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Singapore Turns Tech Beacon with Revolutionary Pharma Manufacturing & Digital Transformation

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In the current pharmaceutical manufacturing environment, linking information technology (IT) with operational technology (OT) systems is increasingly vital. This integration enables a seamless exchange of information between these two historically separate domains – one focused on data management and the other on overseeing physical operations. This enables various aspects of the manufacturing process to gain insights from one another to boost efficiency and refine strategic decision-making. Digital transformation is essential for directing companies through the complexities of implementation and ensuring a seamless shift to a data-driven, digitally optimised manufacturing landscape.

Singapore has been viewed as a global hub in Asia for many years, and has strived to stay ahead of the curve when it comes to technology adoption. The city-state has undergone continued transformation, emerging as a global hub for digital manufacturing, notably in the pharmaceutical industry.

This evolution into a formidable pharmaceutical manufacturing powerhouse is characterised by a remarkable growth trajectory driven by substantial investments from international leaders and innovative local enterprises. The market is poised to reach SG$2.2 billion ($1.7 billion) by 2026, reflecting the resounding success of governmental initiatives, notably the establishment of the Biopolis research hub and the Experimental Drug Development Centre (EDDC).

Prominent global pharmaceutical players have also invested in the city-state. AstraZeneca, for instance, announced a significant $1.5 billion investment to construct its first end-to-end manufacturing facility for antibody-drug conjugates (ADCs) in Singapore. Additionally, AbbVie disclosed a $223 million expansion of its existing Singapore manufacturing facility,

augmenting its capacity for biologics drug substance production.

In today's highly interlinked manufacturing landscape, data-driven insights play a critical role in creating efficient production processes, ensuring compliance with regulatory standards, and fostering innovation. As Singapore's pharmaceutical sector continues to evolve, these insights will prove crucial for sustained growth. However, leveraging data-driven insights presents significant challenges, such as the need to seamlessly integrate diverse systems both within new sites in Singapore and between existing hubs overseas.

Why Singapore is the go-to destination for pharma manufacturers

Singapore's appeal as a pharmaceutical manufacturing hub is influenced by its politically stable environment, which fosters confidence and predictability for investors, as well as its strategic location in the Asia-Pacific (APAC) region, supporting access to key markets nearby.

The government has also nurtured a business-friendly atmosphere, with streamlined regulations and competitive corporate tax rates to encourage investment and growth. For instance, robust intellectual property protection safeguards the rights of innovators, promoting research and development. In addition, the government provides active support through financial incentives, research grants and industry partnerships to foster a collaborative ecosystem that fosters innovation.

Singapore's strategic investment in cultivating a highly skilled workforce and cutting-edge research capabilities, coupled with robust collaborations between industry and academia, has solidified its standing as a global leader in pharmaceutical innovation. All of this has propelled Singapore to the forefront of the pharmaceutical landscape, making it an attractive destination for established companies and emerging innovators alike.

Enhancing manufacturing efficiency in new markets through IT/OT convergence

In today’s pharmaceutical manufacturing landscape, it’s more important than ever to connect information technology (IT) with operational technology (OT) systems. This integration facilitates the smooth flow of data between these two traditionally distinct realms - one responsible for data management and the other for monitoring physical operations. This allows different facets of the manufacturing process to learn from each other to enhance efficiency and improve strategic decision-making.

There are clear benefits of this IT/OT convergence for life sciences companies seeking to enter new markets, such as Singapore. Aggregating data from various sources across the manufacturing process can provide a real-time, holistic view of operations and allow the alignment of global production with local manufacturing data, ensuring consistency and compliance with regional regulations. Integrating IT/OT systems can also deliver automation benefits for process optimisation and efficiency.

Quality control and regulatory compliance can also be enhanced. Data flowing from one system to another must be of high quality, in terms of accuracy and usefulness. IT/OT convergence can enable real-time data monitoring to ensure it meets the organisation’s needs.

In addition to all of this, IT/OT integration can facilitate the traceability of raw materials and finished products once they leave the manufacturing site – an important aspect of regulatory compliance in many markets. Data analysis can support companies in optimising their future supply chains by improving demand forecasting, which can cut production waste.

Accelerating growth through strategic technology partnerships

When entering the Singaporean pharmaceutical market, connectivity is crucial to enhancing quality, compliance, innovation and collaboration throughout the value chain. Digital transformation is the key to achieving this connectivity.

Beyond digitising existing processes, digital transformation in life science manufacturing involves leveraging technologies like automation, artificial intelligence (AI), cloud computing and advanced analytics to optimise operations. Collaborating with digital transformation partners is essential for pharma companies aiming to navigate the complexities of this process.

Partnering with digital transformation experts can speed up time-to-value by providing expertise and comprehensive solutions that streamline data integration, system harmonisation and technology adoption, enabling faster implementation and return on investment.

Embracing these partnerships and prioritising connectivity and automation is also helping to establish Singapore's life science industry as a global leader in advanced manufacturing. In streamlining processes and optimising efficiency, Singaporean life science companies are enhancing productivity and contributing significantly to the nation's economic growth, solidifying its position as a global leader in the field. This proactive approach not only attracts investment from companies seeking to leverage cutting-edge infrastructure and expertise, fueling further growth within the sector but also attracts top talent and fosters a thriving ecosystem of knowledge and expertise.

Driving this collaborative approach forward is the concept of an Automation Engineering Office (AEO), a service digital transformation partners can leverage to help their clients ensure the efficient functioning of their manufacturing plants. When designing and building a manufacturing plant, life science companies will often rely on engineering, procurements and construction (EPC) contractors to undertake construction works. These contractors are not specialists in IT, OT and digital systems. This lack of specialised knowledge can lead to insecure systems, poor integration and difficulties in meeting regulatory requirements. With teams specialising in designing, configuring, commissioning and qualification of all IT, OT (GMP and non-GMP), an AEO can team up with EPC contractors to ensure seamless integration of digital capabilities into a facility from its inception. For pharmaceutical companies, this comprehensive approach can optimise efficiency, minimise risks and expedite time-to-value.

How partners can help harness the power of new data technologies

Strategic technology partners can support life sciences companies entering Singapore and other new markets to realise the benefits of IT/OT convergence by helping them access an array of cutting-edge digital transformation technologies.

A number of such technologies are already changing the manufacturing landscape. For example:

- **Unlocking new levels of efficiency with AI:** Leveraging the capabilities of machine learning algorithms, AI is revolutionising the pharmaceutical manufacturing industry. AI is not only enabling predictive maintenance and anomaly detection but also optimising processes and facilitating the development of personalised therapies. This transformative technology unlocks new frontiers of efficiency, ensuring higher-quality products and fostering patient-centric innovation in the pharmaceutical sector.
- **Real-time monitoring of DCS and MES empowering informed decision-making:** Integrated Distributed Control Systems (DCS) and Manufacturing Execution Systems (MES) networks offer real-time monitoring and data-driven insights that span the entire production process. Through this, informed decision-making is facilitated, resource allocation is optimised and strict quality and regulatory standards are consistently adhered to.
- **Boosting process control through Level 2 (L2) automation:** Through the centralisation of control systems and the coordination of various devices, L2 automation elevates process control and efficiency, thereby diminishing the need for manual intervention and reducing human error. This transition toward automation not only enhances productivity but also establishes the foundation for a more adaptable and responsive manufacturing landscape, fostering agility and responsiveness.
- **Breaking down silos with cloud platforms:** Cloud platforms empower seamless global collaboration and expedite innovation by providing scalable and flexible solutions for data storage, processing and analysis.

To fully realise the potential of these technologies in the dynamic life science market of Singapore, careful planning and meticulous execution are essential. This ensures data integrity, cybersecurity and the seamless convergence of IT and OT. Digital transformation specialists play a crucial role, guiding companies through the intricacies of implementation and facilitating a smooth transition toward a data-driven, digitally enhanced manufacturing environment. This strategic collaboration not only minimises risks but also accelerates the realisation of the transformative benefits offered by these technologies, propelling companies toward sustained success.

Data is key to a bright future for the pharma industry

Singapore is strategically positioning itself for sustained growth by making substantial investments in cutting-edge technologies such as AI, machine learning and automation. These investments, combined with ongoing efforts to nurture a collaborative ecosystem among industry, academia and the government, are fostering an environment conducive to

innovation. This ensures that Singapore maintains its position as a global leader in pharmaceutical manufacturing.

In this undertaking, technology partners will continue to play a vital role. By offering holistic digital transformation support, they can empower pharmaceutical companies to overcome complex challenges, enhance operational efficiency and foster innovation.

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