

Digitalization in Chemical Industry

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ABSTRACT: *Digitalization helps transform an entire industry ranging from business processes to customer relationships. It is a catalyst which will promote innovation and transform the operation of the chemicals industry. There is a wide range of opportunities in which the chemical industry can use digital technologies to create new and sustainable advantage. This paper provides a brief overview of the opportunities and challenges of digitalization in chemical industry.*

KEY WORDS: *chemical industry, digitalization in chemical industry, digital transformation in the chemical industry, digital chemical industry*

I. INTRODUCTION

The rise of the Internet has transformed the way we exchange information and made the world a smaller place. However, recently the chemicals sector has fallen behind other sectors such as banking, retail, media, and telecom which have explored innovative ways to use digital technology to improve their businesses. More than 50% of chemical companies do not have any digital transformation strategy in place. Chemical companies are now innovating to catch up. To maintain competitiveness, chemical businesses must ensure that their companies are ready to meet these new digital challenges. The digital transformation of the chemical industry offers exciting new potential to visionary companies. Companies can use their data to create safer, smarter, and more efficient processes and products. Forward-thinking chemical companies can store the data or use it to generate analytics, which can provide insights into every aspect of a company's operations and help them streamline existing processes and develop new ones. Digitalization provides opportunities for performance improvement for chemical companies' business processes, including manufacturing, marketing, sales, and R&D.

II. DIGITALIZATION PROCESS

Basically, digitalization is the process of converting anything from an analog format into a digital format. An example of digitalization involves the use of sensors to collect data on the conditions of a chemical plant [1]. A typical digitalization process is shown in Figure 1 [2]. Digitizing the enterprise involves:

- **Digital R&D:** The application of digital technology to all aspects of the R&D cycle will increase the efficiency and effectiveness of R&D operations. It can improve all aspects of R&D including ideation and experimentation.
- **Digital Plant:** Applying digital technology to industrial plants enables the entire manufacturing chain to be more efficient because it enables the monitoring of hundreds of elements of the manufacturing process, capturing real-time details and variations of production batches. This requires an industrial Internet of things (IoT), connectivity between sensors, cybersecurity, and data intelligence.
- **Digital Supply Chain:** Digitalization can improve several aspects of the industry's supply chains. It can bolster supply chains through better sourcing, supply chain planning, and product management.
- **Workforce:** To successfully compete in a digital world, companies must equip their workforce with strong digital skills. Digital transformation results in highly digitalized and sophisticated workplace culture. Industry leaders must understand that, in the digital era, they need to compete for the best talent against digital natives. While being connected is at the core of digitalization, it also encompasses the industrial Internet of things, big data, smart machines, smart manufacturing, cloud computing, streaming analytics, augmented reality, and much more [3].

III. OPPORTUNITIES

The digital transformation of the chemical industry offers exciting opportunities to forward-thinking companies. It provides businesses with unparalleled opportunities for value creation and capture.

- **Innovation:** Digitalization gives researchers additional opportunities to implement their creative ideas and to collaborate intensively with others around the world. It makes innovation faster, cheaper and more effective. The chemical industry has been slow to adopt digital innovation due to the overwhelming array of options available to them. The chemical industry can learn from the digital innovation successes of telecoms and energy utility companies that use digital tools to predict demand and reach out to their customers. The chemical industry recognizes that digital innovation can help it stay competitive.
- **Customer engagement:** Customers are now more engaged with the purchasing process than ever and demand more information before making a purchase. Digitalization gives the chemical companies the opportunity to rethink the customer relationship and improve the way customers use products and services. It provides an easily scalable, highly accurate way to predict customer preferences using minimal data. Combining a digital channel with process digitization will create an improved customer experience, while lowering cost. Consumer companies like Amazon are leading the way in the customer engagement with their constant efforts to make interactions more convenient (around-the-clock access) and usable (the site can be accessed easily from smartphones and tablets).
- **New products and services:** Continuing success in the chemical industry will depend on the ability of the industry leaders to quickly create and produce new products to meet changing customer requirements and to ensure existing products continue to meet changing regulations. Due to associated innovation, digital technology opens the way for creating new products and services.
- **Marketing and Sales:** The biggest challenge faced by the chemical industry comes from its conventional way of reaching out to its client base. Therefore, it has become crucial for chemical companies to change their sales and marketing strategies. From raw materials to end-consumers, digitalization makes cross-functional integration of R&D, marketing, and sales teams quite easy. Digital transformation enhances the ability to quickly respond to the latest trends in the market. The digital-enabled initiatives in marketing and sales could improve the industry's average return on investment.

Other benefits of digitalization in the chemical industry include higher productivity, expansion, growth, and safety.

IV. CHALLENGES

The challenges and opportunities of digitalization for new business models, products, and services can create problems. In a digital world, speed is a competitive differentiator that even chemical companies cannot escape. The chemical companies tend to be slow to go to market because they are not used to making quick decisions. To be sure, digitalization will bring many disruptions to the chemicals industry. But with disruption comes a wealth of opportunities for innovation, expansion, growth, building customer engagement and intimacy, new products and services, and better operations. Chemical companies must ensure that their practices and products are in line with local and global regulations, but increasing and rapid regulatory changes across the globe can act as a hindrance. The exponential increase in global information flows has created new risks around data privacy and security. Digitalization heightens the vulnerability to cyberattacks and appropriate attention should be paid to cybersecurity. The chemical industry is facing a progressively harsher environment due to volatile raw material prices, increasing global competition, growing concerns for the environment, and changing customer expectations. As chemical industry strives to exploit the full benefits of digitalization, more expertise will be required. Progress in digitalization in the chemical industry as a whole is already being held back by not having a sufficient pool of talented people with knowledge of data science and engineering [4].

V. CONCLUSION

Recent development in the global economy and technology has had major impacts on the global chemical industry. Digitalization is already impacting how chemical companies operate their businesses by using data, analytics, and new digitally enabled technologies. It will effect changes on many areas of the chemical industry, leading to higher productivity, inducing more innovation, and creating new products and services. As many chemical industries embrace digitalization in areas ranging from business processes to customer relationship, digital transformation is becoming a smart business strategy which can act as a catalyst to unlock enterprise-wide business innovation.

Digital is not just about technology but also in a new way of thinking that brings a bias for action. Digital needs the right culture and climate to grow and thrive. Industry leaders need strategies to succeed in the new digital world. The digital economy is real, and it's here to stay.

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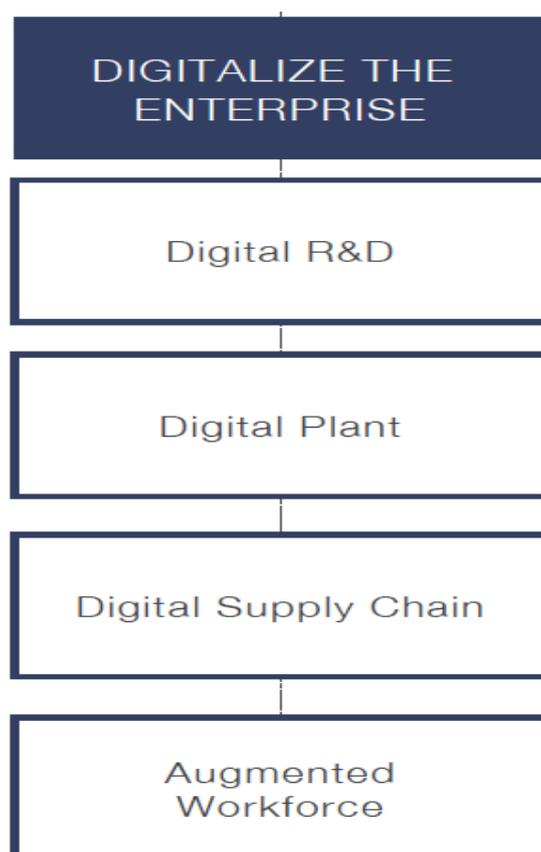


Figure 1. A typical digitalization process [2].