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Achieving an autonomous smart factory

Digital manufacturing is being driven by data and connectivity

Nearly 70% of global manufacturers are pursuing smart-factory initiatives. With the estimated global impact at more than $2 trillion annually, manufacturers need to take advantage of the efficiencies and savings offered by smart factories.

A smart factory is the achievement of full connectivity and inter-communication of all hardware components and operational processes inside a production facility, and the analytical use of the collected data to enable machines and people to make intelligent decisions resulting in either automated or human actions.

Smart-factory characteristics

Connection, data collection, analytics, predictions, decisions, and actions drive the smart factory. It satisfies two key traditional criteria: operational performance and flexibility. It is the ultimate stage of Industry 4.0: autonomous operations that can self-adapt.

Smart factories need to adapt to the evolution of products and production technology with minimum planned disruption to ongoing operations. This includes simulating evolutions to test viability. It also collaborates with its environment to adapt to market conditions, with the potential to produce a batch of product on demand when it makes economic sense.

The evolution also means the factory will anticipate or correct process deviations due to changes in incoming material or drifting equipment, while respecting product specifications. Ultimately, a smart factory will generate insights that can be used to improve its future design.

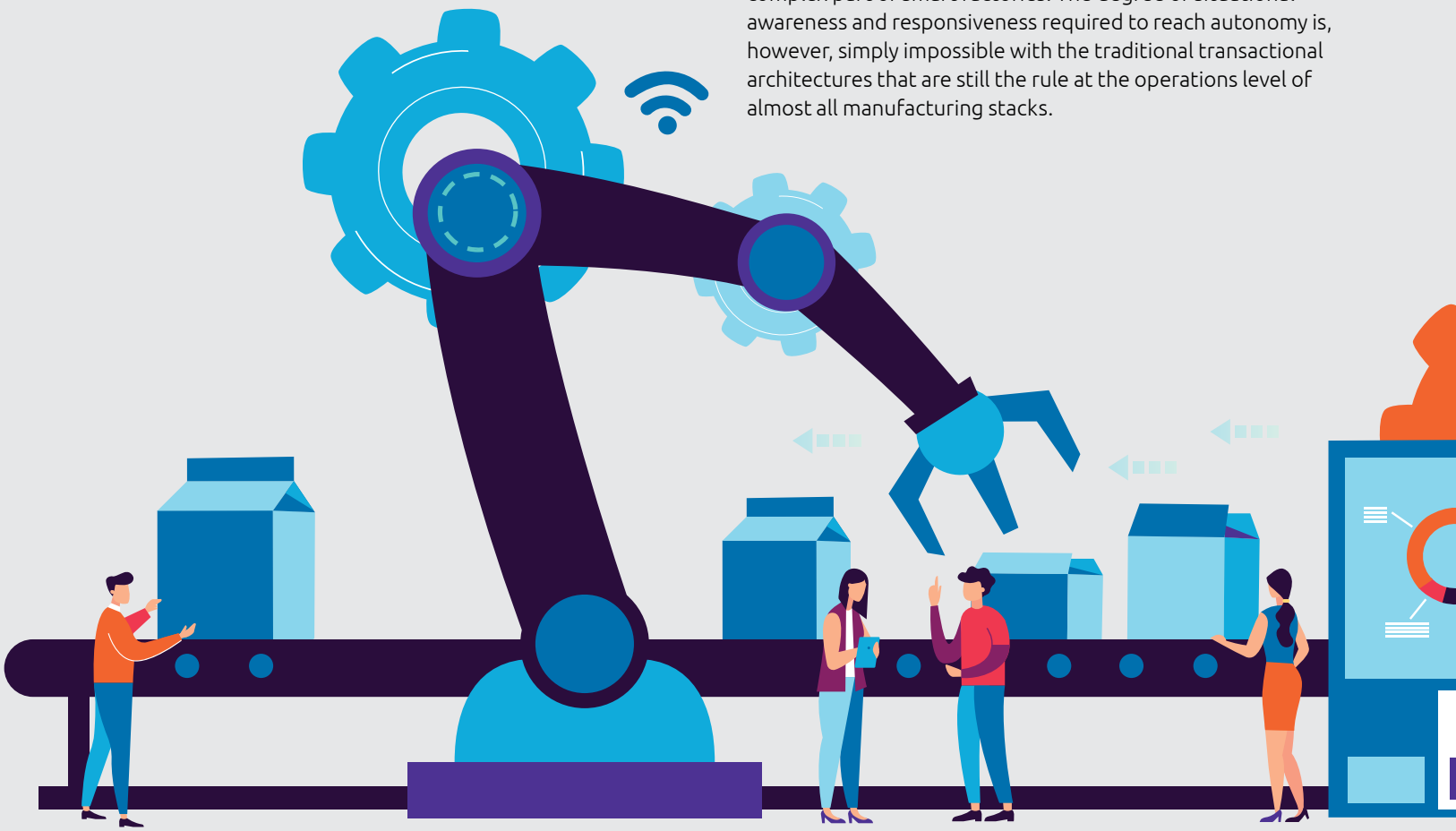
Achieving autonomous operations

Fully automated does not mean there are no employees in a plant; instead, their routine tasks are formally described and monitored, and their decisions supported by the right data.

Integration needs to happen both vertically and horizontally. The vertical must include everything from equipment to enterprise processes. Granular process data can be collected and analyzed at all levels, from real-time at the machine stage to weeks and months for the enterprise.

Horizontal integration begins with upstream product and process design systems, so that product and process data flows directly into manufacturing systems to automatically generate machine programs and operator instructions.

This integration should eventually lead to a factory that is event-driven. This is the least known and potentially most complex part of smart factories. The degree of situational awareness and responsiveness required to reach autonomy is, however, simply impossible with the traditional transactional architectures that are still the rule at the operations level of almost all manufacturing stacks.



More than just technology

The evolution is towards a data-driven management culture. Getting to autonomy will require that plant managers evolve from a hero culture, with one person who can solve the most complex problems, to more of a watchmaker culture. This means the new digital worker will constantly tune a complex, self-running system. We see this kind of change often overlooked, meaning that the current organizational structure will be one of the biggest obstacles to achieving smart-factory objectives.

Implementing this different operating model will affect processes, competencies, organization, performance management, and culture. To be successful, the model needs to be explicitly designed and formally rolled-out.

Change management should be designed to deliver a strong governance structure. A smart factory is a departure from traditional manufacturing projects. It requires complete and deep alignment between engineering, manufacturing, and IT around a highly complex three- to five-year transformation. And it will not consist of the classical design and development rollout of a core system. It is more like a progressive build, with constant evolution and continuous learning for the new manufacturing platform.

Driving the smart-factory transformation

The transformation has four phases:

- Repeatable: deploying a paperless maintenance tracking system will enforce fixed interval-based maintenance routines and collect a first level of information on machine reliability and main causes of failure
- Transparent: connecting machines will collect detailed data on the main parameters, allowing a first level of understanding of which deviations lead to failures and the implementation of usage-based maintenance
- Optimized: once the obvious causes of failure are under control, historical machine data can be systematically analyzed to uncover more complex cause-effect relationships and implement condition-based maintenance
- Autonomous: the theoretical ideal is that, when assets anticipate failure, they select the optimal remedial actions and manage their execution, leveraging specific services offered by the platform or specialized solutions.

To reach autonomy, smart factories need:

- Intelligent automation
- Operational intelligence
- A manufacturing platform.

The right strategy

Capgemini can help manufacturers design an end-to-end platform-based smart-factory transformation. An initial assessment of manufacturing operations can provide insight into digital maturity and the business case for a smart factory. Build your roadmap to design a smart factory so you can execute pilots to confirm the business case and mobilize the organization for the multi-year, complex journey.

For more details contact:

Mark Landry
Executive Vice President, NA Operations
Transformation Practice Leader
Capgemini Invent
mark.landry@capgemini.com

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