Pharma 4.0: Taking CDMO Factories by Storm

CMOs find digital strategies pay off as they stride toward tech leadership. This is the third of a nine-part series of articles addressing pharmaceutical outsourcing industry trends.

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Contract manufacturing firms are ramping up the adoption of Pharma 4.0 technologies as regulators and customers increasingly look for transparency and integrity in manufacturing data.

Many contract manufacturing organizations (CMOs) and contract development and manufacturing organizations (CDMOs) have started the process of transforming their production floors into smart factories by deploying digital tools and systems even though many remain in the early stages of the complex digital journey.

"Most organizations have digital initiatives underway," says Dan UpDyke, strategic marketing manager, life sciences, Rockwell Automation, Inc., a global leader in industrial automation and digital transformation headquartered in Milwaukee, WI. However, he notes there is a barrier to adoption and change in existing facilities.

It's exciting to see, adds UpDyke, many companies having dedicated resources and even departments focused on digital transformation, and most, if not all, understand the business value that can be delivered with Pharma 4.0—a framework for adapting digital strategies to the unique contexts of pharmaceutical manufacturing.

Currently, UpDyke says there is a broad range of digital maturity in the industry. Region-wise, CDMOs located in North America and Europe have led the way in investing in new technologies and integration of systems, but "it really is a global industry, and we are seeing initiatives at that scale."

Magesh Ramadoss, the managing director of Asia-Pacific operations for Inosim Solutions, a global software solutions firm headquartered in Dortmund, Germany, concurs with this view. "There could be some differences due to the applicability and relevance of technology adoption to our context," he says. "But most pharma companies, as well as CDMOs across the world, are on the adoption journey path in the process of enabling

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digital transformation."

With broader adoption and more quantifiable benefits, it is expected that Industry 4.0 tools and implementations continue to accelerate. Ultimately, to be competitive, organizations will have to modernize.

While modern customers expect constant digital accessibility developing these digital and data analytics skill sets, leading drug regulators give top priority to emerging technology and advanced manufacturing as they see this as the only way to spur transparency in production processes and bring in the much-needed reliability during audits.

Pharma 4.0 enables a new level of transparency that has never been seen before in manufacturing. It allows access to the same data for every player along the supply chain. Real-time access to manufacturing data is something every client would love to have.

OPTIMIZING EFFICIENCY

Building capabilities that boost yield has become a strategic imperative for CDMOs because that is exactly what companies that outsource work look at. And digitalization of technologies promises that.

Pharma 4.0 prioritizes digitalization to optimize manufacturing efficiency through a network of cyber-physical systems that span integrated automation technologies, connectivity, analytics, and artificial intelligence (AI).

In a digitized ecosystem of pharma manufacturing, integration of internal and external data sources enables unprecedented real-time responsiveness, monitoring, control, and prediction, studies show.

Contributing to overall equipment effectiveness (OEE) through digitization and analytics, the otherwise high machine downtime experienced by pharma plants can be brought down by 30 to 40 percent.

Leading CDMOs say that things like automated process monitoring, predictive analytics, and fault detection make them more efficient to manage processes, avoid deviations, troubleshoot, and prevent problems before they occur. This helps CDMOs win the customer's trust in their ability.

AI-driven decision-making allows CDMOs to achieve a higher level of GMP application. Predictive analytics and machine learning (ML) functions can also be leveraged for maintenance.

Augmented reality (AR) can help increase control over the manufacturing process, because a little oversight could cost dearly with serious consequences. For example, the erroneous mix-up of ingredients from two different Covid-19 vaccines by workers of Johnson & Johnson's manufacturing partner Emergent BioSolutions in April 2021. This oversight led to around 15 million vaccine doses being wasted.

SMART FACTORIES MAKE CDMOS SMARTER

CDMOs, as manufacturing specialists, have embraced Pharma 4.0 to a greater extent than many major companies in the pharma and biotech industries.

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Beyond focusing on improving cost and quality through operational efficiencies, many CDMOs are looking at enhancing value propositions in various ways through digital transformation.

For instance, the transfer of scientific data from the sponsor company to the CDMO to facilitate faster market access.

The recent transferring of mRNA-vaccine technology by Cambridge, MA-based Moderna to their CDMO partner Lonza is a good illustration of how the process enabled the much-needed vaccine to reach consumers at an unprecedented pace.

"The ability to digitally share recipe and development information, and to collaborate with a brand owner with digital tools can reduce paper or electronic document transcriptions and recipe development," says UpDyke. "Those that adopt automation to speed up tech transfer and recipe development will have an advantage over those that do not."

Digitalization also helps improve speed and thereby efficiency through comprehensive end-to-end service offerings that enhance interoperability across all manufacturing operations.

Trail-blazing CDMOs are setting the course to remove the last paper-based systems, which are still prevalent on the shop floor of many in the industry, to digital and automated systems.

RAPID DRIVE

As Rockwell's UpDyke observes, there are some barriers to digital transformation among manufacturing facilities, in general.

Historically, the pharmaceutical and life sciences industries have been cautious in adopting Industry 4.0 technologies because deploying new systems in a highly regulated industry warrants a lot of time for validation of the tools and their qualification.

However, the pace of digitalization is accelerating. Many manufacturers find that by enabling newer technologies they will make their factories more resilient and help to mitigate the

risk of supply chain disruptions that started out of the pandemic and continue with global geopolitical crises.

While sharing the view that the process industry is slow with digital adoption when compared with the automotive or aerospace industries, Ramadoss of Inosim says that "this reticence is definitely changing, and many organizations are making the adoption of digital technology a priority these days."

Heightened regulatory scrutiny on the safety of products, the need to solve manufacturing challenges of today's highly complex molecules, and the quick introduction of new therapies to the market, are all issues that emphasize the requirement for flexible and connected manufacturing systems—the emergence of novel tech solution platforms like the cloud are among those factors that spur rapid digitalization.

While those CDMOs that have started their digital journey early on are moving forward to a maturity level of predictive or even autonomous plant operations, others are operating either at islands of automation or connected plants.

"Digitalization of manufacturing is a continuous, ongoing process," says Manoranjan Jasti, chief information officer at Divi's Labs, a custom manufacturer of active pharmaceutical ingredients (APIs), headquartered in Hyderabad, India. Divi's, which is listed as one of the top 3 API manufacturers in the world, embarked on a network refresh in February by roping in Sunnyvale, CA-headquartered Juniper Networks.

Divi's currently operates two manufacturing sites which run 24/7 in India, with a gross total of 14,500 square meters of manufacturing space.

Digitalization requirements for API facilities are different from that of formulation plants, Jasti points out.

HUMAN HANDS

Even as manufacturing has become quicker and more automated than ever before, being relatively new to the digital game, pharma contract service providers face several challenges when it comes to the implementation of new technologies.

Cost is one major concern. Large organizations have the bandwidth to go all out in adopting digital solutions. Whereas small and medium manufacturers prefer to make investments in advanced technologies that can deliver calculable benefits like improved operational efficiency and reduced downtime.

Ramadoss finds a visible interest among companies based out of India to invest ever more in digital tools for engineering to achieve operational excellence. Inosim provides special product packages and licensing models to address the needs of small- and medium-sized companies.

Employee resistance and pushback to digital transformation is another big challenge. If such a situation arises, a manufacturer wouldn't be able to achieve the anticipated results despite investing heavily in digital tools.

Smart factories do not require operator-level employees but people who can help manage and process the large pool of data generated by the digital systems. Therefore, shifting to the Pharma 4.0 model requires operational changes—from the workforce's mentality to pharma manufacturing processes and infrastructure.

Studies show that it is essential to reskill and upskill to make it easier for the workforce to perform their job duties while also supporting an innovative and technology-rich environment.

"Human intervention in a system is needed even in a fully digitized environment. Human effort will be channeled to improve productivity tasks rather than on tasks that can be automated and repetitive in nature," says Ramadoss.

Again, a lack of direct knowledge among manufacturing leaders about the inner workings of some of the latest developments can delay the progress of overall digital transformation.

"Any new technologies, any innovation to what is known, must be understood and vetted before we are willing to move forward," UpDyke avers.

MITIGATING CYBER RISKS

Cyber threats are a real challenge to digital infrastructure and more so for Pharma 4.0 techs. A vast amount of data is generated in a pharmaceutical manufacturing facility with many connections. This makes a robust cyber program that effectively safeguards sensitive information in an era of increasing virtual data transfer, essential.

Rockwell Automation partners with its clients in their digital transformation journey by aligning automation and digitization investments to a risk management framework. This puts customers in a position to adapt and evolve their security strategy to respond to changes in the threats they face, says UpDyke.

Cyber experts, in the meantime, emphasize the need for ensuring that data generated doesn't flow bi-directionally by correctly configuring all the firewalls. Pharma 4.0 technologies are a potentially larger attack surface for cybercriminals.

For Inosim, solutions currently are primarily deployed on customer machines and work with data that is available on their secured network. "We are working with major cloud service providers like Amazon and Aveva in offering our solutions on the cloud and count on their exacting standards," says Ramadoss. **CP**

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