Business Intelligence Tools Applied to a Wastewater Treatment Plant

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Highlights:

•   In many Wastewater Treatment Plants in Brazil, data is only used when required by the regulation agent, but seldom analyzed daily.

•   The great amount of data from wastewater analysis is generally lost due to lack of organization.

•   Business Intelligence Tools are used to grant objectivity and clarity when analyzing data in a Wastewater Treatment Plant.

Keywords: BI; Big-Data; Business Analytics

INTRODUCTION

Data management is one of the biggest challenges in both Water and Wastewater Systems. The control of water and wastewater quality and quantity requires a reliable and continuous database. On the other hand, given the lack of resources and equipment for operators, even to perform simple laboratory analysis, the existence of a database with several metrics is quite unusual. In addition to the difficult task of acquiring data, these metrics are sometimes lost and forgotten due to deficiencies in organization and management in these systems. This leads to misunderstanding of the real situation of the analyzed systems, thus affecting decision-making.

One solution might be the use of Business Intelligence (BI). A BI platform refers to the entire system for acquiring data from a company's defined database, containing operational and commercial data primarily related to water and wastewater, when applied to Sanitary Engineering. It can provide deeper insights through organizing data into tables and graphs, constantly updated (PUCRS, 2021). Implementing a BI system provides an additional step towards operational control through the tripod: Reliability (without human interference), agility (constant and agile updating through automated processes), and availability (continuous access possibility).

In this work, we propose the implementation of a BI platform to analyze the wastewater quality and quantity in a Wastewater Treatment Plant.

METHODOLOGY

The platform is used to analyze information such as pH, temperature, Dissolved Oxygen and Suspended Solids in the entrance, within each treatment unit and in the end of the treatment unit, and to control de maintenance services occurring in each unit. To enable the use of the BI platform, it is necessary to integrate data that are usually treated individually within the company, such as operational and commercial data. Based on the acquisition, processing, and loading of a large amount of data (big-data), manipulation and automation of information become possible for easy presentation to business managers (Antonelli, 2009). In this case, the database was illustrative, and inserted manually in an online Excel file designed specifically for BI. Although, data might be available from sensors distributed along the treatment units and provide data automatically for the platform.

From the database already provisioned in a cloud environment for ease of access, the tools are used for data processing in the BI platform. Adjustments and connections between variables are made to make the correct assumptions for the treatment units and parameters. The next step is to format the dashboard, which is the part of the BI that is going to be visible to the final user. The dashboard might show the parameters according to what is required, in tables, graphs and lists. The parameters might be sorted according to treatment unit, date or any other classification already processed with the connection made before.

RESULTS AND CONCLUSIONS

All paragraphs are set with no indent but justified. This section should highlight the main findings of the research, a brief discussion and conclusions.

For the case of a Wastewater Treatment Plant, we considered the most important to control treatment quality parameters such as BOD, QOD, SS, pH and temperature (Figure 1), and the maintenance services in different equipment and units (Figure 2). The first dashboard shows the evolution of parameters in each unit across time and make possible the comparation between different treatment units inside the plant.
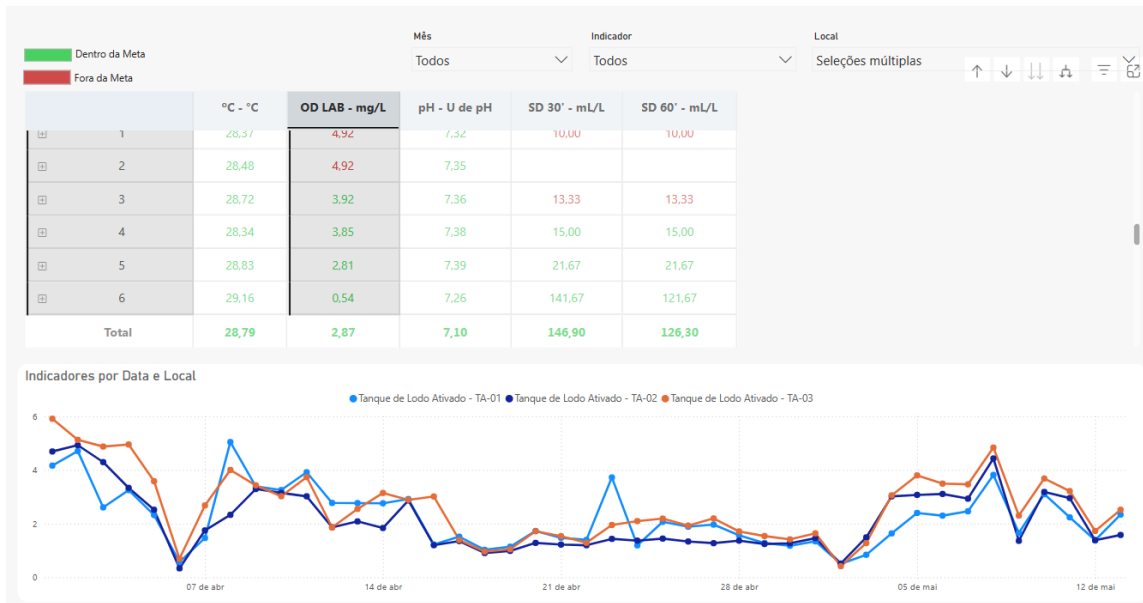
Figure 1: Example of application of the BI dashboard by comparing Dissolved Oxygen in three treatment phases of the WWTP (illustrative data).

The latter is useful to monitor the activities in the plant, which ones are concluded or not, who is responsible for each activity and where. This gives important insights for the manager to act according to facts, not suppositions.
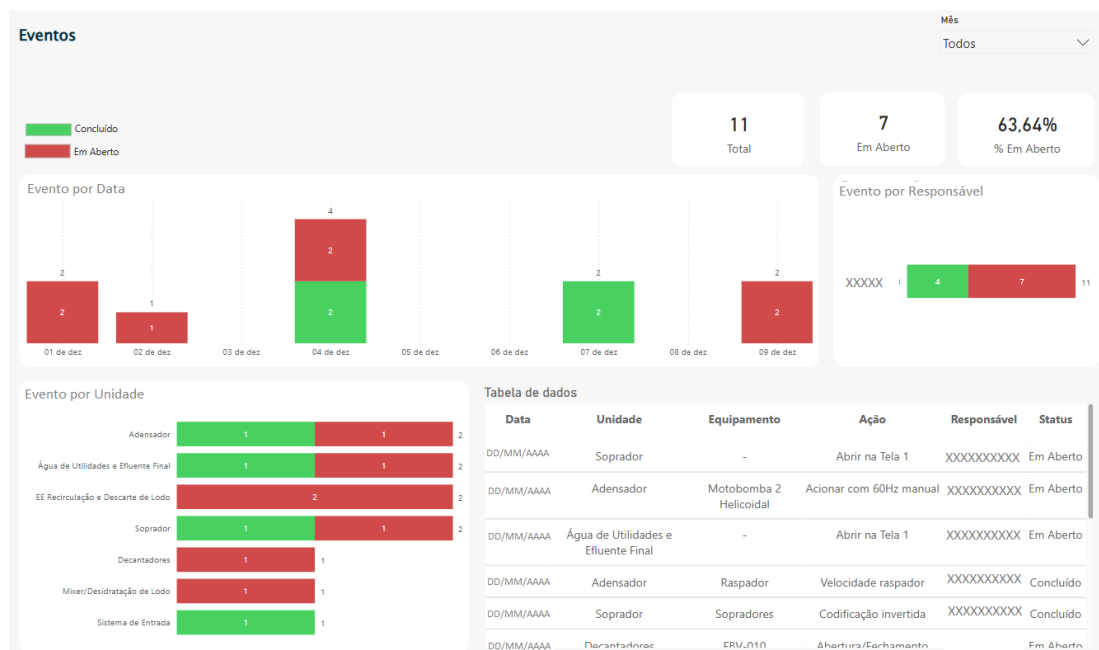

Figure 2: Example of application of the BI dashboard when monitoring maintenance services (concluded and ongoing) in the WWTP (illustrative data).

The application of BI enables a more accurate monitoring of the Wastewater Treatment Plant parameters. This facilitates greater control and analysis of the data, enhancing decision-making in specific locations, guided by business indicators such as treatment efficiency in each unit for each analyzed parameter, based on daily control. The developed tools operate without operational costs for development since the operators already fill in the analysis in the computer and are available whenever needed by a company's management. The automatization with sensors might help even more because it does not require any human interaction, lowering the possibility of errors.

In addition to the results already achieved with data security, availability, and reliability, the project, when applied in a sanitation company, enhances intelligent decisions by management, which can be made to reduce costs or strategically improve a topic related to the company's operational department.

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