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Six steps toward the factory of the future

A solid foundation is required for any initiative

The factory of the future represents a transformation from traditional automation to fully connected and flexible system using streams of data from connected operations. Production environments learn and adjust to new demands. Here is a framework of six key steps to guide you along that journey, regardless of a plant's current maturity level.

1. Lean foundation and ROI mindset

A solid foundation is required for any factory of the future initiative. Existing processes and operations must reflect a high level of maturity prior to any transformation. This is a prerequisite to ensure maturity of people and processes and allow for technology considerations. Management must encourage a continuous improvement culture and adoption of lean principles throughout the organization.

A clear vision and roadmap for the factory of the future approach must be established with a path for both OT (operational technologies) and IT (informational technologies) addressing all company functions beyond the manufacturing process itself. Make financial impact and return on investment (ROI) the epicenter of your transformation, to achieve a long-term and sustainable impact.

2. Technology interoperability

An accelerating transition in the technology world from technology silos of proprietary OT/IT protocols and communications is taking place, into a world of open standards and protocols including OPC and MTConnect for machine (OT) communication, in addition to REST and XML for IT system integration.

This growing interoperability is requiring a new breed of engineering talent with multidisciplinary control system knowledge, IoT protocols and software, cloud platforms and artificial intelligence (AI) or machine learning (ML) data science. Some manufacturers struggle to start their digitalization

journeys due to the lack of such in-house talent. For those manufacturers, it may be most effective to explore cost-effective off-the-shelf solutions and then dedicate their efforts to integrating them with existing enterprise and other type systems.

## 3. Connectivity and real-time data

Data, not oil, is today the world's most valuable resource. Raw data isn't valuable in and of itself, but, rather, the value is created when it is gathered completely and accurately, as well as connected in a timely manner to other relevant data to form actionable metrics. Manufacturing executives must add "smart data" to the list of their most important assets for sound operations, right alongside people and capital equipment.

First and foremost, a plant connectivity strategy must be established, including data collection strategy, data types and sources and an approach appropriate for brownfield versus greenfield manufacturing plants. Many brownfield applications require retrofits or installing cost-effective sensors and IoT gateway hardware, while greenfield application can use machine and process designs that include built-in sensors and ethernet-capable control systems.

If you can't measure it (in real time), you cannot improve it (in real time). The ability to act to and learn from real-time data and metrics will make the factory of the future more responsive, proactive and predictive, and enables the manufacturing organization to avoid operational downtime, scrap and other productivity challenges.

4. Data metrics and analytics

The real challenge is interpreting the data and transforming it in such a way that the raw data becomes meaningful and actionable to the end users. Data must be analyzed and represented in a valid manner to the right stakeholder at the right time. Each stakeholder has different questions they are looking to answer, from machine operators to production manager, plant manager and executives

Factory of the Future Strategy

1 TECHNOLOGY

2 ANALYTICS

3 CONNECTIVITY

4 RETURN ON INVESTMENT
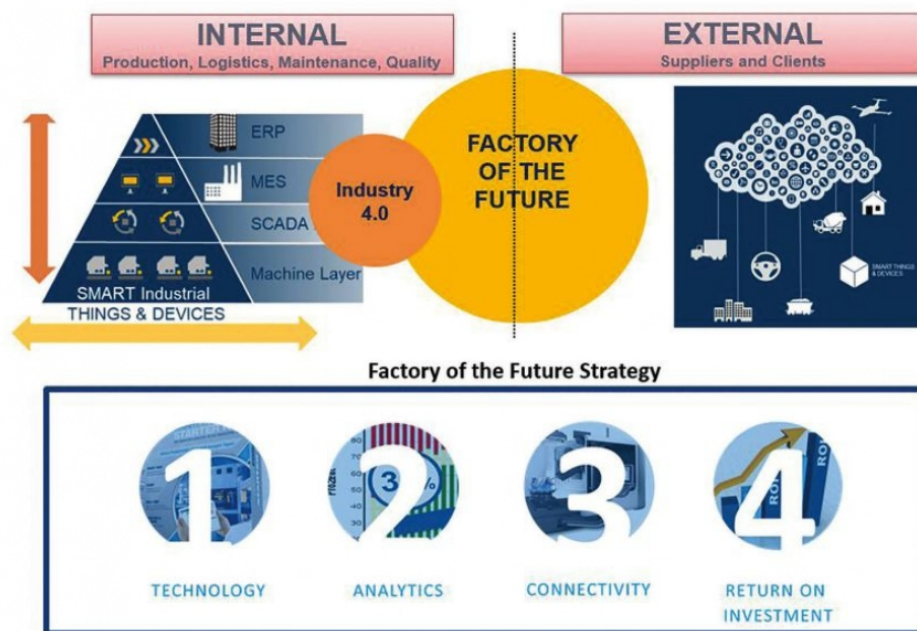
The factory of the future is about connected systems that lead to the use of analytics to better understand operations within the traditional automation triangle. Image courtesy: IoTco

in charge of profit/loss tracking of their manufacturing plants.

Digital plant metrics, like overall equipment effectiveness (OEE), uncover the hidden potential of the operation, in terms of asset uptime, performance and speed of operations, and the quality/yield of parts. With advanced data analytics and the use of AI and ML capabilities, predictive metrics can be tracked, including machine health, useful life predictions of machines and sub-components, as well as failure root-cause diagnostics. Factories of the future transform traditional manufacturing from a fail-and-fix to a predict-and-prevent operational mode.

5. Optimized and agile production

Leveraging data for improved decision making through the application of AI and ML algorithms requires a carefully designed data backbone with a holistic approach for all company functions, leading ultimately to a more optimized and agile manufacturing operation.

An optimized smart factory allows operations to be executed with minimal manual intervention and high reliability, and relies on the use of automated workflows, synchronization of assets, improved tracking and dynamic scheduling, and optimized energy consumption. Agile flexibility allows the factory of the future to adapt to production schedule changes with minimal intervention including the ability to self-configure the equipment and material flows depending on the product being built and schedule changes, and then see the impact of those changes in real time. Such agility can further increase factory uptime and yield by minimizing changeovers due to scheduling or product changes and enable flexible scheduling.

6. Collaborative and orchestrated manufacturing

The factory of the future strategy extends to support functions such as logistics (planning and material handling), maintenance and quality to gain additional improvements. Once the strategy expands beyond the four walls of the plant to the end-to-end supply chain and customer base, collaborative manufacturing begins, and exponential benefits can be realized. Consider the benefits of knowing your suppliers' process status, parts quality and availability beforehand rather than waiting till incoming part inspections or time of consumption.

Orchestrating the factory of the future with suppliers and customers allows for solution-driven manufacturing that fosters product excellence and innovation, new business models and market differentiation.

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Key takeaways

Those looking forward to the digitalization of the means of production should bear in mind the following:

- A solid foundation of lean and an eye for return on investment is required for any factory of the future initiative to be successful.

- Growing interoperability in the technology world to supports OT/IT convergence and includes open standards and protocols

- Manufacturing executives must add smart data to the list of most important assets for their operations, right alongside their people and capital equipment.

- Data must be analyzed and represented in a valid manner to the right stakeholder at the right time. Digital plant metrics, like overall equipment effectiveness (OEE), help uncover hidden potential, as do predictive metrics like machine health, life predictions and failure diagnosis.

- Agile flexibility allows the factory of the future to adapt to production schedule changes with minimal intervention and can further increase factory uptime and yield by minimizing changeovers due to scheduling or product changes and enable flexible scheduling.

- The factory of the future strategy expands beyond the four walls of the manufacturers to the end-to-end supply chain and customer base, leading to collaborative and orchestrated manufacturing.

As you step through your journey, the factory of the future is fundamentally about the proper alignment of people, process and technology, and extending it beyond your four walls into your supplier and customer base. It's important to maintain a zero-downtime, zero-defect vision for the operation, while leveraging data, metrics and analytics technologies for agile, collaborative and orchestrated manufacturing. **PE**

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