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MAINTENANCE DIGITALIZATION

Author: Eduardo Ishikawa[1],

Eduardo Ishikawa[1]
[1] Yokogawa. Brazil

ABSTRACT

Changing market demands are dictating the latest technological evolutions. Digital Transformation, Maintenance Optimization and Changing Workforce are only some of the key industry challenges.

Conventionally, plant operation systems aim to improve production efficiency and product quality while facility maintenance systems aim to both maximize operational efficiency and minimize costs. However, when maximizing production efficiency, maintenance costs are not necessarily optimized. Although, operation information and maintenance information must be combined to maximize profits for the entire plant, this is rarely achieved mainly because maintenance is not always quantified.

Many digital technologies can be applied to improve maintenance, monitoring and visualizing the condition of equipment, utilizing wireless sensors is the first step to make the plant maintenance more efficient. The combination with Advanced Analytics such as Artificial Intelligence and Machine Learning are strong tools for reforming plant maintenance work. Data Analytics allow you to understand equipment conditions more deeply by analyzing process data creating value from process historian Big Data by classifying, standardizing, organizing and interpreting process data accumulated in a plant (big data). The Digital Transformation can be also applied to field activities in a process plant, such as operator rounds, basic equipment care and Predictive Maintenance. It is known that by digitalizing field activities, plant maintenance can reduce maintenance costs while reducing the use of paper, check worker's activity with location data and time, avoid Over-Maintenance and assure the efficiency and integrity of field work (less mistakes and data for procedure analysis). New AR technologies are enabling field operators to improve maintenance efficiency and the quality of field work by providing communication solutions through standard web browsers, where specialists can make video calls to transmit easy-to-visualize image and text data, helping less-experienced operators anywhere, reducing human error and improving the safety and efficiency of field work.

Keywords: Digital Transformation, Advanced Analytics, Artificial Intelligence, Predictive Maintenance and Over-Maintenance.

INTRODUCTION

Changing market demands are dictating the latest technological evolutions. In this sense, we highlight Digital Transformation, Maintenance Optimization and Workforce Evolution as some of the main challenges of the industry.

Digital Transformation has as its main pillars, data collection, standardization, and transformation of data into information for decision making. Through easily accessible channels, it is possible to think about Optimizing Maintenance, without forgetting that human capital is a fundamental part of the whole process.

METHODS

While Control Systems essentially aim to guarantee process safety, improve production efficiency and product quality, Maintenance Systems aim to maximize operational efficiency while minimizing costs. However, by maximizing production efficiency, maintenance costs are not necessarily optimized. Although there is a consensus that operation and maintenance information must be combined to maximize profits, this is rarely achieved, mainly because maintenance is not always adequately quantified. In other words, what is observed in most companies is that there are no systems that can deliver information on the performance of maintenance activities, which could help in decision making.

RESULTS AND DISCUSSION

Many technologies can be applied to help solve this problem. Monitoring and visualizing the real conditions of equipment via wireless sensors, for example, is the first step

Corresponding author: Eduardo Ishikawa. Yokogawa. Alameda Xingu, 850. Barueri, SP, Brazil - 06455-030. Phone: +55-11-3513-1419. E-mail eduardo.ishikawa@br.yokogawa.com

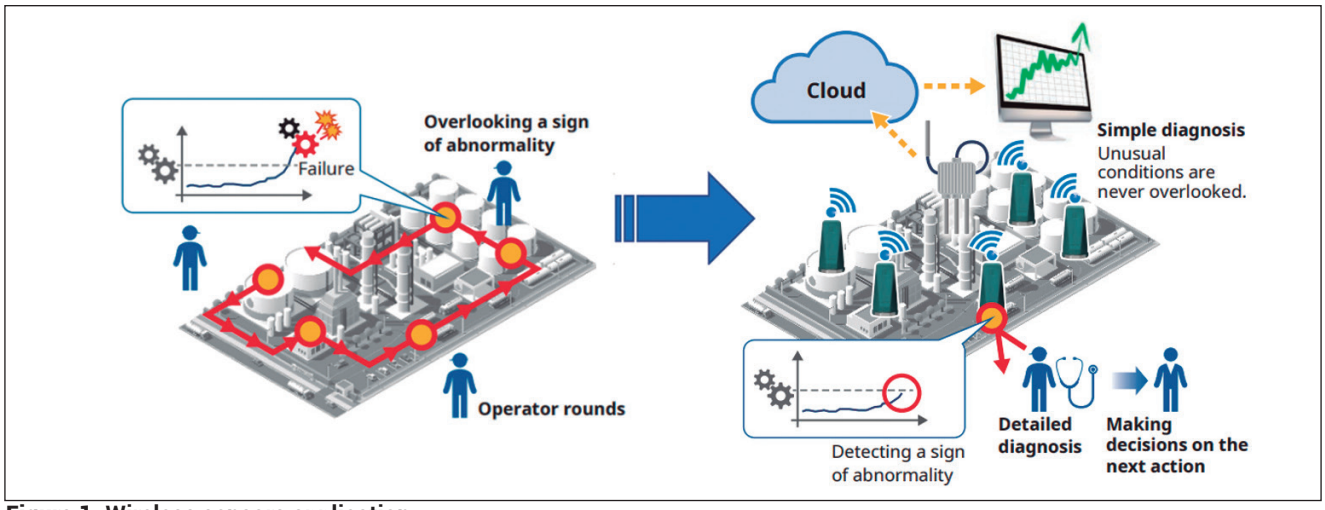

Figure 1. Wireless sensors application

to make plant maintenance more efficient. Sensors can collect basic data for facility maintenance and functions that quantify, accumulate and analyze this data, enabling operators to make objective decisions.

The main benefits include [1]:

Efficiency improvement of field operation

- Transferring field operator knowledge and experience by quantifying and visualizing their work;
- Making Condition-Based Maintenance (CBM) easy and improving work efficiency of field operators by visualizing equipment conditions.

Creating new value

- Improving plant operation efficiency by monitoring equipment that is not being monitored in operator rounds.

Supporting plant equipment maintenance

- Performing detailed monitoring of an instrument that shows signs of abnormality;
- Identifying signs of trouble by monitoring trends of plant-equipment conditions;
- Preventing unexpected equipment failures and plant shutdowns, improving plant efficiency;
- Maximizing investment in plant equipment maintenance.

The combination with advanced analytics, such as Artificial Intelligence (AI) and Machine Learning, makes it even more efficient to identify problems in the field, even before they happen (Predictive Maintenance).

Data Analytics allow you to understand equipment conditions more deeply by analyzing process data, creating value from process historian Big Data by classifying, standardizing, organizing and interpreting process data accumulated in a plant (big data).

Typically, customers try to analyze their data using non-specialized software for process data. However, using such tool will make analysis even harder and cost a lot of time and efforts.

Customers often have few or no internal data scientists familiar with analysis work. In addition, most analysis time is spent thinking on the next action of analysis [2].

"Artificial Intelligence was created on the premise to replicate the cognitive aspects of the human brain". One way to achieve this is by creating an artificial neural network. This network aims to enable automated decision-making with very high accuracy and speed based on data-driven intelligence, coupled with self-learning skills".

This is accomplished by empowering machines, such as computer or robots, with a certain level of intelligence and the capability to learn from deducing patterns on raw data by perceiving a model consisting of sample inputs. Artificial Intelligence is also able to solve complex or ill-defined problems, leveraging perception developed from training.

Artificial Intelligence is able to solve problems in a far better and faster way than humans can. When essential for critical business decisions, Artificial Intelligence is able to apply logic over emotions [3].

Taking Figure 1 as example, we can also apply Digital Transformation to field activities, such as operational rounds and scheduled maintenance. Most companies still use a methodology based on paper notes, making it impossible to standardize the information collected in the field and, as a result, this information cannot be shared between different group n a company.

A recurring problem with the current paper-based methodology is the need to insert the data collected manually in a given system, so maintenance orders can then be generated for the problems identified. In this scenario, supervisors often need to try to "understand" what is written in order to enter the information into the system properly, often requiring a conversation with the person responsible for the activity and even going over to the process to better understand the problem. The traceability of data is also compromised, since the information is not digitized, but rather, filed amid a huge pile of papers. Other known challenges for field tasks are access

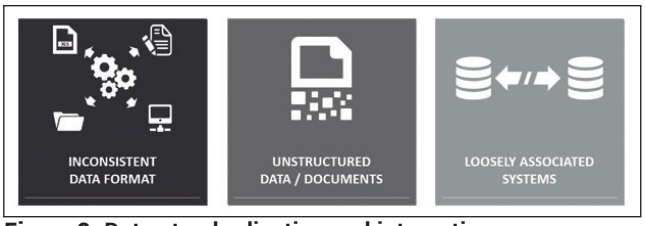

Figure 2. Data standardization and integration

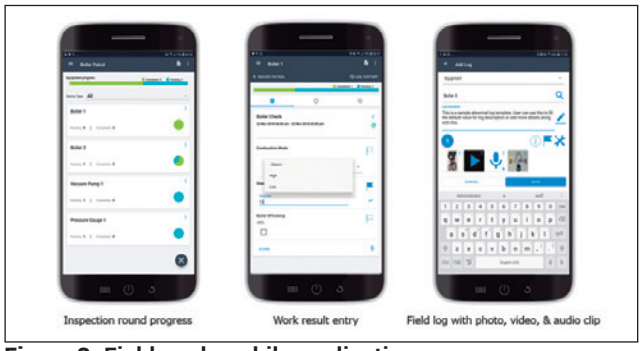

Figure 3. Field work mobile application

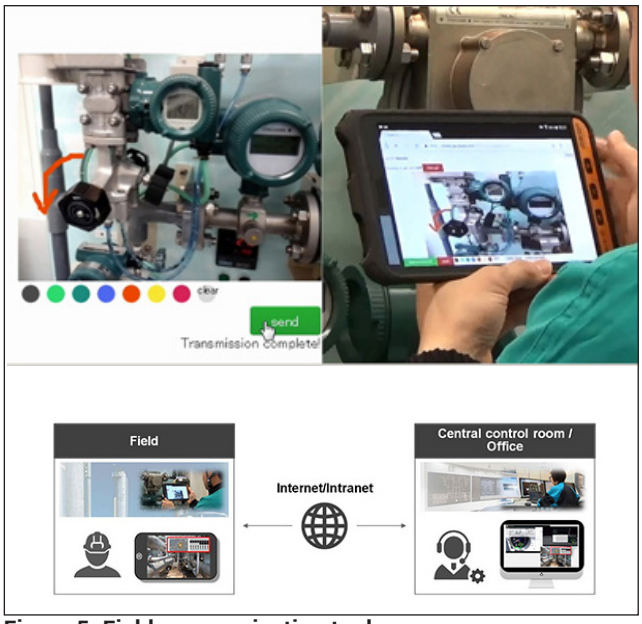

Figure 5: Field communication tool

to information (manuals, specifications, etc.) and history of work performed. There is still very strong dependence on communication between those working in the field and those working in the control room to provide data for the best execution of activities.

Digitizing field activities is the right way to eliminate paper notes, increase efficiency and reduce costs. Platforms that use smartphones, tablets and even "hands free" devices can help execute field tasks, such as operational and maintenance rounds, through the possibility of creating a standardized digital checklist that can cover data collection from any and all field tasks, making it possible to record logs by photo, video and audio, for a better understanding of the problem.

Collaboration between the different groups is achieved, as is traceability of activities already carried out. Manuals and technical specifications can be easily accessed in the field, thus avoiding the consumption of unnecessary hours of resources.

Technologies to make Remote Maintenance feasible are also being developed, online audio and video communication channels, allowing the exchange of experiences between a field operator and a specialist located anywhere in the world, without the need to always maintain a high-cost specialized resource in the field.

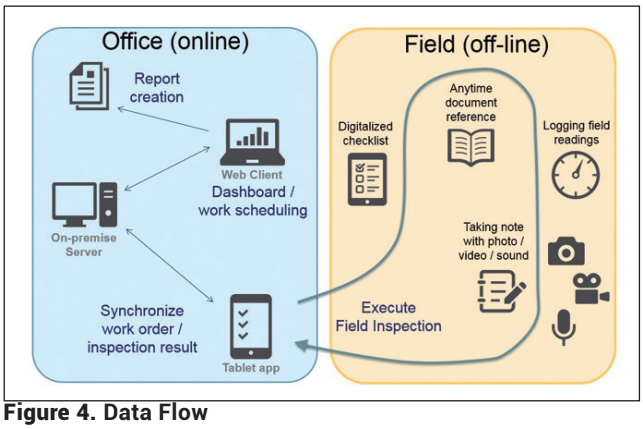

Figure 4. Data Flow

CONCLUSIONS

Nowadays, maintenance is taking on an increasingly key role in company strategies and has technology as its main ally.

Agnostic platforms help break down silos between Operation and Maintenance, making it possible from collection to integration of information, Digital Transformation in Maintenance is already a reality, providing information for decision making.

Along with Technology, we must not forget that Methodology / Process and the human factor are also fundamental to achieve success.

Data Analysis and Artificial Intelligence tools provide powerful information for Predictive Maintenance and Condition-Based Maintenance (CBM).

Access to information is also improving at the same rate; field operators can access in the field, precious information to perform their activities, contributing to more efficient work, while saving on working hours and, thereby, reducing operating costs. ■

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