AT&T Business

Realizing the factory of the future in manufacturing

How investments, training, and new technology help overcome daily challenges and realize ROI

Introduction

Innovation is paramount in modern manufacturing, but even the most ambitious manufacturers struggle with the technology, infrastructure, and executive support they need to realize their goals.

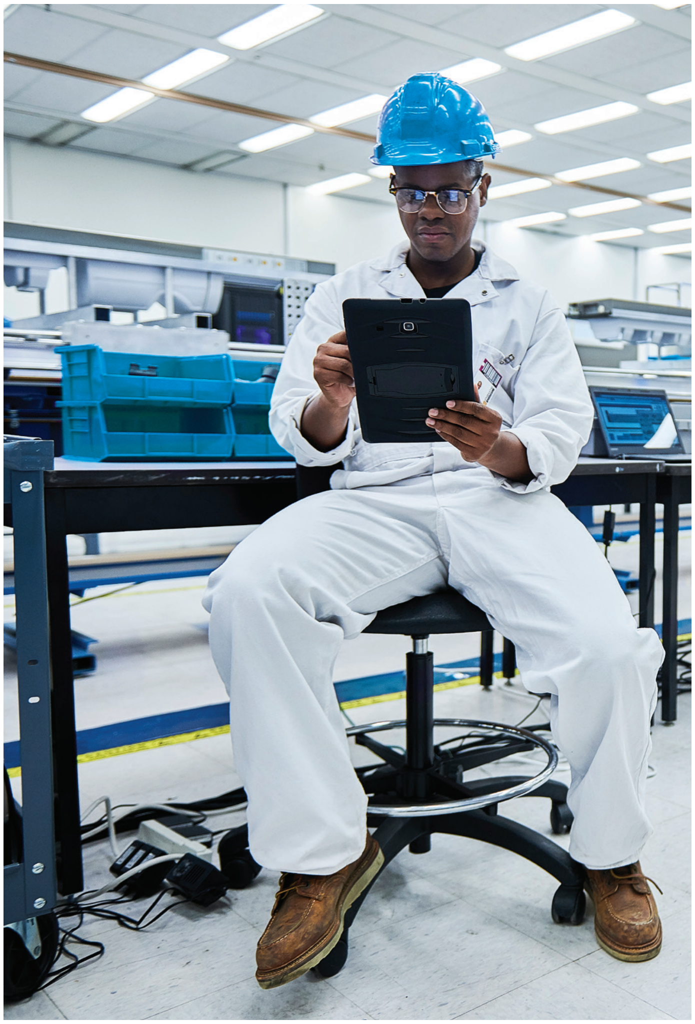
Corporate, IT, operations, and floor management teams are experiencing these effects on the factory floor, where they are working to create a better foundation for new technology adoption. This includes new investments in infrastructure, greater investments in core training, and a willingness to evolve their factory-based technologies.

Manufacturers are aligning these priorities with new revenue opportunities, transforming their product offerings, and building more direct models for engaging with customers. They have prioritized next-gen solutions – including predictive maintenance, integrated communications, and IoT infrastructure – to close inefficiency gaps and innovate product development. But they need executive buy-in to get there.

Manufacturers are setting their sights on IoT

IoT infrastructure is most-cited as the primary "Industry 4.0 disruptor" in manufacturing (16%), and most-cited as the number-one technology or capability manufacturers require to transition to the "factory of the future" (29%). More manufacturers are prioritizing its adoption in the next 24 months (49%) than any other technology in the study.

In this *Connected Manufacturing Forum 2018 Industry Report*, senior leadership at SMB-to-enterprise sized manufacturers share their top priorities and pain points for revenue and technology investments, future objectives, and concerns for the stability and growth of their organizations. The result is a benchmark analysis and model for future developments in the industry – as told directly by industry professionals.



Key insights from the research include:

- More manufacturers identify **factory-based technology** (25%) as their first-priority revenue investment than any other in the study.
- A plurality of process manufacturers (30%) claims **investing in the innovation of products to produce new revenue streams** is their single top priority.
- Half of manufacturers are concerned they will have **no executive support** for their technology investments. 49% are concerned they will **take too much time to realize ROI.**
- Only 47% of manufacturers somewhat (30%) or strongly agree (17%) they have **the right skilled personnel in place to adopt new IoT.**

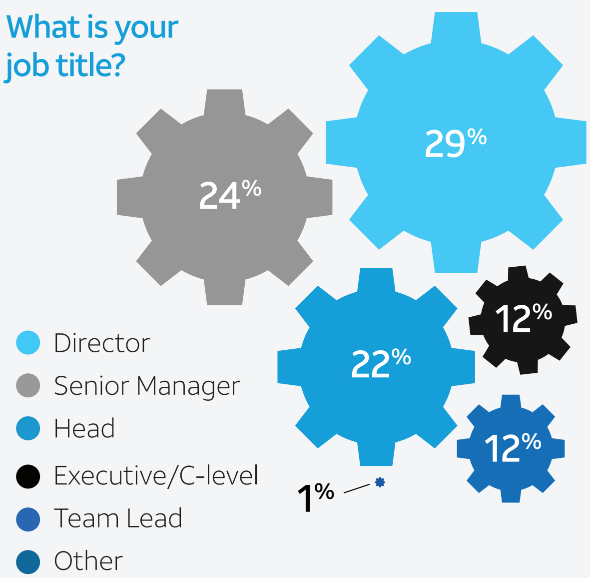
About the study

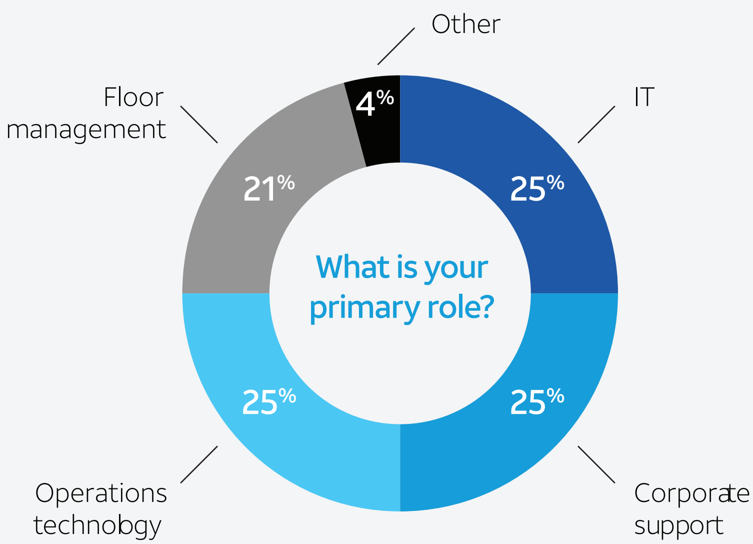
AT&T Business collaborated with the Connected Manufacturing Forum and the WBR Insights research team to survey 100 business leaders in both process and discrete manufacturing. Companies in the study include leading brands in their industries, providing deep insights into the day-to-day objectives and pain points of today's manufacturers.

Sixty-three percent of respondents hold leadership positions, including C-level (12%), heads of departments (22%), and directors (29%) at these companies. Most remaining respondents are senior managers (24%). Twelve percent are team leads, and 1% have some other title.

Respondents are neatly divided in terms of their primary roles. The most common roles among respondents are **corporate support** (25%), IT (25%), and **operations technology** (25%). Twenty-one percent have roles in **floor management**, and 4% claim to have some other role.

Most respondents come from mid-market or enterprise companies equipped to prioritize next-gen solutions and align them with new revenue opportunities. Fifty-two percent of manufacturers make at least $250 million in annual revenue, including 27% that make over $1 billion.





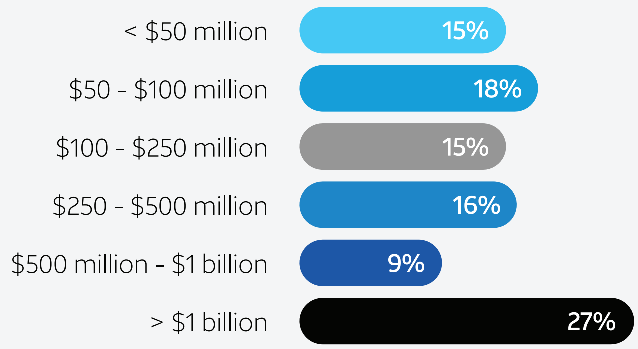
46%

of respondents have either Operations Technology or Floor Management roles.

Most others make between $50 million and $250 million, and 15% of manufacturers make less then $50 million.

The core objective of the report is to establish key pain points, levels of maturity, and individual insights among key figures in manufacturing operations as they transition into their own ideal ‘factory of the future’ models. The report includes direct quotes from industry leaders, some of which are shared anonymously.

What is your company’s annual revenue?



Benchmarking challenges in day-to-day operations

For large scale manufacturing operations, everyday problems such as managing workload and completing target objectives on time are considerable challenges. Inefficiencies in this regard increase pressure and hamper future commitments to delivery. Manufacturers’ factory solutions need to be modified regularly, but keeping up with newer innovations and providing upgrades – even infrequently – is difficult when teams lack effective parts and components at an inventory level.

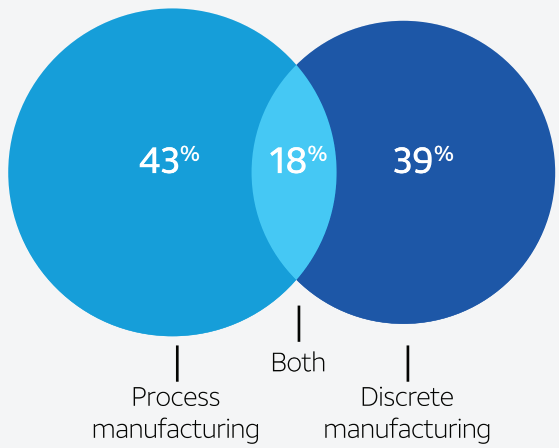
Innovative solutions call for investments that can take a toll on overall budgets for manufacturers. This impact “cannot be denied when dealing with models that require higher inputs,” says one respondent. Innovation requires time and cost, barring which manufacturers are unable to provide the advanced solutions they need to remain competitive.

Researchers set out to identify trends by determining the variations in major pain points between types of manufacturers. They observed the differences between process and discrete manufacturers directly, and asked the same questions to manufacturers that do both types of manufacturing.

Forty-three percent of respondents represent process manufacturers and 39% represent discrete manufacturers. The remaining 18% do both.

Among those involved in both process and discrete manufacturing, a small segment of overall respondents report that it’s a top priority to **integrate design, factory operations, life cycle management, and the supply chain** (33%) together, exceeding all other options by 16% (see chart).

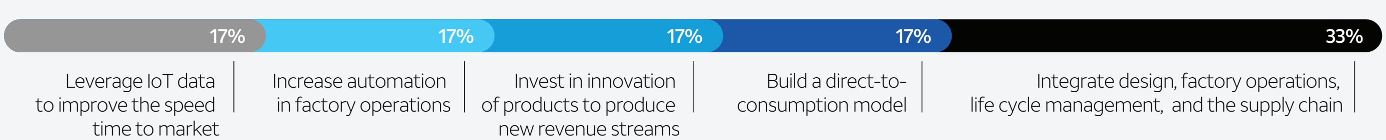
What type of manufacturing is your organization?



In addition to being a top priority for a plurality of these manufacturers, integrating design, factory operations, life cycle management, and the supply chain is the median priority among both exclusive process and discrete manufacturing segments.

While this indicates top priorities may be unique to each type of manufacturer, all manufacturers are working to integrate methods and services for faster processing and greater transparency across teams. This allows them to execute more cost-effective measures, deal with suppliers and clients more effectively, and apply strategies after more detailed consideration. Integration also eliminates concerns that arise from communications breakdowns.

Since you’re involved in both process and discrete manufacturing, what is your top priority?



Aligning priorities in process and discrete manufacturing

Researchers requested the same information from manufacturers exclusively engaged in either process or discrete manufacturing. There were greater variations in prioritization between each segment, and within each segment itself.

Process manufacturers are prioritizing new revenue through product innovation.

Among those involved in only process manufacturing, a plurality (30%) claim **investing in the innovation of products to produce new revenue streams** is their single top priority. Only 15% of discrete manufacturers consider this their top priority.

Process manufacturers are researching technology to streamline fulfillment and data management solutions, then encouraging team members to "innovate by nature" by experimenting with new, potential solutions for customers. According to one respondent:

> "There is constant pressure to meet deadlines, with regular products and customized ones as well. Since we carry a varied range of products, managing and scheduling becomes tougher with higher order volumes. Granted, this is an expected scenario with day-to day-operations, but tricky none the same."

Director of Operations Technology, mid-size process manufacturer

Among those involved in only discrete manufacturing, a plurality (28%) claim **building a direct-to-consumption model** is their single top priority. Only 16% of process manufacturers share that perception, indicating discrete manufacturers have greater financial incentives for building more distinct relationships with end customers.

As we will find, 11% of all manufacturers consider direct-to-consumer sales the primary 'Industry 4.0' disruptor – a large share of respondents choosing among 14 options.

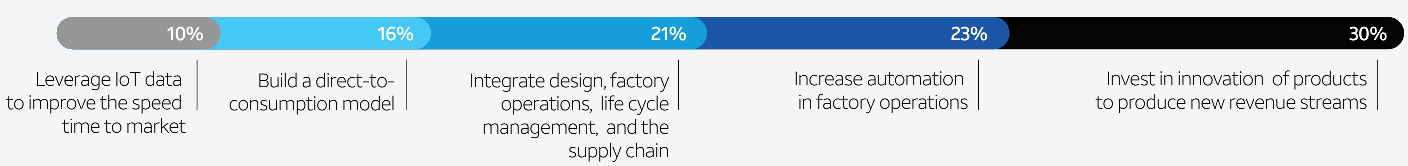
Despite their differences, manufacturers in all three segments share some priorities to similar degrees. In addition to integrating design, factory operations, life cycle management, and the supply chain, all manufacturers continue to struggle with manual operations that are difficult to automate. **To address this challenge, increasing automation** is the top priority for a large share of process manufacturers (23%), discreet manufacturers (19%), and those that do both (17%).

Discrete manufacturers are prioritizing customer engagement with direct-to-consumption models.

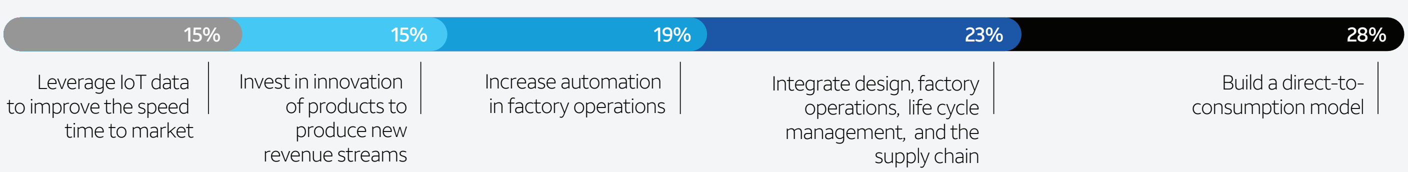
No matter the type manufacturing, "it is [impossible] to totally escape technical glitches altogether," says one senior manager at a nationally recognized automotive company. "With automated functions and applications, schedules have been modified, but some instances are not totally avoidable."

Now manufacturers are transitioning conceptual ideas into working models by gradual trial, testing, and prototyping. This is a continuous process, especially with customized designs that have specific purposes. As we will find, developing factory-based technologies is among manufacturers' top priorities in terms of driving future revenue.

Process manufacturers, what is your top process manufacturing priority?



Discrete manufacturers, what is your top discrete manufacturing priority?



Prioritizing growth and business stability

Researchers asked respondents to prioritize their upcoming revenue-driven investments. Among six answer choices and six rankings in terms of priority, “1st” represents each manufacturer’s highest-priority revenue investment and “6th” represents its lowest-priority revenue investment.

Factory-based technology

Among the options, more manufacturers identify factory-based technology as their highest priority, more (25%) than any other in the study.

Larger manufacturers already use robotics and integrated automation to speed up factory progress, but may lack effective technologies for improving communication and sharing information across factory floors and other networks. Manufacturers claim they frequently check the market for newer communication technologies and measure their feasibility in their company structures.

Business development and marketing

Business development and marketing is the second-most common 1st priority (19%) and a common 2nd priority (19%) for respondents. An accelerated increase in communication methods to meet order fulfillment and provide value-added service to customers is one pathway to business development. “We are progressing rapidly and look to add to these measures for more business opportunities across the globe,” says one respondent.

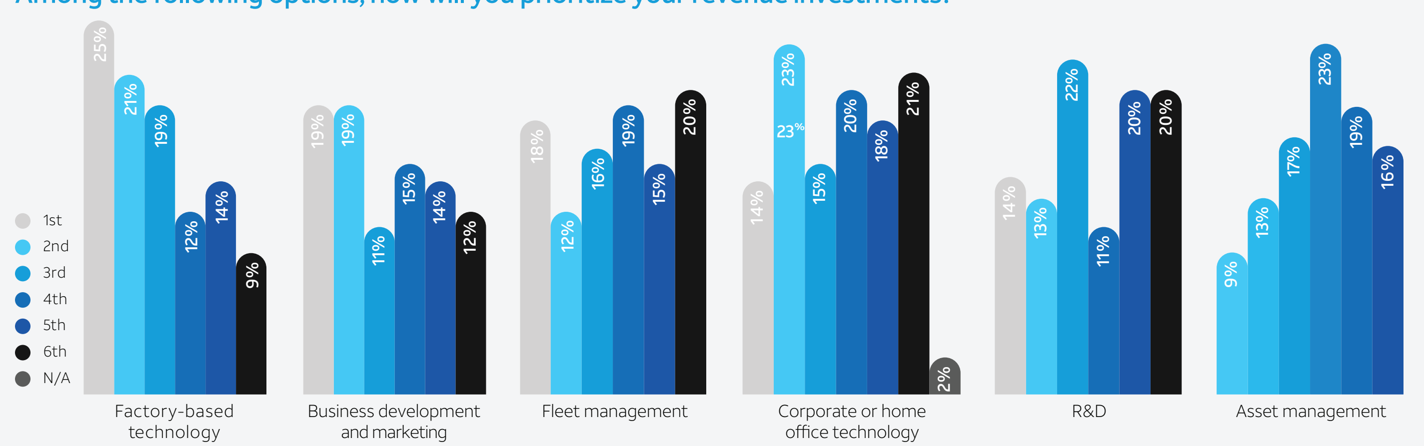
Respondents also express interest in connecting sales force and marketing communications with expertise from the factory floor. This would empower those teams with greater product and process insights when engaging the market.

Fleet management

Manufacturers prioritize methods and services that offer transparency and are more integrated for faster processing means. This includes plant, inventory, and fleet management.

But manufacturers have varying opinions about fleet management. They most commonly identify it as a 1st (18%), 4th (19%), or 6th (20%) priority, indicating differences in sophistication or necessity for fleet management technologies. Still, most somewhat agree (43%) or strongly agree (11%) that fleet management is important to their manufacturing decisions.

Among the following options, how will you prioritize your revenue investments?



> “Most companies are global now, so when you’re talking about technology [adoption], the first thing to consider is if the technology is available around the world. … You want to ensure you’re speaking to reputable companies who have been using that technology you’re thinking about adopting … You want to do your own studies and evaluations of different suppliers, because what may work for one company may not work for yours.”
>
> *Eddie Smith, Director of Operations, Kuhn Krause*

Corporate or home office technology

Respondents most commonly identify corporate or home office technology as their 2nd (23%), 4th (20%), or 6th (21%) priority as a revenue investment. Some manufacturers are already advanced in both their inter-office dealings and factory solutions. "I would say we are maintaining an overall balance where communication is concerned among different channels," says one respondent.

Research and Development

R&D is most cited as respondents' third-highest priority (22%), suggesting it is a long-term priority for almost one quarter of manufacturers. However, 20% of manufacturers consider it their lowest priority.

"I think running the operations and research units with budget constraints is one difficult factor to go about," says one respondent. "The cost structures are complex and dealing with eventualities poses problems where intense research is concerned."

Manufacturers struggle to get their research budgets or deadline extensions approved, while others can constantly improve techniques and apply best measures with daily activities, whether in a research capacity or on the factory floor. This creates disparity in how well manufacturers progress in developing greater efficiencies and new revenue opportunities.

Asset Management

Asset management is cited least as manufacturers' first priority in terms of revenue investments (9%), but 78% either somewhat (69%) or strongly agree (9%) that asset management and tracking are business-critical capabilities.

> "We have a wide range of products lined for production on a daily basis; and if you ask me, a single pain point of our operations is ensuring that materials and tools are readily available to the workforce, along with the rest of the kit for assembly and verification lines."
>
> *Operations Technology Executive, mid-market discrete manufacturer*

Manufacturers may struggle to optimize or fully utilize the capabilities of operational resources when working in asset management. This is also true of technological inclusions in manufacturing processes – not limited to the factory floor. But technology and revenue investments aside, most manufacturers acknowledge that the knowledge and utility of their workforces best determine their long-term success.

In high-demand, technology-driven markets, delivering quality products and maintaining deadlines are taxing on manufacturers' workforces. Respondents indicate they have trouble both managing their obligations due to limited resources and motivating their workforces so they can achieve desired outputs.

Achieving stability and growth hinges on the knowledge and development of the workforce.

In terms of the stability and growth of their business, manufacturers identify the **cost of government regulations on manufacturing** (60%) and a **workforce shortage and aging workforce** (54%) as their biggest concerns – the only two majorities in the study.

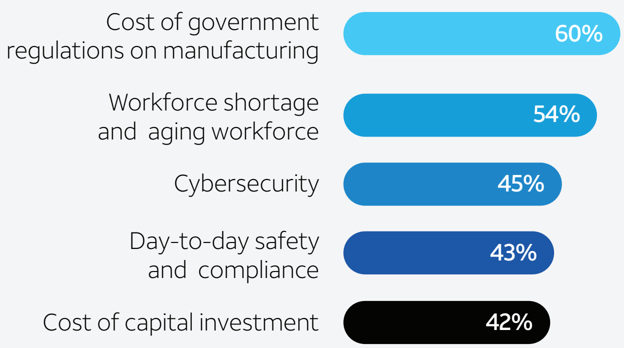
These are common problems that slow down growth, as do changing laws that are location-specific, greater training needs for improved manufacturing capabilities, and cost instability. **Day-to-day safety and compliance (43%)** and **cost of capital investments (42%)** are also of concern to nearly half of respondents.

It's challenging to develop a skilled workforce that is trained to understand safety and security measures during production. According to manufacturers, they may not even have the staff to handle daily requirements during times of heavy demand.

One respondent recommends improving communication between teams to share specifications and strategies that could improve the company's safety, security, and productivity. This could be set in action after determining shareable and secure data, then creating networking options for employees based on skillset, priority, designation, and others.

Network protection itself is a top priority for manufacturers. Forty-five percent of respondents claim one of their primary concerns for the stability and growth of their businesses is cybersecurity. As we will find, 41% of manufacturers are prioritizing adoption of leading cybersecurity in the next 24 months.

What are your primary concerns for the stability and growth of your business?



Altogether, respondents' single greatest concerns are vulnerabilities in:

- **23%** third-party vendors accessing their networks
- **18%** devices that are connected to their networks
- **18%** remote access points into their operations

Keeping a close eye on cybersecurity and methods of protecting privacy options has become critical for both manufacturing units and overall processes. For one manufacturer, even their security team, which 'does a great job,' must ensure that all measures are in place on a daily basis. As manufacturers look to improve their foundations for new technology adoption, they must deliberate on security concerns and executive support before improving their communication infrastructures.

Cybersecurity is a multi-dimensional problem threatening manufacturers' stability and growth.

Making a business case for new technology adoption

When it comes to future technology investments, manufacturers are most concerned with winning the confidence of executives and delivering on their ROI expectations. Half of manufacturers are primarily concerned they will have **no executive support** for their technology goals, and nearly half (49%) are primarily concerned that the technologies they need will **take too much time to realize ROI.**

Similarly, 45% of respondents fear their technology investments **won't be prioritized or align with their business goals.** Another 45% worry **too much cost or a lack of funding** will hold them back.

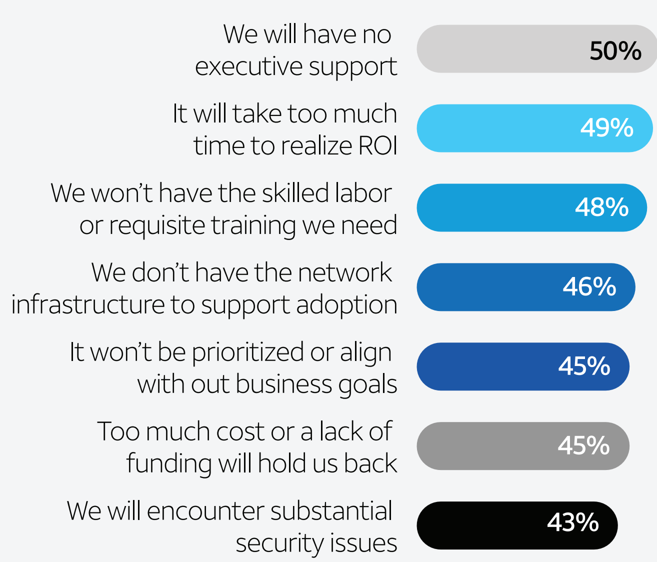
The success of new technology investments also hinge on teams' capacities to support new processes. Uncertainties in this area affect executive buy-in and delivery on anticipated ROI. Investing in skilled labor and core training is critical to creating a better foundation for new technology adoption and nearly half (48%) of manufacturers are concerned they won't have them.

One respondent highlights their difficulties in combining training modules of the latest technologies while managing day-to-day workloads, for example, claiming it is taxing to management and employees.

Notably, anxieties about skills shortages are most often related to IoT adoption as manufacturers transition towards their own 'factory of the future' models.

Fewer manufacturers are concerned about the remaining technology investments, but with evidence they're working towards solutions. Among those that claim they **don't have the network infrastructure** to support adoption, many are investing in infrastructure to create a better foundation. Similarly, among manufacturers concerned they will encounter **substantial security issues,** many are prioritizing adoption of leading cybersecurity in the next 24 months.

What are your primary concerns about investing in technology?



Facing inadequacies in skills and technologies

Respondents' concerns about executive support and ROI stem from an existing lack of technology performance. Less than half of respondents agree that they have the technology they need to be competitive.

Only 47% of manufacturers agree that they have the right skilled personnel in place to adopt new IoT – the lowest response among seven options. As stated, nearly half of respondents claim they lack sufficient skills and training in general.

Internet of Things is most cited as the number one technology or capability required to transition to the factory of the future (29%). But realizing its adoption includes acquiring the right skillsets among team members. The majority of respondents believe they do not have them at present.

Almost one-quarter of manufacturers claim a **modern network infrastructure** (24%) is the number one technology or capability they require to transition to the factory of the future. They identify improved infrastructure as a foundation for not only technology adoption but executive support.

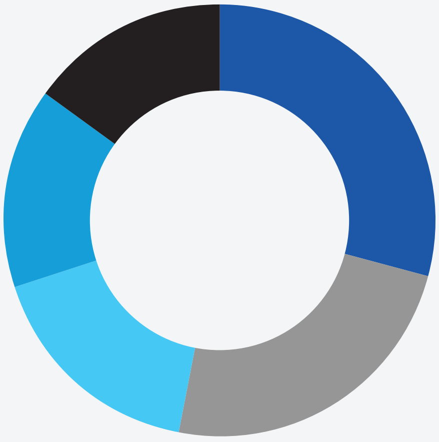
> "
> **When we talk about future technology investments in my factory, we consider equipment and processes that lead to quality and safety improvements, and reductions in cost and time.**
> "
>
> *Antonio Paesano, Ph.D., Materials, Process, and Physics Engineer, Manufacturing Research and Development at Boeing Research and Technology, Rotorcraft Systems*

Seventeen percent feel this way about **cloud virtualization and related technologies.** Fortunately, most manufacturers agree that IT and OT have united objectives for digital optimization (64%), and most agree that they are prepared to evolve their current technology infrastructure (57%) – each of which will contribute to those needed changes.

Manufacturers are maturing their technology infrastructure with the adoption of next-gen solutions.

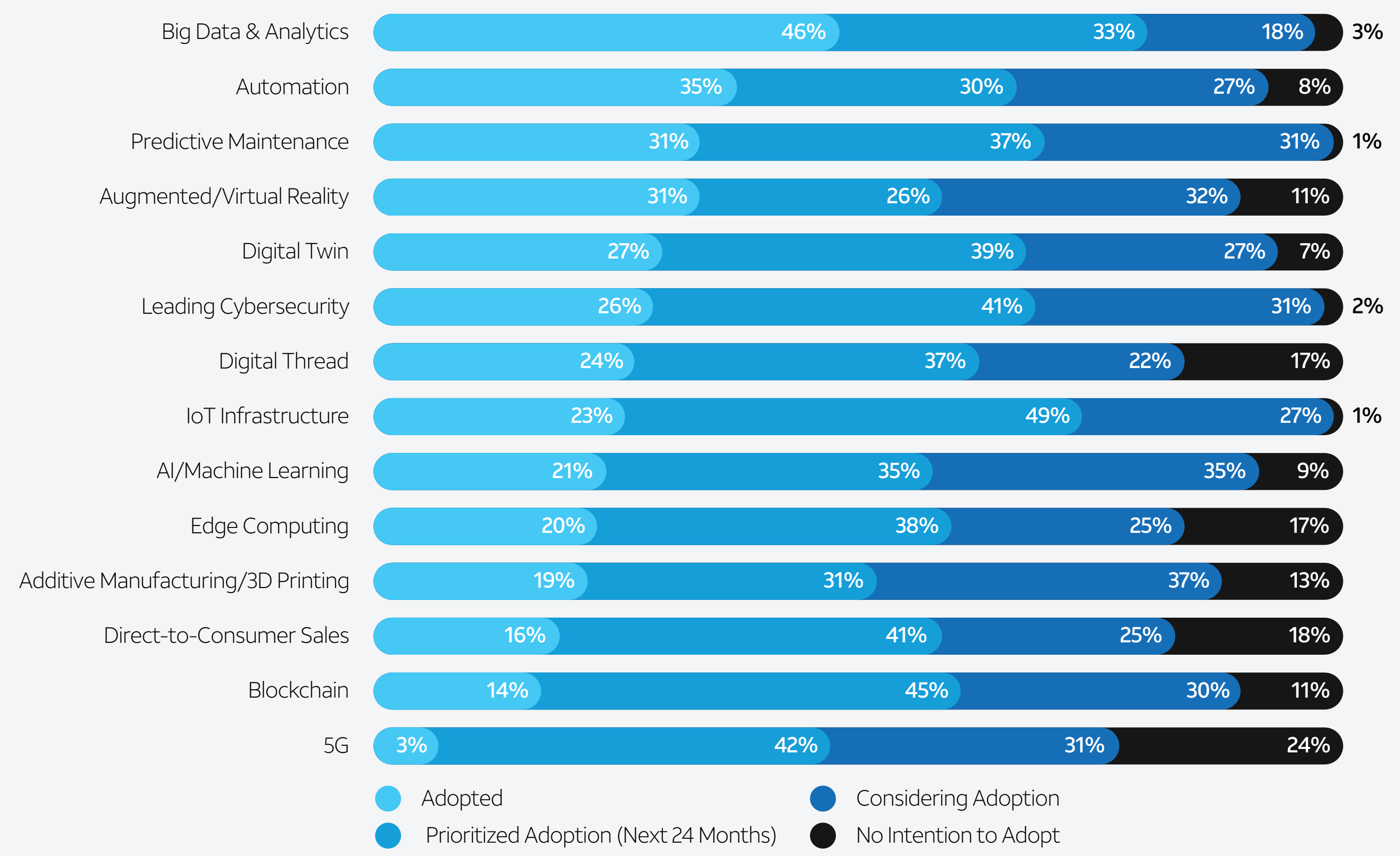
Manufacturers prioritize both cybersecurity and IT skills as necessary for executive buy-in and their transition to a 'factory of the future' model. But only 15% believe **cybersecurity** is the number one technology or capability required for this transition, and 15% believe **increased IT skills** it the number one technology or capability for this purpose. While prerequisites, these may not be top technologies or capabilities when transitioning to the future model. The 'factory of the future' emphasizes practical applications, improved performance, and long-term business value.

What is the number one technology or capability you require to transition to the "factory of the future"?



29%	Internet of Things
24%	Cybersecurity
17%	Cloud virtualization and related technologies
15%	Modern network infrastructure
15%	Increased IT skills

At what stage of maturity are you in your adoption of next-gen solutions?



Respondents concerned about their technology investments claim they don't have the right technologies to stay competitive and lack the skills and training to support new technology solutions. But a closer look at their maturity in terms their plans and adoption of next-generation solutions shows that most manufacturers are making progress.

Achievable disruptive technologies are high priorities for manufacturers

Technologies that are both disruptive and top priorities for manufacturers are more accessible and have greater practical value. Most have either already adopted them or are prepared to do so within the next 24 months.

For example, more manufacturers have adopted **Big Data & Analytics** (46%) than any other next-gen solution measured in the study; 9% consider it the primary Industry 4.0 disruptor in the manufacturing industry—a higher portion than most measured. Similarly, **automation** is the second most-adopted solution in the study (35%), with 30% prioritizing adoption over the next 24 months; and 10% of manufacturers consider it the primary Industry 4.0 disruptor.

"

We have already made some informed decisions by increasing automated services at manufacturing units … The [integrations] have proven to be helpful in further considering development necessities and customer standings.

"

Director, Floor Management,
mid-size process manufacturer

Direct-to-Consumer (DTC) sales is among manufacturers' top priorities for technology adoption. While only 16% have adopted the solution, 41% are prioritizing adoption over the next 24 months. Additionally, 11% consider it the primary Industry 4.0 disruptor, the second most-popular selection alongside AI and machine learning.

Priority technologies aren't necessarily disruptive

Some technologies are priorities but are not particularly disruptive in the eyes of manufacturers. For example, most companies have either adopted (31%) or are prioritizing adoption (37%) of **predictive maintenance,** but only 5% consider it the primary Industry 4.0 disruptor.

Twenty-seven percent of manufacturers have adopted **digital twin,** and 39% are prioritizing its adoption over the next 24 months. However, only 4% consider it the primary Industry 4.0 disruptor. Similarly, 24% have adopted **digital thread** and 37% are prioritizing its adoption over the next 24 months. Six percent consider it the primary Industry 4.0 disruptor.

Manufacturers generally plan to invest in **edge computing,** where 6% consider it the primary Industry 4.0 disruptor. Twenty percent have already adopted it while 38% are prioritizing adoption in the next 24 months. Another one-quarter of manufacturers are considering adoption, but 17% have no intention of adopting edge computing at all.

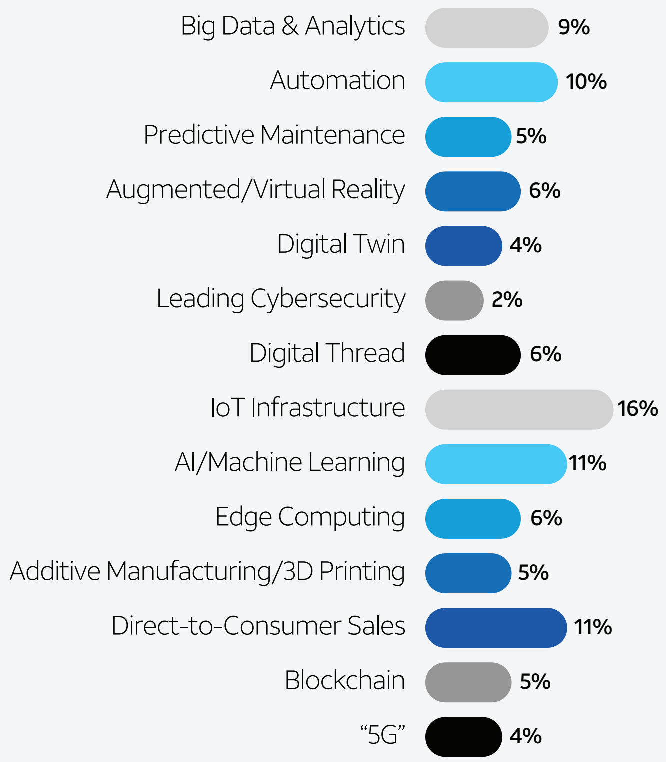
While only 14% of respondents have adopted **blockchain,** they are prioritizing blockchain over the next 24 months (45%) to a higher degree then most next-gen solutions measured in the study. Still, only 5% of these companies consider it the primary Industry 4.0 disruptor.

Disruptive technologies aren't necessarily priorities

Two of the study's most disruptive technologies are not within reach of some manufacturers at present. At 11%, **artificial intelligence (AI)/machine learning** make up the second most-cited Industry 4.0 disruptor, tied only with direct-to-consumer (DTC) sales. Although 21% have adopted and 35% are prioritizing adoption of AI or machine learning, most others are only considering adoption (35%).

Manufacturers are selective in terms of **additive manufacturing or 3D printing** adoption. Exactly half of manufacturers have either adopted (19%) or are prioritizing adoption within the next 24 months (31%). Most others are considering adoption (37%) while 13% claim they have no intention to adopt. These technologies might have applications in some verticals and not in others – 5% consider this option the primary Industry 4.0 disruptor.

Among these same next-gen solutions, which do you consider to be the primary industry 4.0 disruptor in the manufacturing industry?



> "When we talk about future technology We promise flexible solutions, [so] we need to acquire the desired portions to complete orders regularly. This is usually a hassle when huge orders pour in with high demand. But now, with predictive analysis and timelines, we can determine these trends well in advance so they don't totally disrupt proceedings at the factory unit."

Director of IT,
mid-market process manufacturer

The factory of the future is its people

Manufacturers have peak ambitions for new technology adoption and will align those goals with bottom-line financial results. But new technologies and executive support are only two parts of a three-part equation, the third being greater capabilities and skillsets among employees.

Manufacturers' emphasis on building IoT infrastructure exemplifies this dynamic. Their prioritization of adopting sophisticated IoT infrastructures is matched only by their need to build the skills and capabilities required to support it.

Perhaps the real 'factory of the future' is one in which factory-based technologies and integrated communications are empowering team members first, realizing ROI second. While leadership struggles to prioritize training amidst daily operations, it is training team members – and adopting the tools and connectivity that empower them – that will deliver the efficiencies they need to meet core business expectations themselves.

About the Authors

AT&T Inc. (NYSE: T) is a world leader in communications, media and entertainment, and technology. AT&T Communications serves millions of businesses globally with highly secure, smart solutions. Our technology organization is an industry leader in working with developers and startups to open our network to innovation.

Learn more at: www.about.att.com/sites/business

Connected Manufacturing Forum

Connected Manufacturing Forum is a leading cross-industry event that brings together 150+ Operations, Technology, Manufacturing and Advanced Engineering executives, thought leaders and innovators for a collaborative debate on the latest Industry 4.0 trends, challenges and opportunities.

Learn more at: https://connectedmanufacturing.wbresearch.com

INSIGHTS Worldwide Business Research

We are a team of writers, researchers, and marketers who are passionate about creating exceptional custom content. WBR Insights connects solution providers to their targeted communities through custom research reports, engaged webinars, and other marketing solutions.

Learn more at: www.wbrinsights.com