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## Digitization Across Chemical Industry



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Leveraging digital technologies, companies can capture critical data and draw insights to improve output at lower costs, schedule preventive maintenance,

minimize downtime, and facilitate accurate inventory planning. Digital transformations in the chemical industry are also expected to provide significant opportunities for innovation in products and services. While large chemical plants are focused on increasing the speed of throughput, specialty chemicals are concerned with enhancing quality with digitalization.

Here are some of the ways chemical companies are utilizing digital tools and technologies.



### **Asset and Maintenance Data**

Chemical companies are highly asset intensive. With time, the average lifespan of assets in the chemical industry has increased, which has led to apparent demand for maintenance work. As per estimates, 50% of fixed costs for typical chemical plants go into repair and maintenance work. Earlier maintenance work relied on trained specialists to visually inspect machinery to know how equipment was running. Now, internet of things (IoT) technologies employed in the chemical industry automatically collect sensor data, which can better predict the failure of an asset and inform specialists on how to correct the problem. Collection of asset and maintenance data has become paramount for maintenance improvement. However, data accuracy requires a reliable data collection platform and correct data input. Digital technologies allow technicians to capture real-time actual information.

Hence, utilizing digital tools and technologies can help chemical companies achieve.

- Comply with Environment, health, and safety (EHS), and other regulations
- Enable preventive and corrective processes
- Perform fast response to poor equipment performance and breakdowns
- Monitor equipment performance
- Facilitate Offline mobility
- Build SaaS cloud strategy (“evergreen solution”)
- Optimize performance and cost
- Contribute towards sustainable and circular Economy
- Develop resilient supply chains

### **Promote Growth and Innovation**

Disruptions in various industries such as automotive, construction, agriculture, etc. are creating opportunities for the chemical industry to innovate. Traditional methodology for innovation in the chemical industry has created value but the digital revolution could lead towards new business models. Besides, the growing demand for associated chemicals, such as ultra-pure chemicals used in electronics production, battery chemicals, and filaments used in 3-D printing are leading chemical producers in new territories. Advances in quantum computing technologies, atomic force microscope, machine learning are expected to lead the development of ‘in-silico’ experiments that can stimulate large chemical systems. Leveraging insights, chemical companies can digitally conceptualize material with the required chemical, electronic, and physical characteristics. Besides, a number of established companies and start-ups are diving into areas of additive value creation. For instance, artificial intelligence technologies are being applied to design new materials or chemical structures and develop new synthesis pathways. Multivariate analysis allows scientists precise identification of the impact of individual ingredients in the mix. R&D activities that used to take around two-to-three years has reduced to four-to-six months with automation, helping chemical

manufacturers to meet the new demands faster.

### **Build Resilient Supply Chain**

The COVID-19 pandemic highlighted the vulnerability of chemical plants. Consequently, the companies are working towards improving visibility and integration of supply chain with the implementation of digital twins to access a unified view of the entire supply chain, from raw materials to production to market forecasting. Building new suppliers into digitally integrated ecosystem can also enabling plants to reshore and nearshore supply chains. Amidst the rising prices for raw materials and energy and other factors that impact economic conditions, chemical companies can gain the advantage by establishing commercial and logistical transparency by supporting optimization through digital tools. The chemical players are leveraging digital tools for demand estimation, tracing raw materials to sources, real-time order tracking, and automation at warehouses. Machine learning algorithms are enabling managers to take smart decision by offering mitigation advice and proven routine solutions from the past. The enterprise resource planning systems allow the creation of effective “track and trace” system, which enables players to determine status of shipment of goods at any point. The GPS technology enables companies to check exact shipment locations and field sensors reveal about the environmental conditions such as temperature and humidity.

### **Optimizing Production**

Automating some processes, predictive and remote monitoring, and streamlining maintenance, chemical plants can focus on optimize production. Advanced analytics can play a key role integrating and optimizing processes and systems, improving, and integrating data management. Predictive analytics uses machine learning and artificial intelligence to detect anomalies that indicate fouling, impend part failures, bottlenecks, or other issues. Leveraging the accumulated data, one can better understand the continuous process and predict future scenarios. Digital technologies can help plants to re-evaluate their ability to support remote or hybrid operations. Chemical plants are creating digital twins that can reproduce certain

systems, processes, or entire plant in digital form. These twins enable remote visibility into machinery and processes, remote diagnostics, which can help cut down a lot on plant downtime and prevent production slowdowns. Also, digital documentation is important, accurate, and reliable than paper controls and monitoring documents.

### **Sustainability and Circular Economy**

By 2050, the global demand for chemicals is expected to be 50% higher than what was in 2020. The chemical sector is the largest end-user industry, accounting for 13 billion barrels of oil and 305 cubic meters of gas per day. Three ways chemical industry can cut down on its emissions are adopting alternative feedstocks, decarbonizing chemical processes, and adapting new approaches to resource stewardship. And digital transformation can make these three pathways possible. Chemical industries are highly regulated due to the use of hazardous chemicals and the number of end-use industries that depend upon it. Artificial intelligence and machine learning can play an essential role in improving decision making, enabling autonomous ways of working and design new molecules and materials that are less carbon intensive. Hence, chemical companies are working with clients to introduce new products, invest in recycling technologies, incorporate renewable technologies in the growing product portfolio, which would boost sustainability in operations. As chemical players are focusing more on the environmental, social, and governance (ESG) and sustainability, the digitalization can prove to be a huge boon and facilitate expediting the pursuit of sustainability.

### **Way Ahead**

The adoption of digital tool and technologies has been significant among larger and global manufacturers, while a major share of medium and small regional or local companies are either at the early adoption or no adoption stage due to lack of resources, finances, and knowledge. However, the rate of digitalization is highest in the Asia-Pacific as the companies in the region are looking to implement digital technologies beyond primary operations. With greater awareness, the rate of digitalization in the chemical sector is expected to grow significantly in the coming

years. Leading organizations are already implementing digital twins, virtualized copies of physical assets, to support autonomous decision making, scenario planning, predicting outcomes of events, testing and tuning control, and process modifications. As the awareness towards digital twins is rising among chemical industry, their demand is growing significantly.

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