarking iteration includes 35 of Canada's leading cities and regional organizations and is aiming at collecting benchmarking data for the year 2002.

The Canadian Benchmarking initiative is a process that is repeated annually, consisting of four phases, namely data collection (July–December), data dissemination (January–March), the annual benchmarking workshop (April) and the production of the final report (May–June). The success of the project could be ascribed to a number of factors, two of which include the quality of data and the annual benchmarking workshop. The quality and accuracy of data is ensured through on-site data collection at participant municipalities to guarantee the consistent interpretation of data definitions. This in turn provides assurance to participants that the data they and other participants supply is indeed accurate and directly comparable. The annual benchmarking workshop is a five-day conference attended by utility managers and staff members from all the benchmarking participants. Each participating city attends with its performance data in hand to work on a range of performance improvement activities through focused break-out sessions.

5 Models for performance assessment

Most of the assessment models identified in this study have an overall performance assessment approach. Some models are focusing on the utility's performance in terms of quality and service reliability. One is focusing on the economic dimensions of performance only.

5.1 The Ofwat model

The Office of Water Service's (Ofwat) model for assessing operating efficiency applies a "top down" approach. The principal tool for assessing the relative operating efficiency is econometric modelling. Ofwat has a suite of 17 models that are used for calculating the relative efficiency of water companies as part of the price setting process. Ofwat sets an individual price cap for each company so that the companies have an incentive to increase their efficiency. The framework promotes efficiency in the medium and long-term interests of the customers. One challenge for Ofwat is to find a balance between the customer and the shareholder.

Ofwat has three separate targets for operating expenditure:

- An industry-wide target of 1.4 % annually efficiency savings (assumed in 1999) that all companies must achieve. From 2005 a new target will be set for the next 5 years period.
- A "catch-up" target, requiring companies to close 60 % of the initial gap between themselves and the leading company over five years
- For new operating expenditure only, a separate target that combines the above two, but also incorporates a greater factor for technological change and innovation

Periodic review is done every 5 year as base for assessing future efficiency savings and the comparative efficiency of the companies.

The assessment of company performance is done for the following four key areas with a number of measures for each area.

Water supply:
- Properties at risk of low pressure
- Properties subject to unplanned supply interruptions of 6, 12 and > 24 hours
- Population subject to hosepipe bans
- Drinking water quality – percentage of tests meeting the relevant standard for 8 key water quality parameters

Sewerage services:
- The number of properties considered being at risk of basement flooding more than twice in every ten years (capacity)
- The number of properties subject to basement flooding from sewers

Customer service:
- Billing contacts not responded to within 5 days
- Written complaints not responded to within 10 working days
- Bills to metered customers not based on meter readings
- Received telephone calls not answered within 30 seconds

Environmental performance:
- Major and significant pollution incidents per million equivalent resident population (sewage)
- Minor pollution incidents per million equivalent resident population (sewage)
- Sludge disposal
- Percentage equivalent population served by STWs in breach of their consent
- Major and significant pollution incidents (water)

Each assessment of company performance is turned into a score out of 50 points. The better a company's performance, the higher the score. For each measure a score is calculated and the score is given a certain weight. An overall performance assessment is calculated based on scores in the key areas.

The relative efficiency assessments for the water and wastewater services are determined by using a mixture of econometrical models and unit cost comparison. The models used for each of the assessments are set out below.

Water services
Operational efficiency:
- Water resources and treatment
- Water distribution
- Water power (energy expenditure)
- Water business activities

Capital maintenance efficiency:
- Water distribution infrastructure
- Water distribution non-infrastructure
- Water management and general

Wastewater services
Operational efficiency
- Sewerage network
- Large sewage treatment works
- Small sewage treatment works
- Sludge treatment and disposal
- Sewerage business activities

Capital maintenance efficiency:
- Sewage treatment
- Sewerage infrastructure
- Sewerage non-infrastructure
- Sludge treatment and disposal
- Management and general

For each of these categories the estimated costs from the models are combined and compared with the companies actual costs (which have been adjusted for special factors and typical costs). The difference between the actual and estimated cost is calculated as a percentage. The company with the lowest percentage or residual is the frontier company. The company with the smallest residual that satisfies the criteria to be a benchmark company (size, capex, opex etc) is chosen to be the benchmark company. Its residual is set to zero and the other companies residuals are normalised against this. The bandings are then based off the performance of the benchmark company.

As an example of illustration of assessment of the relative operating and capital maintenance efficiency[1] for water service 2001–02 the ranking is illustrated in a matrix (Figure 4, next page).

1. Operating efficiency: Achieving the same service level or better for less operating expenditure (opex finances all the day to day activities needed by the company to deliver services to customers).
Capital maintenance efficiency: Achieving the same or better output for less capital maintenance expenditures (capex is the costs for planned work carried out to replace and repair water and sewerage assets to provide continuing services to customers).

Operating efficiency banding						
	A Leading companies	Wessex Yorkshire	Southern			Portsmouth
	B Above average efficiency	Anglian		Northhumbrian Severn Trent South West Thames United Utilities Sutton & East Surrey		
	C Average efficiency		Mid Kent	Bournemouth & W Hants Dee Valley	South East South Staffordshire Tendring Hundred	Cambridge Three Valleys
	D Below average efficiency				Dwr Cymru Bristol Folkestone & Dover	
	E Least efficient companies					
		E Least efficient companies	**D Below average efficiency**	**C Average efficiency**	**B Above average efficiency**	**A Leading companies**
		Capital maintenance banding				

Figure 4. Relative operating and capital maintenance efficiency for water service.

The Ofwat methodology is scientifically based. The experiences from the use of the assessment system confirm that it is fit for drawing robust conclusions on relative efficiency and the method also is acknowledged by the water industry.

Although the levels of customer service are not included in the operating and capital efficiency models, they are reflected in price limits through the overall performance assessment.

Tests have been made with Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) as an initial crosscheck of Ofwat´s ordinary Least Squares (OLS) efficiency analysis. SFA is an extension of simple regression analysis used by Ofwat. The tests showed that DEA and SFA were workable alternatives. The results were different in a number of respects, but the overall picture of the results was similar and there was in most cases a high degree of correlation between the results of the different techniques.

The Ofwat model presuppose that a number of big companies take part in the comparison and that a lot of work is spent on collecting the necessary input data and on analysing the results.

5.2 The ENGREF model

The basic principles for the French approach is not to focus on price negotiation or price control but to have an approach that guarantee continuity, production of service for the user, public health aspects, environmental protection as well as sustainable assets management. The idea is to create scorecards for each of the criteria bringing together a number of indicators measured for several years.

Criteria for performance are defined with recommended indicators and optional indicators and classified in areas that reflect the main aspects of the management of a water or wastewater services. In Table 4, next page, is the list of water service indicators illustrated.

Table 4. Performance areas and indicators in the ENGREF model.

Performance area	Recommended indicators
Customer service	• Rate of replies to letters within 15 days • Proportion of waiting letters • Existing connections efficiency
Complaints	• Analysis of number of complaints per 1000 subscribers, classified by subject
Resource management (quantity and quality)	• Quality of supplied water rate of conformity in Health Authority tests and in self monitoring tests on distributed water
Network management and service continuity	• Primary water losses per kilometre • Primary efficiency of use of water resources • Mains failures • Water interruptions – rate of unscheduled water interruptions

The system also includes sewerage criterion concerning management and efficiency of the treatment system and budget criterion concerning sustainable assets management.

ENGREF reports that the field tests performed shows that this is an operational tool, which is applicable without a lot of extra costs because most of the basic data were already measured in the utility, even if they were not communicated. The French Ministry of Agriculture (FMA) has adopted the ENGREF model. ENGREF has conducted a study in order to consolidate the indicators collected by FMA.

5.3 The VEWIN-model

The Dutch Waterworks Association (VEWIN) started 1997 with a benchmark study of the Dutch drinking water industry. Based on the results of this study the methodology was refined. A second study was conducted on the performance 2000. The study was performed at 15 water companies. In terms of connections the participants represented approximately 90 % of the water sector in the Netherlands.

The study compared the performance of the different water companies regarding four themes (Table 5).

The results were included in a closed model to evaluate performance in each theme divided in several parts and elements.

5.4 The German framework for assessment of performance

In Germany a group of 14 water and wastewater utilities has developed a multidimensional model for assessment of the performance of their systems. This work was carried out in connection with the IWA field test.

Within the IWA framework, performance indicators are thematically grouped in 6 categories – water resources, personnel, physical and operational indicators, quality of service and financial indicators. Although this structure was maintained within the German framework, an additional multi-dimensional structure was developed oriented towards the presentation and interpretation of the performance of a water supplier.

Table 5. Themes for performance assessment in the VEWIN model.

Theme	Performance Assessment
Water quality	• Quality of drinking water expressed in a single figure – 14 health-related parameters, 6 consumer-related parameters, and 13 process-related parameters
Service	• Customers polled service perception
Environment	• Environmental impact expressed as a single figure – Use of energy, dehydration, auxiliary substances, chemicals and filter materials
Finance and efficiency	• Tariffs and costs brought together in a closed model – Tariffs for five standard user situations – Taxes, costs of capital, together with depreciation and operational costs for five processes

In this re-defined multi-dimensional structure, 93 indicators were attributed to the five categories, allowing the balanced interpretation of quality, reliability, service, sustainability and economic efficiency of a water supplier. The model is illustrated in Figure 5.

From the original IWA PI-set, about 55 % of the indicators were used. Mainly the aspect of sustainability had to be strengthened with additional indicators.

Essential for the interpretation of performance results, is the structuring of information and the matching of performance results and suitable context information. In order to facilitate the interpretation of total costs, capital costs, operation costs and costs of main functions, interpretation tools were developed to assemble relevant and additional indicators covering quality, reliability etc. and provide reference values if available.

Additional indexes were developed for three major aspects:

- index of task fulfillment of the water supplier,
- standardized index of outsourcing and
- index of organizational quality.

In order to evaluate these aspects, a standardized task catalogue had to be developed, defining main, partial and sub-functions of management and administration, customer service and technical tasks. Based on the standardized catalogue, index values were defined for task fulfillment (0–100 %) and the degree of outsourcing (0–100 %). Organizational quality was defined as the fulfillment of 75 issues in 8 categories covering organizational aspects, qualification of personnel, quality and environmental management, on-call duty and documentation.

The main motive for adding these indexes was the need for explanatory factors in the interpretation of PI results. With regard to total and operating costs, personnel intensity, quality and security of supply, the fulfillment of tasks, the degree of outsourcing and the organizational quality are driving factors and essential for the comparison and assessment of performance.

Experience and results of the German group within the IWA field test are to be compiled in the German version of the IWA manual "Performance Indicators for Water Supply Services", anticipated for publication by the end of 2004. This manual should maintain the basic structure of the international manual, but serve as the reference for German utilities in terms of the application of PIs and benchmarking.

5.5 Pilot studies in Scandinavia

5.5.1 Denmark

The Danish Competition Board has in their yearly report for 2002 highlighted a large potential for efficiency improvement in the water and wastewater sector. To illustrate the efficiency potential they have done two benchmarking studies with the help of Data Envelopment Analysis (DEA). This method compares the productivity for a number of similar units in relation to the best units. The analyse model is based on essential input and output variables.

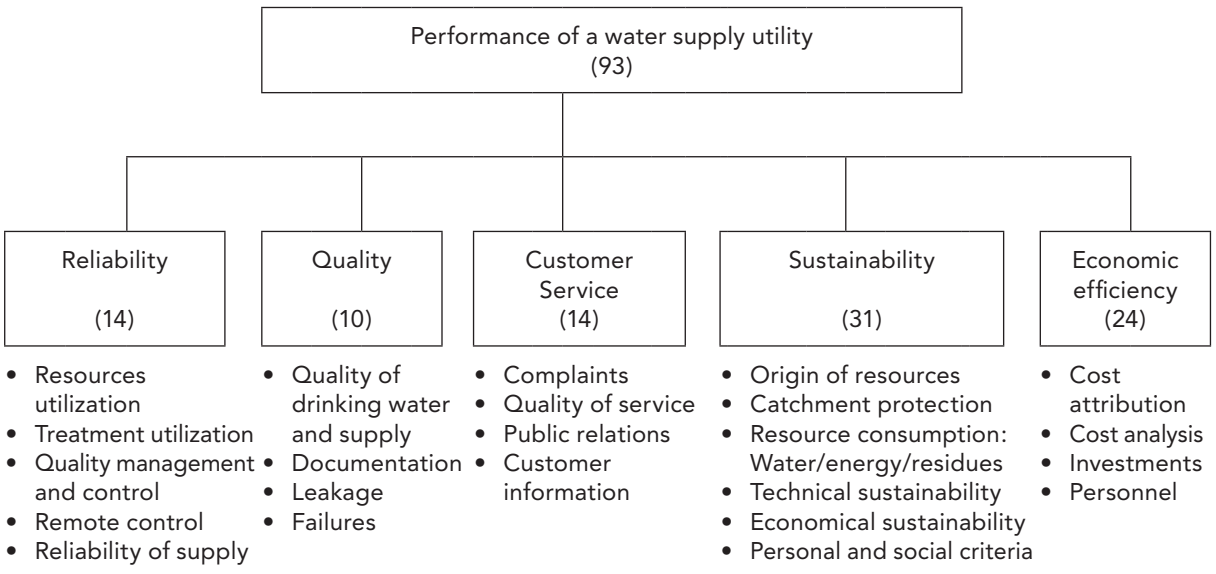

Figure 5. Performance areas and number of indicators in the German model.

The input in a DEA-analysis is what is needed to produce a specified output. Input is things like employees, machines, materials etc. that have a price and that can be expressed in the form of operational costs and depreciation. The output is things that the company produces. The choice of input and output variables is the most essentially part of the efficiency assessment.

The two separate benchmarking studies cover water supply (production and distribution together) and wastewater treatment plants. In the study regarding water supply the following variables were found relevant to test as input and output in the analyse:

- Operational costs (input)
- Number of employees (input)
- Energy consumption kWh (input)
- Water extraction (output)
- Distributed water amount (output)
- Total length of network including raw water pipes (output)
- Number of connected persons (output)
- Number of wells (output)
- Population density (output)

The DEA analysis is only concerning operational cost, since data on appreciation was not available. The starting point for the choice of a relevant model for the analysis was to find output variables for the operational costs (the input). Four models with different variables were tested. The model below, Table 6, turned out to give the most robust results.

A similar study was done for 108 wastewater treatment plants representing about half of the treated amount of wastewater in Denmark. The following variables were found relevant as input:

- Capital costs
- Total costs
- Costs for chemicals
- Costs for sludge disposal
- Discharged loads of COD, BOD, N, P and SS in ton
- Sand grit in ton
- Sludge in ton

Output variable could be:

- Discharged wastewater in m3
- Dimensioning capacity in PE
- PE-load – the pollution from the catchment area in PE
- Incoming load in COD, BOD, N, P and SS in ton

The focus of the analysis was to evaluate the cost-effectiveness of the treatment processes – minimising the total costs and the pollutions discharged. Four models with different variables were tested. The two models below, Table 7, were most robust.

The analysis indicated that there was a great efficiency potential both in water supply and wastewater treatment. The Danish Water Association, DANVA, is critical to the conclusions drawn from the benchmarking results.

The proposal from the Danish Competition Board based on the analysis of the water and wastewater sector was the following:

- The prime cost principle will be replaced by a regulation that promotes efficiency
- The accounting law principles are established for all operators
- To open up for third parts access to water supply
- To allow the consumer to choose operator within network with more than one operator
- To allow private water supply
- To give main users right to leave the sewerage by introducing contracts regulating the charges for connection and disconnection
- To increase the competition

Table 6. Variables in the DEA-model for water production and distribution.

Input variable	External variable	Output variable
Operation cost	Population density	Distributed drinking water volume Total network length

Table 7. Variables in the DEA-model for wastewater treatment.

Input variable	External variable	Output variable
Operation and capital costs Discharged pollution in BOD		The design capacity of the treatment plant
Operation and capital costs		Incoming pollution in PE-load

Table 8. Assessment criteria in the NORVAR model.

Assessment criteria	
Water supply services	**Wastewater services**
Hygienic safe drinking water (2 indicators)	Meeting demands on wastewater treatment (1 indicator)
Technical water quality (2 indicators)	Re-use of sludge in agriculture (2 indicators)
Reliability in water supply (1indicator)	Degree of connection to treatment plant (1 indicator)
Alternative water supply (1 indicator)	Overflow from the network (1 indicator)
Renewal of the network (2 indicators)	Renewal of the network (2 indicators)

5.5.2 Norway

The Norwegian Association of water and wastewater works, NORVAR, is running a test project on performance assessment using an assessment system based on the experiences from the metric benchmarking project carried out in 2002. 11 municipalities is taking part in the test. The main goal for the project is to get the utility companies to focus more on efficiency. Other goals are to gain experience from working with measurement of efficiency based on data from central data banks, evaluate the results, compare utilities, find differences, learn from each other and in that way find improvement possibilities.

The performance assessment system will be further developed based on experiences from the ongoing project and give input to improvement of quality and choice of data reported to the central data banks.

NORVAR's system for efficiency assessment is based on performance indicators for service quality and economy, explanation factors and basic data as illustrated above (Table 8).

For water supply 52 basic data are used and 11 general explanation factors, 17 explanation factors for service quality, 5 supplementary operation factors and 16 explanation factors for economy.

For wastewater 54 basic data are used and 14 general explanation factors, 9 explanation factors for service quality and 16 explanation factors for economy.

In the assessment the utility's performance is classified in the following grades:

- Satisfactory
- Doubtful
- Not satisfactory
- Basis for assessment is missing

The model does not give an assessment of the overall performance, but the assessment of quality and efficiency in 10 areas gives an opportunity for the individual utility to compare performance with other utilities.

5.5.3 Sweden

In the Swedish WUMP 2050 model objectives with measurable targets and indicators are set for the assessment areas below (Table 9).

Key Performance Indicators being continuously assessed, as a basis for:

- Drawing conclusions from past experience
- Current situation analysis
- Forward planning

Table 9. Assessment areas and number of indicators in the WUMP 2050 model.

Assessment area	Number of indicators
Operation of drinking water production	6
Distribution of drinking water	8
Collection of wastewater	5
Wastewater treatment	7
Environmental protection	15
Staff and organisation	7
Customer	3
Economy	4

The utilities performance is classified in the following grades:

- Excellent sustainability
- Good sustainability
- Satisfactory sustainability
- Poor sustainability

5.6 The Government of Western Australia model

A customer survey done by the Office of Water Regulation in 1999–2000 showed that 84 % of residential respondents rated water quality and reliability of supply as the most important aspects of water supply. Commercial respondents expressed similar levels of concern. Therefore four performance indicators illustrating these areas were selected to enable the internal and competitive benchmarking of performance by towns and providers.

Based on this result the standardised performance indicators are used to formulate an (un-weighted) aggregate score for each town as illustrated below (Table 10).

The resulting score considers the four indicators taken together and compare the relative performance of the benchmarked towns. A high level of performance was apparent with 23 towns scoring more than 95 (out of 100). 7 towns scoring between 90 and 95 and just 2 towns scoring less than 90.

5.7 The Canadian Utility Management Model

Since 1997, the Canadian National Water and Wastewater Benchmarking Initiative has been developing a "Utility Management Model" that provides the framework for the performance assessment of water, wastewater and stormwater utilities (Figure 6, next page). The management model was developed through discussion sessions held with representatives from the participant cities and regional organizations, and is continuously being refined with each new benchmarking iteration.

The first layer of the model consists of a set of high-level utility goals that a utility must strive to attain. Subsequently, under each goal, a range of performance measures (PM′s) was formulated to measure a utility's success in attaining the goals. For inclusion in the management model, each performance measure had to comply with criteria such as practicality, measurability, accuracy and relevance to the utility's actions.

Experiences from the Canadian National Water and Wastewater Benchmarking Initiative show that the real value of benchmarking lies in identifying areas of performance gaps and improvement strategies focused on specific processes. To solidify this process, the Canadian initiative has established a number of process benchmarking task forces to address areas of concern to utility managers.

Table 10. Assessment areas and standardised scores in the Western Australia model.

Water quality		**Continuity of supply**		**Performance Assessment**
Standardised Score	**Standardised Score**	**Standardised Score**	**Standardised Score**	
Number of Water quality complaints per 1000 properties served	Microbiological compliance Total coliforms	Average duration of interruptions	Percentage of services not experiencing drinking water supply interruptions > 1 hour	Aggregate Performance Score
The indicators are standardised and scored as follows. Number of complaints on drinking water quality — 100–0.97 * No complaints/1000 properties Approved microbiological tests — Number of approved tests / total number of tests Interruption in water delivery — 100–3.21 * average interruption time in hours Properties with interruption > 1 hour — Number of properties subject to interruption > 1 hour / total number of properties				

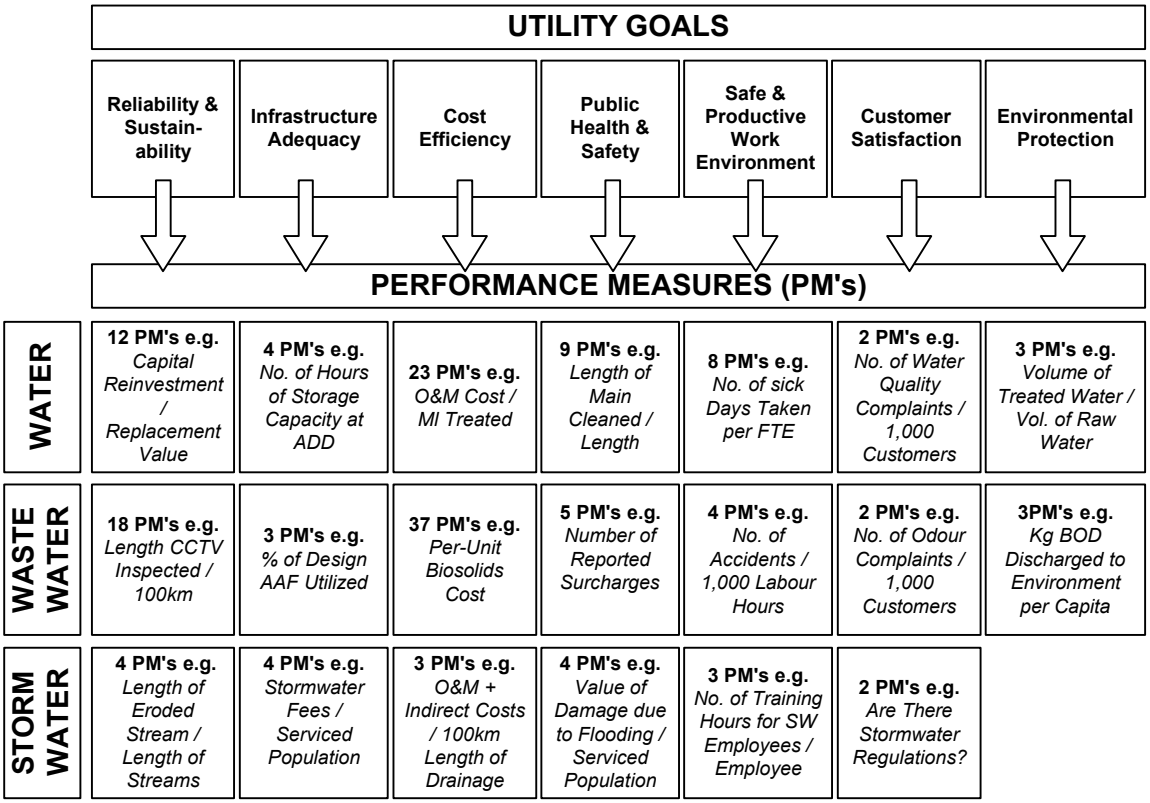

Figure 6. Utility goal areas and performance measures in the Canadian management model.

6 Conclusions

The aim with this study has been to survey the best practice in performance assessment within the water and wastewater sector. The current situation with respect to forms for ownership, operation and regulation has also been surveyed. It is quite obvious that the subject of benchmarking and performance assessment is attracting increasing interest in most countries. There are many interesting benchmarking and performance assessment initiatives in and outside Europe. The survey has also resulted in contacts with organizations interested in exchange of benchmarking experiences.

Public ownership is dominating in Europe. Private ownership may increase in Eastern Europe but the trend is that public ownership will remain in control also in the future. Only in England and Wales the water and wastewater services are fully privatized. Also the operation is dominated by publicly owned organizations with the exception for England, Wales and France. In contrast to ownership the trend is that operation of the utilities by private companies is increasing.

Water and wastewater services are natural monopolies where a real competition is difficult to obtain. This in combination with the fact that the EU policy is in favour of increasing private participation in the public service sector have in many countries resulted in a strive for stronger regulation in order to ensure that the services are performed efficiently. The concept of "pseudo-competition" is used of some regulators and some branch organizations as a useful tool to increase the organisations focus on efficiency.

In the survey a number of interesting initiatives are described. Nine different models for performance assessment were identified. Three models are used by regulation authorities or government departments and six models are developed by branch organisations or network of utilities. Most of the models have the approach of overall performance assessment. Some focus only on the quality of services or on the economic efficiency.

From a Scandinavian perspective the increasing pressure on monopolies has already resulted in governmental initiatives to assess the efficiency of the water and wastewater services. So is the case in Denmark and Norway. In order not to be overrun

by the government the Danish and Norwegian branch organisations are working hard to influence the expected future regulation model so it will become a useful tool for describing the quality of the services delivered and for a fair assessment of the efficiency. Also in Sweden the Water and Wastewater Association has the ambition to take the initiative in the development of a performance assessment model.

The experiences from the described benchmarking and performance assessment initiatives will no doubt be of great value for developing a model for assessment of the overall performance adapted to Scandinavian conditions.

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Appendix 1: Inquiry form and contacted organisations

In the survey of ownership, operation and regulation of water and wastewater services the following form was used.

Inquiry about water and wastewater utilities

State:

Ownership and operation

	Water			Wastewater		
	Public(1	Private(1	Mix	Public(1	Private(1	Mix
Ownership						
Operation						

(1 More than 60 % of inhabitants served

The trend is ☐ keeping the actual status ☐ increasing private ownership
☐ increasing private operation

Comments:

Forms for regulation and supervision

	National level	Regional level	Local level
Drinking water quality supervision			
Environment			
Customer Services and Efficiency			

Comments:

Evaluation models

	Drinking water quality	Water distribution	Wastewater collection	Wastewater treatment	Customer services	Costs	Others
Parameters used in the model							

Short description of the model used:

Name of institution managing the model:

The organisations contacted are listed below.

Country	Organisation	Answer received	No answer
Europe			
Austria	ÖWAV Österreicher Wasser und Abfallswirts chaftsverband		x
	ÖVGW Österreichische Vereinigung fur das Gas und Wasserfach		x
Belgium	Belgian Committee of IWA		x
Bulgaria	Bulgarian Water Supply and Sewerage Association BAWK	x	
Croatia	Croatian Association for Water Pollution Protection		x
Czech Republic	Czech Association of Waterworks SOVAK		x
Denmark	Danish water Supply Association	x	
England and Wales	Ofwat – Office of water service	x	
Estonia	Estonian Water Association	x	
Finland	Finnish water and Waste Water Works Association	x	
France	Laboratory GEA, ENGREF	x	
Germany	ATV-DVWK Deutche Vereinigung fur Wasserwirtschaft, Abwasser und Abfall		x
	IWW Water Center	x	
	Prof. Dr.-Ing. Rolf Pecher	x	
Greece	Ministry for the Environment	x	
Hungary	Hungarian Professional Association of Water and Sewerage Companies	x	
Iceland	Samorka - Federation of Icelandic Energy and Waterworks		x
Ireland	Department of the Environment & Local Government	x	
Italy	Federgasaqua	x	
Latvia	Riga Municipal Enterprise	x	
Lithuania	Public Commission of costs and energetics control	x	
Netherlands	VEWIN Netherlands Waterworks Association	x	
	NVA Netherlands Wastewater Association		x
Norway	NORWAR Norwegian Water & Wastewater Works Association	x	
Poland	Polish National Committee of IWA	x	
Portugal	LNEC - Laboratório Nacional de Engenharia	x	

Country	Organisation	Answer received	No answer
Europe			
Romania	Romanian Water Association		x
Russian Federation	The Institute for Urban Economics	x	
Scotland	Scottish Executives, Scottish Government	x	
Slovakia	Slovak Technical University, Department of Sanitary Engineering	x	
Spain	Hispagua – The Spanish Water Association		x
Sweden	Swedish Water – The Swedish Water and Wastewater Association	x	
Switzerland	SVGW - Schweizerischeer Verein des Gas- und Wasserfaches	x	
	Verband Schweiz Abwasser & Gewässerschutzfachleute	x	
Yugoslavia	YU National Committee of IWA		x
South and Central America			
Argentina	AFERAS – The Association of Argentinian Regulation Authorities	x	
Bolivia	SISAB - Superintendencia de Saneamiento Básico	x	
Chile	AIDIS – The Regulatory Agency	x	
Costa Rica	ARESEP – Autoridad Reguladora de los Servicios Públicos	x	
Honduras	The Regulatory Agency	x	
Nicaragua	INAA – The Regulatory Agency	x	
Peru	SUNASS – The National Superintendence for Sanitary Services	x	
Asia			
Japan	Nagoya City Water and Sewage Works Bureau	x	
	Japan Water Works Association		x
	Japan Sewage Works Association		x
Australia			
Western Australia	Office of Water Regulation	x	
North America			
Canada	Canadian Water and Wastewater Association	x	
	Earth Tech Inc.	x	

Appendix 2: Ownership and operation of water and wastewater services

Survey of the situation in Europe

Dominating forms for ownership and operation of water supply in the European countries that have answered the inquiry are described below. In the inquiry respondents dominating form was defined as a form representing more than 60 % of the consumers served. For countries that have not answered the inquiry information data from the report "The European Water Industry – A country by country analysis" by David Owen (Financial Times Energy 1999) has been used.

Ownership and operation

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation
Austria(1								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
Water and wastewater services are directly supplied by the municipalities.								
Belgium(1								
Ownership	> 60 %					x		x
Operation	> 60 %					x		x
1997: Private sector water provision 2 % and private sector sewerage 54 %. The National Water Distribution Agency is regionalised and divided into: WMW, 8 inter-municipal consortia and 22 municipal organisations. Sewerage is under aegis of Aquafin (51 % held by WMW and 20 % by Severn Trent and the reminder by private investors. Brussels Inter-municipal Waterworks SWDE, 22 inter-municipal consortia, 16 private concessions (regies´) and 110 municipal organisations.								
Bulgaria								
Ownership	> 60 %			> 60 %				
Operation	> 60 %			> 60 %				
52 water supply and sewerage utilities – 13 regional state companies/16 regional mixed state-municipal companies/22 municipal companies								
Czech Republic(1								
Ownership	> 60 %			> 60 %				x
Operation			x			x		x
Private sector share of water provision WAS in 1998 28 % and of sewerage 26 %. From the original 8 regional entities and Prague 57 water/sewerage companies have emerged. In theory all of these companies have been privatised, but in some of the privatisations the municipal authorities have retained effective control op operations and the asset holding companies through large shareholdings. Seven of these companies (serving 2.9 million people) have been fully privatised. Normal private sector structure involves having an "asset owning company" held by relevant municipalities and the government, which rent the infrastructure and approve water charges to an "operating company" via an operating contract, which include the agreed price formula.								

(1 Data from "The European Water Industry – A country by country analysis".

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation
Denmark								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
Of water distributed 61 % is managed by 166 public owned organisations and 39 % by small consumer managed co-operatives, private companies and management contracts.								
Estonia								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
Only in Tallinn private ownership and operation are increasing.								
Finland								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
Municipalities are owners and operators of the services. In some cases "Water companies" can be "private companies" owned by municipality or by municipalities. In the countryside there are a lot of small co-operatives owned by the customers. They sell 5 % of the water in Finland. No water utilities are privately owned.								
France								
Ownership	100 %			100 %			x	
Operation	20 %	80 %		47 %	53 %		x	
The ownership of the assets remains public, but under the status of delegation, it can for a fixed period be transferred to a private investor.								
Germany								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
The Water Supply Services are normally organised as joint stock companies, which in the most cases are owned and controlled by the communities. The communities are responsible for the outlets to recipients from the Wastewater Services and there are also other obstacles for privatisation. In Eastern Germany water and wastewater are integrated at the municipal level and in Western Germany they are separate. There are about 6.000 water entities in Eastern Germany and about 1.400 water supply companies in Western Germany.								
Greece								
Ownership	> 60 %			> 60 %				x
Operation	> 60 %			> 60 %				x
The competent authorities for the wastewater management are local (public) except for the major cities of Athens and Tessaloniki, where the authorities are partly private.								
Hungary								
Ownership	> 60 %			> 60 %				x
Operation	> 60 %			> 60 %				x
Water and wastewater services were 1991 transferred from the government to the municipalities. Privatisation of the sector is being carried out on a concession basis. Budapest water and sewerage services were privatised 1997 but otherwise privatisation to date has been on a small scale.								

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation
Ireland								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
88 mainly local authorities provide Water services directly, but from 2004 responsibility for water services will be transferred from town to county level, reducing this number to 34. In rural areas where a public water services is not available, water services are organised and provided by local community co-operatives (GWS) on a self-help basis with grant assistance from central funds. There are 5.500 such GWS most of them serving less than 50 persons.								
Italy								
Ownership	98 %	2 %		> 99 %			x	
Operation	> 60 %	6 %	25%			25%		Private and mixed
Water supply is managed by 8 000 municipal administrations, which work either individually or in association with other municipalities. The 1994 Galli law recognises the inadequacy of the current operational structure. The law that the water entities are to be rationalised into 100–120 more manageable entities, with the intention that these should combine water provision and sewerage.								
Latvia								
Ownership	x			x			x	
Operation	x			x			x	
Almost 100 % public ownership and operation.								
Lithuania								
Ownership	x			x				
Operation	x			x				
Almost 100 % public ownership and operation.								
The Netherlands								
Ownership	100 %			100 %			x	
Operation	100 %			100 %			x	
Water and Wastewater Services are based on the "Waterworks Act" from the late 1950s. At that time there was 150 water supply entities and 11 provinces were responsible for organisation of the water supply. 1975 the law was revised and opened for structural changes in order to increase quality and efficiency. Today there are 15 water supply companies. Municipalities and provinces own the companies and privatisation is not allowed.								
Norway								
Ownership	100 %			100 %			x	
Operation	~ 100 %			~ 99 %	~ 1 %		x	
About 100 % public ownership and operation. Public also include small waterworks owned and operated by the customers. During the last years other forms of operation and ownership of the water and wastewater sector have been discussed and explained in order to make the sector more efficient, but except for some very few cases nothing new has been realized yet.								

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation
Poland								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
Urban water and sewerage services have been reconstructed as limited companies but remain under the direct control of the local authorities. It is up to each authority to decide if privatisation will take place. Privatisation is expected to be a slow process.								
Portugal								
Ownership	> 60 %			> 60 %				x
Operation	> 60 %			> 60 %				x
Romania(1								
Ownership	> 60 %			> 60 %				x
Operation	> 60 %			> 60 %				x
Russian federation								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %				x
Slovakia								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
In the past all water and wastewater utilities have been owned by the state. Recently some of them were transformed to municipal hands, the rest will be transformed this year into municipal ownership and municipal shareholder companies will be created.								
Spain(1								
Ownership			x			x		x
Operation			x			x		x
Private sector extent 45 % for water and 48 % for sewerage in 1997. By 2010 70–80 % of water provision and sewerage market are expected to be privately held.								
Sweden								
Ownership	99 %			99 %			x	
Operation	98 %			98 %				x
Water and wastewater utilities are with exception of 2 utilities fully owned and controlled by municipalities.								
Switzerland								
Ownership	> 60 %			> 60 %			x	x
Operation	> 60 %			> 60 %			x waste-water	x water
The municipalities own and control the water and wastewater services. Privatisation is not to be considered in the foreseeable future.								

(1 Data from "The European Water Industry – A country by country analysis".

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation

United Kingdom

England and Wales

Ownership		100 %			100 %		x	
Operation		100 %			100 %		x	
In England and Wales before 1974 there were over 1600 separate, often municipally run, water and wastewater utilities. The 1973 Water Act rationalised the water industry structure. Instead of the many small locally based water undertakings, there emerged 10 large regional public authorities, each based on river catchment areas. In addition there were 29 statutory water companies, many of which had been in existence for over 100 years. In 1989 there was a further reorganisation and the utilities in England and Wales were fully privatised. Today there are 10 companies with water and wastewater services and 15 companies with water service only.								

Scotland

Ownership	100 %			100 %			x	
Operation	> 60 %			> 60 %			x	
In Scotland water and wastewater services are publicly owned and operated. In April 1996 the water and wastewater services were taken away from the existing 12 regional and islands councils and 3 regional public owned authorities were formed. In 2002 the Scottish Parliament decided that water supply and sewerage should remain publicly owned and managed. However, in order to be able to meet increasing quality demands and improve efficiency the three regional authorities should be integrated in one authority, Scottish Water. Scottish Water is in operation since 1 April 2002.								

Northern Ireland

Ownership	100 %			100 %			x	
Operation	> 60 %			> 60 %			x	
In Northern Ireland water and wastewater services are owned and operated by Water Service, an Executive Agency within the Department for Regional Development.								

(1 Data from "The European Water Industry – A country by country analysis".

Examples from outside Europe

Country	Water			Wastewater			Trend	
	Public	Private	Mix	Public	Private	Mix	No changes	Increasing private participation
Western Australia								
Ownership	> 60 %			> 60 %				
Operation	> 60 %			> 60 %				
Japan								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %				x
The number of water supply utilities in Japan is 14.580. 90 % of them are serving population less than 5 000 persons. There is a pressure to merge small utilities by rationalisation. There are several private owned and operated water utilities. Wastewater utilities are owned and operated by municipalities under existing law. 2001 a guideline on entrusting to private enterprise based on performance specification contract was published.								
Argentina								
Ownership	100 %			100 %			x	
Operation			x		> 60 %			x
Ownership is public in almost 100 %, while operation is in private hands by means of concession contracts for roughly 60 % of the population. 40 % remains in public and in small towns cooperative hands.								
Bolivia								
Ownership	> 60 %			> 60 %			x	
Operation			x	> 60 %			x	
The 27 service providers currently under concession provide services to approximately 50 of the total population. 19 are co-operatives serving 34 % of the population, 7 are municipal companies serving 29 % and 1 private company serving the remaining 37 %.								
Costa Rica								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %			x	
A state institution operates the service for 47 % of served population, municipal companies 5 %, Rural Aqueducts 28 %, municipalities 20 % and Private Aqueducts 0,1 %.								
Honduras								
Ownership	> 60 %			> 60 %			x	
Operation			x	> 60 %				x
The Water Service property is owned by the municipality and operated by a stock company with the Municipality as a principal stockholder. A strategic plan for selling shares in the company is under development.								
Nicaragua								
Ownership	> 60 %			> 60 %			x	
Operation	> 60 %			> 60 %				x
More than 90 % of the water and wastewater services are under public management and operated by a public company (ENACAL9 because by law the concessionary must be a public company. The municipalities operate rural aqueducts with technical assistance from ENACAL.								
Peru								
Ownership	100 %			100 %			x	
Operation	100 %			100 %				x
The property is 100 % public. Each municipality or city government is responsible by law for the supply of water services and can delegate the operation to public, private or mixed utility companies.								

Appendix 3: Regulation of water and wastewater services

Survey of the situation in Europe

Forms for regulation of in the European countries that have answered the inquiry are described below.

Country	Drinking water quality			Environment			Service and efficiency		
	National level	Regional level	Local level	National level	Regional level	Local level	National level	Regional level	Local level
Bulgaria	x	x		x	x	x	x	x	x
Ministry of Health – drinking water quality supervision Ministry for Environment and Water - Integration management and water quality supervision There is no general evaluation model in common use.									
Denmark	x		x	x	x	x	x		x
The Danish Competition Board has 2003 performed a benchmarking analysis with the intention to evaluate possible efficiency potential. The Danish Water and Wastewater Association has developed a system for voluntary metric benchmarking.									
Estonia	x	x	x	x	x	x	x	x	x
There is no general evaluation model in common use.									
Finland	x		x	x	x		x		x
Drinking water: National drinking water quality standards are given by Ministry of Social and Health affairs. Local Health Authorities supervise the drinking water quality. Waste water: The Regional State Authorities give permits and supervise waste water quality discharged to the recipient. Customer service: Customers may complain about the fees to the Competition Authority. There is no general evaluation model in common use.									
France			x		x	x			
There is no model evaluating the performance as a whole. The regulation is done at local level with no complete homogeneity from one municipality to another. Some projects of "national observatory" are in progress.									
Germany			x	x	x				x
There is no general evaluation model in common use.									
Greece	x	x	x	x	x	x	x	x	x
There is no general evaluation model in common use.									
Hungary	x	x [a]	x [b]	x	x [c]		x [d]	x [d]	x [d]
The regulation is on national level in every case. Public health authorities manage the supervision. [a] Regional systems and local systems, except Budapest [b] Budapest [c] Drinking water resources [d] Budapest has its own supervision There is no general evaluation model in common use.									
Ireland	x			x					x
Standards are set by regulation to transpose EU drinking water and wastewater treatment diectives. The Minister undertakes general supervision of local authorities. A report on national drinking water quality is prepared annually by the Environmental Protection Agency.									

Country	Drinking water quality			Environment			Service and efficiency		
	National level	Regional level	Local level	National level	Regional level	Local level	National level	Regional level	Local level
Italy	x		x	x	x	x			
The Government sets standard definitions. Wastewater monitoring is performed by the Regional Environment Agency. Water quality monitoring is performed by Local Health Agencies. There is no general evaluation model in common use.									
Latvia	x	x	x	x	x	x	x	x	x
No unified evaluation model exists.									
Lithuania	x	x	x	x	x	x	x	x	x
Water law and model of management are on the stage of preparation. There is no general evaluation model in common use.									
The Netherlands	x	x	x	x	x	x		x	x
The Netherlands Water- and Wastewater Works Association has developed a model for performance assessment of the waterworks. The performance is evaluated in 4 areas – water quality, environment, customer service and costs.									
Norway			x		x	x			x
WWTP > 1 000 pe: Licences and supervision on regional level. WWTP < 1 000 pe: Licences and supervision on local level. The Norwegian Water- and Wastewater Works Association has developed a model for performance assessment. The waterworks performance is evaluated with respect to quality and efficiency in 10 areas. The model is in the testing phase.									
Poland	x	x	x	x	x	x			x
National level: Statutory regulations or executive orders. Regional and local levels: Control and supervision. There is no general evaluation model in common use.									
Portugal	x			x			x (1		x
The Drinking water quality supervision is currently a responsibility of IRAR, the Institute for the Regulation of Water and Solid Wastes Water. However, the Government announced very recently that a new separated entity will be established, the "Drinking Water Quality Authority", in order to separate the (economic and customer service) regulatory activities from the advisory and inspection role related to the drinking water quality control. The Environmental regulation is under the responsibility of the Institute for Water (INAG), which depends on the Ministry for the Environment The municipalities are currently self-regulated with regard to customer services and efficiency. A national project (PI-Waters Project) for testing and implementing the IWA-PI system was launched in 2001. Some of the entities have already adapted the IWA PI to their own system. There are no cases of global performance, only individual indicators. The IRAR (Institute for Regulation of Waters and Residuals is developing systems of performance indicators for promotion of regulation by comparison. (1 IRAR is the regulator for the cases of concessions and for the multi-municipal undertakings. At present, IRAR regulates 3 regional water companies, 4 regional wastewater companies, 7 water and wastewater companies and 1 water, wastewater and solid wastes company. Companies with one city system are 7 water, 1 wastewater and 9 water and wastewater.									
Russian Federation	x	x		x	x			x	x
Great difficulties with tariff regulation. There is no general evaluation model in common use.									

Country	Drinking water quality			Environment			Service and efficiency		
	National level	Regional level	Local level	National level	Regional level	Local level	National level	Regional level	Local level
Slovakia	x		x	x					x
Drinking water: Water quality assurance is in the hand of the owner/operator. Supervision is done by the State Inspectorate of the Environment. Wastewater: Environmental issues are regulated and supervised by the State Inspectorate of the Environment. Customer service is in full responsibility of the utility operator. There is no general evaluation model in common use.									
Sweden	x		x	x	x		x		x
Drinking water: National drinking water quality standards are set by the The Ministry of Agriculture with the National Food Administration the central supervising agency. Local health authorities supervise the water quality. Waste water: The Ministry of Environment is responsible for water protection. The Regional Environmental Courts give permits for the discharge of treated sewage and a Supreme Environmental Court deals with appeals. The Environmental Protection Agency on a central level, the county administration on regional level and health authority on local level provide the supervision. Customer service: Customers may complain about the services fees to the Water and Wastewater Court. The Swedish Water- and Wastewater Works Association has developed a system for metric benchmarking. There is no general evaluation model in common use.									
Switzerland	x	x	x	x	x	x			x
Drinking Water: Federal Office of Health sets Standards on national level. Cantons are responsible fro the execution of the Federal law. Water quality is supervised by self-control. Wastewater: the Federal office of Environment sets Standards on national level. Cantons are responsible for the execution of the Federal law. Supervision is executed by the cantons. Customer services: Different regulations in the municipalities. There is no general evaluation model in common use.									
United Kingdom									
England and Wales	x			x			x		
The Drinking Water Inspectorate (DWI) has responsibility for monitoring the quality of water supplied to customers. DWI can and has prosecuted companies for failing to meet water quality standards. The Environment Agency regulates and enforces national environmental water quality standards in rivers, estuaries and coastal waters. The Office of Water Services (Ofwat) is the economic regulator in England and Wales and has four key responsibilities: Facilitating competition, protecting customers, promoting economy and efficiency by the companies and setting price limits. Ofwat uses the price-cap model to set efficiency targets and control the tariff level. These caps set maximum revenues for each water company in five-year cycles. Through performance comparisons Ofwat derives yardsticks that it used to assess efficiency of the water companies. Less efficient companies are given more demanding efficiency targets and are expected to come up to the standard set by best performers.									
Scotland	x			x			x		
The Drinking Water Quality Regulator (DWQR) has responsibility for monitoring the quality of water supplied to customers. The Scottish Environment Protection Agency regulates and enforces national environmental water quality standards in rivers, estuaries and coastal waters. Economic regulation is carried out by the Water Industry Commissioner for Scotland (WIC) who operates in a similar fashion to that of Ofwat for England and Wales. The WIC uses Ofwat´s model for evaluation of service and efficiency with only slight changes for adapting to the public ownership and operation.									

Examples of regulation in countries outside Europe

Country	Drinking water quality			Environment			Service and efficiency		
	National level	Regional level	Local level	National level	Regional level	Local level	National level	Regional level	Local level
Western Australia		x	x		x	x		x	x
In 1996 the Office of Regulation (OWR) for Western Australia was formed to support the licensing of water services under the Water Services Coordination Act 1995. The functions of the Office are to ensure the administration of licensing system, to assist the Minister in planning and coordinating the provision of water services across the state and to coordinate and advise on water service policies. The Office also provides advice to the Minister on annual prices and charges on submissions made by Water utilities and provide a complaint resolution service to utility customers. Health department sets the drinking water standards. Department of Environmental Protection licenses wastewater treatment plants. In 1999 OWR set about defining and securing the essential information that would enable the evaluation and reporting of the Western Australian water industry's performance and that of its major service providers. Based on this result the standardised performance data to formulate an (un-weighted) aggregate score for each town against: • Number of water quality complaints per 1000 served properties (water quality) • Microbiological compliance (water quality) • Average duration of supply interruptions (supply continuity) • Services not experiencing drinking water supply interruptions lasting longer than 1 hour									
Argentina		x		x	x	x		x	
Water and wastewater services are regulated by the provincial states (Federal political regime). There is National, Provincial and Municipal environmental legislation, with some times controversial enforcement. A model for evaluation in 5 areas drinking water quality, Water distribution, Wastewater collection and Customer services – is implemented, A model for costs is under development.									
Bolivia	x			x	x	x	x	x	x
Superintendencia de Sanaemiento Básico (SISAB) is the national agency regulating the water and sewage services. The Los Llanos Regional office has a customer service facility (ODECO). Both SISAB and ODECO are planning to implement regional offices. The regulator supervises the operators at "arms length" based upon objectives of service and quality of services defined in the Concession contracts, environmental laws and established standards..									
Costa Rica	x	x		x	x		x	x	
There is only one Regulation Agency for the whole country, but it has not any authority for the aqueducts administered by the municipalities. A general evaluation model will be implemented in the future.									
Honduras		x				x			x
The Regulator Agency is under the process of carrying out the supervision of drinking water quality by contracting out the services of a private laboratory for water inspection. Evaluation is made based on national norms and rules.									

Country	Drinking water quality			Environment			Service and efficiency		
	National level	Regional level	Local level	National level	Regional level	Local level	National level	Regional level	Local level
Nicaragua	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	
The water and sewage system is controlled and regulated by the INNA, the regulatory agency that has regulation functions (norms, regulations, guides etc.) and control and supervision functions through technical inspections to localities and direct supervision. The evaluation model used is based on the execution and compliance of the Regulation and Control General Norm for the drinking water and sanitary service, which states the direct supervision of seven major indicators that are evaluated in each locality. The water and sewage companies should comply with the established parameters and report to INAA about the perfo9rmance indicators. The agency can inspect “in situ” the quality of services reported.									
Peru	**x**		**x**	**x**		**x**	**x**		**x**
The drinking water and sewage services are regulated by the National Superintendence for Sanitary Services (SUNASS)									
Japan	**x**			**x**	**x**	**x**			**x**
Water quality standards will be more strict and water examination items will be added under revised Waterworks law. Pollutant load in wide area closed water body is totally regulated and regulation items will be added and environmental quality standards will be more strict under revised Water pollution control law in next fiscal year.									

Performance assessment of water and wastewater services – survey of best practice

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