Developing Performance Dashboard for Operational KPIs of Water Distribution Network

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Abstract

Developing and implementing dashboards are prevalent in the vast advanced companies. This paper proposes to develop dashboards for the performance management of water distribution networks aimed at improving the efficiency and productivity by implementing operational excellence approach. Efficient operation of the water distribution networks is essential. Losses and failures along the water distribution network are major challenges for the water organizations around the world. Operational information from systems and field teams provide massive amount of data and many opportunities to monitor and evolve the effectiveness of water distribution networks. The collected information from the required measurements can be shown digitally on professional dashboard with graphs and trends that characterize the indicators in a clear to understand by visual demonstration. A practical performance dashboard was successfully developed and implemented in the chosen zone for the main factors of water networks such as leaks, shortages, new connections, preventive maintenance, corrective maintenance, and pressure readings. The results are automatically updated daily and monthly. Data gathering was conducted through the used operational technical systems and records from field teams. Customized dashboards allow the users to explore the performance metrics as per the requirements and review their accomplishments and patterns. This facilitates motivation to improve performance and reach to professional benchmarks. There is great potential of digital technology for managing works in the proposed procedures assisting water authorities in improving the service quality, communications and promoting a culture of continuous improvement.

Keywords

Dashboard • Operational excellence • Performance management • Water networks • Key performance indicators

1 Introduction

The use of dashboards for professional management in many businesses and fields is increasing in the sophisticated organizations for improving the performance and productivity. Using of the graphic analytic methods is highly affective for improving the operations management, efficiency, quality, and staff performance. This tool has grown dramatically in the last 10 years, because of the development of Technologies and Information (Hensley et al. 2021).

Performance dashboards are using dynamic graphic screens to show improvement of the performance, productivity, and trends behavior of related business. These visual presentations on computer screens are interacting with the users to choose, categories, filter, zoom in, and overview data. It is updated continuously which resulting variation on the results and trends over the time. Sometimes the information can be displayed as real time and the update is every few seconds. Applying the visional influence is great to summarize and link a large amount of information, operational dashboards empower the users to effectively identify the characteristics to classify patterns. This methodology is

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cognitive tools that progress control over huge, mixed, and transitioning of data (Young and Kitchin 2020).

Water supply networks are very basic for the people life. It is critical component in the country's infrastructure, providing healthy and comfortable life required safe and continuous drinking water. Measuring the efficiency of water distribution networks can create benchmarking references and baselines to improve the quality of services and provide valuable information about the level of effectiveness in the sector (Storto 2020). Therefore, the closed monitoring of the related parameters progress is required for achieving better level.

2 Methods

The various requirements for the dashboard are mainly to have appropriate it functional and practical use. The entire chosen of KPIs should be implemented in the dashboard. Then, it is considered to have clear colors and meaningful for each parameter. Overstated using of colors can confuse the users, so it is preferred to have limited colors and ranges on the dashboards. Additionally, the users should have basic skills for graphs readings and meanings of shown numeracy. Finally, there are professional computer programs for creating the required customized dashboard, for example, Power BI, Qlik Sense, or QlikView. Each of these programs has its features and strengths for graph options, data connectivity, etc. (Baalbergen 2019).

Oman Water and Wastewater services Company OWWSC is providing potable water in Sultanate of Oman. The system is complicated due to the geographical nature there. In some fields, there are challenges to have excellent implementations of the company strategies. There are areas that need to be improved in management of performance, because it is affecting the productivity, service quality, and creation of effective decisions. Therefore, improving the performance of the staff and departments inside the water authority organization is essential. However, the management of water distribution networks from the production sites to the customers is very complex mission with many steps and processes (Taha et al. 2020). Dashboard was constructed in Muscat water networks—zone 3 with daily and monthly operational data from the last 3 months from customer relationship management system (CRM) for complaints and field teams' technical reports, using the excel formats which planned to be moved later in power BI system. The dashboard was designed to display 12 technical parameters. (leaks, shortages, preventive maintenance, planned maintenance, pressure, flow, power consumption, rehabilitation, assets status, DMAs isolation, shutdowns, leak detection).

Reduction of leaks and complaints water distribution networks is essential priority. This paper presented performance parameters, such as the Leakage Performance Index (LPI), to reduce leakages starting from clear and continuous measurements of pressure and flow rate. This strategy was efficient to minimize the leakages (Cavazzini et al. 2020).

3 Results

Figures 1 and 2 show the main used parameters of performance dashboard in water distribution networks for the leaks and shortages complains. The results demonstrate an increase of the efficiency from July 21 to September 21 due to applying of required field actions and using the dashboards concept and to monitor the daily progress.

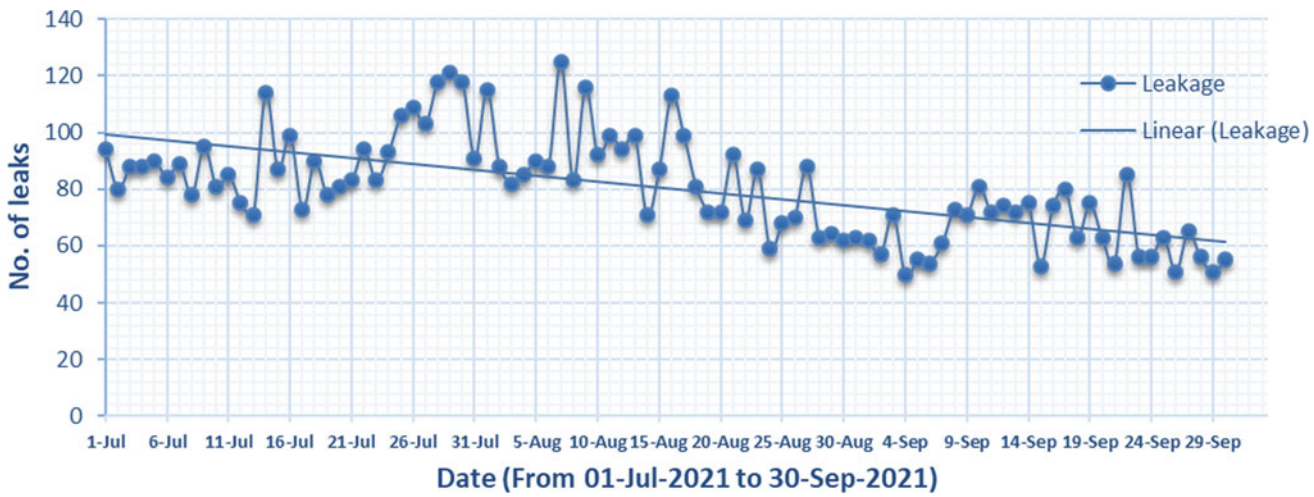

Fig. 1 Reduction of number of leaks from month of July 21 up to end of September 21

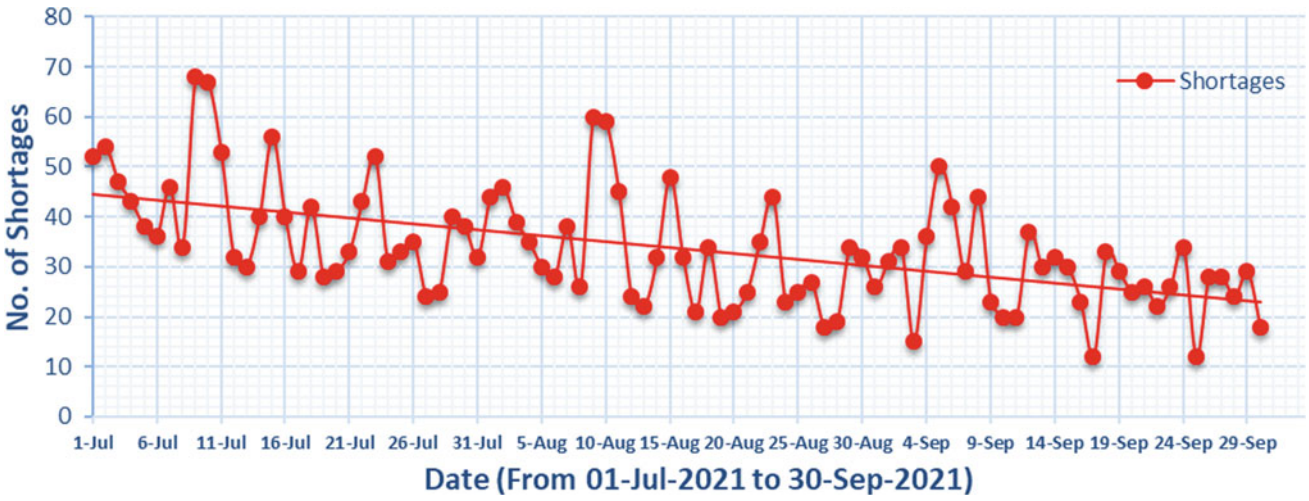

Fig. 2 Reduction of number of shortages from month of July 21 up to end of September 21

- The implementation of performance dashboards started in water distribution networks in Muscat Zone-3 in the month of July 21, as shown the impact on the performance is demonstrated in next months. The reduction in leaks and shortages is interesting for August-21 and September-21 compared with July 2021.
- By continuously monitoring of the progress in the shown parameters on the operational dashboard, the teams and technical staff is looking always for better results by implementing solutions and following the impact on the dashboards.
- The reduction of leaks and shortages came after applying few action plans related to pressure management, rehabilitations of small routes, and controlling the supply to some parts.

4 Discussion

The concept of performance improvement by using key performance indicators is substantial for the growth of the organizations and businesses. This paper presents monitoring, selecting, evaluating, and visualizing operational KPIs in professional technical dashboard. The dashboard is required to be appropriate for different skills capabilities of the users. During developing the required dashboard, it is significant to know the users, because each employee has a different level of technical skills to understand the meaning of graphs and numbers (Baalbergen 2019).

The management-level dashboard is not same for the technical teams, so it is important to have flexible dashboards which can summarize or expand the information.

The presented results in Table 1 show that the use of performance indicators and dashboards has a direct impact on raising efficiency, as the number of leaks decreased with the passage of time, and the same thing happened with regard to water service interruptions as shown in Table 1.

The gradual successful improvement of the performance can be partially due to continuously available information about the work progress and current efficiency of the water networks, because in case of any failures, the results will be displayed directly. The teams are trying to increase the quality of service by reducing the failures. Keeping the eyes on dynamic visual screens enhance everyone to give more productivity.

5 Conclusions

The objective of this study was to develop a customized operational dashboard for the technical teams and staff to increase the performance and efficiency. The results were impressive with direct increase of the motivation and productivity within 3 months. It is expected that the used performance dashboard will be very beneficial for technical

Table 1 Change in number of leaks and shortages from July 21 to September 21

Month	Leakage	% Change	Shortages	% Change
July 21	2839	–	1,250	–
August 21	2636	− 7.2%	1,012	− 19.0%
September 21	1928	− 26.9%	842	− 16.8%

teams and managers to support them fulfill the tasks more quickly with better quality. Also, the mentioned methodology of clear dashboards is improving the communication and discussion between the groups in the organization due to more clarity of the related parameters and linked factors between different departments. The managers and field teams think that the use of the dashboard is an affective concept and with more motivation in the work environment. The implementation of the performance dashboards can be deeper to complicated parameters and levels to cover and link all affective factors which can be considered as future plans in the company.

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