

# Top 5 Strategic Technology Trends in Manufacturing Industries for 2021

Published 4 June 2021 - ID G00745972 - 24 min read

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Initiatives: [Manufacturing Digital Transformation and Innovation](#); [Manufacturing IT Optimization and Modernization](#)

Strategic technology trends drive significant disruption and exponential opportunity for manufacturers. CIOs can use this research to assess how these top five technology trends will impact their future platforms and business.

## Additional Perspectives

- [Summary Translation: Top 5 Strategic Technology Trends in Manufacturing Industries for 2021](#)  
(24 June 2021)

## More on This Topic

This is part of an in-depth collection of research. See the collection:

- [Applying AI in Industries](#)

## Overview

### Opportunities

- Anywhere operations blends on-site work with people who are physically remote, greatly improving flexibility of operations and potentially creating a new pool of talent.
- Autonomous things have the potential to assist, replace or redeploy human workers, creating high — and occasionally transformational — business benefits such as speed and quality.
- Hyperautomation creates more explicit manufacturer ownership of product and process knowledge, from product design through manufacturing. When workers leave the company, the know-how doesn't leave with them.
- Companies that effectively apply the concept of intelligent composable business will be able to unlock and convert more opportunities for disruptive innovation. These organizations will also be able to achieve greater speed of response and agility in dealing with external disruptive events.
- Smart factories create increased competitiveness and cultivate new forms of productivity, flexibility, and human interactions, while simultaneously minimizing risk and either maintaining or improving performance.

### Recommendations

CIOs looking to digitally transform their technologies should:

- Adopt team structures, processes, skills and tools to drive business model innovation using a digital-first, location-independent strategy for anywhere operations.
- Determine which use cases are most suitable for autonomous things, based on cost savings and worker safety. Partner with both autonomous things ecosystem providers and broader IT/OT services companies. Bridge the skills and experience gaps that currently exist in most manufacturing organizations.
- Develop a three- to five-year aspirational hyperautomation vision that highlights business outcomes and reflects the use cases of digital technology in your industry.

- Redefine intelligent composable business in the company's operational system (including major production platforms like PLM, ERP, SCM or MES) under the premise that disruption is the norm, to shrink the time gap between the detected need for business change and the response. Bear in mind that this is a long-term and considerable investment that demands a lot of commitment from the company's leadership.
- Avoid a digital black hole by using a supply chain strategy cascade that describes and quantifies the smart factory's intended impact to the business. This establishes the governance, which defines the touchpoints between factory, supply chain priorities, methods, business objectives and quantifiable business outcomes.

## Strategic Planning Assumptions

- By 2023, 40% of organizations will blend virtual and physical experiences, leading to increased workforce productivity and customer reach.
- By 2026, the use of autonomous things will displace 25% of warehouse logistics operators such as forklift drivers.
- By 2025, manufacturers will lower operational costs by 10% by combining hyperautomation technologies with redesigned operational processes.
- By 2023, organizations that have adopted a composable approach will outpace competition by 80% in the speed of new initiative implementation.
- By 2025, three out of five manufacturers' smart factory initiatives will stall from a lack of supply chain integration.

What You Need to Know

Table 1: Trend Profiles: Click links to jump to profiles.

Location Independence	Resilient Delivery
<a href="#">Anywhere Operations</a>	<a href="#">Hyperautomation</a>
<a href="#">Autonomous Things</a>	<a href="#">Intelligent Composable Business</a>
	<a href="#">Smart Factory</a>

Source: Gartner (June 2021)

The focus in the manufacturing technology trends is definitively on leveraging technology through automation and composability.

Location Independence

The pandemic has greatly increased the need for location independence. **New ways of working mean that employees, customers, suppliers and everyone across the business ecosystem can be located anywhere.** Our location independence theme addresses the technology shifts that are driving a distributed cloud structure that facilitates anywhere operations in both business and IT. This theme also describes how a cybersecurity mesh shifts the security perimeter to the individual.

- Our trends: Anywhere Operations, Autonomous Things

Resilient Delivery

This theme isn't about "bouncing back" — it's about having the ability to nimbly adapt or pivot in a dynamic business or IT environment. The theme's underlying assumption is that volatility exists, so it's vital to have the skills, capabilities, techniques, operational processes and systems to constantly adapt to changing patterns. This means organizations **must be composable with modular, adjustable autonomous components.** They must use sophisticated technologies such as AI, engineering the approach with a disciplined focus to achieve sustained resiliency. It also means organizations must be composable with modular, adjustable and autonomous components, with business and IT processes augmented by hyperautomation. They must also use sophisticated technologies such as AI to engineer a sustainable resiliency approach.

- Our trends: Hyperautomation, Intelligent Composable Business, Smart Factory

## Anywhere Operations

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*Analysis by Ivar Berntz and Michael Ramsey*

**SPA:** By 2023, 40% of organizations will blend virtual and physical experiences, leading to increased workforce productivity and customer reach.

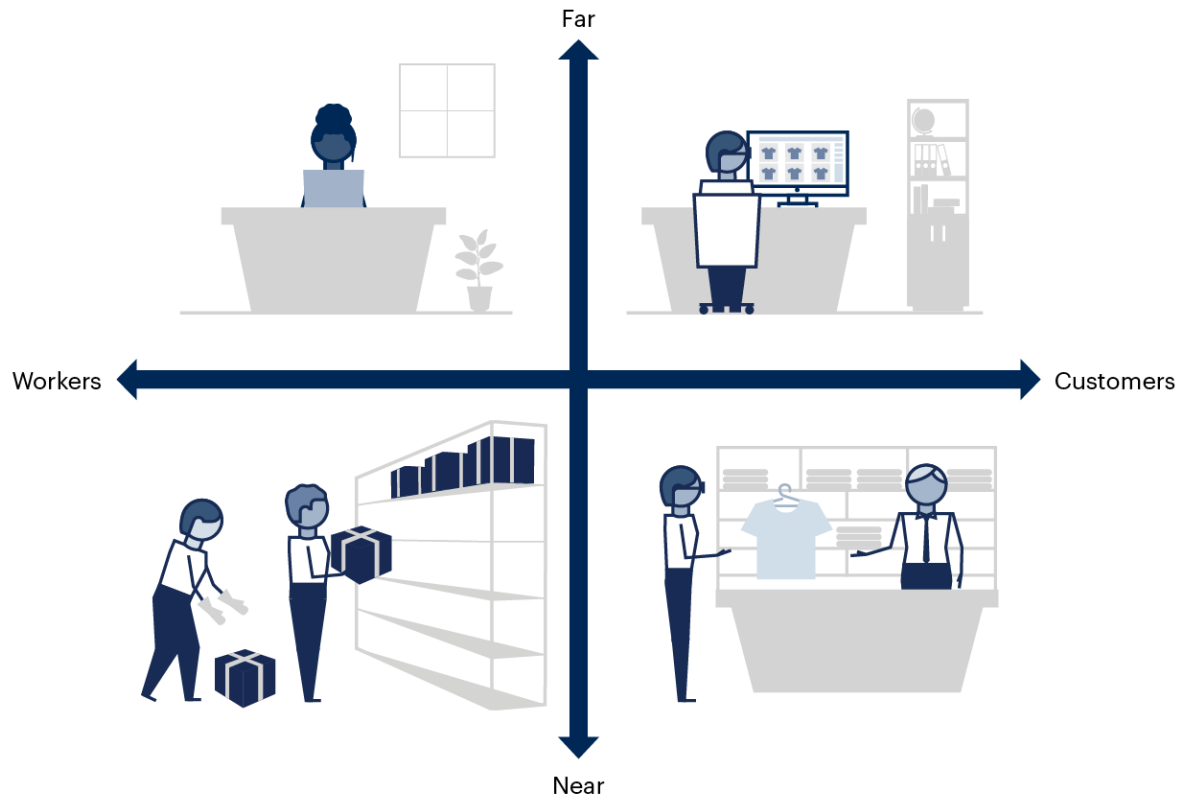
### Description:

Anywhere operations describes an organization that uses technology, team structures, processes, skills and tools to empower a dispersed workforce, harness a distributed infrastructure and serve a ubiquitous customer base, as shown in Figure 1. It challenges the conventional wisdom that it's necessary to be in a specific location, interacting face-to-face, to maximize value and efficiency. It envisions employees, contractors, business partners, customers and end consumers working remotely from one another.

**Figure 1: Anywhere Operations: Embracing Near and Far for Workers and Customers**

## Anywhere Operations: Embracing Near and Far for Workers and Customers

Reach customers anywhere, enable employees anywhere and deliver business services anywhere



Source: Gartner  
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**Gartner.**

Providing a seamless and scalable digital experience requires changes in the technology infrastructure, management practices, security and governance policies, and employee and customer engagement models.

Technologies that enable a distributed digital workplace provide the foundation for anywhere operations. This technology foundation comprises five building blocks:

- Collaboration and productivity
- Secure remote access
- Cloud and edge infrastructure
- Quantification of the digital experience

- Automation to support remote operations

## Why Trending:

Organizations that emerge successfully from the COVID-19 pandemic will have an anywhere operations foundation. Organizational preparedness and resilience to cope with the crisis depend largely on the maturity and readiness of digital capabilities. The 2020 Gartner CEO Survey indicates that before COVID-19, half of responding CEOs expected a downturn. <sup>1</sup> However, only 9% braced for the impact. The crisis has accelerated plans for digital transformation and digital workplace initiatives that organizations either put on hold or defunded:

- Most of the infrastructure and operations leaders at a virtual Gartner forum said they resumed their plans to roll out cloud services for employee collaboration and digital experience monitoring, in addition to zero-trust security capabilities. <sup>2</sup>
- In a Gartner poll of 317 CFOs and finance leaders, almost a quarter of respondents said they would move at least 20% of their on-site employees to permanent remote positions. <sup>3</sup>
- Fifty-seven percent of heavy manufacturing respondents of the 2021 Gartner CIO Survey indicated that they would be spending new or additional funding for cloud services/solutions (i.e., SaaS, PaaS, IaaS) in 2021, compared to 2020.
- Seventy-three percent of the heavy manufacturing respondents of the 2021 Gartner CIO Survey had already deployed a digital workplace to support working from home, while another 18% indicated they would deploy it within the next 12 months.
- Demand for digital services increased because of stay-at-home orders and physical distancing norms caused by COVID-19. Organizations that moved to digital business models to support their customers and employees have rebounded faster than others.
- Large manufacturers such as Ford have already announced that they won't return to a normal office environment and that 30,000 employees could choose whether to return to the [office](#). <sup>4</sup>

## Implications:

For manufacturers, creating a blend of on-site work with people who are physically remote will greatly improve flexibility of operations and potentially create a new pool of talent. For instance, Phantom Auto, a remote operations software platform, now allows logistics firm [GEODIS](#), to let workers operate forklifts from hundreds of miles away. <sup>5</sup>

The workplaces of the future will evolve in response to the pandemic, regardless of whether they're offices for knowledge workers or automobile manufacturing plants. The changes will include the adoption of remote support technologies using mobile devices, wearables and augmented reality headsets. Some companies like Dow are relying on video inspection to reduce travel expenses. <sup>6</sup>

Contactless and passwordless interactions using IoT sensors, smart cards enabled by near-field communication and wearables will become the norm for mundane transactions such as unlocking physical access to restricted spaces and devices, operating machines or moving materials and tooling.

#### Actions for CIOs:

- Enhance employee experience in a perimeterless work environment using digital experience monitoring, endpoint analytics, self-service provisioning and remote troubleshooting tools.
- Enable frontline workers to be productive by giving them augmented reality wearables for remote support and voice-controlled collaboration tools.
- Adopt team structures, processes, skills and tools to drive business model innovation using a digital-first, location-independent strategy.
- Invest in distributed cloud and edge technologies that enable the building of a blended workplace to seamlessly move work environments between physical and virtual locations.

#### Further Reading:

[4 Steps to Implement a Perimeterless Digital Workplace](#)

[Tool: Prepare I&O for the Everywhere Enterprise](#)

[I&O Leaders Must Transform Their Teams to Lead With SaaS Cloud](#)



## Autonomous Things

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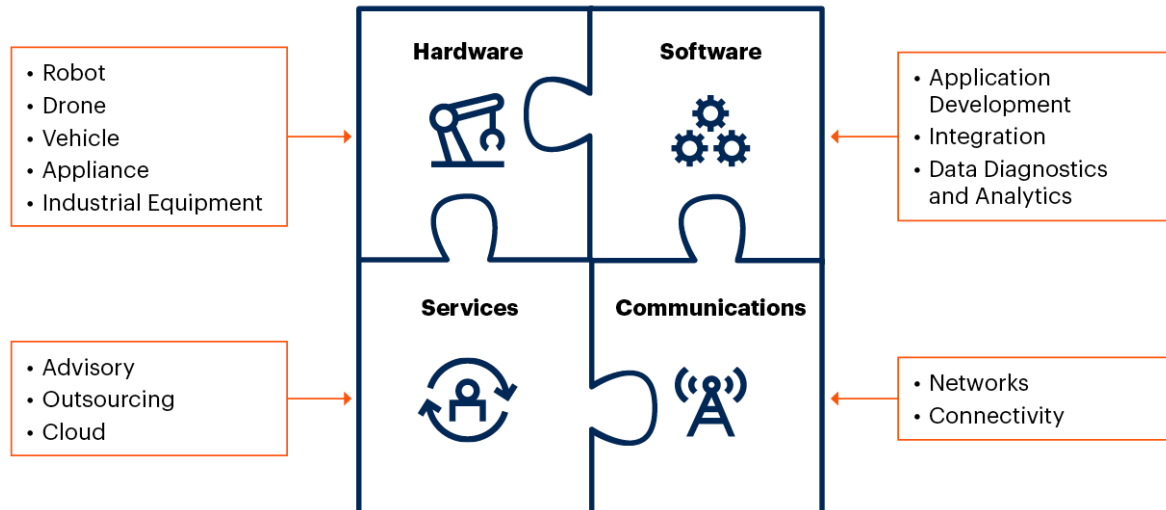
*Analysis by Jonathan Davenport, Michael Ramsey*

**SPA:** By 2026, the use of autonomous things will displace 25% of warehouse logistics operators such as forklift drivers.

**Description:** Autonomous things are physical devices that use AI to navigate their environment and automate functions previously performed by humans. Each physical device must be capable of operating without human supervision within a defined context or to complete a task, as shown in Figure 2. Automation of autonomous things goes beyond the automation provided by rigid programming models, and exploits AI to deliver advanced behaviors that interact more naturally with their surroundings and with people. For instance, this distinguishes them from conventional robots found across many production lines.

**Figure 2. Autonomous Things**

### Autonomous Things Ecosystem Building Blocks



Source: Gartner  
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**Gartner.**

### Why Trending:

Autonomous things have the potential to assist, replace or redeploy human workers, creating high – and occasionally transformational – business benefits. Though the concept of autonomous things is nascent, manufacturers have already displayed an appetite to take advantage of the benefits that can be delivered. Trials and proofs of concept have been undertaken, with autonomous things deployed for active use. Example of use cases include:

- **Robot:** Ford Motor Company uses autonomous robots to capture lidar images of its factory, which it uses to retool facilities. The pilot could enable the current \$300,000 operation to be undertaken for a fraction of the cost and ultimately help Ford to bring new vehicles to market sooner. <sup>7</sup>
- **Drone:** ZF's Industries implemented logistics-by-drone as part of its Industrie 4.0 initiative. These drone deliveries will decrease the amount of vehicle traffic at the plant and save time on the up to one kilometer-long delivery routes that are often on the upper floors of buildings. <sup>8</sup>
- **Vehicle:** Grupo Bimbo operates autonomous forklifts to automate the repetitive movement of finished products from wrapper machines to its warehouse, reducing the number of trips needed to move the goods through the warehouse, which increases efficiency and risk of congestion involved. <sup>9</sup>
- **Ship:** Yara International, the Norwegian fertilizer company, has commissioned an autonomous container ship as part of its vision for zero emissions. The electric vessel will replace 40,000 diesel truck journeys made transporting product from its Porsgrunn plant to the port at Larvik. <sup>10</sup>
- **Industrial Equipment:** Rio Tinto in Australia is using an autonomous drill system (ADS) that enables a remote operator to control up to four autonomous drill rigs from various manufacturers simultaneously, improving both the precision of the drill and equipment utilization. <sup>11</sup>

## Implications:

A new paradigm is emerging where the manufacturer's workforce will be made up of humans and autonomous things that collaborate together to do things more efficiently. For manufacturers, a complex ecosystem will emerge to source and manage these devices. The complexity lies not only with selecting vendors, but also writing software applications and integrating these solutions into enterprise systems.

Automation also will mean shifting the workforce from operational jobs to management jobs. Managing and maintaining the different autonomous things devices that are deployed to deliver different manufacturing-specific use cases will become an increasingly complex challenge. In particular, an important part of ensuring the successful collaboration of a human and machine workforce will require the different autonomous things' AI systems to be continuously trained in order to refine and improve the machine's operational ability.

#### Actions for CIOs:

- Align IT/OT/ET. Identify joint workgroups. Address technical and cultural aspects associated with autonomous things.
- Determine which use cases are most suitable for automation, based on cost savings and worker safety. Partner with both autonomous things ecosystem providers and broader IT/OT services companies. Bridge the skills and experience gaps that currently exist in most manufacturing organizations.
- Integrate autonomous things software platforms into mainstream workflows and processes by using a checklist of requirements during discussion with vendors (for example, access to SDKs and APIs).
- Prepare to redeploy workers in areas where automation will cannibalize jobs by creating a reskilling program to enable staff to undertake higher-value, higher-impact tasks.

#### Further Reading:

- [Autonomous Things Deployment: 5 Best-Practice Stages That Require Manufacturing CIO Leadership](#)
- [Autonomous Things Ecosystems Open Opportunities for IT Services Providers in Manufacturing](#)
- [Lessons From Mining: 4 Autonomous Thing Benefit Zones for Manufacturers](#)
- [Forecast Analysis: Autonomous Vehicle Net Additions, Internet of Things, Worldwide](#)
- [Cool Vendors in Autonomous Vehicle Systems](#)
- [Hype Cycle for Connected Vehicles and Smart Mobility, 2020](#)

## Hyperautomation

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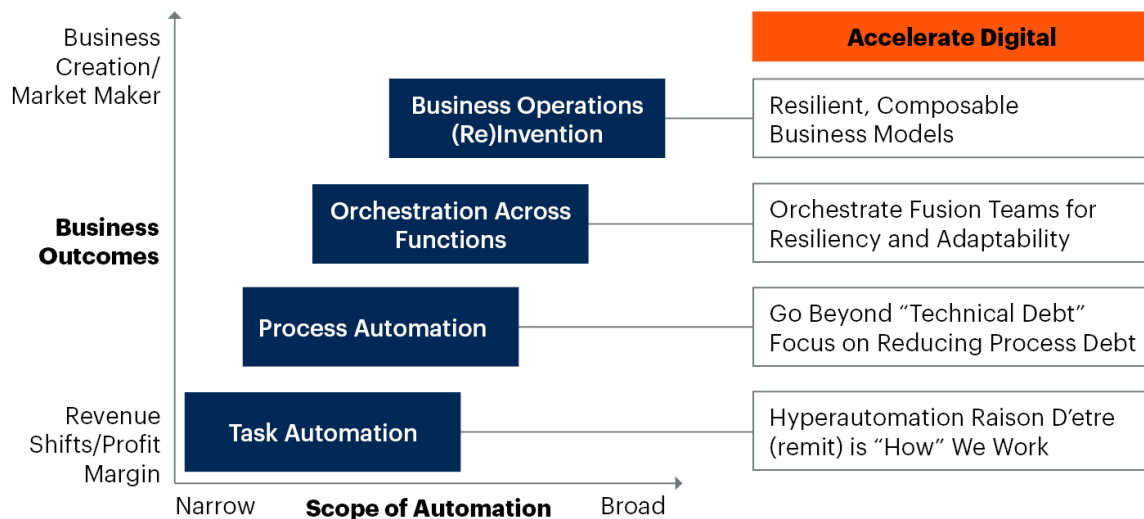
*Analysis by Marc Halpern and Dale Kutnick*

**SPA:** By 2025, manufacturers will lower operational costs by 10% by combining hyperautomation technologies with redesigned operational processes.

**Description:** Exploiting maturing digital technologies will enable most enterprises to further automate their internal and external operations to support digital acceleration in identified phases, as shown in Figure 3.

**Figure 3. Hyperautomation**

### Hyperautomation Principles are the Foundation for the “Future Work”



Source: Gartner  
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**Gartner**

### Why Trending:

Enterprises plan to accelerate automation of activities by exploiting repeatable transactional workflows that require minimal human involvement to improve efficiency. As robotics and AI technologies such as machine learning continue to mature and be used more broadly, hyperautomation will be applied to increasingly sophisticated tasks across product development, manufacturing operations, supply chains, sales and marketing, and customer service.

Hyperautomation shows great potential to remotely manage and control operations in far-flung geographies. The pandemic highlighted the fragility of human involvement in global operations and supply chains. Increasingly, hyperautomation can augment or replace humans for those requirements.

Executive leaders must increase resilience and flexibility while lowering costs, and they can increasingly do it via “onshoring” (or “nearshoring”) with hyperautomation techniques. By automating processes and exploiting predictive AI, a manufacturing plant can coordinate incoming parts, materials, ingredients for unloading, storing, assembling, processing, packaging and shipping products.

More standardization and interoperability of software across plants is a critical capability to support more remote management and control. Highly distributed, regional cloud data centers such as Amazon, Microsoft, Google, IBM, Alibaba, Tencent and others exploit this aspect of hyperautomation, not only to enable labor efficiencies, but to provide workload balancing, resiliency and “data localization” and meet citizen privacy requirements.<sup>12, 13, 14</sup>

#### Implications:

- Performance becomes more consistent, because different offices, plants and warehouses can be compared (based on products or services generated, customers engaged, energy consumption, quality controls, and so on).
- Product and process knowledge from product design through manufacturing and service becomes more explicitly owned by the company. When workers leave the company, the know-how doesn't leave with them.

#### Challenges:

- Full or even semiautomation requires sophisticated data collection, AI and algorithm capabilities, and the ability to apply them in a specific domain. This requires new skills and training in analytics.
- Hyperautomation requires more reliable levels of application integration and consensus on data flow and workflow than more manual processes require
- Effective AI requires good data to train the applications and monitoring to ensure that learning does not lead the AI application toward bad outcomes.

- Implementers must maintain flexibility to continually adapt the orchestration of these technologies as new enabling technologies emerge or business conditions change.
- Initial capital costs for retrofits in existing operations can be substantial.
- Displacing workers will often create ethical, legal and political challenges. Leaders must address employee concerns by sharing some of the gains in bonuses, benefits, stock grants and so on.
- Hyperautomation makes manufacturers more vulnerable to cyberattacks

## Actions for CIOs:

- Develop a three- to five-year aspirational vision that highlights business outcomes and reflects the use cases of digital technology in your industry.
- Start small, with a proof of concept. Create a simulated, replicated operating facility at or near headquarters or a major operations center to test and fine-tune the concept.
- Begin with repeatable processes and services where hyperautomation experience and expertise exists broadly.
- Plan for protection of hyperautomation by investing in cybersecurity technology and practices
- Orchestrate additional hyperautomation technologies that are interdependent, such as automating material and part orders.
- Develop a long-term plan for hyperautomation that describes goals and costs, and what the enterprise must accomplish at each stage before moving onto the next one.

## Further Reading:

- [Toolkit: Use AI Use Cases' Strategic Industry Maps in Your Planning](#)
- [Move Beyond RPA to Deliver Hyperautomation](#)
- [Three Steps to Hyperautomation](#)
- [Investing in Digital Infrastructure Will Defend Asset-Intensive Businesses From Digital Giants](#)

- [Magic Quadrant for Robotic Process Automation](#)

## Intelligent Composable Business

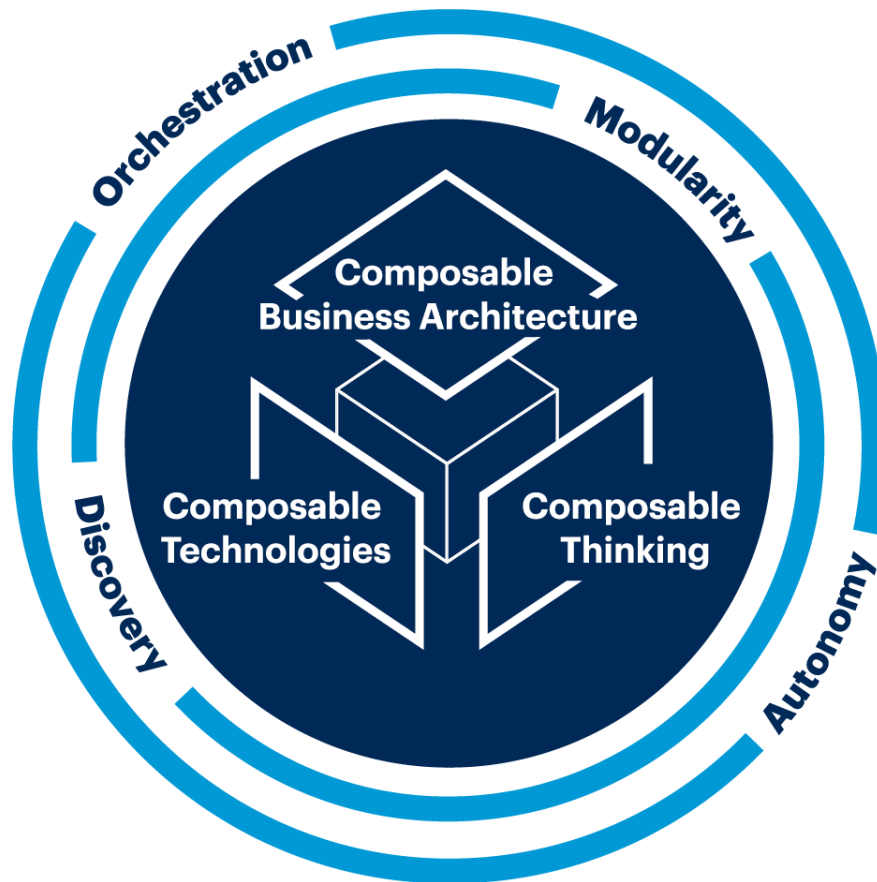
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*Analysis by Pedro Pacheco and Christian Hestermann*

**SPA:** By 2023, organizations that have adopted a composable approach will outpace competition by 80% in the speed of new initiative implementation.

**Description:** An intelligent composable business is one built around a modular corporate mindset with associated capabilities, as shown in Figure 4. It will include efficient orchestration of those capabilities to achieve goals, the foresight to identify the need for disruptive transformation, and the autonomy of different parts of the organization to trigger that transformation. This means the company's culture, organizational structure, governance and capabilities are reset in a way to rapidly embrace transformation and turn that into execution. Intelligent composable business should be progressively extended according to the business areas where transformation is most needed.

Figure 4. Intelligent Composable Business

**Composable Business**

Source: Gartner  
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**Gartner.**

**Why Trending:**

The disruption caused by the pandemic is motivating manufacturing companies to build agility in order to quickly respond to disruptive events. For example, the major chip shortage experienced by automakers in the beginning of the year is expected to cost them \$60 billion in revenue — something OEMs must quickly respond to. <sup>15</sup> At the same time, accelerating corporate transformation entails breaking the company's cultural barriers in order to enable disruptive change. For these reasons, manufacturing companies are increasingly focused on finding management concepts that allow them to not only be better prepared to deal with disruptive events, but also to trigger disruptive digital innovation. Intelligent composability is a game changer for partitioned systems — the composable, autonomous parts are faster, safer and more efficient to change and adapt than those in monolithic systems.



## Implications:

- Companies that effectively apply the concept of intelligent composable business will be able to unlock and convert more opportunities for disruptive innovation. These organizations will also be able to achieve greater speed of response and agility in dealing with external disruptive events.
- More efficient use of resources and capabilities. Instead of operating under silos and rigid structures that limit the flexible deployment of these capabilities, intelligent composable businesses will be able to allocate resources around the opportunities to create disruption.

## Actions for CIOs:

- Redefine the company's structure and processes (including major production platforms like PLM, ERP, SCM or MES) under the premise that disruption is the norm, to shrink the time gap between the detected need for business change and the response. However, bear in mind that this is a long-term and considerable investment that demands a lot of commitment from the company's leadership.
- Orchestrate the mix and match of different business functions to achieve transformational goals by developing cross-functional teams focused on jointly delivering business outcomes.
- Create a business architecture featuring modular capabilities that can be flexibly deployed as demanded by the need for business change.
- Create mechanisms to support agents of change in quickly turning ideas into proofs of concept and, once vetted, moving them into the "go to market" phase.

## Further Reading:

- [Innovation Insight for Composable Business for Manufacturers](#)
- [Quick Answer: What Is Composable Business Architecture?](#)
- [Predicts 2021: Enterprise Architecture Designs the Composable Organization](#)
- [Strategic Architecture Roadmap for Composable Enterprise Applications \(Presentation\)](#)

- Use Gartner's Reference Model to Deliver Intelligent Composable Business Applications

## Smart Factory

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*Analysis by Simon Jacobson*

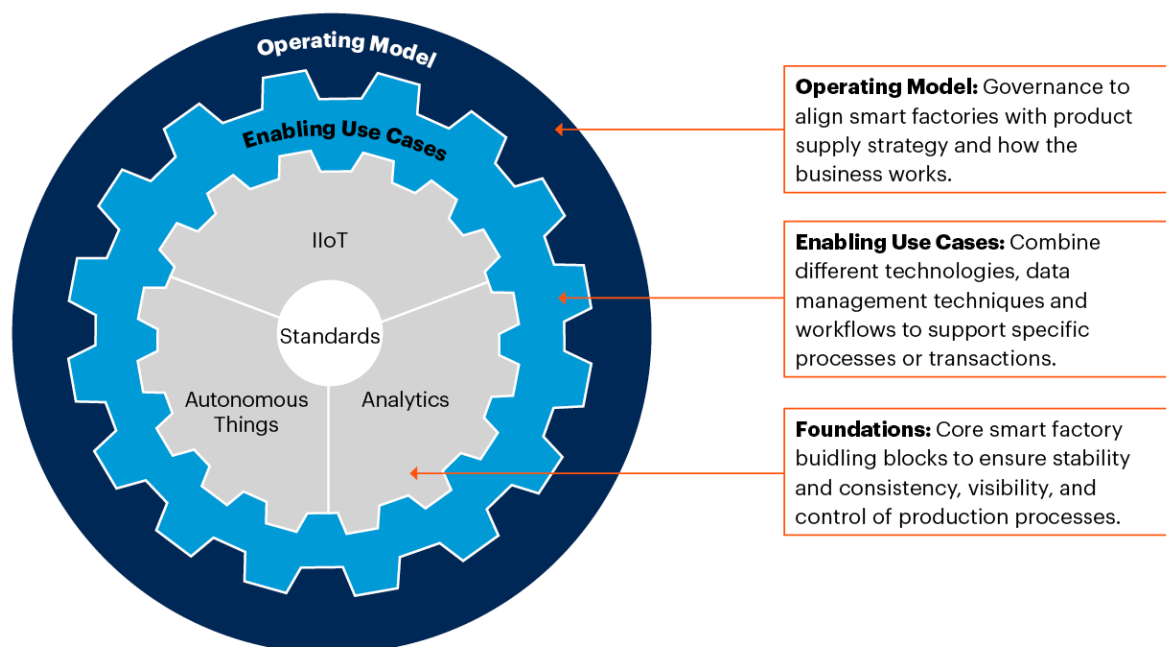
SPA: By 2025, three out of five manufacturers' smart factory initiatives will stall from a lack of supply chain integration.

### Description:

The smart factory is a concept that is used to describe the combination of existing and modern technologies with standard work to create a hyperflexible, self-adapting manufacturing capability, as shown in Figure 5.

**Figure 5. Smart Factory**

### Smart Factory



Source: Gartner  
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## Why Trending:

The digitization of manufacturing operations has catalyzed applications of technologies to improve operational excellence and flexibility by adapting production processes to take on more orders, meet shifting market requirements, or support newer and more complex products. This raises the profile of smart factories as a platform to deliver reliable supply from efficient operations.

Smart factories have wide appeal with companies such as Schneider Electric, Lenovo, Henkel, Unilever, Haier, Mercedes-Benz and Johnson & Johnson.<sup>16,17,18,19,20,21, 22</sup> Each has done so as part of a broad digital transformation that reflects Industrie 4.0, digital supply chains and smart manufacturing ambitions. Often CIOs will partner with stakeholders in manufacturing, supply chain, engineering and IT.

## Implications:

- Smart factories are an opportunity to create increased competitiveness and cultivate new forms of productivity, flexibility and human interactions, all while simultaneously minimizing risk and either maintaining or improving performance. Beware of smart factory initiatives becoming “technology projects at sites” that are not orchestrated as part of an end-to-end supply chain network design. Otherwise, tactical wins at the site level risk resulting in constraints for product supply, creating cost and complexity for the business.
- Not all use cases will feature a high level of automation at first. Over time, it is anticipated that automation levels will grow and levels of self-configuration will increase. However, in many instances, a redefinition of standard work proving the value of the use case must come first.<sup>23</sup>
- Smart factories are the future of production. They offer an opportunity to leverage different technologies — cloud computing, AI and edge — to simultaneously minimize risk, increase competitiveness, and innovate production processes and human interactions. Ultimately, smart factories will play a role in enabling new ecosystem models, such as direct to consumer (DTC), or different capacity orientations like mobile factories and asset-light or lights-out factories.

## Actions:

- Obtain quick, measurable and visible returns using operational excellence as the short-term burning platform. Leveraging quick and measurable reductions in variability will prove value for initiatives and create performance baselines.
- Avoid a digital black hole by using a supply chain strategy cascade that describes and quantifies the smart factory's intended impact to the business. This establishes the governance that defines the touchpoints between factory, supply chain priorities, methods, business objectives and quantifiable business outcomes.
- Extend governance to workforce development by creating hybrid teams that blend stakeholders across IT, operational technology (OT), engineering technologies (ET), supply chain and HR functions. This will help communication and upskilling and create the alignment for both new ways of working and scale.

#### Further Reading:

- [Innovation Insight for Smart Factory](#)
- [Make Smart Manufacturing Work by Knowing These Benefits and Challenges](#)
- [Scale Smart Manufacturing With a Clear Innovation Strategy](#)

## Evidence

Gartner's 2021 Digital Worker Experience Survey was conducted online during November and December 2020 among 10,080 respondents from the U.S., Europe and APAC. Participants were screened for full-time employment, in organizations with 100 or more employees and were required to use digital technology for work purposes. Ages range from 18 through 74 years old, with quotas and weighting applied for age, gender, region and income, so that results are representative of working country populations. Digital technology includes any combination of technological devices (i.e., laptops, smartphones, tablets), applications and web services that people use for communication, information and/or productivity

The 2021 Gartner CIO Survey was conducted online from 14 July 2020 through 14 August 2020 among Gartner Executive Programs members and other CIOs. Qualified respondents were each the most senior IT leader (CIO) for their overall organization or a part of their organization (for example, a business unit or region). The total sample was 1,877, with representation from all geographies and industry sectors (public and private), including 111 heavy manufacturing respondents. The survey was developed collaboratively by a team of Gartner analysts, and was reviewed, tested and administered by Gartner's Research Data and Analytics team. *Disclaimer: Results do not represent "global" findings or the market as a whole but reflect sentiment of the respondents and companies surveyed.*

Gartner conducted the 2020 Gartner CEO and Senior Business Executive Survey from September through December 2019 to examine CEO and senior business executive views on current business issues, as well as some areas of technology agenda impact. Gartner qualified and surveyed 444 business leaders via an online survey (362), an additional 70 surveys were done by telephone interview and 12 were self-administered paper surveys. All respondents were screened for active employment in organizations greater than \$50 million in annual revenue. The survey was developed collaboratively by a team of Gartner analysts that examines technology-related strategic business change, and was reviewed, tested and administered by Gartner's Research Data and Analytics (RDA) team. The results of this study are representative of the respondent base and not necessarily business as a whole.

<sup>1</sup> [2020 Gartner CEO Survey: The Year of Recession](#)

<sup>2</sup> On 31 March and 1 April 2020, Gartner hosted a virtual forum for 49 heads of I&O based in North America for their response to the COVID-19 pandemic. Gartner asked the participants: "Has COVID-19 enabled you to accelerate planned initiatives?" Most of the 29 respondents said, "Yes." The survey sample was small, so view the results as indicating a direction only.

<sup>3</sup> [Gartner CFO Survey Reveals 74% Intend to Shift Some Employees to Remote Work Permanently.](#)

<sup>4</sup> [Iconic American Automaker Ford Motors Says Employees Can Work From Home 'Indefinitely' With Their New Redesigned Hybrid in-Office and Remote Model, Forbes.](#)

<sup>5</sup> [Remote-Controlled Forklifts Have Arrived in France, Courtesy of Phantom Auto, Tech Crunch.](#)

<sup>6</sup> [Post-COVID Future Manufacturing Workforce](#), Design News.

<sup>7</sup> [No Bones About It: Ford Experiments With Four-Legged Robots, to Scout Factories, Saving Time, Money](#), Ford Motor Company.

<sup>8</sup> [ZF Is First in Germany to Fly Drones Over Plant Premises](#), ZF Industries.

<sup>9</sup> [Case Study: Grupo Bimbo](#), Asti Mobile Robotics.

<sup>10</sup> [The World's First Electric Autonomous Container Ship to Set Sail in Norway](#), CleanTechnica.

<sup>11</sup> [Rio Tinto Orders Robot Trucks, Drills For Digital Mine](#), iTnews.

<sup>12</sup> [Asian Paints Deploys Sight Machine for Digital Transformation of Manufacturing](#), PR Newswire.

<sup>13</sup> [Deepmind AI Reduces Google Data Centre Cooling Bill by 40%](#), DeepMind.

<sup>14</sup> [Georgia-Pacific Optimizes Processes, Saves Millions of Dollars Yearly Using AWS](#), IndustryWeek.

<sup>15</sup> [How COVID Led to a \\$60 Billion Global Chip Shortage for Automakers](#), CNBC.

<sup>16</sup> [How Schneider Electric Is Making Its Factories Smarter](#)

<sup>17</sup> [Video: Lenovo's Smart Manufacturing, Good to Great — Are You Ready?](#)

<sup>18</sup> [Video: Henkel — Industry 4.0](#)

<sup>19</sup> [Production Systems 2025: Rewriting the Working Systems for Industry 4.0](#)

<sup>20</sup> [4 Tactics for CSCOs to Shift Manufacturing From a Cost of Doing Business to a Competitive Weapon](#)

<sup>21</sup> [Alabama Mercedes Plant Among First in World to Use Innovative Production System](#), Alabama NewsCenter.

<sup>22</sup> [Video: J&J Manufacturing for the Future — Enhancing Customer Value Through Innovation and Digitalization](#)

<sup>23</sup> [Apply Bimodal to Achieve the Next-Level Benefits of Smart Manufacturing](#)

## Acronym Key and Glossary Terms

ADS	Autonomous drill system
AI	Artificial intelligence
API	Application programming interface
CX	Customer experience, which includes understanding several dimensions of customers: wants, needs, expectations, beliefs, feelings and past experiences
ERP	Enterprise resource planning
ET	Engineering technology, which is used to define, design, simulate, analyze, visualize and validate
EX	Employee experience, which includes increased employee satisfaction, retention, skill level and productivity
IaaS	Infrastructure as a service
IoT	Internet of Things
IT	Information technology, which is used to record transactions and business processes
MES	Manufacturing execution systems
OEM	Original equipment manufacturer
OLA	Operational-level agreement
OT	Operational technology, which is used to operate and monitor
PaaS	Platform as a service
PLM	Product life cycle management
R&D	Research and development
SaaS	Software as a service
SCM	Supply chain management
SDK	Software development kit
SLA	Service-level agreement



## Document Revision History

[Top 10 Strategic Technology Trends for Manufacturing Industries - 17 July 2019](#)

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[2021 Top Trends in Manufacturing Industries](#)

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Table 1: Trend Profiles: Click links to jump to profiles.

Location Independence	Resilient Delivery
<a href="#">Anywhere Operations</a>	<a href="#">Hyperautomation</a>
<a href="#">Autonomous Things</a>	<a href="#">Intelligent Composable Business</a>
	<a href="#">Smart Factory</a>

Source: Gartner (June 2021)