Use of Benchmarking For the Improvement of the Operation of the Drinking Water Supply Systems

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Abstract

An effective way to identify the main elements that can provide an image about the efficiency of a system is to compare your performance level with that of another similar system. Therefore, water and wastewater systems need a wide and reliable database that can provide such a comparison. The water and wastewater sector has become interested in the implementation of this management technique in the last two decades, in order to improve the performance of the companies in the sector, an also the Romanian operators has started the benchmarking exercise, in order to find ways to improve their own efficiency. The results of the benchmark exercise are presented in the paper, and also first conclusions drawn from the first benchmarking process.

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1. Introduction

The provision of reliable water supply services and sufficient service coverage represents a main objective for the public utilities. Although the demand for better quality services from a qualitative perspective is higher, and also covering a larger number of customers is increasing, the level of financing of such services is more and more limited.

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For this reason, the utilities worldwide are seeking ways of performance and level of service improvement, at least cost.

One of the main management techniques oriented towards the improvement of delivered product/service quality and increased profitability is benchmarking.

Benchmarking is a management technique designed to help improve performance through systematic research and adaptation of best practices in the marketplace. The water and wastewater sector has become interested in the implementation of this management technique over the past two decades to improve the performance of companies in the sector.

Benchmarking is the process by which an organization compares and improves its performance by learning from the best in a group. The process involves identifying, familiarizing and successfully adopting the methods and processes used by benchmarking partners.

2. The Method Used in the Benchmarking Exercise

2.1. Methodology

The benchmarking approach used and recommended for benchmarking exercises is that proposed by International Water Association (IWA), respectively performance evaluation and improvement.

Since its publication, IWA’s performance indicators have become standard in the water and wastewater field. IWA textbooks for water and wastewater services, presents lists of indicators and variables for calculating these indicators and is a good starting point for designing a performance evaluation system.

The performance evaluation stage determines how efficiently or how well a particular company operates or performs a function, task, or process. This assessment is made through performance indicators that have to be compared with a benchmark (a standard or a target) to get an evaluation. This is called the comparative stage of performance evaluation.

In the performance improvement stage, the best practices of operators with better performance are identified and adapted to improve the performance of a particular company for a particular function or process. This phase requires the participation of several companies or benchmarking partners to bring together additional information that will lead to the identification and adaptation of the best practices.

These two stages are parts of the benchmarking that are defined as "a tool for improving performance through systematic research and adaptation of best practices".

The Performance Indicators System used in Romania is based on the lists in the IWA manuals and is adapted to the needs, conditions and objectives of regional operators in Romania. It contains variables for the company's main functions, namely:

- commercial, containing data on connection to services, counters and consumption;
- financial, with operational data on water, waste water and other activities, tariffs, profit and loss account and balance sheet;
- water and wastewater balances;
- technically-operational, separate for water and wastewater activities;
- investments, from own sources, or from local authorities and EU funds;
- human resources, containing data about company personnel.

The variables and indicators are presented separately for water and wastewater activities. Where possible, IWA parameters are used, and where necessary new parameters (or derived from IWA parameters) are introduced.

2.2. Background of the Benchmarking Implementation

The Benchmarking exercise was initiated in Romania with the help of the European Bank for Reconstruction and Development (EBRD) through a program on the provision of technical assistance services and support for the implementation of projects funded through the EU Structural Instruments.
The main objectives of the technical assistance are to strengthen the capacity of the regional operators and to support the Intercommunity Development Associations in order to fulfill their role, according to the institutional arrangements provided for this sector.

The program included two benchmarking exercises to provide support to improve the performance of the 22 participating regional operators. The program also resulted in a benchmarking methodology aligned with IWA's performance variables and indicators, but adapted to the Romanian water and wastewater sector, allowing comparisons between local water and waste water companies as well as European or International benchmarking systems.

The operators involved in this program were: Arges, Bacau, Bihor, Bistrita, Botosani, Braila, Brasov, Buzau, Constanta, Covasna, Dambovita, Dolj, Galati, Iasi, Maramures, Mehedinti, Mures, Prahova, Satu Mare, Sibiu, Timis and Valcea.

2.3. Parameters

The parameters used in the benchmarking exercise are the main indicators used in the IWA methodology, customized for the Romanian water and wastewater sector and filled with new specific indicators, generated by the need to present a detailed picture specific to the water and wastewater sector in Romania.

The variables and indicators are presented separately for water and wastewater activities. Where possible, IWA parameters are used, and where necessary new parameters (or derived from IWA parameters) are introduced.

The variables and indicators specific to the Romanian water and wastewater sector contain "RO" in the code. The particularization is related either to the fact that a minor change has been made in the meaning of the variable, in the unit of measure or subdivision of an IWA variable.

A variable is a date of the system that can be combined to define a performance indicator. The variable groups were established according to the data source, regardless of the indicators for which they were used. Incidentally, a variable can be used to calculate multiple indicators from different groups.

Performance indicators are grouped into a structure that makes sense for each company and for all kinds of system uses. A performance indicator can be compared to a target value, with previous values of the same indicator, or values of the same indicator from other companies. A performance indicator consists of a value (resulting from a formula) in specific measurement units.

Performance indicators are arranged in the following water activity groups, and similar for wastewater:

- Pe - Staff indicators
- Ph - Physical Indicators
- Op - Operational indicators
- QS - Quality Service Indicators (Water Quality and Customer Services)
- Fi - Economic and financial indicators

3. Results and Discussions

The results reported by the operators involved largely covered the indicators required by this exercise. Indicators could not be fully completed by all operators due to lack of data, but this does not affect the validity of reporting.

The reported data shows a relatively high degree of confidence, the large majority of participants were aware that only a faithful presentation of reality can lead to further improvement of performances in the activity carried out.

Data analysis is extremely complex. Correlations can be made between various parameters that provide a complete image of how a water supply system works.

3.1. Technical Indicators

An important operating system parameter that any operator attempts to maximize is the degree of connection to the water service. A high level of connectivity is a potential source of income to maintain activity, and for this reason all operators pay special attention to the degree of connection. There are many situations where the metering level is low
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An important operating system parameter that any operator attempts to maximize is the degree of connection to the water service. A high level of connectivity is a potential source of income to maintain activity, and for this reason all operators pay special attention to the degree of connection. There are many situations where the metering level is low and the water consumption is high. A high degree of connection does not represent the guarantee of cashing as real consumption.

As can be seen from the previous figure, few operators have a metering level about 100% but the connections rate is low. For these operators it is obvious that the target in the near future is the full connection of the potential consumers.

Fig. 1. Population connection rate and metering connection rate.

Fig. 2. Domestic consumption and Non-Revenue Water.
The individual consumption is directly related to the metering rate. In many situations, the domestic per capita water consumption is very high compared to the average of the values of the other operators.

This situation is shown in the previous figure, and can be observed very high individual consumption for the operators from Dolj, Constanta, Covasna, Timis, and this can be explained by the low level of metering which leads to an inefficient allocation of employees within the institution. Also, a low cost to personnel shows an exaggerated increase of the other costs, which may mean: whether the operator makes investments and rehabilitates the system, externalizes expenses.

Another important aspect of the efficiency of the operation is the efficiency of the proposed investments for the rehabilitation of the system. In order to establish the rehabilitation measures of the systems or their components, besides the technical aspects that determine the rehabilitation solutions to be adopted, an economic analysis is necessary, which will lead to a prioritization of the works and a scheduling of the necessary investments.

The necessary costs to be recovered for each diameter of the replacement pipe are very high, which leads to the idea that it is not feasible to replace the entire affected area. Pipeline replacement can only be made economically efficient when the cost of replacing pipelines is equal to or less with profit rates generated by recovering actual water losses.

According to Romanian regulations, the quantity of the billed water, if the water consumption is not metered, has a maximum value imposed, and any consumption exceeding the imposed value cannot be recovered by the operator. For this reason, the increase in metering is urgency in terms of the measures needed to improve the operation of water supply systems.

Also, if large consumption is unjustified, it is also necessary to analyze other parameters that can lead to increase the per capita consumption.

The analysis of non-revenue water (NRW) quantities highlights the fact that most operators record values of over 50% of water that do not bring revenue from the total amount injected into the system. It is noticed that there is no correlation between water consumption and the amount of NRW, so reducing water quantities requires an in-house analysis within each operator.

The analysis of the correlations between the non-revenue water quantities and the physical water losses reported by the operators participating in the benchmarking exercise is shown in the following figure.

![Fig. 3. Total real losses and NRW.](image-url)
From a strictly financial point of view, in some situations it seems to be feasible to replace pipelines, but maintaining damaged pipes is not a technically acceptable solution, even if the costs are very high and the recovery of investments takes place over a very long period of time. Analysis and decision to replace pipelines should be done on a multi-criteria analysis, as the financial aspects are important but not the only ones involved in the rehabilitation decision.

3.2. Economic Indicators

The main objective of any economic operator is to achieve profit. For generating profit, any economic activity must minimize the costs of cost-generating components to the profitability limit. All these components of the economic activity are ultimately found in the total operating cost and implicitly in the tariff applied by the operator of the marketed product.

To reduce production costs, it is necessary to analyze the components that generate costs for an operator. In this way, a structure of component expenditures can be achieved, which includes: costs generated by the purchase of raw water, costs generated by electricity consumption, costs for raw materials and materials, personnel costs, maintenance and repair costs, costs generated by the outsourcing of services (services provided by third parties), and other operating costs specific to a particular operator, due to local conditions and the specific area of operation.

The analysis of the data of the operators participating in the benchmarking exercise, performed for the average values of the individual reports of the operators, for each component, is presented in the next figure.

![Structure of the component expenditures](image)

Fig. 4. Structure of expenditures generated by drinking water activity - average values.

Depending on the values recorded by each operator, it can compare them to the average values reported by other operators and may intervene in the sense of profitability over that component that generates the highest costs.

It can be seen from the previous chart that the largest contribution in the expenditure structure is the personnel expenses.

A high percentage of personnel costs may mean inefficiency in the operator's staff, too many employees or an inefficient allocation of employees within the institution. Also, a low cost to personnel shows an exaggerated increase of the other costs, that may mean: whether the operator makes investments and rehabilitates the system, externalizes
services, and increases efficiency by operating on a specific target, which means efficient operation in as a whole, or it may mean inefficient operation through excessive energy expenditure or high repair and maintenance costs.

Another aspect that needs to be taken into account and generating costs for operators is the level of investment made in the systems operated, as the operators have borrowed for their realization, and the additional costs of repaying credits have a direct influence on production costs.

Investment levels are directly influenced by the financial strength of operators and depend on a number of factors that are not directly related to their efficiency. The level of investment depends on past loans, the historical debts of operators, the level of consumer supportability.

The fact is that there is a permanent concern of the operators to make investments in the existing systems, which are the premises of an efficient operating in the future, and the effects of the current investments will materialize after the completion of their implementation.

3.3. Quality of Service Indicators

An important aspect of an operator's activity is the quality of service offered to customers. Quality control of customer service has two components that provide information about this satisfaction: an internal component of the operator and an external component coming from consumers.

As far as the internal component is concerned, each operator ensures that the supplied product falls within the quality limits imposed by the legislation in force. In this respect, each operator has water quality analysis laboratories testing their distributed water.

From the point of view of the clients' perception regarding the quality of the service provided, the element that conveys their degree of satisfaction is the number of complaints.

In order to analyze the intervention strategies for solving customer complaints, it is necessary to know the type of complaints by categories of complaints.

![Fig. 5. Number of complaints concerning water quality, service continuity and pressure.](image)

All complaints should be analyzed in the context of the system operated by each operator, and service improvement solutions will result as individual solutions applied to each case.
4. Conclusions

A set of advantages can be spotted at a first level of analysis. Compared to the organizations which are not using benchmarking, those which are using it are benefitting of:

- Increased organizational performance by identifying improvement methods of the service delivered, as a result of the comparison with the other companies in the sector;
- Understanding of the relative position in the sector in relation with the cost, the profit margin, and other key performance indicators of the company, which helps with identifying the areas where improvement actions are required;
- Gaining a strategic advantage, deriving from the same comparison analysis and identifications of those areas in which the company has critical capabilities or key strategic reserves;
- Increased learning pace within the organization, as the benchmarking related activities bring new ideas in the organization, thus helping with advancing along the learning curve.

Additional to these advantages, resulting straightforward from the benchmarking exercise, other benefits can be identified:

- Encouraging performance culture within the organization, as acceptance and adoption of such exercise generates a continuous performance improvement concern;
- Can be used for setting up targets, as benchmarking is supporting realistic objectives adoption;
- Benchmarking and compared results are generating an incentive to increase organizational performance by clearly identifying the existing situation;
- Creation of a knowledge package which can push forward the whole sector;
- Benchmarking can be used for underpinning internal proposals, by exposing the success of certain initiatives in companies in the same sector of activity.

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