Does public or private ownership defines the performance of water supply systems? evidences from literature

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Abstract

We developed a concise literature review to investigate if public or private ownership is a determinant factor on the performance of water supply systems. This is a relevant research issue because privatization and increased private sector participation in water supply systems are global trends, aimed to improve the low levels of performance and efficiency of these systems.The evidences collected in the literature shows that the ownership, itself, is not a determining factor on the performance levels of water supply systems. This finding shows that privatization can be an inefective operation to improve water supply systems performance, if other factors are not jointly considered. Regulation, competition and transparency are the main factors that define the efficiency and performance of this sector.

Keywords: Performance measurement; Efficiency; Effectiveness; Resources conservation; Service quality.

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A propriedade pública ou privada define os níveis de desempenho de sistemas de abastecimento de água? evidências da literatura

Resumo

Desenvolvemos uma revisão da literatura concisa para investigar se a propriedade pública ou privada é um fator determinante no desempenho dos sistemas de abastecimento de água. Este é um tema de pesquisa relevante porque a privatização e aumento da participação do setor privado nos sistemas de abastecimento de água são tendências globais, destinadas a melhorar os baixos níveis de desempenho e eficiência dessas evidências systems. The recolhidos na literatura mostra que a propriedade, em si, não é um fator determinante nos níveis de sistemas de abastecimento de água de desempenho. Esta descoberta mostra que a privatização pode ser uma operação Não Efetiva para melhorar o desempenho dos sistemas de abastecimento de água, se outros fatores não são considerados em conjunto. Regulamento, a concorrência e a transparência são os principais fatores que definem a eficiência e o desempenho do setor.

Palavras-chave: medição de desempenho. Eficiência; Eficácia; Conservação de recursos; A qualidade do serviço.

Introduction

The need to implement performance measurement systems for the water supply sector, although technically indisputable, finds predominantly political barriers in developing countries. According to The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2009), public utilities are subject to low performance caused by low motivation, poor management, cost recovery and inadequate political interference in many of these countries.

According to Barrett and Wallace (2011), privatization and increased private sector participation in water supply systems (WSSs) are global trends, aimed to improve the low levels of performance and efficiency of these systems. This trend is based on the economic theory, which suggests that privately-owned enterprises are more efficient than public ones (RENZETTI; DUPONT, 2004), in spite of empirical literature that shows no evidence to prove this statement in regard to water companies (ANWANDTER; OZUNA, 2002; RENZETTI; DUPONT, 2004).

Among the reasons for this lack of consensus, Renzetti and Dupont (2004) highlighted: the influence of the regulatory environment on the choices and behavior of systems; pricing policies and inefficient accounting practices in both types of ownership; unavailability of data suitable for modeling the performance; external factors (e.g. geographic location and water sources for the systems) and peculiarities of the water industry in comparison to some others that are also subject to privatization (such as the difficulty of establishing the competitiveness in water supply). As a complement, we can mention the work of Lobina and Hall (2007), which suggests that private participation in water supply may run the risk of an imbalance between business interests/economic agents and the public interest of the water end users, such as social and environmental issues involved.

The following question can be then formulated: is the ownership nature - public or private - a determining factor on the performance levels of water supply systems? This question has a great importance in WSSs planning and management, as well in policy making. Water supply, as a public interest service, performs an important social function, once access to drinking water is a need for human development. In association with this social aspect, environmental pressures related to the WSSs main inputs – raw water

and energy - attribute to water supply systems a key role in the sustainability of cities.

The relevance of such question was the motivating factor for us to perform a concise literature review to find evidences to accept or reject the hypothesis that private WSSs present a better performance than public ones. Performance is here defined as the combination of efficiency and effectiveness. Efficiency refers to the better use of resources, which in WSSs can be, for example, financial, raw water, energy, chemicals, labor. Effectiveness refers to the quality of services provided to consumers, which may involve meeting the norms and standards, customer service, supply interruptions, among others. In a corporate perspective, effectiveness is understood as the level of service achieved in relation to consumer needs, while efficiency refers to the economical use of company resources to provide some level of satisfaction to those consumers (NEELY; GREGORY; PLATTS, 2005).

The present literature review analyses the methods, results and conclusions of several relevant studies that directly or indirectly investigated the WSSs performance. Besides answering the main question proposed, the literature review allowed the identification of the key factors that influence the WSSs performance.

Methodologically, the review began by defining search terms such as "water supply", "performance", "efficiency" and "effectiveness". After that, research bases of recognized scientific quality, such as ScienceDirect, Wiley Online Library, SpringerLink, Taylor & Francis, ASCE, among others, were selected. The selection of these bases aimed to ensure the quality of the articles analyzed. Once the selection of the research bases was done, we performed the search for articles by the combination of the search terms defined. The articles were selected taking into account the appropriateness and relevance to the research topics. These articles were analyzed individually in order to identify their key conclusions regarding two issues: (1) public or private WSSs present better performance?; (2) what are the main influencing factors on the performance of WSSs? The conclusions of individual articles evaluated were then compiled and compared, allowing answering the questions investigated in the present article.

Literature evidences about the influence of ownership on WSSs performance

The discussion about the performance of water supply systems is not new, and although recently treated in the literature, the

discussion on the comparative advantage between public and private WSSs comes from previous decades. In this way, in the late of 90's Bhattacharyya, Harris, Narayanan and Raffiee (1995) considered econometric techniques for the analysis of stochastic cost frontiers to assess the economic efficiency of water supply systems, based on information from 190 public and 31 private systems. Their main conclusion, for the case analyzed, was that the ownership has strong influence on the economic efficiency of WSSs when associated with production scale. Bhattacharyya *et al*. (1995) also concluded that private systems are economically more efficient when operating on a small scale, while public systems are more efficient when operating on a large scale.

Anwandter and Ozuna (2002) applied the data envelopment analysis (DEA) technique in WSSs from Mexico, to investigate the hypothesis that the ownership is not the determining factor of Mexican WSSs inefficiency, but that this inefficiency is due the lack of competitiveness of the sector, associated to regulatory distortions. The authors concluded that the decentralization of water supply by itself is not able to increase their level of performance, which can be achieved through reforms aimed to increase competitiveness and transparency in the sector. Braadbaart (2007) corroborated the conclusion of Anwandter and Ozuna (2002) regarding the importance of transparency of water industry to increase its performance.

Braadbaart (2007) evaluated the role of collaborative benchmarking as a mechanism for increasing the performance of WSSs from Netherlands, concluding that this technique immediately increases the transparency of the systems, and their positive impact on the performance occurs as soon as the results become public. Lobina and Hall (2007) also emphasized the role of transparency in WSSs operations, along public participation, as factors that improve the efficiency of the systems. Kosec and Wallsten (2008), analyzing the quality of water supply through indicators of violations of the quality standards, concluded that the increased competitiveness of WSSs through benchmarking can effectively improve performance.

Renzetti and Dupont (2004) evaluated WSSs performance indicators from United States, United Kingdom and France, concluding that privatization by itself does not imply an increase in WSSs performance. The authors suggest that, regardless of ownership, factors such as cost accounting and pricing rules, investment rules, forecasting methods, and rules for dealing with scarcity can effectively increase the performance of WSSS.

Hassanein and Khalifa (2007) evaluated, in a comparative way, the performance of 234 water and sewage systems from developed and developing countries. Therefore, the authors considered a set of operational and financial indicators. Despite performance comparison between public and private systems have varied according to the indicators considered, the authors suggested that private sector involvement in the water industry can lead to improvements in performance, but it still suffers rejection in developing countries because people assigns the possibility of local community to participate and influence decisions to public ownership, while drawbacks such as increased water prices and reduction of jobs are also attributed to privatization.

Kosec and Wallsten (2008) used indicators (of levels of violations of maximum contaminant, treatment techniques, monitoring and reporting) to compare the efficiency of public and private WSSs from United States. By comparing these indicators and the application of econometric techniques, the authors concluded that the ownership, by itself, does not define the quality of water supply.

After analyzing several works, Abbott and Cohen (2009) found no consensus on the role of ownership on the performance of WSSs. Abbott and Cohen (2009) suggest that privatization can only promote the improvement of WSSs performance through economic regulation, depending on the monopoly conditions of the sector.

Norton and Weber (2009) evaluated the efficiency of WSSs through data envelopment analysis and obtained the following conclusions regarding the influence of ownership on the efficiency of these systems: 1) public systems are more efficient than private for-profit systems; 2) whenever measures of numbers of connections were considered in the analyzes, public systems are more efficient than private for-profit ones; 3) the efficiency superiority of public systems is more moderate in comparison to private nonprofit systems; 4) nonprofit private systems are more efficient than those for-profit.

Worthington (2011) analyzed several studies focused on studying the influence of ownership on the efficiency of WSSs, beyond the implications of privatization on their efficiencies, concluding that there is no consensus on the greater or lesser efficiency of public and private systems. The author emphasizes the need to harmonize the technologies of production (inputs, outputs and their weights) in the analysis of relative efficiency between public and private systems, citing, for example, the fact that profit maximization can be considered

with greater weight in the case of private systems, which would invalidate the efficiency measures obtained.

Another highlight from Worthington (2011) refers to the evolution of the quality of the information used in WSSs performance measurement, especially when the evolution of performance before and after privatization is intended to be compared. According to the author, both data and systems´ characteristics can evolve significantly in the time scale, resulting in very odd contexts before and after privatization, which also compromises the quality of comparative performance measures.

Generalizing the reference of Worthington (2011) regarding the compatibility of production technologies, as well as the set and weights of inputs and outputs used in comparative analysis of public and private WSSs, it may be concluded that the lack of a unified measure of performance in studies about WSSs´ performance contributes to the lack of consensus on the role of ownership on this systems´ performance. Although often similar, works that seek to evaluate the influence of ownership on the performance of WSSs invariably use different sets of inputs and outputs, even partially, making it difficult to obtain a consensus. Accordingly, Walter et al. (2009) also concluded that there was no consensus on the role of ownership on the performance of WSSs, suggesting that this type of analysis should always consider the institutional and regulatory contexts.

Despite not focusing on the ownership issue, but on the relative economic efficiency of WSSs, Byrnes et al. (2010) did not find a consensus on the role of ownership too. The authors list several works with different results - some attributing higher efficiency to public systems, others to private ones.

Ruester and Zschille (2010) used econometric techniques to assess the impact of governance on the performance of 765 WSSs from Germany, noting that private systems are associated with higher water prices at retail. The authors suggest that this condition stems from the different goals of public operators (a public interest service, resulting in higher quality of service) and private (more profitable). We interpret the results of Ruester and Zschille (2010) as indicative of higher economic efficiency of private WSSs from German, and higher operational and social efficiencies of public systems from that country.

Barrett and Wallace (2011) analyzed the impact of privatization on household's water conservation in Australia and England, concluding that private companies had a lower commitment to water conservation, given that private companies, for minimizing costs, seek

for maximizing profits (instead of maximizing technical efficiency). Barrett and Wallace (2011) stated that even in these cases government involvement through regulation is crucial to the effectiveness of water conservation actions by imposing rules and conservation goals. Gerlach and Franceys (2010) and Barrett and Wallace (2011) indicated that the improvement in technical performance of WSSs is highly tied to the commitment of local governments to promote it.

For Guerrini, Romano and Campedilli (2011), public water companies carry out more investments and use their productive resources more efficiently (better technical performance), while private companies are more profitable (better economic performance). These results emphasize the importance of PMSs to be developed and implemented primarily without considering the economic/monetary goal.

Peda, Grossi and Liik (2011) evaluated 43 water companies in Estonia through DEA and verified no statistically significant differences between the efficiencies of public, private or public-private WSSs. The authors assume that this result is due to the lack of centralized economic regulation in the sector and, in a compensatory way, the establishment of various incentive programs, resulting in resources savings of public systems to be similar to the others. According Peda et al. (2011), monopolies and lack of regulation in the sector of water supply in Estonia occur regardless of the nature of ownership.

Romano and Guerrini (2011) applied the data envelopment analysis to measure and compare the efficiency of Italian WSSs, concluding that public systems are more efficient, both in relation to the constant returns to scale and variable returns to scale. DEA models using constant returns to scale assume that variations in the inputs rates result in proportional variations in products rates. Moreover, models that use variable returns to scale assume that such variations are more than proportional.

When evaluating the explanatory factors of leakage water losses in WSSs from Spain, Gonzalez-Gomez et al. (2012) identified a positive association between privatization and water loss rates. Water losses by leakage are admittedly the main cause of inefficiency (poor use of resources) of WSSs, and according to Gonzalez-Gomez et al. (2012), private operators not have sufficient incentives to reduce water losses, while the government has little control over this situation. Gonzalez-Gomez et al. (2012) also emphasize the lack of targets for reducing water losses in the contracts of private operators. Finally,

Gonzalez-Gomez et al. (2012) mention the asymmetry of information shared between private operators and public authorities as an aggravating factor of the relationship between privatization and water losses in WSSS, referring to the issue of transparency approached by Anwandter and Ozuna (2002), Braadbaart (2007) and Lobina and Hall (2007).

Silvestre (2012) used analysis of variance to assess the influence of public-private partnerships (PPP) and public sector corporative organizations (PSCO) on the social performance of water supply services from Portugal. In such work, social performance equals to lower prices for consumers and high quality of products and services. Contrary to what is expected theoretically, Silvestre (2012) concluded that private participation in water services does not improve resource efficiency, service quality and price to the end user, being the social performance of municipal (public) WSSs better than private ones.

Results and discussion

The first challenge in determining whether public ownership, private, or a mix of both, defines the level of performance of water supply systems, lies in the very heart of the issue: there is not a standardized measure of performance, efficiency or effectiveness. The literature presents several works aimed at measuring these variables in the context of WSSs that, although similar, almost invariably uses different methods, data sets and/or separate indicators for quantifying performance. Some methods commonly used include data envelopment analysis (ANWANDTER; OZUNA, 2002; NORTON; WEBER, 2009; ROMANO; GUERRINI, 2011) and econometric techniques (BHATTACHARYYA et al., 1995; KOSEC; WALLSTEN, 2008; RUESTER; ZSCHILLE, 2010). The approach to performance analysis is also quite variable in the literature: some studies analyze the overall performance, while others focus in more specific aspects of performance (economic, operational, and social, among others).

Even in front of this methodological heterogeneity, it is noticed that most of the reviewed studies concluded that ownership alone does not influence the performance (efficiency and/or effectiveness) of WSSs. Chart 1 compares the conclusions and convergence of the studies analyzed.

Chart 1: Convergence of the conclusions of the studies analyzed in relation to the influence of ownership - public or private - on the performance of WSSs

Main conclusion	Authors
Public systems presents better performance	Norton and Weber (2009), Romano and Guerrini (2011)
Private systems presents better performance	Renzetti and Dupont (2004), Hassanein and Khalifa (2007), Barrett and Wallace (2011)
Private systems are associated with deleterious effects over performance (imbalance between business and public interests, higher prices or higher water losses)	Lobina and Hall (2007), Ruester and Zschille (2010), Gonzalez-Gomez et al. (2012)
No consensus about the influence of ownership over systems´ performance	Abbott and Cohen (2009), Byrnes et al. (2010), Peda et al. (2011)

According to the literature, the main influential factors on this performance are (1) regulation, (2) the lack of competitiveness and (3) the lack of transparency in the sector.

Water supply systems generally have no competition and the literature shows that regulatory and market characteristics are the main actors that define the efficiency and performance of this sector. The public or private ownership of the systems is not the determining factor of its performance – public systems tend to have better operational efficiency, while private are usually more profitable. Regardless of the type of ownership, the role of the government in establishing rules and performance targets for the water supply sector, through regulation, seems to be a determining factor for improving the performance of WSSs. From case studies developed mainly in Africa and Asia, Gerlach and Franceys and (2010) concluded that the economic regulation of water services can be an effective mechanism for governments to institutionalize their commitments to universal access and consumer protection while promoting incentives for efficiency and effectiveness of these systems.

The lack of competition in the water supply sector in which there are monopolies in production and supply is indicated by Tupper and Resende (2004) and Abbott and Cohen (2009) as a key factor on the low efficiency of national water supply systems. Several studies indicate that the regulation is the main factor to influence the performance of WSSs, surpassing the question of public or private

ownership (SAAL; PARKER, 2001; TUPPER; RESENDE, 2004; NAUGES; VAN DEN BERG, 2008; ABBOTT; COHEN, 2009; WALTER et al., 2009; BYRNES et al., 2010). Ehrhardt and Janson (2010) indicated that the regulation used in conventional water services has no commercial motivation and this prevents the profits maximization. For the authors, such legislation should be adapted to allow citizens to assess the performance of services to force the government to consider the issue of efficiency in the management of systems.

The transparency of the water supply sector seems to influence his performance as favors competition and also allows managers and society view the status of systems in relation to their goals, with regard to the public interest. These results demonstrate that the global trend to privatize and/or increase private participation in water supply services by itself will not produce the expected improvement in performance (better use of resources and better quality of service) of WSSs.

Conclusion

Based on evidences from the literature, we conclude that the ownership - public or private - by itself does not defines the level of performance, efficiency and effectiveness of water supply systems. Three factors are crucial in the performance level of WSSs: regulation, competitiveness and transparency. The establishment of clear and consistent rules for the sector, setting efficiency targets, seems to be the prerequisite for increasing the performance of WSSs, and in this case ownership is a secondary factor.

These findings suggest that, contrary to the global trend, privatization of water services cannot be taken indiscriminately as an alternative to improve the efficiency and effectiveness of WSSs.

Future studies may investigate standardized definitions and indicators of performance, efficiency and effectiveness for WSSs. Once defined these standard indicators, performance analysis of WSSs can be made more consistent.

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