5 Critical decisions for manufacturing digital transformation

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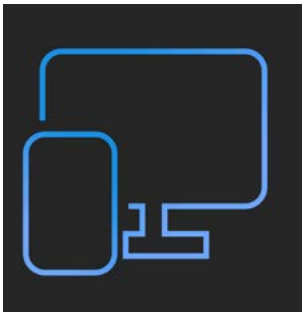


72 percent of industrial products executives surveyed say digital initiatives will be critical to the success of their organization in the next three years.

The blueprint for scalability and process flexibility

The challenges and rapid changes that characterize the modern business environment lay bare the inflexibility of many manufacturers' operations. For more than a decade, Industry 4.0 and smart manufacturing concepts and initiatives have arisen to help combat these issues. New technologies, such as cloud, AI and edge computing, which have completely changed the IT landscape have accelerated their impact. Yet their full potential has yet to be realized as manufacturers continue to struggle to scale these advances throughout their operations.

Most industrial enterprises have implemented pilots or proofs of concept with Industry 4.0 technologies but have been unable to meaningfully expand these projects throughout their plants and across locations. In many cases, these projects, intended to address specific issues, may even add more complexity to an already complicated heterogeneous environment.

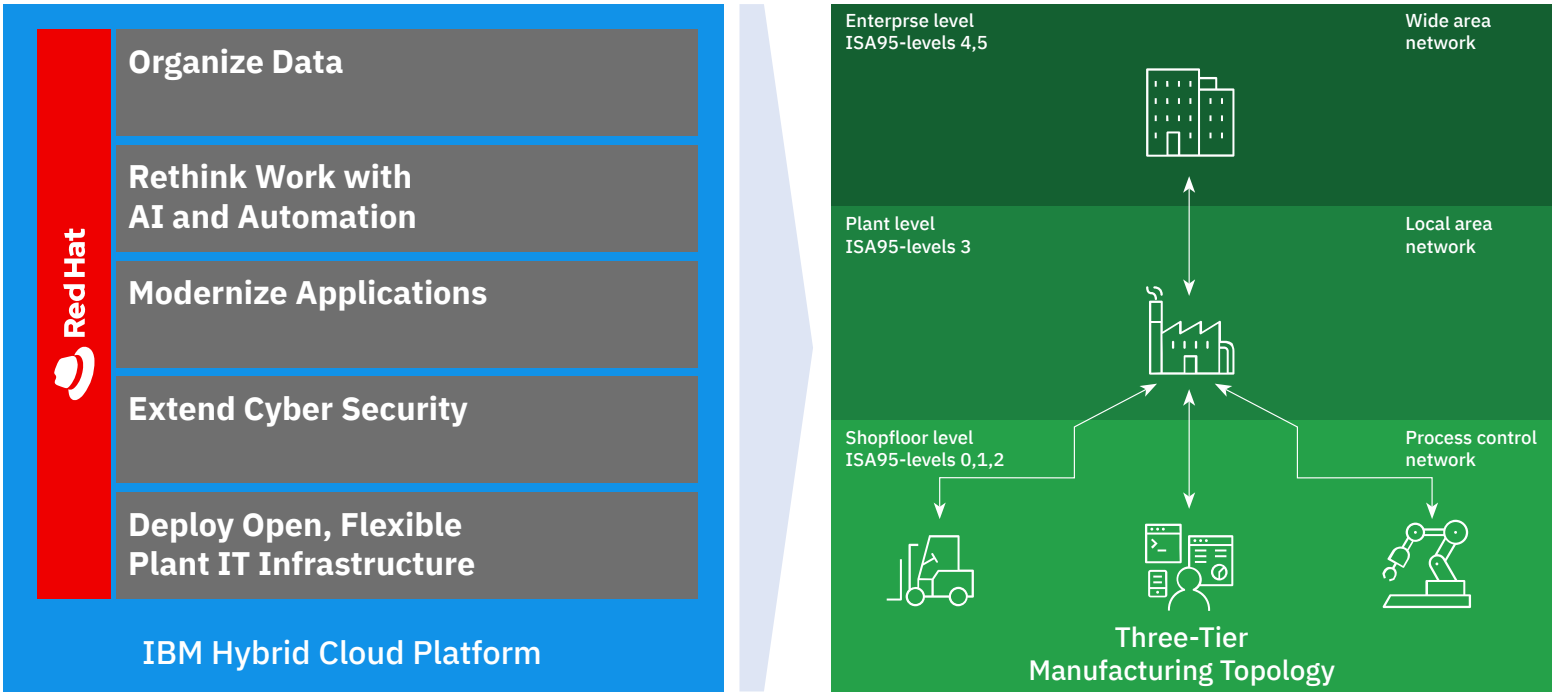
A more holistic, technology platform approach is required. Enterprises must begin with the end in mind, with a vision for an open, flexible, integrated and AI-infused architecture that's designed to scale. This approach doesn't mean that high return on investment (ROI), quick-win technology projects shouldn't be pursued. But rather, that they should be implemented with a broader understanding of architectural decisions within the context of a platform approach. In this way, isolated initiatives will contribute to the big picture: a fully modern digital manufacturing environment.

IBM brings hybrid cloud technologies to the factory floor

IBM's extensive work with industrial clients has taught us that manufacturers need a guiding architecture. This blueprint for digital transformation provides the foresight to pull together the patchwork of good intentions that exists across manufacturing plants today into a bold, unified vision for modern manufacturing. IBM's architecture for manufacturing is driven by the goal of improving operations' flexibility and guided by the principle of acting where the action is.

IBM's hybrid cloud approach is uniquely open and provides a security-rich, industrial-ready foundation for manufacturers. It's grounded on a common, industry standard platform for data, applications and cybersecurity, built on the Red Hat® OpenShift® Platform with Kubernetes containers. Our open hybrid cloud enables you to manage and run applications on your choice of public cloud, on-premises systems in your plant or on edge computing devices. IBM uniquely offers an on-premises cloud option, so you get all the modern tech advantages while keeping manufacturing data under your direct control.

IBM's architecture brings hybrid cloud technologies to the action, in each level of manufacturing



Our open architecture embraces the manufacturing ecosystem of operational technology (OT) vendors, industry independent software vendors (ISVs) and systems integrators (SIs). This architecture protects your current investments and allows you to continue to grow your business with the offerings and experience of leading OT vendors and others in the manufacturing ecosystem.

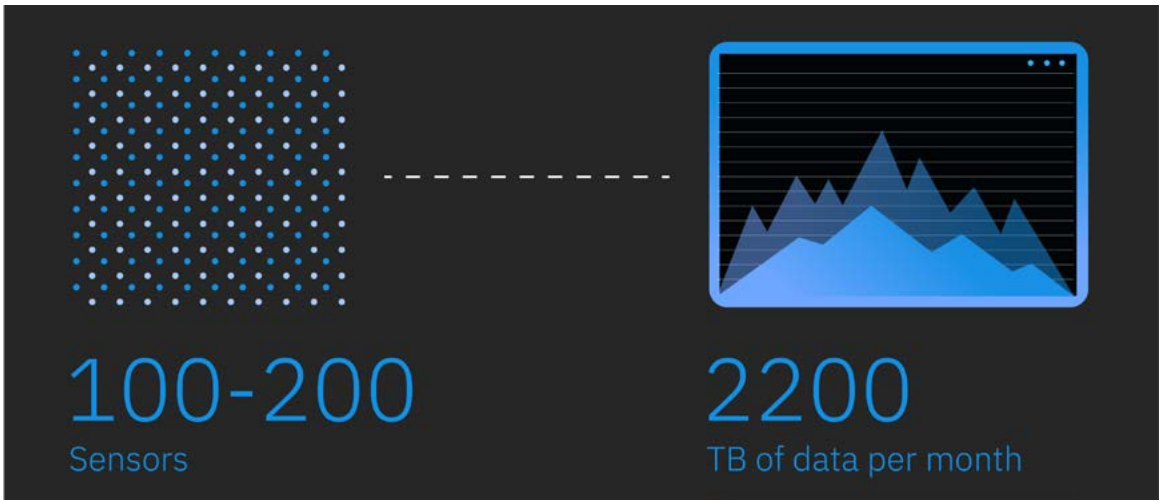
IBM Services® helps clients co-create intelligent workflows with preconfigured industry solutions and tools for automation and integration. With the IBM Garage™ methodology for Industry 4.0, IBM can help you define your vision and co-create a blueprint to achieve it. With a focus on using your existing OT and systems investments, use cases with the most important metrics and highest ROI are targeted first.

The advent of AI offers new possibilities to derive predictive insights and learnings which can improve plant-wide operations, but only if plant data can be unlocked from within these heterogeneous silos.

Operate smarter with predictive insights

Modern manufacturing creates terabytes of data, but only a fraction of it is acted upon. The typical plant operates across a labyrinth of multigenerational equipment, controllers and plant systems, each carrying out specific tasks.

Many manufacturers are analyzing data from individual machines or systems for equipment monitoring and predictive maintenance. But this analysis is only scratching the service of the potential of using data from across all equipment and systems. The advent of AI offers new possibilities to derive predictive insights and learnings that can improve plant-wide operations, but only if plant data can be unlocked from within these heterogeneous silos.



Each line could have 100 to 200 sensors that collect data continuously, generating 2,200 terabytes of data each month. Insights based on the aggregation, classification, and analysis of this data through AI and predictive analytics could increase productivity and reveal opportunities for data monetization.

Data must be organized into an “information architecture” that aligns with the various levels of manufacturing systems. From edge equipment to line, plant and enterprise systems, minimizing unnecessary data movements is key to reducing cost, security risk and latency. Specific use cases and automation objectives should drive the decisions about where various data should reside.

AI is applied to create actionable insights, leading to overall equipment effectiveness (OEE) improvement. Edge operations require near real-time analysis for time-sensitive activities like quality inspection and worker safety. At the manufacturing line, throughput is maximized using insights drawn from data integrated across equipment and controls systems, manufacturing execution systems (MES), maintenance and other systems. Optimizing production across lines and across plants requires broader visibility into enterprise systems, customer demand and the supply chain.

Architectural Decision
Where will you manage and organize your various manufacturing data? At the enterprise level in the cloud, in the plant or at the edge with the equipment?

Learn more →

Q: Looking ahead, which of the following machine learning use cases that your organization has not yet deployed to you plan to deploy in the next two years?
Base: Manufacturing industry respondents (n=154)
Source: 451 Research's Voice of the Enterprise: AI & Machine learning Use Cases 2021

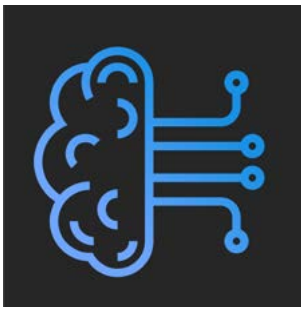
With IBM's hybrid cloud for manufacturing, you operate on the data where you need it, without requiring moving it to a central repository or out of the plant.

Our hybrid cloud approach lets you securely manage and leverage use data across edge devices, on-premises systems and in public and private clouds in a security-rich environment. This approach allows you to bring AI to the data versus sending the data to AI in the Cloudcloud. IBM Cloud Pak® for Data software simplifies data collection, organization and analysis.

A flexible architecture means you can perform faster and less costly with more secured analytics to achieve your automation objectives. For instance, image capture from AI-driven visual inspection for quality generates huge amounts of data. It would add time, cost and security risk to move all the data to the cloud, so this analysis is best performed at the edge where the data is produced. This way, inspection results and associated exception data can be transferred to plant or enterprise databases. The data can then be used for further training of machine learning (ML) models, analysis with other data to pinpoint root causes or for communication to engineering.

Read: Kyocera improved productivity across manufacturing processes by developing smart factories. →

The goal is to augment humans with the power of AI technologies, allowing both humans and machines to focus on tasks for which they're uniquely suited.



Reduces production defects by 97% by applying AI/Machine Learning at the edge for quality monitoring.

Forrester TEI

Rethink how work gets done with AI and automation

Today's workforce brings a new set of expectations to the job, as well as a digital-native skill base. It wants fewer rote tasks and more creative problem-solving. At the same time, manufacturing processes are under pressure for continued efficiency gains and improved flexibility. These forces lead manufacturers to rethink how work gets done.

Digital transformation is enabling new ways of working. Automation of repetitive tasks improves consistency and reduces costs. AI serves up insights to employees for improved decision-making, delivered through traditional computers, hardened handheld devices or even through augmented reality (AR). Augmenting humans with the power of AI technologies allows both humans and machines to focus on tasks for which they're uniquely suited.

These new technologies enable "intelligent workflows" which integrate data insights across applications and domains to follow a more natural flow of work. This process doesn't just improve the employee experience and job satisfaction by eliminating repetitive manual tasks, it also empowers employees all along the organizational ladder to make better, data-driven decisions.

The transformation program must address the skills and cultural challenges for existing employees on the shop floor who need to transform their skills and learn new ways of working.

Leading organizations expect to realize an average ROI of 24% within three years from edge computing investments.

IBM IBV →

Architectural Decisions
How will you orchestrate and automate new intelligent workflows? How will you access data from the plant, edge and enterprise? Where will you run these workflows – at the edge, plant or in the cloud?

Learn more →

IBM co-creates with clients to automate processes and build intelligent workflows.

With IBM's preconfigured industry solutions, new intelligent workflows, infused with AI, extend to the closest point of action and integrate processes between machines, the plant and the enterprise. The IBM Garage methodology for Industry 4.0 collaboratively prioritizes development to the highest ROI use cases and takes a human-centered approach to facilitate employee buy-in.

IBM Cloud® Paks software automate business processes and integrate data flows. Key IBM technologies that bring workflows to life in a manufacturing environment include the IBM Plant Service Bus and IBM Watson® AI.

IBM Plant Service Bus includes manufacturing protocols to integrate across industrial equipment and automation tools, while IBM Watson AI draws insights from all types of data, including visual and acoustic data. Edge computing solutions bring the power of IBM Watson AI to workers and machines to capitalize on data and extend the experience of experts in the organization.

Watch: Isedemir set out to manage end-to-end maintenance activities more efficiently, optimize parts inventory, improve the useful life of our facilities, and enhance worker health and safety. →

Co-creation of modern applications pairs developers with plant SMEs, ensuring solutions are designed to meet manufacturing needs.

According to the director of digital transformation, there was always a risk of downtime, since systems were cobbled together over more than 30 years, spanning regivons and divisions within the interviewed organization. By implementing a platform approach, it eliminated downtime, while improving quality and agility.

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Increase OEE by building and modernizing next-generation apps

The average plant relies on a portfolio of hundreds of aging, heterogenous plant applications. Some applications are proprietary or may be fraught with lack of documentation. Other apps may be back-level or running on unsupported operating systems. Such a patchwork of siloed apps is costly to maintain and enhance and puts production continuity, quality and safety at risk. The advent of more edge computing applications coming alongside 5G is poised to expand the challenge even further. This issue grows exponentially for large organizations that are operating dozens or hundreds of individual plants.

Fortunately, there's a path out of this jungle. Modern DevOps techniques apply modularized development in small chunks, so applications can be rapidly deployed and expanded over time. Co-creation of modern applications pairs developers with plant experts, ensuring solutions are designed to meet manufacturing needs.

Manufacturers need to adopt an architecture that grows with their business priorities, one that facilitates integration and can adapt as needs change. New applications should be aligned with the information architecture, with workloads performed at the edge, line and plant levels.

An open, container-based approach enables the creation of modular systems to speed deployment, increase reuse, simplify maintenance and easily scale. With modern application development technologies, you can be less reliant on specialized skills, enabling workforce flexibility and more nimble, efficient operations.

Architectural Decisions
How will you modernize plant and edge applications for more resiliency without risking stability and operational disruption? Will you use proprietary or open-source development techniques?

Learn more →

IBM's hybrid cloud approach builds cloud-native applications using Red Hat OpenShift with industry-standard Kubernetes containers.

This leading platform brings the advantages of open-source technology, but is "industrial-ready," with the reliability, security and support needed for critical operations. IBM's open platform enables new applications to run in essentially any operating environment—private clouds, on premises or a choice of public clouds.

IBM's solution includes a reference semantic model that handles the mapping of integration points, such as data, OT, other applications and so on. This semantic model separates the complexity of the plant environment from the applications to simplify development and allow changes to the operating environment to be reflected in all affected applications.

With the principle of bringing the applications as close to the point of action as possible, IBM® Edge Application Manager lets you create, deploy, run, maintain and scale edge solutions basically anywhere.

IBM's solutions help reduce costs; speed development; enable tuning new applications for edge, line and plant systems; and provide scalability and flexibility for the future.

Watch: L'Oreal is accelerating their Industry 4.0 journey with performance diagnostics, operations strategy, and AI solutions to deliver new products faster. →

How will you identify cyber attacks within the plant and respond swiftly? How will you secure data and access points within the plant? How will you combine security monitoring in the plant with IT?

A yearly research study conducted by IBM shows that in 2019 there was a 2,000 percent (20x) increase in OT cybersecurity attacks. Yes, you read that correctly — 2,000 percent. As operational organizations and industries experience innovation and connectivity, bad actors can take notice and execute security attacks. To help mitigate these risks, organizations can adopt an operational technology security strategy.

Secure assets, information, and people

As the connectedness between manufacturing equipment in the factory—and across factories—increases, so does vulnerability to attacks. The average plant runs hundreds of apps. It's no wonder that cyberattacks on industrial facilities are up 20 times in the last two years. The outcomes can be catastrophic financially or, in some cases, even life-threatening.

In this increasingly risky environment, manufacturers need to be sure that all software and control systems can be monitored and protected in a clear framework to avoid gaps. End-to-end visibility allows for a more consistent security practice, including threat response and continuous learning. Security needs to be embedded within all processes and at every point of data transmission.

Understand your risk

Architectural Decisions
How will you identify cyber attacks within the plant and respond swiftly? How will you secure data and access points within the plant? How will you combine security monitoring in the plant with IT?

Learn more →

Extend your visability

Mitigate the impact

IBM helps you define and develop your comprehensive security blueprint for the IT and OT infrastructure.

Building applications and workflows with IBM's hybrid cloud comes with built-in security in all IBM environments, and across third-party ecosystems. The IBM QRadar® architecture and the IBM Cloud Pak for Security solution help you manage threat monitoring and response from the enterprise to the edge, for full visibility of cyberattacks. IBM is collaborating with OT vendors like ABB to extend the security perimeter into OT equipment and the Internet of Things (IoT) platforms.

With 8,000 dedicated professionals around the world, IBM is one of the largest enterprise security vendors and brings the experience of managing security for leading banks, retailers and other global enterprises to industrial environments.

Read more: ABB is combining its process control systems with IBM's security platforms to help industrial operators improve their security. →

The infrastructure choice between manufacturing and cloud doesn't need to be either-or. A multi-cloud approach enables manufacturers to achieve the best of all worlds.

It has been demonstrated that the value derived from a full hybrid, multicloud platform technology and operating model at scale is 2.5 times the value derived from a single platform, single cloud vendor approach.

Deploy an open, flexible plant IT infrastructure

Traditionally, manufacturing has exerted direct control over the IT infrastructure to run plant applications and data management in systems on premises, and often outside the realm of IT. As cloud computing has emerged to offer attractive new technologies, manufacturers have the option to shift workloads to public clouds. Yet plant managers express concerns that public clouds introduce a loss of control, increase the potential for security threats and create latency issues. Additionally, some operations are restricted from using public clouds due to data residency and privacy regulations that restrict movement of data beyond national boundaries, or lack of accessible data centers in some regions.

Manufacturers need the flexibility to move workloads between on-premises systems, including edge devices, and to different public clouds, depending on latency requirements, costs, security and other considerations. The infrastructure choice between manufacturing and cloud doesn't need to be either-or. A multicloud approach enables manufacturers to achieve the best of all worlds.

A modern infrastructure uses a software-defined approach to optimize computing, networking and storage resources for maximum control and flexibility. At the same time, it allows the enterprise to share solutions and rapidly scale new capabilities globally, across hundreds of plants, with significantly reduced IT operating costs.

According to the director of digital transformation, there was always a risk of downtime, since systems were cobbled together over more than 30 years, spanning regivons and divisions within the interviewed organization. By implementing a platform approach, it eliminated downtime, while improving quality and agility.

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Architectural Decisions
How will you design the technology architecture for your plant? Consider options for connectivity, data management and processing? Consider the level and scope of IT skills to preserve within the plant?

Learn more →

IBM's open, hybrid cloud architecture gives you choices instead of limitations.

Adopt IBM's hybrid cloud approach, based on Red Hat OpenShift, and your manufacturing infrastructure can run on essentially any public cloud, reducing the risk of vendor lock-in. Your infrastructure can also run on private on-premises systems, so you can retain control within your operations.

IBM's open approach embraces OT providers and public cloud vendors to allow you choice of the best infrastructure for particular workloads. We work with network equipment and telecommunications providers to enable edge computing and low latency operations.

IBM brings cloud technologies into your manufacturing environment, so you can locally apply AI, ML, 5G edge computing and software-defined networking and storage. Our approach brings the tech to the action, rather than sending your data outside of the plant. Run your workloads wherever is most appropriate for the job, whether that's at the edge, an on-premises server or a public cloud—basically any public cloud. The IBM Cloud Satellite™ solution lets you scale these deployments across multiple types of infrastructures and across plants and the world.

IBM worked with Samsung and M1 to deliver solutions that take advantage of the ultra-low latency, high reliability, and security of 5G connectivity to create the first 5G Industry 4.0 Studio. →

IBM Cloud Satellite lets you deploy and run apps consistently across on-premises, edge computing and public cloud environments from any cloud vendor. →

Get started today:

IBM works with you to co-create a customized roadmap with a focus on using existing OT investments, improving key metrics and using people that know best. We help you:

- Set your direction based on our Industry 4.0 reference architecture and industry standards.
- Unleash maximum value by selecting use cases to address immediate needs with high ROI.
- Validate your security posture for IT and OT.
- Achieve scale by consistently deploying advanced technologies on an open platform.

The IBM Garage methodology is an end-to-end model for accelerating digital transformation. It helps you generate innovative ideas and equips you with the practices, technologies and expertise to rapidly turn those ideas into business value.

When you work with the IBM Garage methodology you bring your pain points into focus. You include and build on the insights of your business and technology leaders. You empower your team to take manageable risks. And together, you adopt leading technologies, speed up product development and measure the value of everything you do. We support you in your business goals, whether that's helping you respond quickly to disruption or guiding your full-scale transformation.

IBM Garage clients experience 10 times more innovative ideas, 67% faster speed to outcomes, 6 times as many projects into production and a 102% ROI.1

Validate your security posture for IT and OT

Supervisory control and data acquisition SCADA and industrial control systems are increasingly vulnerable to cybersecurity attacks as they become more connected. →

Explore IBM's Industry 4.0 solutions →

Engage an IBM expert to learn more about manufacturing solutions and services to support advanced manufacturing for your business. →

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