

LISTEN.
THINK.
SOLVE.®

Unlocking the value of your Connected Enterprise

Digital Transformation in the
Fourth Industrial Revolution

**Rockwell
Automation**

 Allen-Bradley • Rockwell Software

Optimal production, quality and regulatory compliance

The Digital Transformation of your entire value chain – from components to systems and from suppliers to customers – is the key to hidden value which can make a significant contribution to the productivity, quality, compliance and profitability of your enterprise.

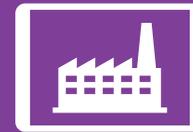
Critical success factors:



Integrating and analyzing enterprise data



Sharing outcomes across the value chain



Ensuring connectivity with production assets



Optimizing or redesigning classic production systems

Achieving those factors demands collaboration and convergence of operations and enterprise information and unparalleled visibility of cost and efficiencies, delivered by digitalization of enterprise data from:

- machine and equipment design
- plant engineering, maintenance and operations
- supply chain management
- customer relationship management

“With the new system, we can finally add, change or expand processes as we need. Our improved flexibility and the associated cost savings alone helped pay for the system in just one year.”

Southwest Baking Company



Demystifying digital transformation

Terms and concepts used in discussion of the digitalization of the enterprise.

The Fourth Industrial Revolution

Often discussed as part of industry and government visions and initiatives such as Industry 4.0, Manufacturing USA, China Manufacturing 2025, Manufacturing Innovation 3.0, Industrie du Futur, Associação Brasileira de Internet Industrial, etc. Essentially the complete digital transformation of a fully connected enterprise.

Industrial Internet of Things (IIoT)

Intelligent devices and systems connected using IP networking. Enables unlocking of hidden data from the entire value chain for more effective decision-making and more efficient operations at every level throughout the enterprise.

Cyber Physical Systems

Completely digitalized physical systems, creating a digital representation of the physical system which co-exists in real time. It is comprised of physical components that can be monitored, controlled and optimized by smart sensors, software and actuators.

Digital Thread

Digital data flow throughout the enterprise. Provides a common infrastructure for organizations to collect, use and share data.

Digital Twin

A digital representation of a physical product, system or process to enable testing before physical implementation and virtual comparisons of real-time operations. Reduces time to production, optimizes efficiency, and reduces waste and scrap.

“Convergence among operating and information systems as well as the availability of operational data, combined with the ability of parameter traceability and trend definition, definitely meets our aims of being a real Connected Enterprise, while providing us with new supporting tools for decision making.”

Andrea Cavalli, Gancia

Driving value with Digital Twins

When a physical asset – product, machine, component or system – exists alongside its digital equivalent, they are Digital Twins. Linked together so that operations and changes in one are reflected in the other, Digital Twins can be utilized at any stage throughout the lifecycle from machine building to the production process and for maintenance and training.

Machine and Equipment Building

At its base, a Digital Twin starts with the design and subsequent real-time simulation of the equipment using automation logic and a complete digital representation, which includes data on each component, every interaction, and the overall machine. The machine's twin can be run in simulation mode during its design, making changes less costly and time-consuming. Factory acceptance testing, commissioning and start-up can all be carried out more quickly, and once the machine is running, changes and upgrades can be proved before being applied.

Manufacturing and Industrial Operations

Simulating and modeling the process and control system interaction before installation, and testing different processes and advanced

algorithms during the lifecycle of the plant, can both be carried out using Digital Twins. Many existing sensors and monitoring devices, as well as different types of electrical and control equipment have detailed, but dormant, digital descriptions. These can now be utilized to deliver the time and cost-saving benefits, whether being used for assessing improvements in specific machines or equipment or across the full process or workflow of the operation.

Maintenance and Operator Training

Combining the concept of the Digital Twin with virtual/augmented/mixed reality (VR/AR/MR) can enhance the maintenance and operation of equipment. For example, a maintenance engineer wearing a mixed reality device can approach a machine experiencing unplanned

Digital Twins delivers...

- 80% less downtime
- 10%+ increase in throughput

Achieved by a food manufacturer using a simulation model to test and validate a facility upgrade before implementation.

- 50% less downtime
- Millions of \$ saved

Predictions for a major multinational company currently testing production scenarios (increasing output for a promotion; changing to cheaper production materials) on physical equipment rather than a simulation model.

downtime and have access to virtual information to help solve the issue and if needed, connect to remote specialists who are able to see the same view. They can then direct the engineer to gather additional information, diagnose the problem, or instruct the fellow engineer on how to repair it. The same technology can be utilized for training of operators and maintenance technicians, increasing safety, reducing time to start-up and reducing downtime.

Synchronizing production along the Digital Thread

In the digitally transformed enterprise, a digital thread or trail of information is collected throughout the lifecycle of a product, asset, system or process and brings the world of Smart Manufacturing together with product and process lifecycle management. This information can provide context and critical insights which enable action by delivering the right information to the right place at the right time for improved enterprise performance.

Digitizing the manufacturing workflow

Beginning in the design phase with the creation of a functioning Digital Twin; manufacturing and industrial systems can now provide data and insight that contribute to the Digital Thread. Following commissioning the Digital Twin can be leveraged, enabling the integration of information into the manufacturing workflow and production processes. These workflows and processes support optimized operations, improved maintenance, training programs, and are a valuable linkage with other systems that contribute to the Digital Thread. This affords improved overall management of the full product and production lifecycle.

Some manufacturers and industrial operators currently support elements of the Digital Thread concept. Many already incorporate MES to manage the manufacturing workflow in concert with information from ERP, supply chain and automation platforms. Long-used in highly regulated industries such as pharmaceuticals and those making complex products like automobiles and airplane manufacturing sectors, an MES can:

- help ensure all steps in a production process are as prescribed in the original recipe or design
- help guide operators with timely work instructions

Digitalization delivers...

- 50% reduced lead time to customers
- 50% reduction in defective parts
- 4-5% annual productivity improvement
- more satisfied customers
- greater market share

Achieved by a global manufacturer which implemented Manufacturing Execution Systems across 19 of its 20 manufacturing locations.

- help confirm steps were taken in the correct order
- help confirm ancillary activities such as in-line quality sampling and operator training are performed as integral parts of the manufacturing process

Incorporating digitalization in your enterprise

Enabling the flow of data between its originators and its users will lead to greater digitalization, wider use of data, increased productivity, enhanced quality and comprehensive regulatory compliance.

Improved Data Visibility

Eliminating information related bottlenecks can improve operations, and using the on and off premises cloud for storage of manufacturing and industrial data may improve the visibility of information throughout the value chain. Additionally, the cloud can be used for application delivery.

Demand-Based Decision-Making

Integrating real-time information from enterprise and manufacturing systems can facilitate production planning to meet peaks and troughs in demand, and highlight production issues so they can be remedied sooner.

Customizable Manufacturing and Operations

An integrated value chain can enable customization of product configuration to help make sure the customer receives the precise product they require, reducing rework, scrap and lead times.

Improved Customer Service

A Connected Enterprise can improve production, order predictability and responsiveness. For example, one manufacturer improved customer satisfaction with a reduction in lead times to customers of 50%, and a similar percentage reduction in defective parts.

Lean Supply and Inventories

Ready availability of stock and inventory data enables lean supply and inventories for greater cost-efficiencies.

Maintenance and Training

Virtual/Augmented/Mixed Reality can facilitate faster, more effective maintenance and create realistic simulation for training [see p.5].

Safety and Security

By leveraging the Digital Thread, appropriate machine-to-operator interaction can be maintained by integrating Human Resource

The IIoT delivers...

- new income streams
- improved productivity
- revenue growth

Anticipated by 84% of executives polled in an Accenture CXO Survey.

(HR) and production systems. The HR system can provide an alert when an operator logs onto a machine or system. This could be that – for example – the operator will soon require refresher training. Alternatively the system can deny access to untrained operators or those whose training is out of date.

New Revenue Streams

Digital Transformation can drive new revenue streams as companies uncover new ways to bring value to their customers. Whether in Business to Consumer or Business to Business environments, opportunities for connected products or services are changing the landscape. For example, some organizations are now offering “Equipment as a Service” in complement to simply selling their products.



Network, security and strategy

A secure Ethernet backbone is critical to the digitally transformed enterprise.

A successful security strategy addresses tolerance for risk, though this is a risk often ignored. A defense-in-depth approach to manufacturing and enterprise security is a proven strategy which extends beyond the network alone.

Choosing suppliers and industry partners with defense-in-depth security practices built-in to their products and solutions are vital.

Security policy and procedure development that encourage and monitor good management practices include:

- security training
- constant security awareness
- effective enforcement



Implementation in your enterprise

The comprehensive expertise of Rockwell Automation can facilitate efficient, cost-effective and timely implementation.

An effective implementation strategy requires converging Information Technology (IT) and Operations Technology (OT) people, processes and technologies, with secure Ethernet network strategies, policies and technology. There are a number of ways to achieve this.

Infrastructure as a Service (IaaS)

An IaaS model enables the building of a secure infrastructure based on pre-engineered solutions. It applies IT concepts to the manufacturing floor and leverages the engineering, configuration and deployment of a converged architecture at a low operational cost over a multi-year term. Employment of this model affords the protection and maintenance of an infrastructure with managed security services, threat detection, infrastructure monitoring and 24/7 remote support.

Contracting Services

Deploying outside expertise to implement a secure network can provide faster delivery with minimum disruption to the everyday work of the IT or OT communities.

IaaS delivers...

- simplified, cost-effective technology deployment
- proactive, phased modernization
- predictable/reduced downtime impact
- fully-managed support

Achieved by a manufacturing company implementing an IaaS solution which includes Industrial Data Centers (pre-configured, scalable, virtual servers), software, Ethernet, and around-the-clock remote support.

The time for **Digital Transformation** is now

OEMs – Competitive Advantage

As a machine or equipment builder you can add value and gain competitive advantage for you and your customers. Previously isolated machine data can turn into insights, which help engineers improve performance, provide early warning of machine breakdowns and reduce support costs. Organizations can also offer services to stay connected to their machines in their customers' facilities or across multiple facilities, with a focus on reducing unplanned downtime. Additionally, greater insight into usage patterns can drive innovation in machine, equipment or end customer product development.

Manufacturers and Industrial Operators – a New Workforce

Changing demographics are creating workforce challenges for manufacturers and industrial operators with retirement, economic expansion and technology evolution

overwhelming companies' abilities to staff operations. Incoming talent often lacks the necessary skill for existing technology, although may bring new visions of work and technology. Organizations must capture the knowledge of those leaving the workforce, in order to create repeatable processes and tools which new workers can utilize. And, take advantage of how innovative technology can help improve business performance as well as offer the type of work that will attract new hires.

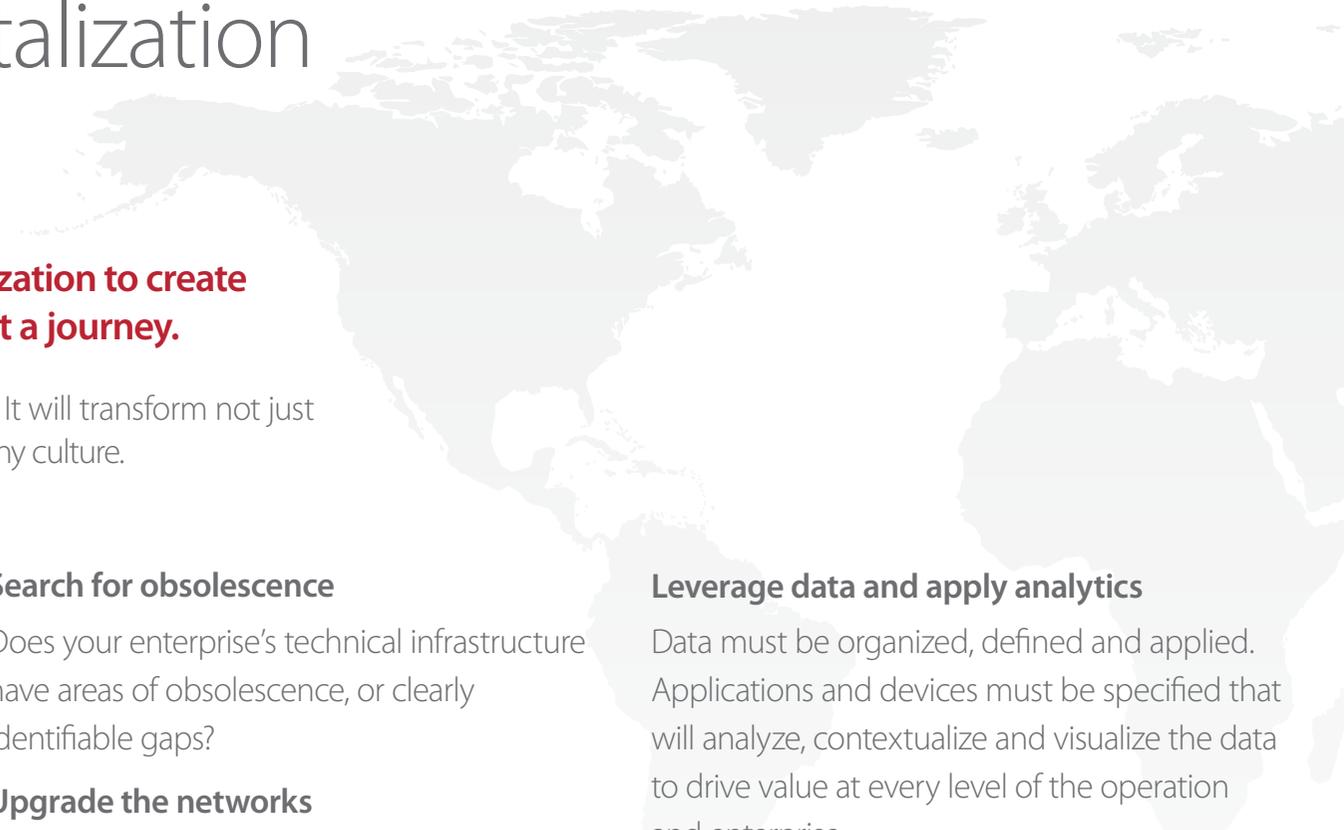
Businesses – A New Opportunity

The transformation has already begun. Technologies exist. Bringing people together with the vision, empowerment, and will to succeed comprise the next steps. The first transformation begins with the collaboration and convergence of operations and enterprise information groups. The historical separation of the two groups has held back progress.

Digital Transformation brings them together into a common cause – enterprise success. Leading companies are already on the way to digital transformation to improve productivity and stay globally competitive. These companies are unlocking the value in their manufacturing assets, returning improved profits to shareholders.



Preparing for digitalization



The Digital Transformation of your organization to create a Connected Enterprise is not an event but a journey.

It requires executive support and continuous effort. It will transform not just manufacturing and industrial operations, but company culture.

It starts here.

Leaders in your enterprise must identify the challenges and opportunities which lie ahead. Where are the gaps in the supply chain? Are there current KPIs that imply underperformance? Is there a new process that could yield better results? Where can value be found?

Evaluate the culture and executive sponsorship

What are the current cultural norms of IT and OT operatives? Where can common ground be forged and an atmosphere of trust enabled? Is continued executive sponsorship expected and is there an established cadence for the evaluation of progress?

Search for obsolescence

Does your enterprise's technical infrastructure have areas of obsolescence, or clearly identifiable gaps?

Upgrade the networks

Secure upgrading of the network and existing industrial control structure is essential. Specific plans and designs must be completed to prepare for future configurations, the implementation of ongoing policy and the introduction of advanced technologies further down the line.

Leverage data and apply analytics

Data must be organized, defined and applied. Applications and devices must be specified that will analyze, contextualize and visualize the data to drive value at every level of the operation and enterprise.

Talk to Rockwell Automation

Strategy consultants and implementation systems integrators are keen to endorse the digitalization of the enterprise. However, connecting enterprise efforts to operations demands direct collaboration with operations specialists who have an eye on change management requirements across people, process and technology.

Enabling Digital Transformation

Companies can take pragmatic steps today to continue to enable Digital Transformation throughout the lifecycle, both technically and culturally. Here are some of the areas in which Rockwell Automation can help:

Scalable Execution

Help ensure workflow adherence, collaboration and tracking. Scaling from focused applications for quality or performance to industry-specific suites of applications, or comprehensive Manufacturing Execution Systems (MES) for multi-plant roll-outs.



Collaboration and Design Tools

Enable seamless collection and sharing of knowledge to empower teams in better decision-making. Can be used for sharing and discussing incidents, device information, alarms, trends, location and other information useful for improving performance.



Scalable Analytics

Computing and presenting information closest to the sources and the consumers, on a variety of new appliances, edge devices, and on and off premises cloud platforms. Enables faster, easier incremental derivation of value from data.



Connected Services

For training or supplementing in-house teams. From design of smart manufacturing systems, through implementation and optimization. Enables maximum utilization of production data in continuous improvement initiatives.



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www.rockwellautomation.com/connectedenterprise

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www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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