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ABSTRACT
In France, good governance of public water and sanitation services revolves around the definition and monitoring of performance indicators designed as steering tools and targeting results. Among the 29 statutory performance indicators, the network efficiency rate plays a key role in water services asset management. Indeed if water services fail to comply with a specific efficiency rate by 2015, they may face a 100% increase in the intake tax paid to the French water agencies. Using data from the French national observatory on water services, the actual situation of French water services with regard to the leakage regulation was assessed. Three different groups of water services were identified and described using their generic characteristics. The overall quality of their asset management is analysed using the asset knowledge and management index, the network renewal rate and the water price.
Several conclusions were drawn. Firstly, the use of the efficiency rate as a tool to assess the overall asset management quality of services seems to be relevant as it properly reflects the service knowledge and efforts to maintain and manage its water infrastructure. Moreover, services not complying with any regulatory threshold show the poorest level of asset knowledge and management index in the whole working sample. On the contrary, water services complying with the 85% regulatory efficiency rate have the highest level of asset knowledge and management index and the highest network renewal rate in the whole working sample. Lastly, the two groups of services complying with the French leakage regulation show a higher water price than the group failing to match the regulation. Implementing an asset management policy is costly as it induces higher maintenance and investments costs which increase the price of water. On the contrary, services not complying with the regulation show cheaper water prices which reflect little efforts to know and manage their infrastructure.

KEY WORDS: asset management, network efficiency rate, performance.

INTRODUCTION

In France, all water and sanitation services are public and fall within the responsibility of municipal authorities or inter-municipal cooperation bodies. Good governance of water and sanitation services relies on the promotion of service performance and best practices. This system mainly revolves around the definition and monitoring of performance indicators designed as steering tools and targeting results. These good governance instruments should enable operators to achieve a certain quality of service and guarantee consumer satisfaction. The Ministerial Order and Decree dated 2nd May 2007 define a list of 29 statutory performance indicators to be calculated annually by each water and sanitation service (table 1). The observatory on public water and sanitation services aims to collect and bring together data and information relating to these statutory performance indicators.

Table 1. List of French regulatory performance indicators for water and sanitation services

Water performance indicators	Collective sanitation performance indicators
- Microbiological compliance rate	- Service rate by wastewater collection networks
- Physico-chemical compliance rate	- Asset knowledge and management index
- Asset knowledge and management index	- Compliance of effluent collection with Decree 94-469 amended by the Decree dated 2 May 2006
- Network efficiency rate	- Compliance of sewage treatment equipment with Decree 94-469 amended by the Decree dated 2 May 2006
- Linear index of unaccounted volumes	- Compliance of sewage treatment plants with Decree 94-469 amended by the Decree dated 2 May 2006
- Leakage index	
- Network renewal rate	
- Water resource protection improvement index	- Compliance of sewage treatment equipment performance with the provisions of the individual act enforcing water regulations
- Sum of debt waivers & payments to a solidarity fund	- Effluent overflow rate in consumers premises
- Occurrence rate of unscheduled service interruptions	- Network renewal rate
	- Number of collection network points requiring frequent dredging per 100km linear
- Compliance rate of new customer maximum connection times	- Sum of debt waivers & payments to a solidarity fund
- Debt extinguishment period	- Rate of sludge evacuated according to compliant processes
- Rate of unpaid bills	- Index of knowledge on discharge into the natural environment
- Complaint rate	- Debt extinguishment period
	- Rate of unpaid bills
	- Complaint rate

source: SISPEA (Onema)

In a context where drinking water consumption is dropping (1% on average since 2000), national and European health and environmental standards are becoming stricter and infrastructure is ageing, knowledge and management of infrastructure is a key issue for all public water and sanitation services. In 2003, an inventory of public water and sanitation services infrastructure was conducted by the International office for water (Berland, Juery, 2002). In this study, the overall length of the French drinking water network was estimated at 850,000 kilometres and the renewal needs amounted to □1.5 billion per year. Sustainable management of networks therefore appears as one of the main challenges of the coming decades for water services.

In such context, regulatory performance indicators can be used as steering tools to ensure good and sustainable water asset management. In this perspective, the network efficiency rate has recently been selected to play a key role in water services asset management.

This indicator is defined as the ratio between, on the one hand, the volume consumed authorized plus the volume sold in bulk to other public drinking water services, and, on the other hand, the volume produced plus the volume purchased in bulk to other water services. It is calculated as follow:

Network efficiency rate = (volume consumed authorized + volume sold in bulk) /
(volume produced + volume purchased in bulk) x 100

with volume produced + volume purchased in bulk = volume distributed + volume sold in bulk,

volume consumed authorized = volume metered + retail volume not metered + volume for service requirements.

A French Decree published in January 2012 sets a specific level of network efficiency rate which all water services should reach by 2015 (figure 1). If services fail to comply with this threshold, they may face a 100% increase in the intake tax they pay to the French water agencies provided no action plan is undertaken to improve the performance of the service.

Figure 1. *Abstract of article 3 of Decree n°2012-97 published in January 2012*

"The increase in the redevance rate for the use of "drinking water" is applied if the action plan [☐] is not established [☐] when the performance of the water distribution network efficiency rate calculated for the previous year or, in the event of significant changes in water sales, over the last three years and, expressed in percent, is less than 85 or, when this value is not reached, the result of the sum of a fixed term equal to 65 and to one fifth of the value of the linear consumption index equal to the ratio between, on the one hand, the average volume consumed daily by users and for service requirements, increased by water sales to other services, expressed in cubic meters, and on the other hand, the network length excluding connections expressed in kilometres. If raw water intakes subject to specific allocation rules exceed more than 2 million m³ / year, the value of the fixed term is 70.

The action plan includes an annual monitoring of the water distribution network efficiency rate, taking into account the water supply of the year for which the rate of water loss exceeded the value specified in the previous paragraph. Under the action plan, the detailed description of the asset of drinking water transport and distribution [☐] is updated indicating the areas which have been subject to research of water loss through distribution networks as well as repairs."

This new decree has been elaborated in the perspective of giving a strong incentive to water services to better manage their assets and more specifically their networks.

METHODS

Using the 2010 data collected and gathered by the French national observatory on water services (figure 2), we have assessed the present situation of French water services with regard to the network efficiency thresholds set in the January 2012 Decree. The data used were extracted from the national database in May 2013.

Figure 2. The French national observatory on public water and sanitation services

The French national observatory on public water and sanitation services was launched in 2009 and provides on line access (www.services.eaufrance.fr) to public data on service organisation, management and performance levels. This information is used to assess the economic, technical, social and environmental performance of the services on an objective basis, acknowledged by all stakeholders in the sector.

Data retrieved from the information system on public water and sanitation (SISPEA) provide information on the network efficiency rate for a total of 3,529 water services which supply drinking water to more than 39 million inhabitants through 579,980 kilometres of water network (table 2). This represents 24% of all French water services, 68% of the total water network length and 58% of the French population.

Table 2. Representativeness of water services from the working sample

Drinking water, 2010	France	With data on network efficiency rate
Number of services	14,405	3,529
Population covered	64,000,000	37,265,733
Water network length (KmL)	850,000	579,980

source: SISPEA (Onema) □DDT(M) - 2010

Among this working sample, three groups of water services have been identified:
- a group gathering water services with an efficiency rate higher than or equal to 85%;
- a group gathering services with a rate complying with the alternative threshold set in the Decree;
- a group composed of services which do not comply with the regulation as they do not reach any of the thresholds defined in the Decree.

For simplification purposes and due to lack of information, we have not considered the situation of services with specific water resources allocation rules (see abstract of article 3 of Decree n°2012-97 published in January 2012). Hence our assessment of services complying with the regulatory alternative threshold may be a little bit overestimated.

To put it in a nutshell, we have considered that the two first groups of water services identified do comply with the French regulation on leakage whereas the third one does not.

In order to describe these three groups of water services and characterize the overall quality of their asset management, the following data and elements were analysed:

- generic and contextual characteristics of the service (organisation, management, population covered);
- asset knowledge and management index;
- network renewal rate;
- water price.

The asset knowledge and management index ranges from 0 to 100 points. The service scores up to 20 points for the existence of a system map updated annually, up to 40 points for the existence of an information system on network components (age of pipes, location of branch lines, etc.) and up to 40 points for information on system maintenance (identification of maintenance operations, implementation of a multi-year schedule to renew branch lines and mains, etc).

The network renewal rate is the ratio between the average network length renewed yearly over the past five years and the total network length (excluding connections).

RESULTS AND DISCUSSION

The following table gives a quick overview of the water services composing the working sample (table 3).

The services complying with the 85% efficiency rate represent 1,070 services, supplying more than 16 million inhabitants with about 222,000 km of pipes.
The number of services complying with the alternative efficiency rate amounts to 1,702. They supply more than 16 million inhabitants with approximately 288,000 km of network.
The services which do not comply with the regulatory requirements add up to 757. They supply 4.8 million customers through 70,000 km of pipes.

Table 3. *Water services situation with regard to regulatory network efficiency thresholds*

	Services complying w/85% threshold	Services complying w/alternative threshold	Services not complying w/any threshold	Total Sample	Total France
Number of services	1,070	1,702	757	3,529	14,405
Population covered	16,120,439	16,273,402	4,871,892	37,265,733	64,000,000
Network length	222,142	287,729	70,109	579,980	850,000

Given the 2010 set of data, 60% of the French water network complies with the leakage regulation whereas 8% do not. For the remaining 32%, it is not possible to draw any conclusion from the available data.

Overview of water services complying with the regulatory efficiency rate of 85%
Among the 1,070 water services reaching the regulatory efficiency rate of 85%, 56% are municipal services and 44% are inter-municipal services.
Moreover, 44% of these services are managed by a public operator and 56% by a private operator (table 4).

*Table 4. Organisation and management of services reaching a network efficiency rate of 85%*

	Municipal services	Inter-municipal services	Direct management	Delegated management
Number of services	604	466	468	602
Population covered	5,431,847	10,688,590	10,818,395	5,302,042
Network length	112,361	109,781	164,421	57,721

The average population density is 73 inhabitants per network linear kilometre proving that this group of services is mainly urban. Indeed water services supplying more than 15,000 inhabitants represent 73% of the total network and 83% of the total population of this group of services.

The average asset knowledge and management index for this group of water services adds up to 58 (median 50) with 57% of services rating between 40 and 60 points. This figure is a little bit higher than the average asset index for the whole working sample (57).
The distribution of water services according to their asset index value shows a good rating for this group of services, proving they implement a management policy of their infrastructure (figure 3).

Figure 3. Distribution of services according to their asset index value □1st group of services
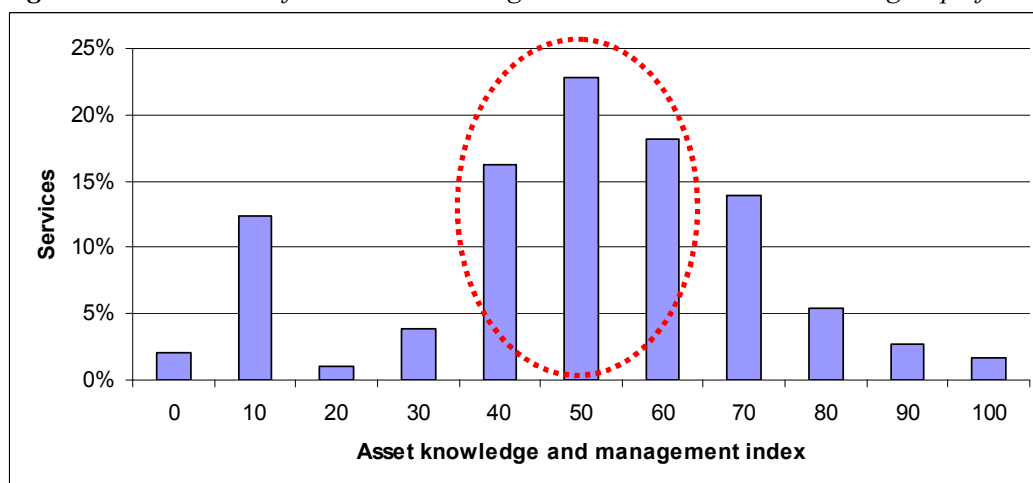
The network renewal rate rises up to 0.64% which is significantly higher than the average renewal rate for the whole working sample (0.54%). This result shows a specific effort to invest in network renewal.

The average water price for this group of services amounts to 1.93 ☐incl.VAT/m³. This mean value is in line with the average price of water for the whole sample which adds up to 1.94 ☐ incl.VAT/m³. The water price median is 1.9 ☐ incl.VAT/m³ showing a low dispersion of prices around the average.

Overview of water services complying with the alternative regulatory efficiency rate
Among the 1,702 water services reaching the alternative regulatory efficiency rate, 45% are municipal services and 55% are inter-municipal services.
Moreover, 39% of these services are managed by a public operator and 61% by a private operator (table 5).

Table 5. *Organisation and management of services complying with the alternative regulatory rate*

	Municipal services	Inter-municipal services	Direct management	Delegated management
Number of services	774	928	670	1032
Population covered	3,918,655	12,354,747	10,576,105	5,697,297
Network length	37,964	249,765	185,656	102,073

The average population density is 62 inhabitants per network linear kilometre showing these services are less urban than in the previous group. Water services supplying more than 15,000 inhabitants represent 47% of the total network and 68% of the total population of this group of services.

The average asset knowledge and management index for this group of water services adds up to 57 (median 50) with 56% of services rating between 40 and 60 points. Although this figure matches the average asset index for the whole sample (57), water services in this group do not perform as well as services from the previous group (figure 4).

Figure 4. *Distribution of services according to their asset index value ☐2ⁿᵈ group of services*
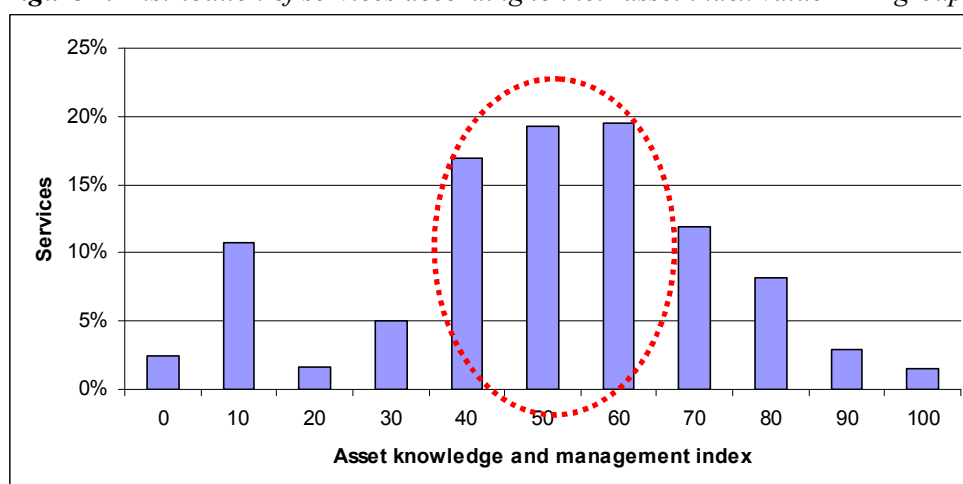
The network renewal rate rises up to 0.53% which is a bit lower than the average renewal rate for the whole working sample (0.54%) and significantly lower compared to the first group.

The average water price for this group of services amounts to 2 □incl.VAT/m^3 which is 3.6% more expensive than the previous group of services. There may be several explanations to this situation. For instance, these services are less urban than the ones in the previous group. The price of drinking water is influenced by the population density: it drops as the density increases due to economies of scale.

The water price median is 1.95 □incl.VAT/m^3 showing a low dispersion of prices around the average.

Overview of water services failing to comply with regulatory efficiency rate thresholds

Among the 757 water services failing to comply with the regulatory efficiency rate thresholds, 59% are municipal services and 41% are inter-municipal services.

Moreover, 37% of these services are managed by a public operator and 63% by a private operator (table 6).

Table 6. *Organisation and management of services failing to comply with efficiency rate thresholds*

	Municipal services	Inter-municipal services	Direct management	Delegated management
Number of services	450	307	277	480
Population covered	1,723,804	3,148,088	2,755,088	2,116,804
Network length	16,010	54,099	38,683	31,426

The average population density is 77 inhabitants per network linear kilometre showing these services are mainly urban. Water services supplying more than 15,000 inhabitants represent 37% of the total network and 64% of the total population of this group of services.

The average asset knowledge and management index for this group of water services adds up to 53 with 35% of services rating less than 10 points, and 36% of services rating between 40 and 60 points (figure 5). This figure is significantly lower than the average asset index for the whole sample (57), showing a poor knowledge and management of assets for this group of water services. Moreover, the median value for the asset index is 32, showing a great dispersion around the average. These results underline a need to improve the asset knowledge and management policy for this group of services.

Figure 5. Distribution of services according to their asset index value □3ʳᵈ group of services
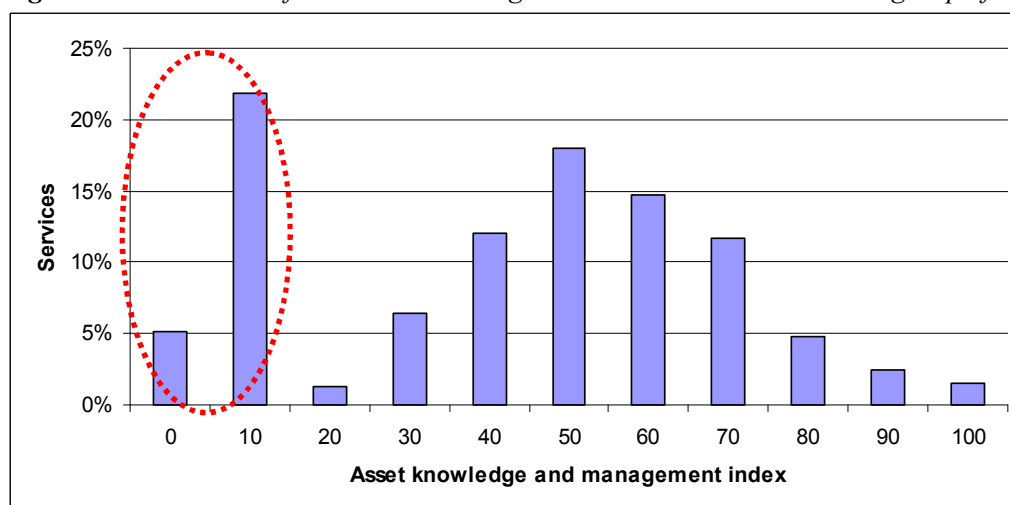
The network renewal rate rises up to 0.55% which is a bit higher than the average renewal rate for the whole sample (0.54%) and significantly lower compared to the first group.

The average water price for this group of services amounts to 1.83 □incl.VAT/m^3 which is about 5% and 9% less expensive than the first and the second groups of services. There may be several explanations to this situation. For instance, implementing an asset management policy induces maintenance and investment costs which increase the price of water.
The water price median is 1.82 □incl.VAT/m^3 showing a low dispersion of prices around the average.

CONCLUSION

Several conclusions can be drawn from this work on water services network performance indicators.

First of all, the use of the efficiency rate as a tool to assess the overall asset management quality of the service appears to be relevant. Indeed this regulatory performance indicator seems to properly reflect the knowledge and efforts of the service to maintain and manage its water infrastructure. For instance, we have noted that services complying with the 85% regulatory efficiency rate have the highest network renewal rate of the overall working sample.

Moreover, services not complying with any regulatory thresholds show the poorest level of asset knowledge and management index in the whole working sample. On the contrary, water services complying with the 85% regulatory efficiency rate appear to have the highest level of asset knowledge and management index in the whole working sample.

Last but not least, the two groups of water services complying with the French leakage regulation show a higher water price than the group of services failing to match the regulation. There may be several explanations to this situation. But it can be noted that implementing a real asset management policy is costly as it induces higher maintenance and investments costs which increase the price of water. On the contrary, services failing to comply with the regulation show cheaper water prices. In such situation, low prices reflect

little efforts to know and manage the water infrastructure. On the bright side of the picture, it can be noted that these low water prices allow future increases to fund a proper asset management policy in the future.

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Décret n°2012-97 du 27 janvier 2012 relatif à la définition d'un descriptif détaillé des réseaux des services publics de l'eau et de l'assainissement et d'un plan d'actions pour la réduction des pertes d'eau du réseau de distribution d'eau potable