Original Research

Performance Benchmarking in Utility Regulation: the Worldwide Experience

Rui Cunha Marques[1]*, Pedro Simões[2], João Simão Pires[3]*****

[1]Centre for Management Studies (CEG-IST), Technical University of Lisbon, Avenida Rovisco Pais, 1049-001 Lisbon, Portugal
[2]Centre of Urban and Regional Systems (CESUR), Technical University of Lisbon, Avenida Rovisco Pais, 1049-001 Lisbon, Portugal
[3]Water and Waste Services Regulation Authority (ERSAR), Rua Tomás da Fonseca, Torre G, 8º 1600-209 Lisbon, Portugal

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Abstract

This paper presents the results of an investigation about water regulation, which included more than 50 regulators worldwide. One of the topics analyzed was the use of benchmarking in each country/state in the regulatory context. It was noticed that 72% of the regulators applied benchmarking either in the quality of service regulation or in the economic regulation for the setting of prices and tariffs. This article analyzes in detail the results obtained with this survey and presents comprehensively the different ways of employing benchmarking in the regulatory process, exemplifying them with case-studies of different countries from different continents.

Keywords: benchmarking, regulation, water sector, yardstick competition

Introduction

The water and wastewater services (WWS), usually provided in a monopoly regime and endowed with other market failures (sunk costs, scale and scope economies, externalities and public service obligations), do not offer the operators natural incentives toward efficiency and innovation in opposition to competitive markets [1]. This circumstance has worsened with the change of customers' habits over time, environmental risks [2], and the growing restrictions with public budgets. The fostering of a competitive environment in the WWS is only possible by means of the competition by comparison (or yardstick competition – YC). Thus, the use of benchmarking assumes a strategic importance for the WWS [3]. Being aware of this, regulators more and more employ benchmarking as a way to create markets and, therefore, to encourage the WWS to be more productive. Benchmarking can be briefly defined as the process of seeking excellence through the systematic comparison of performance measures with reference standards [4]. The YC model was developed in the USA in the 1980s for the health sector, where a system of economic regulation was inspired by a cost comparison between different firms [5]. It is based on the performance evaluation of the results from firms within the same sector (i.e. benchmarking application) and on the possible consequences of a financial or other nature that might arise from that evaluation. The key idea of this model consists in redirecting the incentive to improve the efficiency of a given firm through the information obtained from other firms [5]. If a firm reduces the costs unlike its partners it will have profits, but in the opposite situation it will have losses.

The adoption of benchmarking has been expanding itself, especially in the regulatory systems that supervise the

*e-mail: rui.marques@ist.utl.pt
**e-mail: psimoes@civil.ist.utl.pt
***e-mail: joaosimaopires@gmail.com

quality of service by means of performance indicators or the use of price or revenue cap regulation (CPI-X) formulas in tariff setting [4]. Its application strengthens the fundamental principle inherent to incentive regulation, which is the stimulus to productivity improvement. Nowadays there are even the ones who defend a transnational regulator whose chief activity would be the application of international benchmarking between the WWS of different countries [3].

This paper, based on recent research [6], tries to take a snapshot of the benchmarking application by regulatory authorities worldwide. It aims to systematize the main approaches of applying benchmarking by regulators and present some relevant international case-studies of benchmarking used in the regulatory perspective. This research encompassed more than 50 regulators in five continents. After this brief introduction, the main benefits of using regulatory benchmarking are highlighted. In the next section the different approaches of applying regulatory benchmarking are displayed. Afterwards the methodology adopted in the current research is described and the major results obtained are given. Then, the following section presents some empirical case-studies and, finally, the most relevant conclusions are drawn.

Benefits of Benchmarking Use in the Regulation

The application of benchmarking in regulation has many potential benefits, mainly in the WWS, where the competition in the market is more difficult to implement as the operators generally work in a regional (local) natural monopoly regime [7]. Among the main advantages of benchmarking use [8], the following can be pointed out:

a) strong incentives are provided to operators to be efficient and innovative, mitigating the costs of operation and capital expenses;
b) on-going pressure is put on the water utilities to improve service quality;
c) a fairer recovery of costs and of the capital investments is assured, and
d) an increase of transparency and sharing of information, minimizing its asymmetry between different stakeholders (especially between the regulator and the operators).

The incentives for efficiency improvement of the firm under analysis are provided by means of the information extracted from other firms and the regulatory process becomes an artificial form of competition between the regulated firms [8]. They can be compulsory or voluntary, ranging from the simple act of publicizing and comparing the performance to more coercive forms where the prices and tariffs are set considering the prices or the tariffs of the other firms (WWS) in the same sector.

There are several uses of benchmarking in the water sector. It can be used in regulation by comparison (YC) in the economic regulation or be a key tool in sunshine regulation, and it may have a pro-active role in industry, which should be promoted by the regulator. Benchmarking refers essentially to the application of comparative and quantitative methods of evaluation and performance measurement of operators over time (metric benchmarking), which enable the regulator to take decisions in the regulatory process.

The advantages of applying benchmarking in the water utilities are so significant that in some countries the merging and acquisition of operators is forbidden (e.g. in the UK by the Competition Authority) in order to keep a sufficient number of players to allow for the use of benchmarking [9], even if efficiency earnings are lost due to the increase of scale and scope diseconomies. In other countries the restructuring and reform of the water sector [10], despite the loss of scale and scope economies, has led to the split up of operators to obtain higher efficiency earnings as a result of the incentives provided by benchmarking. This circumstance, for example, took place in Melbourne, Australia; Jakarta, Indonesia; Manila, Philippines; and in Mexico City, Mexico.

Benchmarking Approaches

Benchmarking methods are found in several regulatory processes around the world. Despite the growing trend observed, not many applications of regulation in the water utilities based on performance comparison with a framework similar to Shleifer's are found (contrary to the other network utilities, such as electricity). YC is mostly associated with the X factor computation in the price cap formulas [11].

The kinds of benchmarking employed (data envelopment analysis – DEA, total factor productivity – TFP, ordinary least squares – OLS and stochastic frontier analysis – SFA) depend on the actors and on the features of the countries involved. These methods are mainly adopted with the aim of estimating the productivity earnings expected for each WWS in the regulatory period. The UK, Colombia, and some States in Australia are adopting these incentive regulation methods, determining their water tariffs through the benchmarking techniques referred to [12].

Yet, there are other approaches of YC, such as sunshine regulation or the efficient company model. Sunshine regulation consists of the comparison and public display of the performance of the regulated WWS [8]. It becomes a powerful and effective tool to provide performance incentives by promoting virtual competition between operators. They become aware of their performance through the pressure put upon them by the different stakeholders (customers, media, politicians, NGOs, ect.). The WWS with a poor performance gets "embarrassed" and, as a consequence, tends to correct the discrepancies detected. The sunshine regulation approach can be implemented alone or as a complement to other regulatory techniques. Portugal, the UK, and Australia, among other countries, have made the sunshine regulation quite popular in the water sector, which is also proven by its results and by its application over several years [13].

In the efficient company model, the regulator defines the standard (efficient) behaviour for each operator [14].

There is no comparison with other operators but a theoretical operator is designed to show exemplary performance, assuming current and future responsibilities. This regulatory method is being applied in Chile and Peru.

Methodology

This research, based on worldwide investigation of the water sector regulation, followed the methodology described next [6]. Firstly, the existence of regulators in the water sector, the authorities responsible for activities related to regulation (prices and tariffs, quality of service, and public service obligations), the main players of the water sector (operators, associations, etc.) and all relevant information about these entities and the existing regulatory processes were searched for each country all over the 5 continents. Concerning this step, the most noteworthy result was the absence of water regulators in western Europe and Asia, and their predominance in South and Central America. As the water sector is highly fragmented in Europe and usually the municipalities are the ones responsible for it, and due to the existence of competition for the market (public-private partnership agreements), explicit regulation is more difficult to implement. Secondly, a questionnaire was sent to all regulators and to the main entities with regulatory functions of the WWS for all countries in the world. This questionnaire was composed of six chapters in the main body, which include general aspects of the WWS, scope of regulatory activity, general aspects of the regulatory functions of the regulator, economic regulation, and public service obligations and quality of service regulation. The entities were compelled to provide supplementary information about their work context and they had the possibility to express their opinion and comments about the contents of the inquiry. The questionnaire was sent to 279 entities (worldwide), but only 63 responded.

According to this research (April 2008), 136 regulators were found globally. These regulators were placed in 57 countries, 12 of which were located in Africa, 5 in Asia, 16 in Europe (2 in Euro-Asia), 2 in Oceania, and 22 in America. Although 25% of the world's countries had regulators for the water sector, in terms of population the percentage falls down to around 23%. The differences between regulatory approaches and their developmental level were tremendous. One common point was the great interest and the growing application of benchmarking techniques both in quality of service regulation and in tariff setting.

Results

Performance indicators are predominantly adopted in the quality of service regulation. This occurred in 95% of the international cases analyzed. The underlying idea is, in most cases, to apply sunshine regulation, comparing, disclosing and discussing publicly the performance of the operators to press those with worse performances and recognize the merits of the best ones.

Frequently, the comparison carried out (e.g. benchmarking) is related to the performance of previous years. In about 57% of the case-studies there is a comparison with other operators, in 15% with operators of other countries, and approximately in 20% with reference benchmarks. In some countries (about 25%) penalties are imposed, including consequences in the tariff system when the performance or levels of service are not the most adequate. In some countries there is a direct reimbursement to the users, whereas in others it goes directly to the government (near 12%). In other countries there are rankings sorting the operators' performance (8% of the situations analyzed).

As far as economic regulation is concerned, in the casestudies analyzed, around 40% (20 countries) adopt incentive regulation. Most of them use price cap regulation and, from these, 41% adopt benchmarking methodologies to determine the X factor and, consequently, are based on regulation by comparison. Two countries employ the efficient company model (Peru and Chile), and four others use either totally or partially revenue cap regulation, such as Scotland and Trinidad and Tobago. Fig. 1 displays the countries with water regulation on the left side. The ones that answered the questionnaire are in the middle. Finally, the regulators that apply benchmarking and answered the questionnaire are on the left side of the page.

The next section presents some international case-studies of water utility regulation, highlighting the importance of benchmarking in their regulatory processes.

Case Studies

Victoria, Australia

In the Australian State of Victoria, benchmarking is seen as the basis of the WWS regulatory method. The regulator has applied sunshine regulation since 1994. The periodic publication of performance increases the transparency and accountability of the WWS. Alongside the public comparison, it places pressure on operators and also provides clear and unequivocal information to the customers on the quality of service they are getting. Until 2003, the regulator (now Essential Services Commission – ESC) was mainly responsible for the quality of service delivered, namely the quality of the supply (e.g. drinking water quality and compliance with the quality norms), service reliability (e.g. interruptions, non-revenue water, and blockages), service availability (e.g. prices, special customers, and lack of payment) and customer service (e.g. call centres, claims, and customer satisfaction). After this date it also became responsible for economic regulation. The performance reports since the beginning (1995/96) have shown the operators' progress in their levels of service and prove the positive effects of this light-handed form of regulation. For example, Fig. 2 points out the evolution of the indicator water interruptions and highlights the positive change across the time span studied and the success of the regulatory method adopted [15].

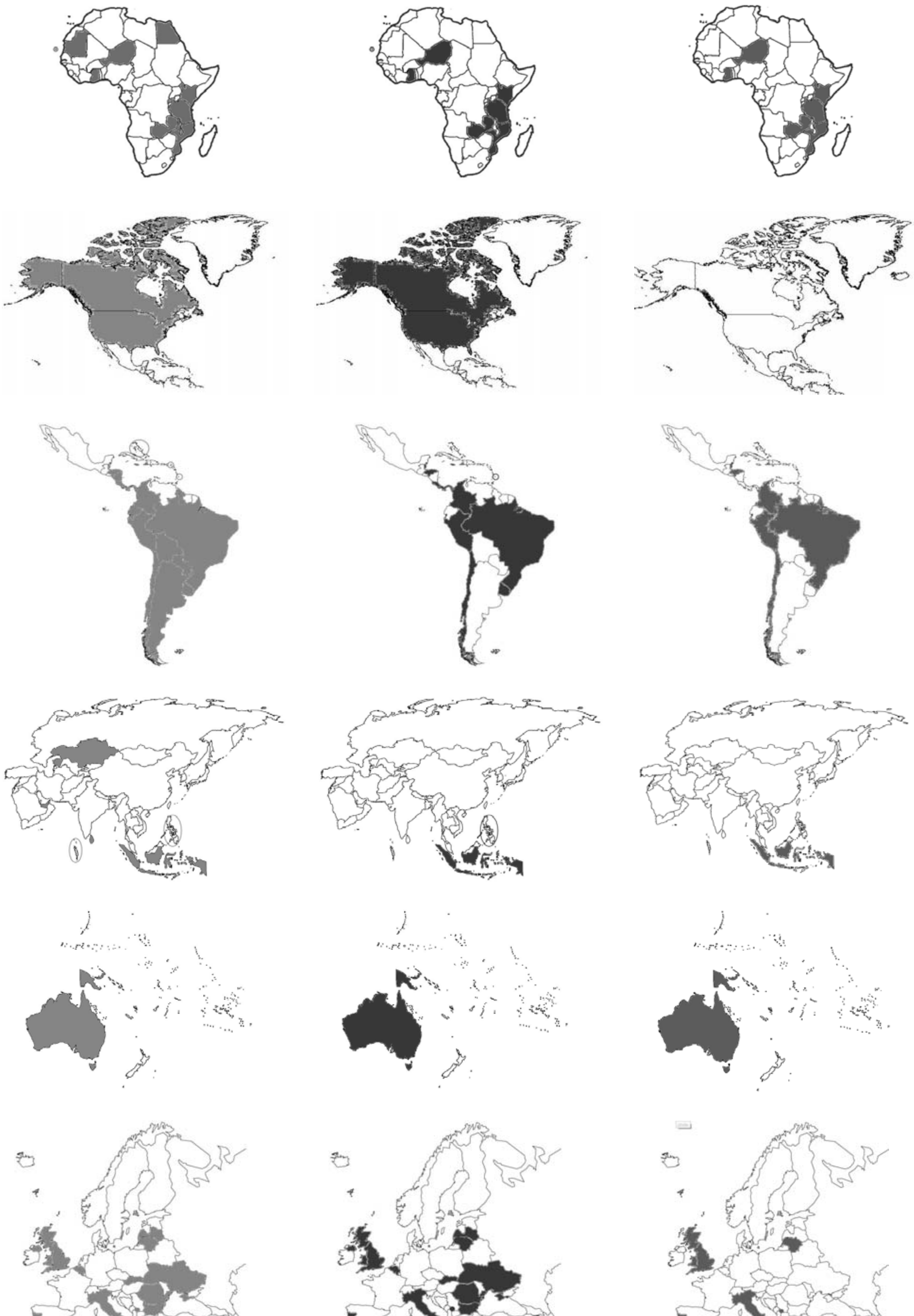

Fig. 1. Regulation and benchmarking in a worldwide context.

Table 1. NWASCO performance indicators for water supply and their weights [17].

Utilities	UFW [%]	Trend	Water quality [% compliance]	Trend	Metering ratio [%]	Trend	Water service coverage [%]	Trend	Sanitation coverage [%]	Trend	Hours of supply (h)	Trend	Staff (no./1000 connections)	Trend	Collection efficiency [%]	Trend	O&M cost coverage by collection [%]	Trend	●	●	●
NWSC	35	↑	70	↑	43	↑	85	↑	63	↑	20	↑	8	↑	80	↑	103	↑	4	5	0
LWSC	51	↑	80	↑	45	↑	64	↑	9	↑	15	↑	13	↑	83	↑	102	↑	1	4	4
KWSC	58	↑	93	↑	11	↑	92	↑	67	↑	15	↑	8	↑	85	↑	114	↑	4	3	2
SWSC	43	↑	94	↑	76	↑	83	↑	23	↑	14	↑	10	↑	102	↑	93	↑	4	3	2
LGWSC	61	...	71	...	1	...	40	...	17	...	15	...	18	...	64	...	62	...	1	1	7
MWSC	56	↑	8	↑	22	↑	91	↑	86	↑	17	↑	8	↑	64	↑	94	↑	4	0	5
WWSC	47	↑	13	↑	15	↑	47	↑	24	↑	8	↑	13	↑	108	↑	86	↑	2	1	6
NWWSC	36	↑	69	↑	100	↑	60	↑	4	↑	20	↑	12	↑	85	↑	90	↑	4	2	3
CHWSC	54	↑	10	↑	3	↑	47	↑	10	↑	9	↑	19	↑	65	↑	69	↑	0	0	9
CWSC	31	↑	58	↑	97	↑	59	↑	33	↑	24	↑	12	↑	121	↑	114	↑	4	3	2
Average	47 (w)	↑	57 (s)	↑	39 (w)	↑	70 (w)	↑	34 (w)	↑	15 (s)	↑	••		84 (w)	↑	102 (w)	↑			

● Worse than the relevant average and benchmark not achieved

● Better than the relevant average but benchmark not achieved

● At least "acceptable" benchmark achieved

UFW - Unaccounted for Water

(w) weighted average
(s) simple average

Chile

In Chile, WWS economic regulation is based on the efficient company model. However, in this case, the benchmarking process does not encompass real operators but a hypothetical operator (idealized to be efficient and effective). In this regulatory system, the operators can retain all the surpluses of efficiency earnings beyond the established bounds, and the heterogeneity problem is minimized. Nevertheless, the method is discretionary and the asymmetric information has a high influence on it. The concept of efficient operator is imposed to enable the regulator (Superintendencia de Servicios Sanitarios – SISS) to determine the pattern of costs for tariff settings and can further include the expected productivity earnings (X factor) in the price cap formula [16].

Zambia

In Zambia, the WWS regulatory authority (the National Water Supply and Sanitation Council – NWASCO) has as one of its objectives to guarantee the quality of the services provided, including the quality of drinking water. The main tool of the quality of service regulation is the comparison of a set of performance indicators applied to each operator followed by its public display (sunshine regulation). NWASCO developed a set of 9 performance indicators (Table 1 for water) that are computed and published annually [17]. Reference values are made available by the regulator for each performance indicator according to which the scores obtained by the regulated companies are compared. For each performance indicator, NWASCO also provides explanatory factors. The operators are classified with colours, such as green, yellow, and red, depending on their performance. In addition, NWASCO develops a ranking based on the performance indicators results, assuming weights for them. Although the regulatory method adopted does not have coercive powers, the public display of results has good results because the utilities become embarrassed and are pressed to achieve better performance.

England and Wales

The WWS regulation in England and Wales is pointed out in the literature as a benchmark for the application of benchmarking in the regulatory system. OFWAT (Water Services Regulation Authority) has used regression and DEA models to determine the efficient costs that are the basis for X factor calculations (in the price cap formula)

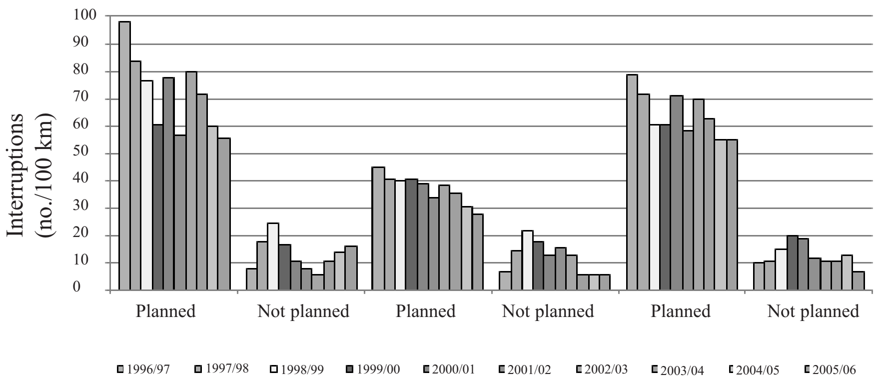

Fig. 2. Evolution of the indicator service interruptions in Melbourne WWS in Australia.

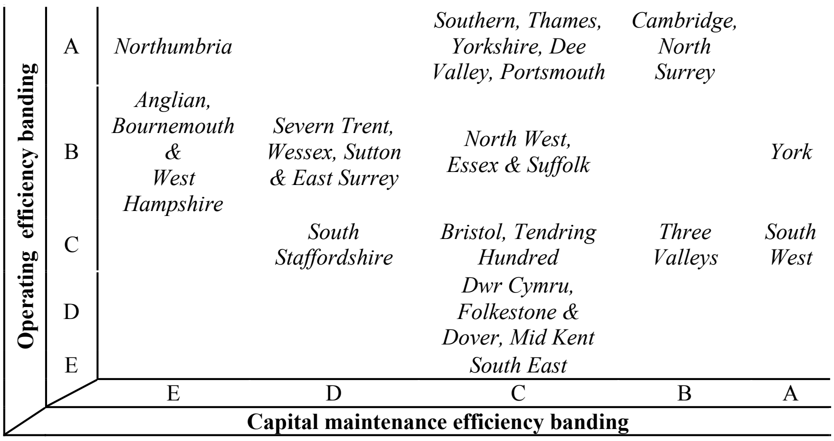

Fig. 3. Efficiency of the British and Welsh WWS.
A – most efficient; B – over average; C – average; D – below average; E – less efficient.

specific to each WWS. Fig. 3 presents an efficiency matrix computed by OFWAT, showing how the dichotomy between operating and capital maintenance efficiency is dealt with [18].

The efficient costs are transformed into X factors and become the goals to be reached by each WWS in the following regulatory period. Moreover, OFWAT [19] developed a set of 9 performance indicators (but with sub-indicators) in order to evaluate the quality of service and assure the protection of the users' interests. In addition, to instigate even more (virtual) competition in the water sector, OFWAT has also developed international benchmarking studies, comprising a set of performance indicators for several utilities comprising different countries (Scotland, Northern Ireland, EUA, Canada, Scandinavia, the Netherlands, Portugal, and Australia).

Colombia

In Colombia, the water regulatory authority (Comisión de Regulación de Agua Potable y Saneamiento Basico – CRA) has functions of economic regulation. CRA adopted an ambitious (but transparent) regulatory process based on YC that uses a benchmarking technique (in this case DEA) as its main regulatory tool. The tariff system includes the fixed costs corresponding to average administrative costs and the variable costs obtained by the sum of the average operation and maintenance costs (OPEX), plus the average investment costs and the environmental charges by unit of consumption. The regulatory process uses DEA to determine the efficient administrative costs and the efficient OPEX. It is based on a system of price caps defined for a period of five years which also includes a minimum limit of 50% (price floor). The sample quality is controlled by minimum parameters and by a statistical rule to avoid the presence of outliers. Although the models adopted can be pointed out as complex and misleading (see, about the Colombian regulatory model [20]) the incentives provided to the water companies are high and can lead to good results.

Italy

Since the restructuring of the water sector in Italy, the WWS are regulated by an authority created in 1994, the Comitato per la Vigilanza sull'uso delle Risorse Idriche (COVIRI). Influenced by the success of the OFWAT regulatory system, the regulatory method based on benchmarking adopted by COVIRI initially was quite similar, using parametric benchmarking techniques to estimate the X factor in the price cap formula. After some controversy, some changes were implemented and the regulator nowadays computes a set of 55 performance indicators of the WWS, which are published in an annual report. More precisely, COVIRI developed 19 technical indicators, 18 management indicators, and 18 economical-financial indicators [21].

Portugal

In Portugal, the benchmarking application is the pillar of the regulatory system. In this domain, the regulator (ERSAR) applies a set of 20 performance indicators for each regulated activity, respectively water, wastewater, and urban waste, both for the wholesale and retail segments [22]. ERSAR (Water and Waste Services Regulation Authority) publishes an annual report of benchmarking that computes the performance indicators, establishing explanatory factors, and reference values. The set of performance indicators includes several kinds of indicators assigned by three distinct groups, such as a defense of the users' interests (6 indicators) that tries to translate the quality of the services provided, the sustainability of the operator (11 indicators) that evaluates the sustainability of the operators, and environmental sustainability (3 indicators) that aims to quantify environmental sustainability. ERSAR uses a system of balls (scores) with different colours associated to the performance highlighted. Comparing each performance indicator with benchmarks, if the water utility has a good score it will get a green ball, a bad score will correspond to a red ball, and an average score to a yellow ball. This kind of 'name and shame strategy' has proven to be very effective [13].

Table 2. Performance indicators for the water supply service.

Performance indicators (Water)	2004	2005	2006	2007
Protection of the user interests				
User service accessibility				
Service coverage (%)	70 (86)	70 (86)	67 (84)	73 (84)
Average water charges (€/m^3)	0.35 (1.06)	0.37 (1.13)	0.39 (1.24)	0.39 (1.28)
Quality of service supplied to users				
Service interruptions (n.º 1000 sc/year)	0.01 (2.24)	0.01 (0.97)	0.01 (0.66)	0.01 (0.40)
Water tests performed (%)	99.74 (97.95)	99.91 (99.93)	99.97 (99.46)	99.78 (99.99)
Quality of supplied water (%)	99.38 (99.12)	99.42 (99.21)	99.61 (98.95)	99.75 (99.09)
Answers to written complaints (%)	87 (80)	98 (66)	70 (73)	85 (87)
Sustainability of the operator				
Economical and financial sustainability				
Operating cost coverage ratio (-)	1.83 (1.17)	1.77 (1.22)	1.76 (1.24)	1.98 (1.28)
Unit running costs (€/m^3)	0.20 (0.88)	0.22 (0.92)	0.23 (0.90)	0.21 (0.88)
Solvency ratio (-)	0.38 (0.28)	0.59 (0.35)	0.52 (0.29)	0.52 (0.23)
Non-revenue water (%)	4.6 (26.1)	4.1 (25.1)	4.2 (23.6)	5.0 (22.3)
Infrastructural sustainability				
Fulfillment of the water intake licensing (%)	90 (23)	64 (1)	64 (3)	64 (10)
Treatment utilization (%)	70 (69)	62 (62)	66 (62)	64 (63)
Transmission/distribution storage capacity (days)	0.6 (1.3)	0.7 (1.4)	0.7 (1.4)	0.8 (1.4)
Mains rehabilitation (%/year)	3.0 (0.9)	1.8 (1.6)	1.3 (1.3)	0.6 (0.8)
Service connection (SC) rehabilitation (%/year)	(2.2)	(2.9)	(2.6)	(2.3)
Operational sustainability				
Mains failures (n.º/100km/year)	16 (99)	12 (81)	12 (67)	11 (63)
Human resource sustainability				
Employees (no./100km/year) or (no./1000 SC)	1.7 (3.5)	2.0 (3.4)	2.3 (3.8)	2.3 (3.9)
Environmental sustainability				
Utilization efficiency of water resources (%)	4.2 (18.6)	3.2 (16.9)	3.0 (15.8)	4.1 (15.2)
Use efficiency of energy (kWh/m^3/100m)	0.4 (0.5)	0.4 (0.5)	0.4 (0.5)	0.4 (0.5)

Table 2 shows the ERSAR 's 20 performance indicators adopted for the water sector for the retail and wholesale sectors (in brackets) and highlights the positive evolution of performance across time.

Belgium

In Belgium's Waloon region the regulatory authority (Comité de Contrôle de l'Eau – CCE) has quality of service supervision as its main attribution. For this purpose, CCE developed a set of 15 performance indicators related to WWS operations and activities. These evaluation measures are classified into six groups, such as quality of service, catchments protection, management and sustainability of assets, pricing and management, coverage and solidarity, and user satisfaction and communication. They intend to estimate and compare the quality of service between operators, creating and encouraging competition (by comparison) between them. CCE also establishes the reference values (benchmarks) for each performance indicator [23].

Conclusions

The use of benchmarking has several advantages that are reinforced in the water utilities due to their particular features. In the WWS the use of benchmarking by the regulators consists of one of the few tools that are available to create a competitive environment in both markets (water and wastewater). Besides, its use is encouraged by the existence, in general, of a significant group of players in each market. This reality mitigates one of the main problems of benchmarking, which is the comparability between operators. In fact, the application of benchmarking creates strong incentives for the operators to be efficient and innovative by mitigating their operation and capital costs, promoting efficiency with regard to capital expenses, assuring "fair" recovery of costs and a "fair" return of the capital invested, increasing information sharing and transparency, and minimizing the traditional asymmetry of information that often exists among the different stakeholders.

Actually, both in the supervision of the levels and quality of service and in the setting of prices and tariffs (in the determination of efficiency and productivity of the operators), this tool has enormous potential. Even though, in some cases, the results obtained from benchmarking are not coercive, many are the earnings obtained from public display alone ('name and shame strategy'). The experience of several regulators has proven the effectiveness of this method with the good results achieved.

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