How Automation and Digitalization can Help in Sustainability in Chemist and Oil&Gas Industry

Manuel Járrega
ISA Spain steering Committee member. Innovation and Digital Cluster Leader Process Automation. Schneider Electric

Sustainability has become one of the biggest concern for the industry, due to their need to maintain their reputation as well as their bottom line. On other hand the stock market is is rewarding those companies that include sustainability as one of their main strategies. This challenge is particularly important for Chemist and Oil&Gas companies. For example, chemical industry is under particular pressure because it is the foundation of sustainability in many other industries like agriculture and fertilizers, housing, plastics, and pharma.

Keywords: Automation, Digital transformation, Chemical industry, Oil & Gas Plants.

La sostenibilidad se ha convertido en una de las mayores preocupaciones de la industria, debido a la necesidad de mantener su reputación y sus resultados. Por otro lado, el mercado de valores está premiando a aquellas empresas que incluyen la sostenibilidad como una de sus principales estrategias. Este desafío es particularmente importante para las empresas químicas y de petróleo y gas. Por ejemplo, la industria química está bajo una presión particular, porque es la base de la sostenibilidad en muchas otras industrias como la agricultura y los fertilizantes, la vivienda, los plásticos y la farmacéutica.

Palabras clave: Automatización, Transformación digital, Industria química, Oil& Gas Plants.

A PWC survey revealed that 58 % of CEOs in the chemical industry are already planning investments in sustainability in the coming year, making it their top concern. A study run by the ARC at the end of 2020 (The sustainability future for Energy and Chemical, ARC Strategies, September 2020) is reporting that 90 % of global energy and chemical companies have sustainability initiatives in place (Figure 1).

The chemical and Oil&Gas industry has been a pioneer in the automation of processes and manufacturing, with a very clear and specific purpose:

- Operational efficiency.
- Lower costs.
- Increase Safety.
- Quality improvement.

Now there is a new challenge named sustainability which it's at the same level to deliver financial results. Now companies are requested to be profitable and sustainable. Companies must balance between Economy, Society and Environment. What's the weapon that companies have found to get these goals: automation and digitalization.

DIGITAL CAPABILITIES FOR IMPROVING SUSTAINABILITY

As mentioned ARC study has

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found, Seventy-five percent of survey respondents believe digital transformation is extremely important or very important for achieving sustainability goals (Figure 1). The following digital capabilities were ranked in order of their importance to improve sustainability:

• Digitalization applied to Supply chain optimization. It's clear that supply chain is changing after COVID-19 and companies are looking for more resilient and nearest suppliers. Flexibility is a must and digital tools are helping supply chain departments. These tools are eliminating silos and providing intelligence to help to solve price and supply issues.
• Advanced process control (APC) to reduce process variability, minimize cost of energy, optimize process against constraints, and in-context guidance (provided by AI-enabled

insight from previous operations) supports less-experienced users as they expand digital applications to drive further improvements. In fact there are several applications applying intelligence only for each PID. There are studies about installed systems show that about 70 % of control loops are underperforming. If the PID tuning is not in line with the process dynamics that it is trying to control, there can be problems, especially with long dead times on the control loop. If the control strategy isn't aligned to the process control objectives, we can look at interactions to ensure they're working correctly and help stabilize the process, improve control and therefore drive the energy performance.
• Energy and utility optimization: this is a must right. First we need to measure to find where we are and set up actions to find energy efficiency.

FIGURE 1. Source: The sustainability future for Energy and Chemical, ARC Strategies, September 2020

How Would Your Company Rate the Above in Terms of Importance?

The integration of automation systems with electrical or power systems is the cornerstone of energy efficiency, since it allows the intelligence of electrical devices to be used as part of the automation system control strategies, and thus optimize use of assets, raw materials and energy. Automation systems applied to electrical devices and process assets can give the right image about where we are losing efficiency in the use of energy.

• Predictive and prescriptive maintenance to improve asset utilization and return on capital by use of machine learning and advanced analytics to shift maintenance operations to predict failures and avoid process disturbances and equipment downtime. Using this type of digitalization applied to assets it's possible to foreseen when this one could fail and therefore, avoid costly shutdowns.

• Digital Twin: A digital twin is a software-based virtual replica of the complete physical assets of a production facility, including its process equipment, instrumentation and controls, as well as the production processes. Through this replica, the operation of these assets is modelled and simulated through their lifecycles… This information is then converted and developed into a

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software-based representation of the process using simulation software. As this software has a wide range of unit objects pre-configured, models can be developed efficiently to provide a highly accurate representation of the behaviour and dynamics of the process under consideration. The digital twin becomes an invaluable tool to analyse various 'what if' design scenarios, such as different rectifiers or water purification systems, different balance-of-plant design improvement ideas and others. When the plant is operational, the digital twin can provide data and insight into equipment and system health, helping plant management to

optimize preventative maintenance practices and avoid costly unscheduled downtime. The accuracy of the digital twin can be constantly enhanced with data taken directly from the process as it becomes available.

• IoT: typically companies which have started they "digital journey" first have consolidated their databases in one unified in Cloud. After this process they are applying Big Data and Machine Learning technologies but it's pretty normal at this stage they have realized they are missing some data. At this moment technological companies offer IoT devices to get the missing data and include it in the

FIGURE 2. Source: The sustainability future for Energy and Chemical, ARC Strategies, September 2020
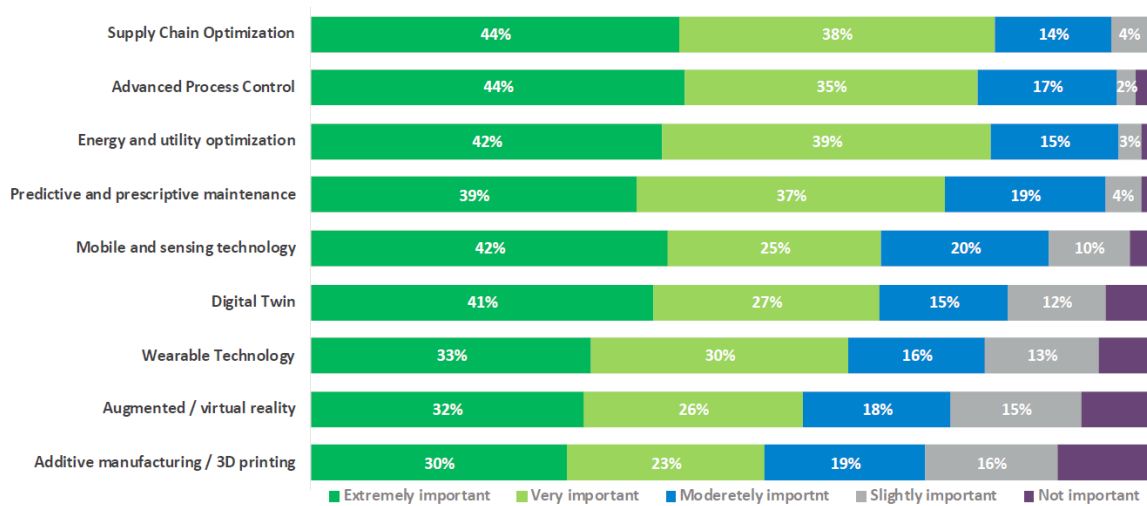
How Valuable Are These Digital Capabilities for Improving Sustainability?

database. There are several projects to include non-wired instrumentation to include missing data in master database.

• Augmented/virtual reality: These technologies allow to give on the field the necessary information to the maintenance team, helping them to work safer, quick and efficient. Now it's possible to have the expert remotely helping the field maintenance engineer or to provide him with the preventive maintenance routines on the field.

What is becoming pretty clear is that automation and digitalization is a powerful tool in O&M phase for Chemist and Oil&Gas plants. Nevertheless this is a tool (even IA systems) for the human teams which can't manage huge amounts of data that without these tools. Without IA support it wouldn't possible to do.

For example, it's typical to set up IA applied to rotative machines and on top a expert human team looking in the data to improve the model or to answer when the conditions are changing in the Plant for whatever reason.
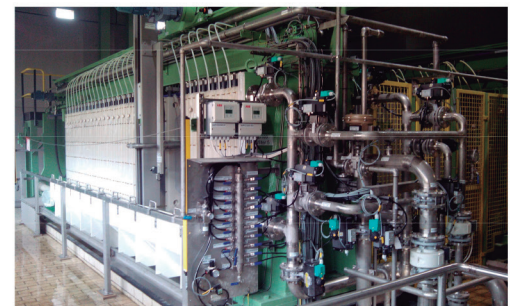
DIGITAL JOURNEY

Some Chemical and Oil&Gas plants are unable to implement more advanced tech that drives sustainability. Legacy software and outdated devices that can't support smart data sharing mean that plants are unable to connect their data or enable remote monitoring, let alone adopt AI-based solutions like predictive analytics or digital twins. In any case the actual level of technology can help these plants to set up Digitalization Plan to start their "digital journey". As mention before this is a must and it's necessary to set up this plan to get results as soon as possible (obviously taking into

account budget constraints). What it's necessary is:

• Understand where we are and set up a clear goals we want to achieve.
• Set up an internal team to analyze the issue and set up Digitalization Plan.
• Select the technologies that really solve the difficulties to achieve the goals set. Find the right providers and partners.
• Prepare Change Management Plan. Several digitalization plans fail because lack of communication and adoption by workforce.
• Execute the plan and follow up.

We have to remind technology is not a goal. Digitalization and automation are powerful technologies that are key to get new company goal for Chemist and Oil&Gas industry: to become profitable and sustainable business. IO

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