TECHNOLOGY DRIVEN MAINTENANCE OPTIMIZATION – HOW DIGITALIZATION INCREASES PRODUCTIVITY IN WATER

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ABSTRACT

Developments in digital measurement technologies are enabling water companies to gain a deeper insight into all aspects of their operations, presenting new avenues for predictive targeted maintenance and enhanced network performance.

Although digitalization is talked about frequently in water, there is a perception that its potential can sometimes be difficult to realize. This paper presents examples demonstrating how digital technology is driving productivity and opening opportunities for optimized maintenance. Through the deployment of proactive asset management in a range of applications, operators can use data to gather hitherto unprecedented insights into the performance of equipment and processes.

Data is perceived by many water companies globally to be a silver bullet to improve efficiency and lower cost. However, data is of little value without the ability to convert it into meaningful action, filtering out noise and ensuring that the right information reaches the right personnel at the right time.

Unlocking the power of data, will yield previously unseen insights, enabling predictive diagnostics and preventative maintenance. This paper focuses on two examples of successful technology-driven maintenance optimization in the field. Example 1 – Melbourne's largest water company's approach to using technology to better manage fluoridation of drinking water, driving greater process efficiency. Example 2 – how digital technology is helping a regional water authority in Victoria, deploy a proactive asset management regime.

1.0 INTRODUCTION

In a recent industry survey carried out by Amane Advisors, 51 percent of water companies stated that digitalization directly resulted in the prevention of supply issues, and improved service reliability (Figure 1). 46 percent of those surveyed reported extended lifetime of assets (e.g, pipes, pumps etc). This paper presents two case studies in which digitalization has been proven to have significant positive outcomes in the field, helping to improve network resilience, and decrease maintenance costs. The two applications covered – digitalization in continuous fluoride measurement and digitalization in flow measurement – were deliberately chosen for their ubiquity throughout the water industry, and as such are not statistical outliers which benefited from favourable circumstances. The solutions described could therefore have an immediate impact for installations around the world.

Despite the enthusiasm of many water companies towards embracing digitalization, the industry as a whole has been comparatively slow in adopting digital technologies and approaches into everyday operations. One of the main barriers reported by many is the unfamiliarity of viable solutions, making the adoption of them relatively slow, while converting data into meaningful action is also identified as a challenge. A system which bombards its operators with irrelevant information can potentially do more harm than good. The two applications covered in this report represent instances in which digitalization has been rolled out without having to overhaul existing systems and processes, while delivering significant value and return on investment for companies.

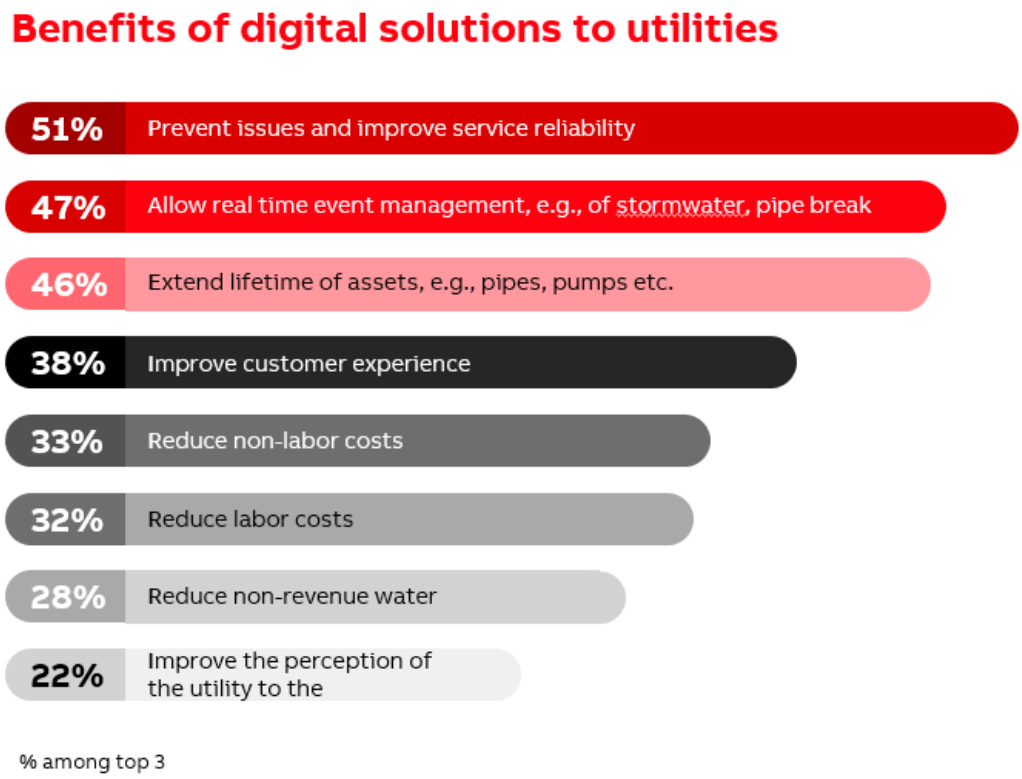

Figure 1: ***Evolution into Digital - Utility perspectives on benefits of digital solutions (source: Amane Advisors)***

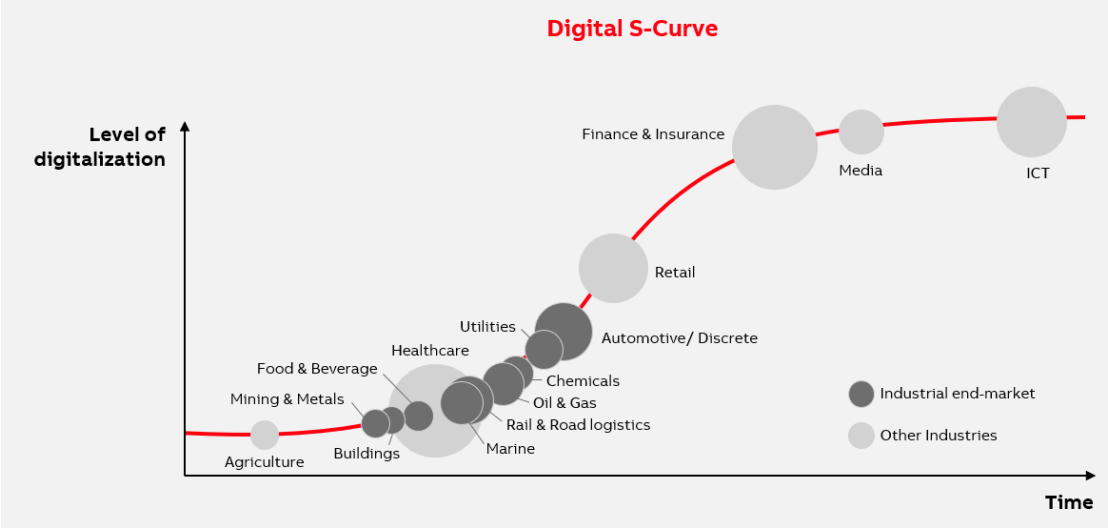

Figure 2: ***Digital S-Curve estimating the level of Digitalization by various industries***

2.0 DISCUSSION

Proactive asset management is in essence the practice of attempting wherever possible to get ahead of asset faults and failures. Where previously condition monitoring would be carried out primarily through visual inspection, proactive asset management seeks to use sensors and the data they generate to gain a more accurate picture of equipment behaviour, condition and performance, thus allowing any potential faults to be flagged up and rectified long before they develop into failures. Digitalization facilitates this approach through the widespread installation of sensors to measure various parameters related to process health,

and by making this information accessible and actionable.

2.1 Melbourne

Fluoridation of drinking water, wherever employed, is a critical measurement that must be monitored and controlled accurately. Information relating to amount dosed (mg/L) must be accessible and reported to the local authority. Traditional measurement technology required a high level of manual intervention, increasing cost of ownership and waste. A major water company in Melbourne trialled a Profibus enabled fluoride analyser. This allowed data on sensor diagnostics and alarms to be digitally communicated back to control room. Greater detail on alarm conditions, e.g. instrument off-line, out of sample or low on reagents gave actionable insight. Rather than getting a simple pass/fail message, 2-way communication enabled technicians to remotely interrogate the instrument as well as to instigate a calibration during the backwash process rather than when the process was online. This overcame the issue of the fluoride plant being forced "offline" during the calibration process, ensuring continuous operation. The solution provides greater visibility over process health, while significantly reducing the latency between measurement and results, facilitating quicker and better-informed decision-making.

Profibus was chosen as the communication protocol, in part because the water company wanted the ability to instigate a remote calibration on the fluoride analyser while the plant was offline. Carrying out a calibration when the plant was online would mean that they were not measuring fluoride concentration for the 40-minute duration of the calibration cycle. This would leave them vulnerable if the fluoridation process failed during the calibration cycle, potentially leading to intervention ranging from warnings and fines to forced shutdowns by regulators.

As a result, calibration is performed by pushing a button in the control room while the plant is in backwash or offline. The analyser then calibrates during this period, and the water company does not miss "live" fluoride measurements. Profibus is an open standard and therefore manufacturer independent.

The result was a notable uplift in efficiency (4 hours per calibration cycle, typically 1 calibration per week), allowing technicians to focus on core activities. Site visits consequently became more targeted, taking guess work out of which spares/tools to take. A predictive maintenance regime for the fleet was employed by logging spares requirement through asset management. Self-calibrating sensor further reduced the need for expensive external services, with monthly savings of $1,500 per analyser (with analysers across several sites). These outcomes were proven to be sustainable initially over a 3-month trial period and in permanent operation thereafter since July 2017. The real value of the project was in the actionable insights that could now be extracted, which in this instance facilitated targeted utilisation of resources. Profibus has become the company's standard communication protocol for subsequent fluoride analyser installations.

2.2 Victoria

Water company assets typically have a broad age range, with a combination of both new and older equipment. In a recent ARC advisory group survey, 80 percent of all operational losses caused as a result of asset functionality issues were found to be avoidable. Being able to confirm that assets such as flowmeters are performing within specification digitally and without disrupting the process has enabled a regional Water Authority in Victoria to get ahead of potential problems.

The water company uses in-situ verification technology. By connecting to the meter via simple non-invasive infrared communication and a software package, they perform a full health check against a known baseline (a fingerprint produced at the factory when the meter is originally manufactured) and produce a live result on the spot, along with supporting documentation. As verification technology has evolved, so has access to previously hidden data. Rather than a simple pass/fail, technicians now have information providing deeper process knowledge and insight into asset health. Predictive diagnostics delivered in simple accessible format have enabled the water company to implement a preventative maintenance regime, extending asset life and more targeted utilisation of resources.

Eliminating guess work has also eliminated frequent firefighting. As the process does not need to be interrupted to perform this digital test, the client can check their assets at regular intervals without the loss of measurement due to downtime. The test procedure is simple and automated. It can be carried out by water company's own technicians, eliminating the need for external service support.

In-situ flowmeter verification of products is a considerably lower cost option compared with full removal and wet calibration. The Victorian water company sought to carry out continuous verifications to ensure performance did not deviate from specified tolerances. This is particularly important for custody transfer or billing applications where significant costs can be avoided or income be generated, while also ensuring regulatory compliance. The software solution used is capable of verifying multiple types of flowmeters, providing near real-time feedback on equipment performance and maintenance requirements.

Following the installation of the digital verification solution, it was discovered that 15percent of the meters checked needed some form of corrective action. Given that the age of the meter can vary significantly, it is not surprising there is a need for some intervention.

This is where a proactive maintenance routine using in-situ verification can add value. By carrying out verification on a regular basis, there is a data trail of meter performance throughout its operational life. This enables a complete picture of asset health to be established. For operators, a significant benefit is the ability to use this data to identify trends such as deteriorating performance that can be used to create targeted preventive maintenance strategies. In this way, issues can be easily pinpointed and fixed to optimize flowmeter performance, regardless of the age of the device.

Examples of problems that can be detected through in-situ verification include problems with cables caused by rodent damage or fouling of electrodes due to silt build up or other factors.

Furthermore, by eliminating the need to remove the meter from service for testing, in-situ verification can also help to save time, minimize OPEX costs and avoid disruption caused by the loss of measurement while the meter is out of the line. These savings are multiplied for larger line sizes where the cost of removal are higher, providing a convincing case for in-situ verification to be adopted wherever possible.

3.0 CONCLUSION

Data alone is of little use without context. Moreover, extracting data for the sake of it can be counter-productive, and lead to operator overload. A successful digital plant is one that presents the right data to the right person at the right time, in order to facilitate better, more timely decision-making, and flag up any potential issues before they affect process health.

These case study examples illustrate how digital technology is driving continuous improvement, eliminating downtime and increasing productivity for water companies. By being able to better manage their own assets, water companies have further reduced reliance on expensive third-party service providers, making significant OPEX savings in the process.

Digitalization does not necessarily require large capital investment, nor does it require an overhaul of process equipment, as many processes can be retrofitted with sensors and transmitters to incorporate digital functionality. The examples detailed in this paper demonstrate that technology-driven maintenance optimization is helping water companies to accelerate their ascent up the S-curve, while delivering substantial productivity gains.

As digital technologies develop, the tasks described here will become fully automated enabling fewer manual interventions and further improving the productivity of the water companies.

4.0 ACKNOWLEDGEMENTS

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