PLEX®

6TH ANNUAL

STATE OF SMART MANUFACTURING REPORT

Today's Challenges &
Tomorrow's Opportunities
for Manufacturers →

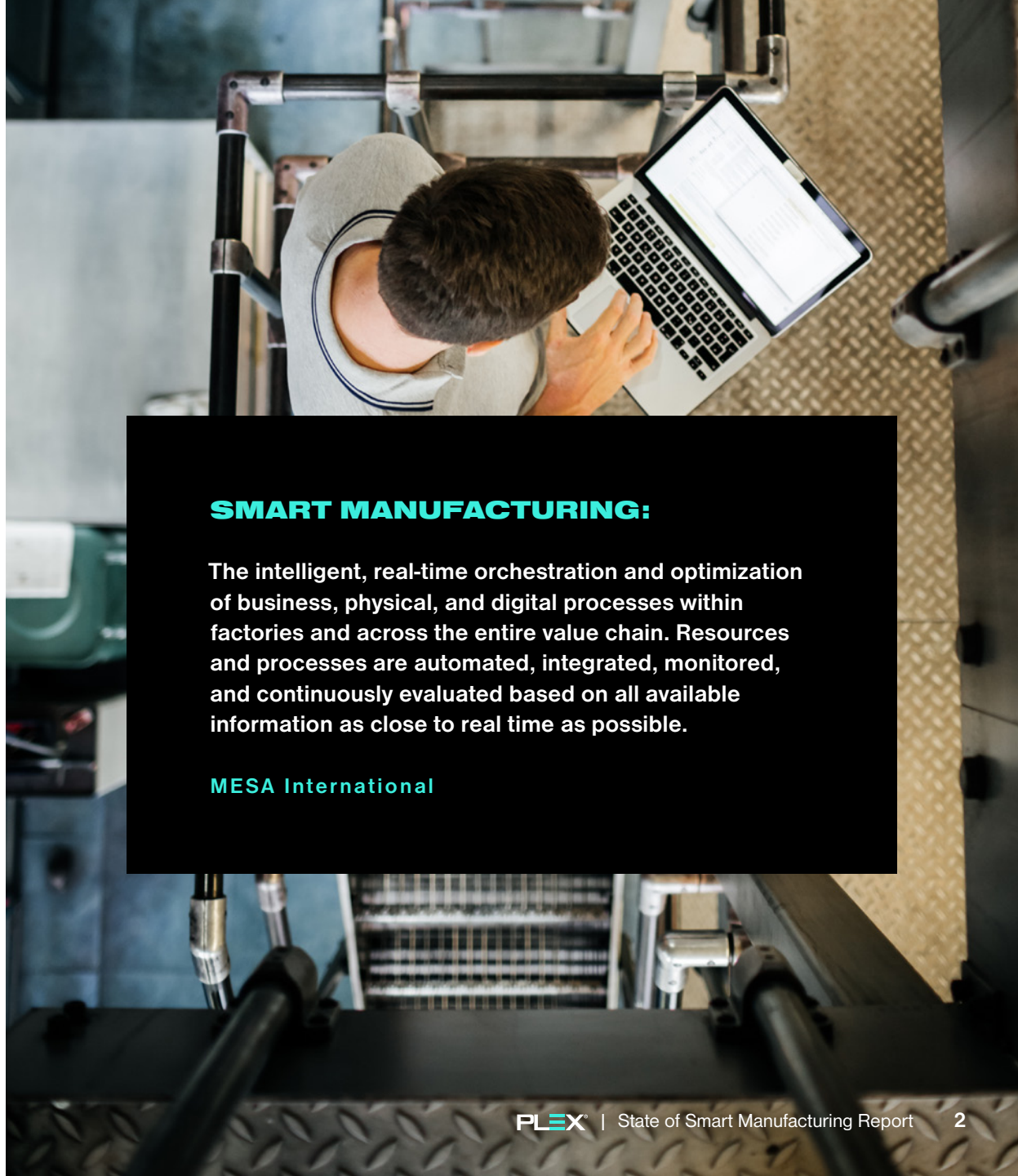
Participants in a recent global survey of nearly 300 manufacturers* recognized the importance of smart manufacturing for agile decision making, process automation, and greater efficiency.

This study from Plex Systems, in collaboration with Hanover Research, explores how manufacturers can use technology to address today's challenges and take advantage of long-term opportunities.

The data reveals a clear need for smart manufacturing technology in order to address current challenges, especially those created or heightened by the COVID-19 pandemic.

- Most manufacturers are currently using at least some components of smart manufacturing to achieve their business goals.
- Whether manufacturers build a complete, integrated system or focus on a few key tools or processes, smart manufacturing helps organizations solve business challenges and become more competitive.

**Respondent demographics are shown in the Appendix.*



SMART MANUFACTURING:

The intelligent, real-time orchestration and optimization of business, physical, and digital processes within factories and across the entire value chain. Resources and processes are automated, integrated, monitored, and continuously evaluated based on all available information as close to real time as possible.

MESA International

ADOPTION OF SMART MANUFACTURING TECHNOLOGY IS INCREASING.

Manufacturers are always looking to invest in technology that drives greater efficiency and visibility, and many are already using innovative manufacturing technology—even if they don't use the term "smart manufacturing."

- Smart manufacturing **drives modern manufacturing** by making processes faster, more automated, and more intelligent.
- It's a **strategic approach** to address key business challenges through technology that can be connected to increase value over time.

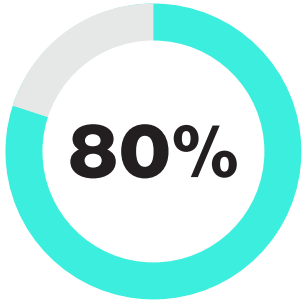
CURRENT BUSINESS CHALLENGES CREATE EVEN GREATER NEED FOR SMART MANUFACTURING.

Manufacturers face a variety of challenges in today's global market, including security risks, supply chain disruption, and a shortage of skilled workers. The COVID-19 pandemic has exposed existing challenges and revealed an urgent need for smart technologies that enable manufacturers to be more nimble.

SMART MANUFACTURING CAN HELP MAXIMIZE FUTURE GROWTH OPPORTUNITIES.

Leading manufacturers have been quick to adopt innovative technologies in recent years, driving an urgent and growing need to connect these technologies through a truly integrated smart manufacturing approach.

Understanding the value and ROI potential of smart manufacturing will enable businesses to pursue the technology they need to become more agile, resilient, and prepared to maximize future growth.



of survey respondents believe smart manufacturing is a key to their organization's future success.

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KEY FINDING 1:

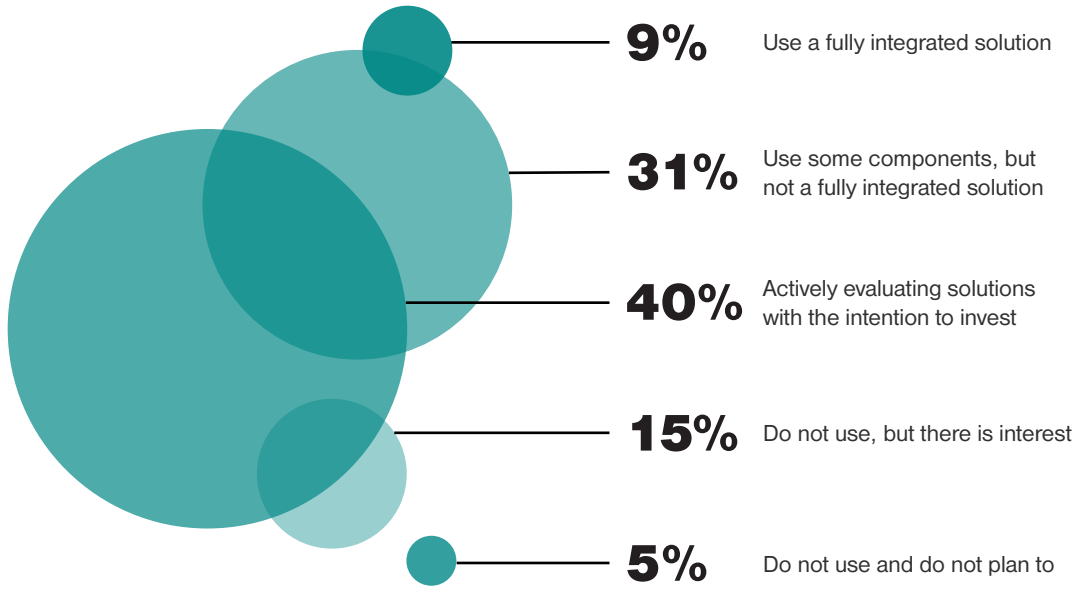
SMART MANUFACTURING ADOPTION HAS BEGUN

CURRENT ADOPTION

Manufacturers have already begun adopting smart manufacturing technology faster than many may realize.

- **4 out of 5** manufacturers are optimistic about smart manufacturing and recognize that it is very important to their future success.
- **Only 5%** said they have no plans to use smart manufacturing technology.

To what extent is your organization using smart manufacturing?



KEY SOLUTIONS

Enterprise Resource Planning (ERP): A solution that automates front- and back-office processes, including financial management, revenue management, human capital, order management, billing, and inventory

Manufacturing Execution Suite (MES): A solution that tracks and documents the transformation of raw materials into finished goods, providing real-time production management to drive enterprise-wide compliance, quality, and efficiency

Quality Management System (QMS):
A solution that standardizes and automates quality documentation, processes, and measurements.

Supply Chain Planning (SCP): A solution that combines data from multiple departments across the business to sync demand and supply forecasting to improve inventory accuracy and production management

Industrial IoT (IIoT): A solution that combines process, operational, and machine-level data to improve business performance, automate production and business processes, and increase plant floor production efficiency

Manufacturing Analytics: A solution that provides systematic analysis of data to discover deeper insights, make predictions, or generate recommendations

As companies grow more comfortable with technology, integrating tools makes them more efficient and effective.

Nearly three-fourths of manufacturers are beginning to use technology to better connect the business, automate processes, and gain valuable business insights.

Which operational activities are you currently supporting with software and/or hardware?

70%
Connecting people, systems, machines, and supply chains

70%
Tracking corporate data (e.g., financials, human capital management)

70%
Automating processes

65%
Gaining analytics and insights into the business

58%
Tracking plant floor production data

"The traditionally siloed nature of the operational functions such as procurement, inventory, manufacturing, customer project management, and the various areas of finance is rapidly changing. The walls are finally starting to break down, necessary for more coordination, collaboration, and communication among these and other functions. As such, decision makers will have a much more holistic view of the company's performance at all times so that better strategic decisions can be made."

IDC MarketScape: Worldwide SaaS and Cloud-Enabled Medium-Sized/Midmarket Business ERP Applications 2020 Vendor Assessment (doc #45972120, July 2020)

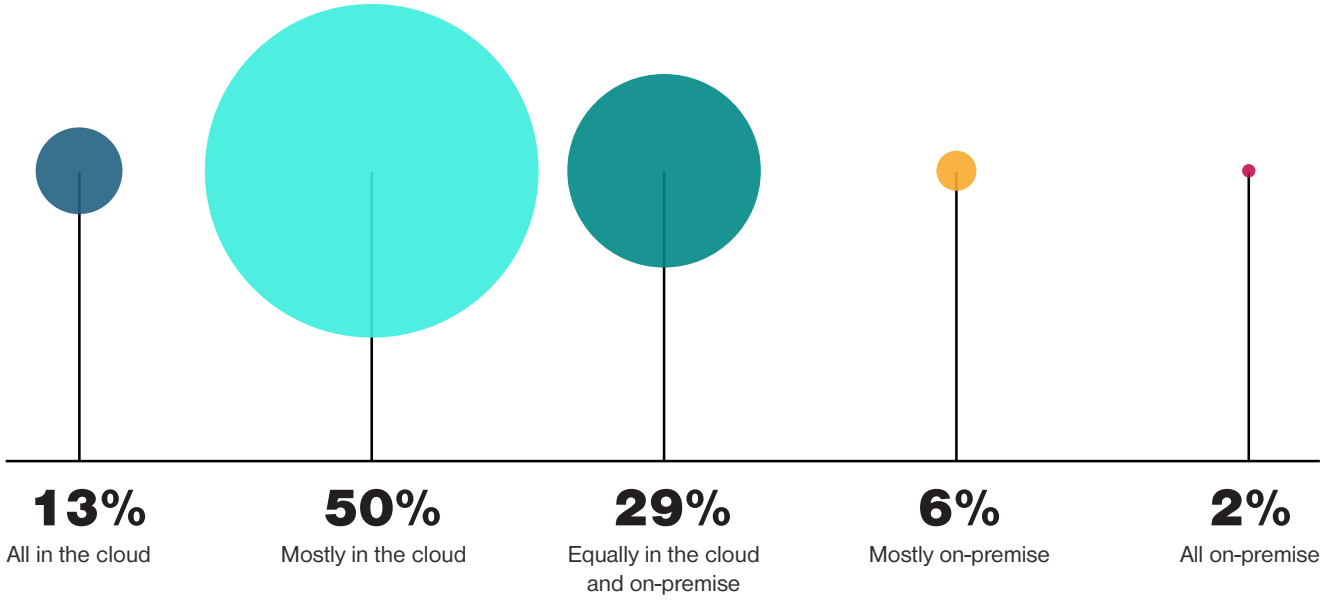
IDC ANALYZE THE FUTURE

CLOUD

Cloud adoption among manufacturers is at an all-time high, with very few using completely on-premise solutions.

Before 2020, manufacturers' shift to cloud was slower than other industries, but the COVID-19 pandemic accelerated cloud adoption for manufacturers, laying the foundation for future smart manufacturing initiatives.

How much of your enterprise software is in the cloud vs. on-premise?



"The COVID-19 pandemic became the tipping point for businesses to rethink their entire business as a digital organization. From fulfilling orders digitally and physically to remote working by employees, businesses have found they need cloud and software-as-a-service (SaaS) software to run their businesses effectively."

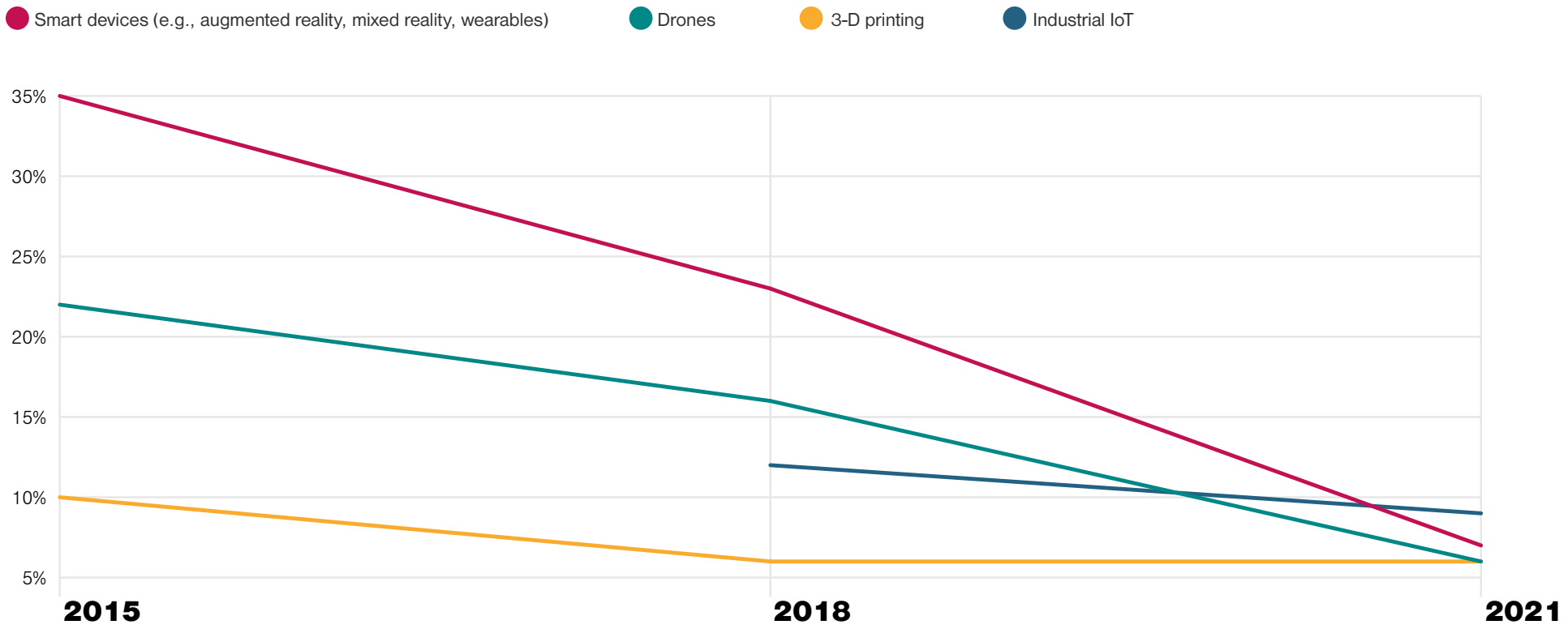
IDC MarketScape: Worldwide SaaS and Cloud-Enabled Medium-Sized/Midmarket Business ERP Applications 2020 Vendor Assessment (doc #45972120, July 2020)

IDC ANALYZE THE FUTURE

EMERGING TECHNOLOGIES

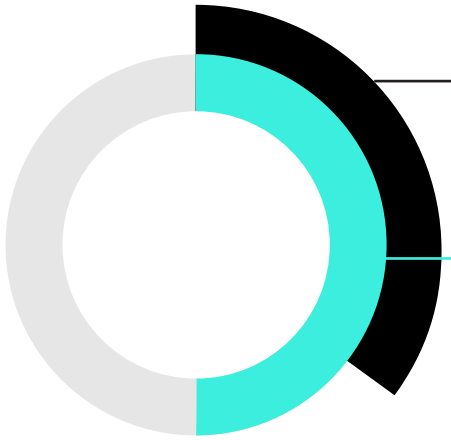
The perception of emerging technologies is changing with increased adoption. Survey results show many smart manufacturing technologies have moved through the early “overhype” phases of adoption and are now considered mainstream.

Which technology do you think is most overhyped in manufacturing?



As hype dies down and tangible benefits emerge, many cutting-edge smart manufacturing technologies have seen significant increases in adoption.

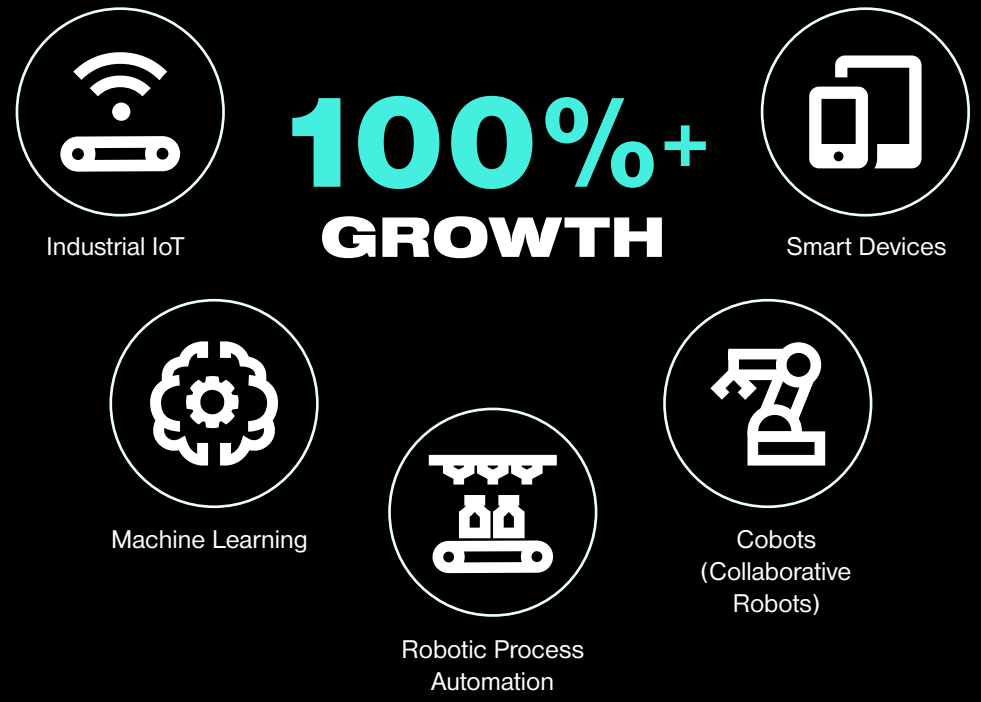
These technologies will eventually be considered mainstream, like tablets on the plant floor, robotics, and webcams—all now considered table stakes in many sectors.



In 2018, 35% of respondents planned to adopt IIoT within the next five years.

Today, adoption has **outpaced that prediction**, with nearly half using IIoT in their operations.

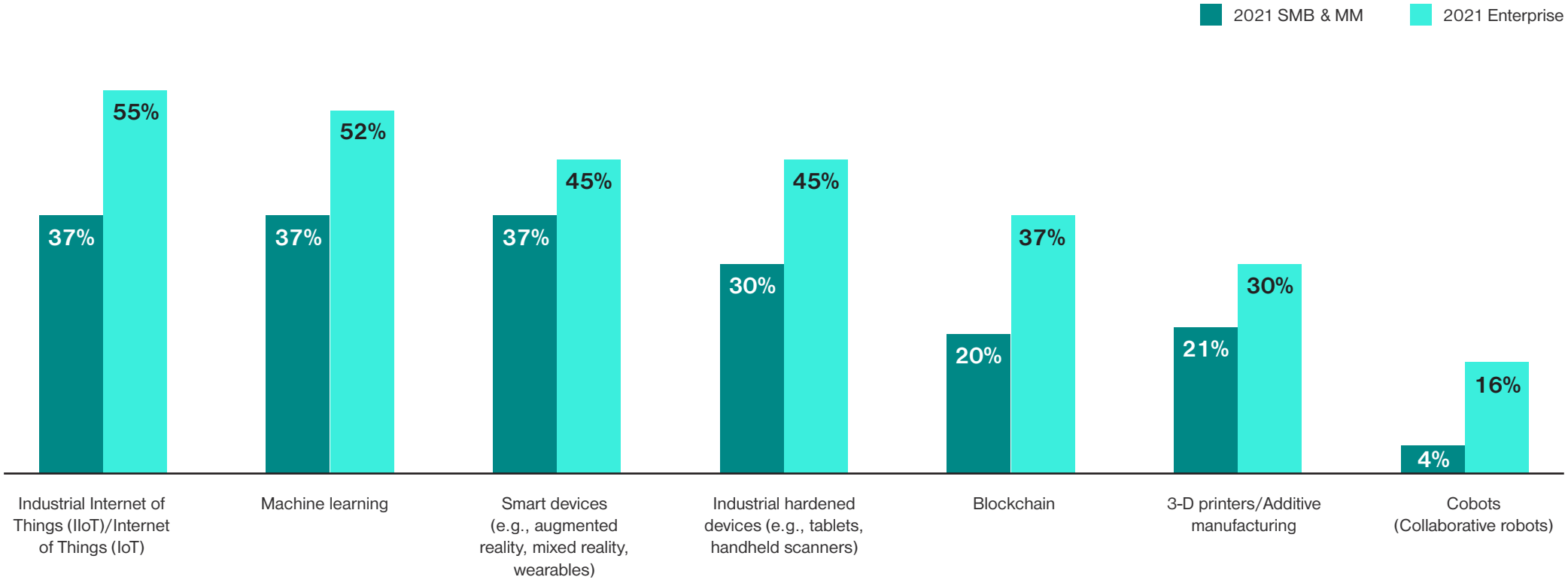
ADOPTION OF KEY TECHNOLOGIES HAS GROWN SIGNIFICANTLY IN JUST THE PAST YEAR.



Enterprise manufacturers lead in the adoption of smart technologies, especially IIoT, machine learning, blockchain, and 3-D printing.

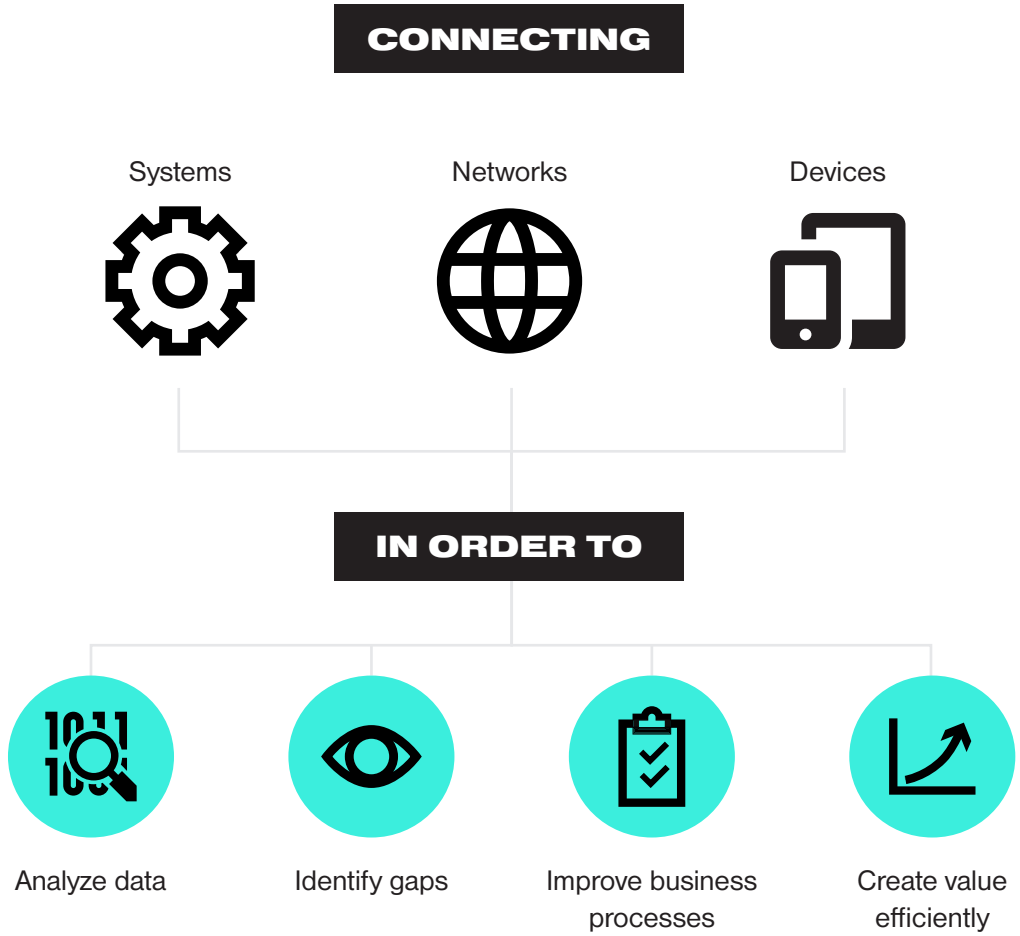
Small and midsize manufacturers (SMB & MM) are gaining ground, indicating that these technologies are becoming more accessible and cost effective for organizations of any size.

Which emerging technologies are you currently using in your manufacturing operations?

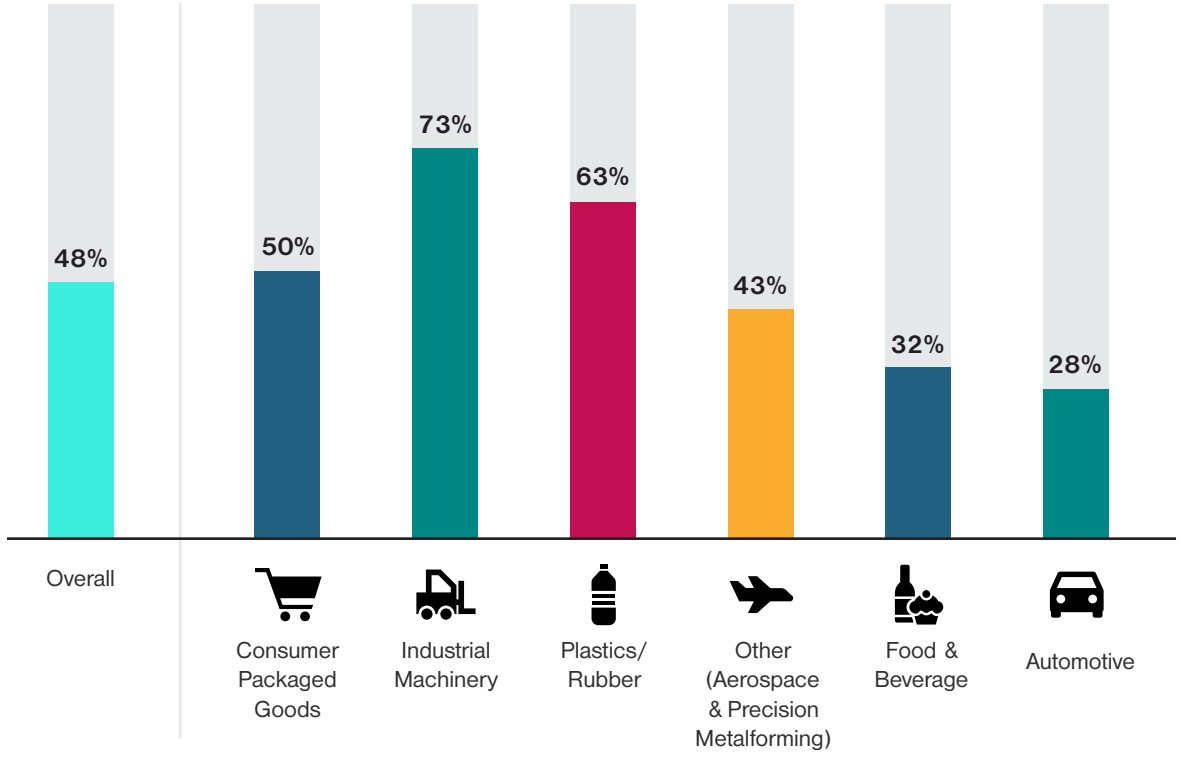


INDUSTRIAL INTERNET OF THINGS (IIOT)

IIoT adoption has increased significantly over the past three years as manufacturers are realizing its value.



Are you currently using IIoT in your operations? (by industry)



While IIoT adoption lags somewhat in Automotive and Food & Beverage, these sectors have the most aggressive plans to capitalize on IIoT in the next year.

PROOF POINT: MPI CORPORATION

"IIoT presents an opportunity to look at the business and say, 'How can we change? What can we do better? What can we impact in a positive way?' At MPI, we targeted reducing gap time on heat treat furnaces. We've seen up to a 10% increase in revenue during our busiest times simply by increased productivity of our assets."

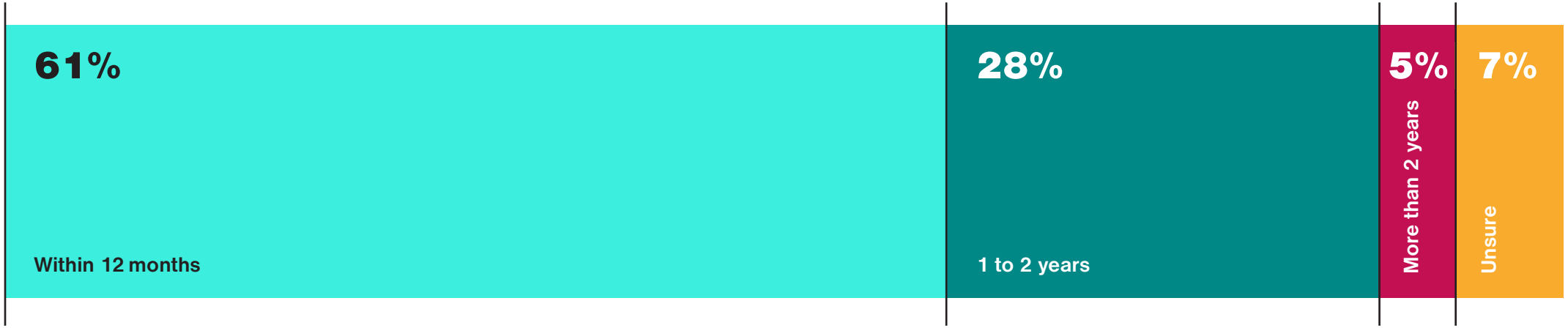
Robert Bierwagen
*VP of Digital Strategy at **MPI Corporation***

FUTURE PLANS

Manufacturers are increasingly willing to explore smart manufacturing solutions to tie together all their devices and data in a more impactful way.

- Most organizations with plans to adopt smart manufacturing intend to begin within two years, with more than half in the next 12 months.
- Sectors most impacted by COVID-19 are projecting faster adoption rates than the industry overall. For example, 70% of automotive and 68% of food & beverage plan to do so in the next year, demonstrating the urgency to close gaps and address challenges exacerbated by the pandemic.

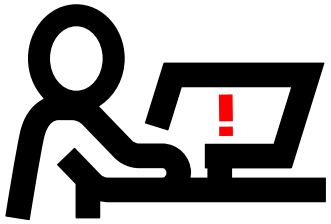
When does your organization plan to adopt smart manufacturing?



KEY FINDING 2:

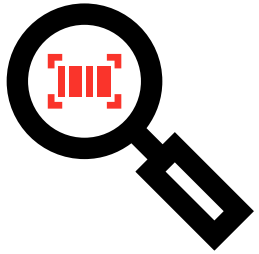
MARKET CONDITIONS DRIVE URGENCY IN TECH ADOPTION

CHALLENGES FACING MANUFACTURERS:



Poorly connected people and systems

Silos throughout the organization

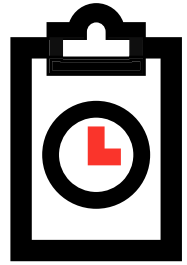


Lack of inventory and process visibility

Costly, time-consuming, or inaccurate manual measurements

Weak quality control

Avoidable scrap

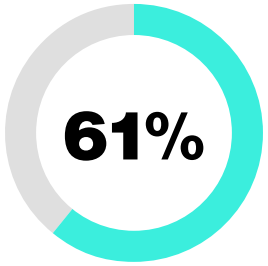


Slow or inaccurate reporting

Inability to accurately act on what's happening in the business

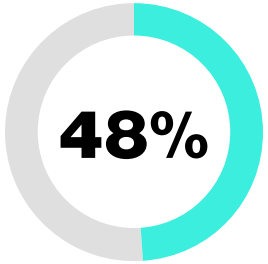
IMPACT OF COVID-19 ON MANUFACTURING

The pandemic is the biggest obstacle facing manufacturers this year, illuminating several urgent preexisting challenges.



of manufacturers have seen a moderate to major **reduction in workforce** due to COVID-19.

Many companies didn't have contingency plans or infrastructure in place to quickly transition to remote work, and plans that did exist were largely untested.



Nearly half cite **supply chain disruption** as a major obstacle to growth.

PROOF POINT: AARON THOMAS COMPANY

"There has been a tremendous surge in demand for packaged foods during the pandemic. Meeting this demand can create lead time challenges with our suppliers, so it's crucial for us to plan for that risk and account for the additional time in order to fulfill our orders. Through Plex, our inventory management capabilities have given us the visibility and planning we need to account for risk in the supply chain."

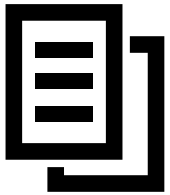
Aaron Bacon
*President of **ATCO Corp.** & Executive Vice President of Sales at **Aaron Thomas Company***

DRIVERS OF ADOPTION

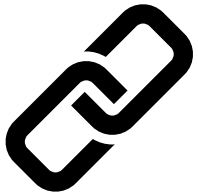
Smart manufacturing adoption is driven by business challenges, including competitive threats, fluctuating demand, and workforce availability. Proactively investing in technology can help pragmatic manufacturers boost ROI and adapt to ever-changing conditions.

COVID-19 has had a moderate to high impact on internal operations, highlighting previously neglected business areas and causing manufacturers to change key areas of their operations:

More than 70% of manufacturers are now:

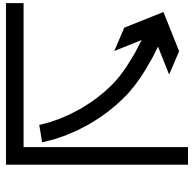


Creating contingency plans for widespread business disruption



Developing a more agile supply chain

Re-prioritizing investments



Increasing workforce efficiency

“The digital world has enabled a new reality. It will be the companies with the right mix of talent and software tools that will be best able to recover and thrive in these changing conditions.”

IDC MarketScape: Worldwide SaaS and Cloud-Enabled Medium-Sized/Midmarket Business ERP Applications 2020 Vendor Assessment (doc #45972120, July 2020)

IDC ANALYZE THE FUTURE

HEIGHTENED URGENCY

Ultimately, the pandemic has heightened the need to adopt smart manufacturing technology across all sectors.

83% of manufacturers say the COVID-19 pandemic has made adopting smart manufacturing technologies and processes more of a priority.

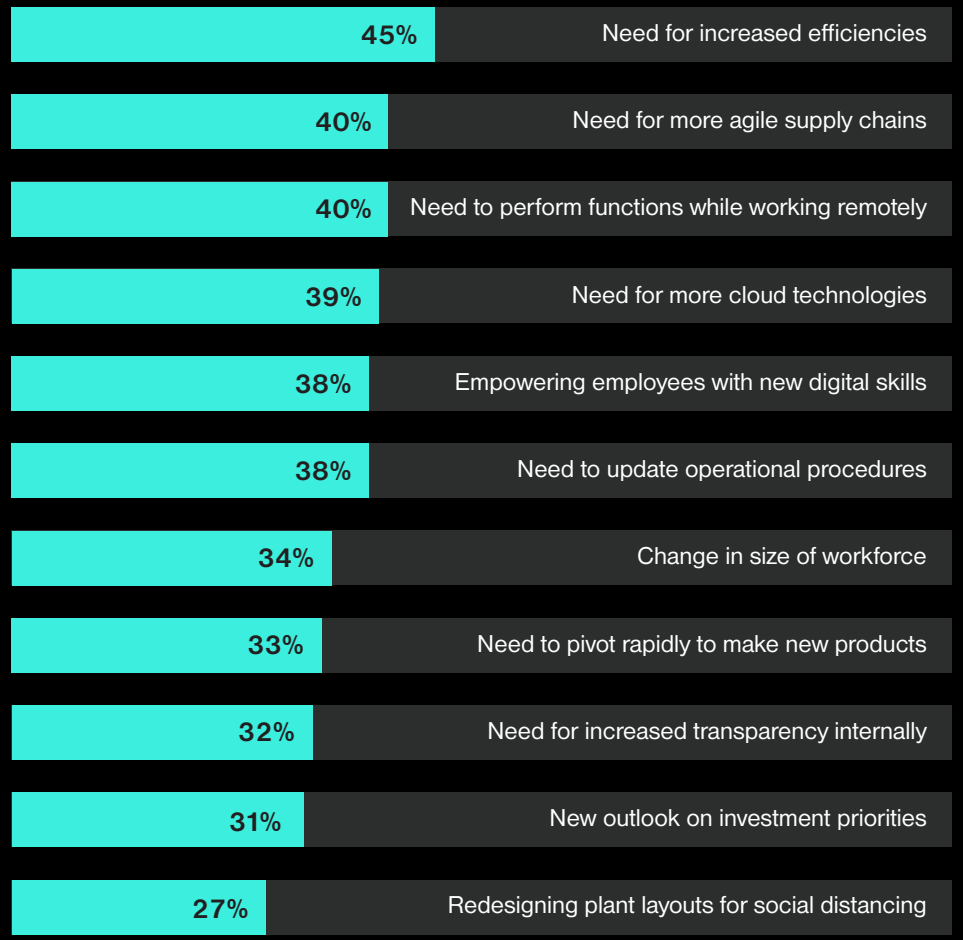
Modern technology like cloud-native infrastructure are proving critical to meeting manufacturers' needs.

PROOF POINT: CREATIVE FOAM

"Our cloud-based system is a huge advantage for us. We don't have to worry about having folks in the buildings to secure that on-premise hardware, to make sure the redundant power systems are available, to secure that infrastructure."

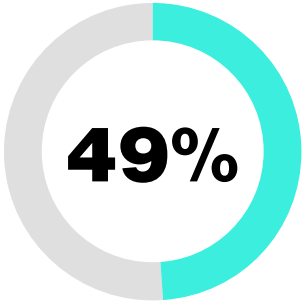
Tareq Faleh
*Vice President, IT/IS at **Creative Foam***

How has the COVID-19 pandemic increased the need for smart manufacturing technology?



OPTIMISM AMIDST DISRUPTION

Despite today's challenges, manufacturers are optimistic. Navigating the COVID-19 pandemic has helped manufacturers see what they're doing well and how they've been resilient.



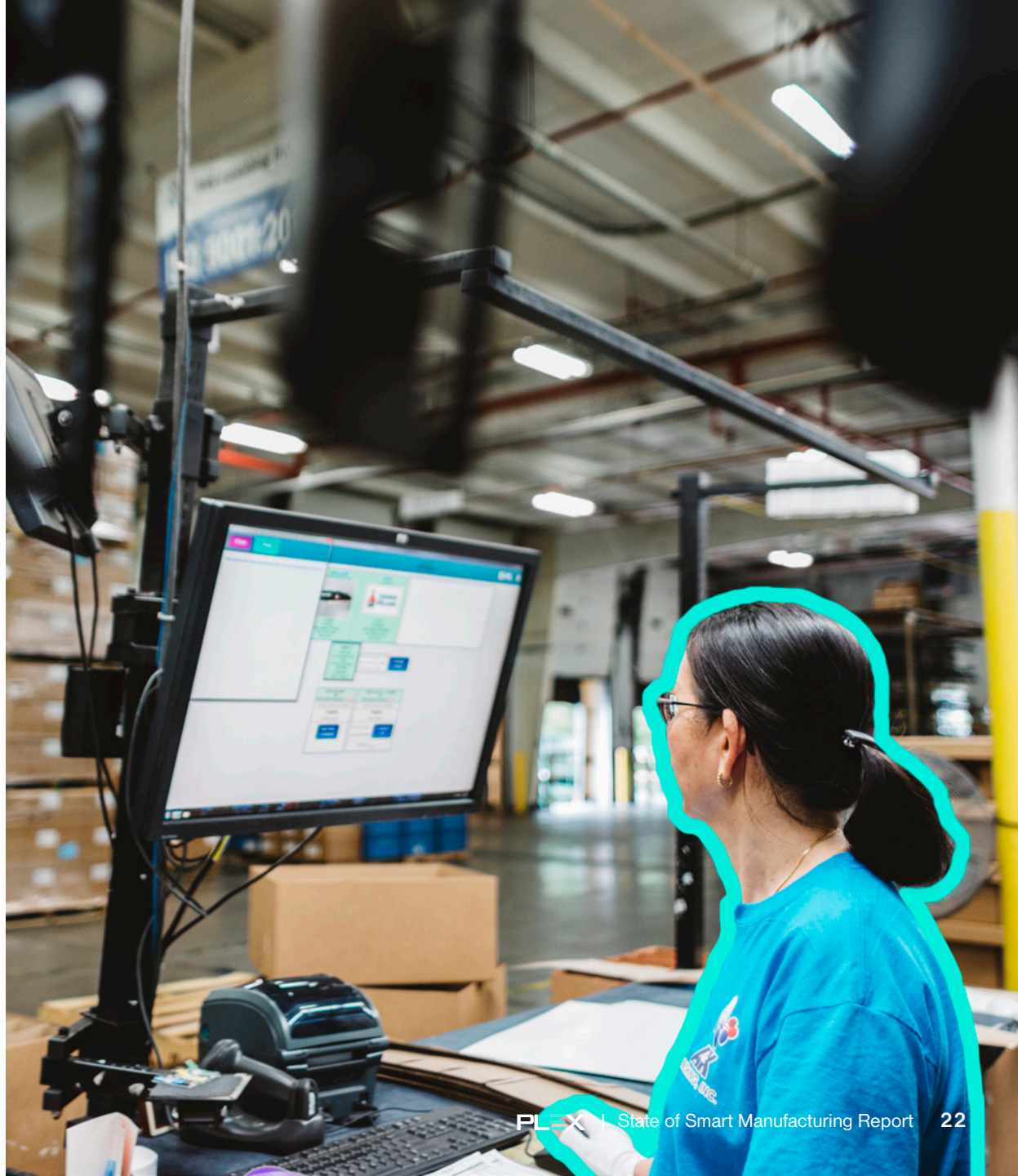
of respondents were confident in their organizations' ability to successfully use technology, suggesting strong potential to drive value through future smart manufacturing investments.

KEY FINDING 3:

SMART MANUFACTURING MAXIMIZES TOMORROW'S GROWTH OPPORTUNITIES

Manufacturers are increasingly confident in smart manufacturing as it continues proving its value amidst an ever-changing global market.

- Many manufacturers have implemented some level of smart technology, whether or not they use that term.
- Every stage of adoption adds value, with greater efficiency the closer manufacturers get to a fully integrated smart manufacturing system.
- This year's challenges have emphasized the need for a more strategic approach to smart manufacturing.

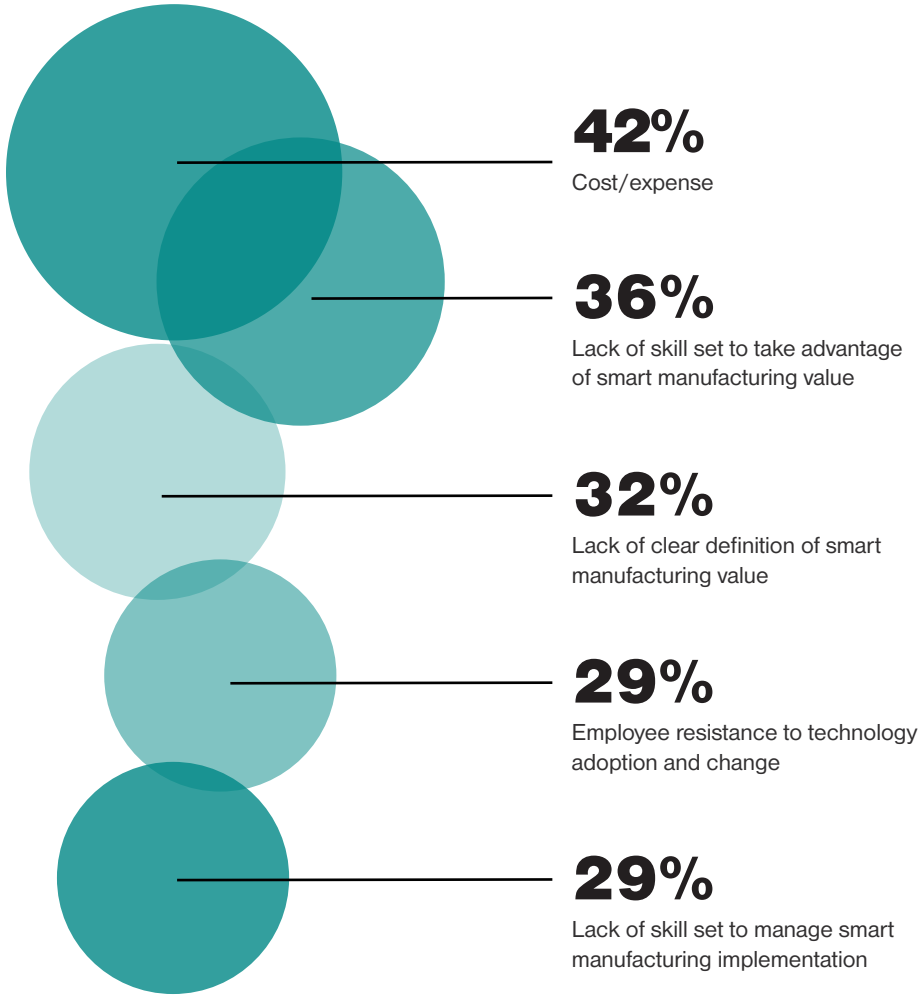


BARRIERS TO ADOPTION

Companies are looking to adopt smart manufacturing solutions but face some roadblocks.

Cost and lack of clarity around the value of smart manufacturing are among the top barriers to adoption—when the value is not understood, the cost is perceived as high.

What are the top barriers to adopting smart manufacturing?



THE ROI OF SMART MANUFACTURING

The ROI of smart manufacturing is much higher and easier to quantify compared to other operational or capital improvements.

- Multiple points of entry to smart manufacturing are possible with a lower-level investment, including quality management, machine integration, process automation, production monitoring, or supply chain planning.
- These investments help manufacturers decrease waste, improve resource efficiency, and enhance operational performance—thereby improving customer satisfaction and market competitiveness.

Value Cases for Smart Manufacturing

INVENTORY

- ↑ **Inventory Accuracy**
- ↑ **Inventory Turns**
- ↓ **Inventory Levels** (Raw, WIP, FG)
- ↓ **Inventory Obsolescence** (Reduce Write-offs)
- ↓ **Inventory Shrinkage**
- ↓ **Inventory Taxes** (Inventory levels tax - State level)

PRODUCTION

- ↑ **Production Throughput**
- ↓ **Machine Downtime**
- ↓ **Avoidable Overtime**
- ↓ **Premium Freight** (Expedites)
- ↑ **Direct Labor Efficiency**
- ↑ **Indirect Labor Efficiency**

QUALITY

- ↓ **Defect (PPM)**
- ↑ **First-Pass Quality (FPQ) Yield**
- ↓ **Sorting & Containment Costs**
- ↓ **Scrap & Rework Costs**
- ↓ **Warranty Costs** (As Applicable)
- ↕ **QS 9000/TS 16949** (Reduce FTE, Fines; Improve Audit Scores)

EMPOWERING THE WORKFORCE

Three of the top five barriers to adopting smart manufacturing technology are workforce-related:

- **Lack of necessary skill set**
- **Resistance to change**
- **Inability to manage implementation of smart manufacturing technology**

Manufacturers have the opportunity to address these challenges directly.

- ☑ Involve skeptics early on to address concerns, convey intended outcomes, and enroll in training programs.
- ☑ Attract the next generation of digital-native employees familiar with smart technologies, teamwork, and flexibility.
- ☑ Partner with technology providers experienced in navigating the challenges specific to your business and industry.

Employee attitude, technical knowledge, and skills are the most important workforce characteristics for the future. Manufacturers want to build adaptable teams that have a strong understanding of technology.

What skills are most important in the next generation of employees?

81%
Communication/teamwork

79%
Flexibility

77%
Critical/analytical thinking

77%
Knowledge of smart technology

74%
STEM (science, technology, engineering, mathematics)

PROOF POINT: THAI SUMMIT

"Nobody knows more about what's happening on the shop floor than the people who are down there running that equipment. I like to empower them with the ability to provide input, so we launched a digital 'suggestion box' within our system last year. Within the first six months of putting that in place, our employees had given us $9 million in productivity improvements. We've had 143 suggestions to date, and probably 93% of them had yielded back a reward to the employees. It's pretty impressive what this has given us."

Janice D'Amico
*Executive Manager of IT at **Thai Summit***

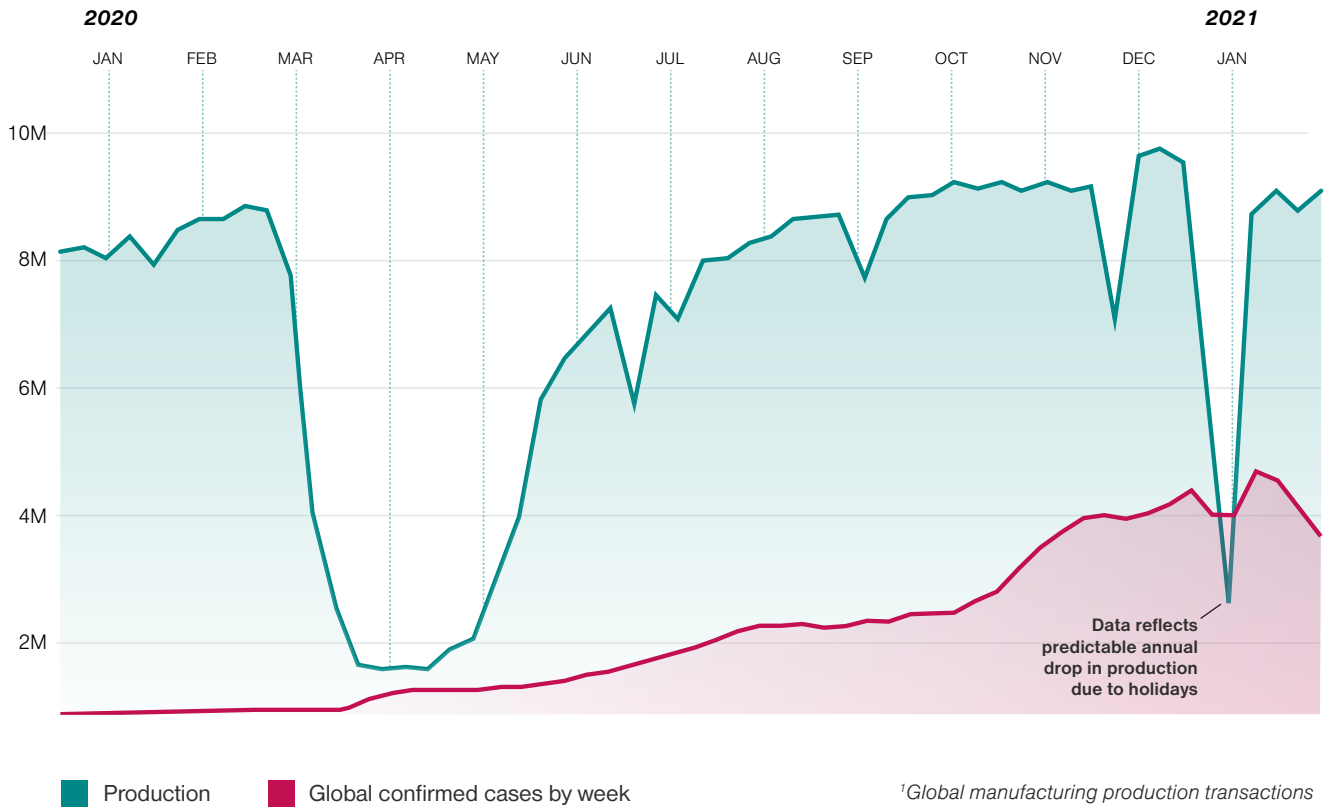
ADAPTING DURING COVID-19

Manufacturers have been able to pivot and ramp up production amidst obstacles brought on by the pandemic.

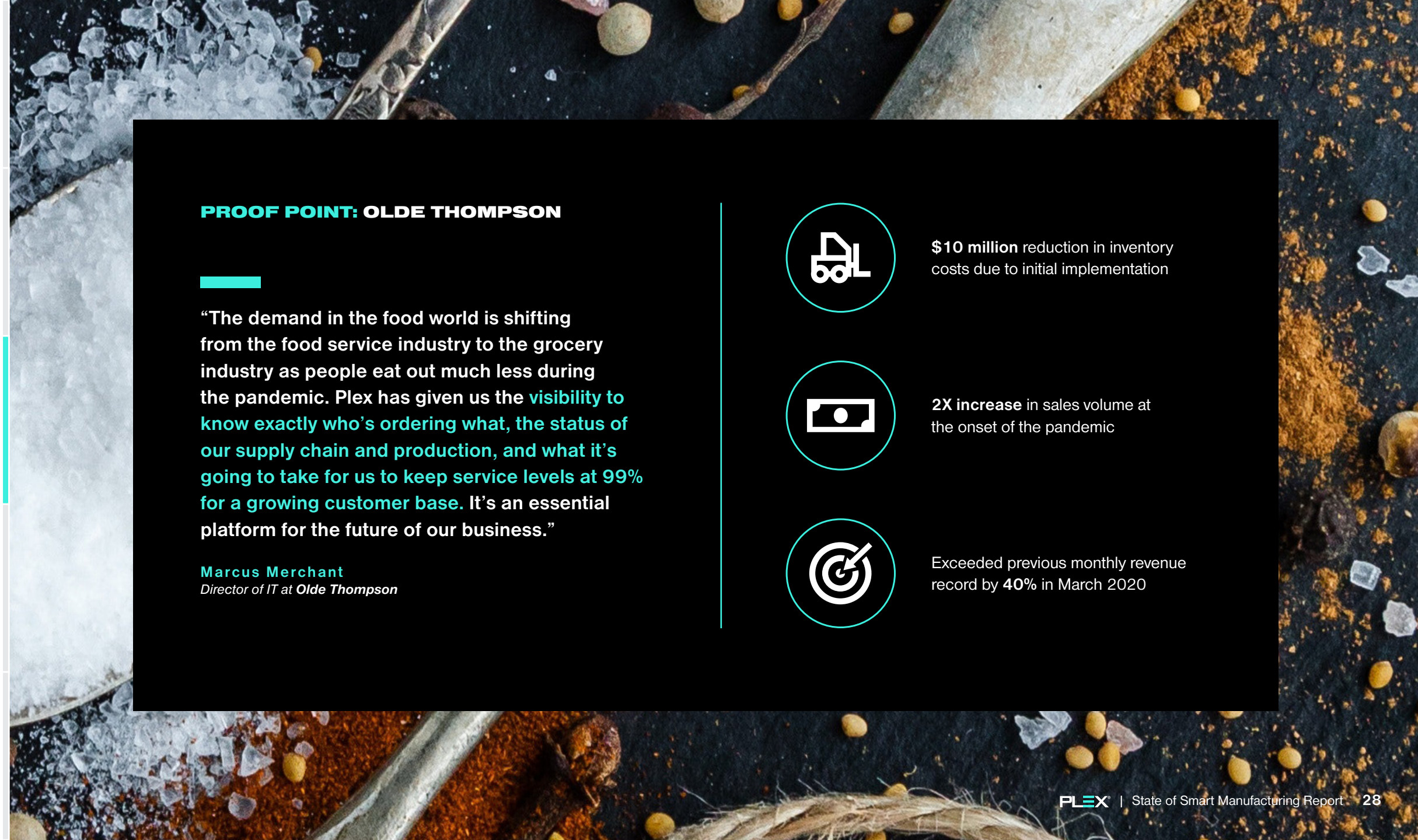
- When COVID-19 cases peaked, so did manufacturing output.
- Manufacturers are now producing at higher levels than pre-pandemic, steadily closing the production gap from 70% at its worst to just 27% cumulative loss by EOY.
- Despite a smaller workforce, manufacturers increased global production levels using automation and smart technology.
- Manufacturers who quickly pivoted to remote work faced less overall business disruption.
- Supply chain planning (SCP) technology helped manufacturers adapt to meet market demands.

(Source: Plex)

Global Manufacturing Production[1] vs. COVID-19 Cases[2]



[1]Global manufacturing production transactions
[2]Source: World Health Organization



PROOF POINT: OLDE THOMPSON

"The demand in the food world is shifting from the food service industry to the grocery industry as people eat out much less during the pandemic. Plex has given us the visibility to know exactly who's ordering what, the status of our supply chain and production, and what it's going to take for us to keep service levels at 99% for a growing customer base. It's an essential platform for the future of our business."

Marcus Merchant
*Director of IT at **Olde Thompson***

$10 million reduction in inventory costs due to initial implementation

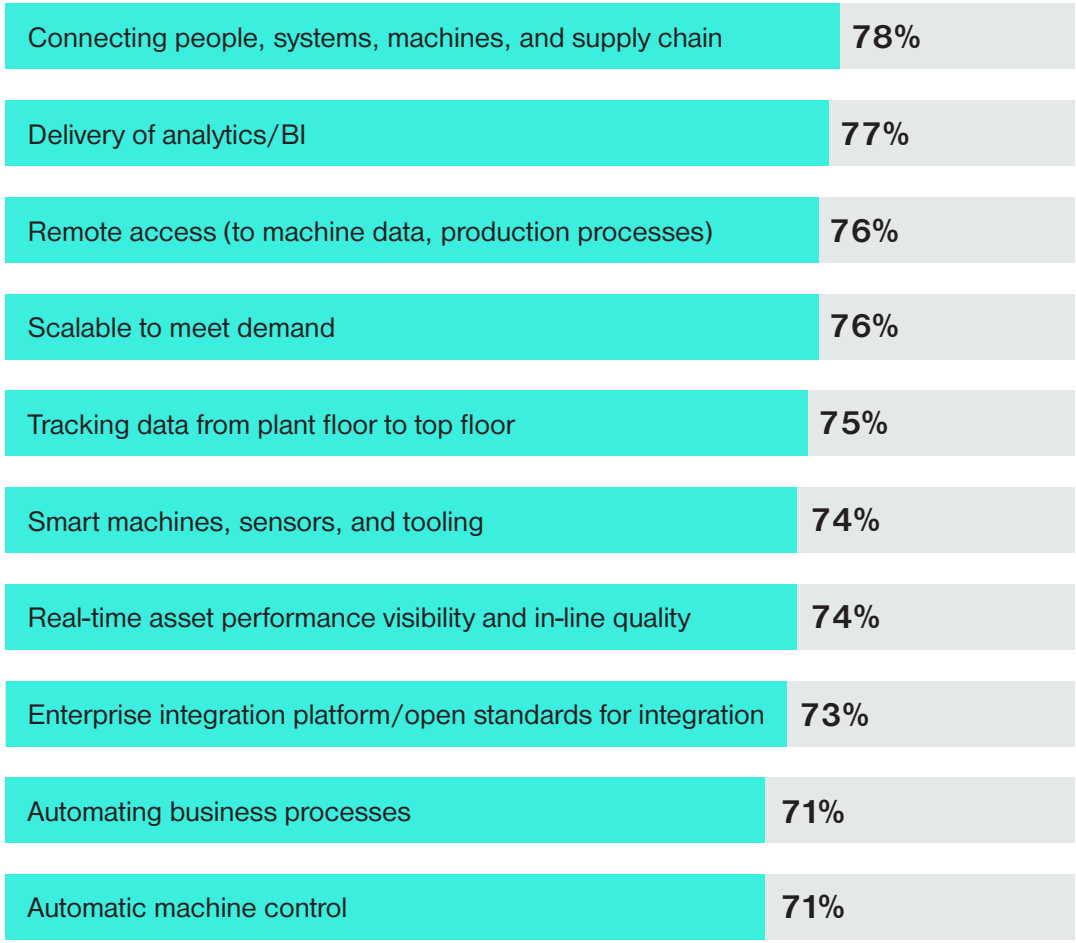
2X increase in sales volume at the onset of the pandemic

Exceeded previous monthly revenue record by **40%** in March 2020

INVESTING IN SMART MANUFACTURING

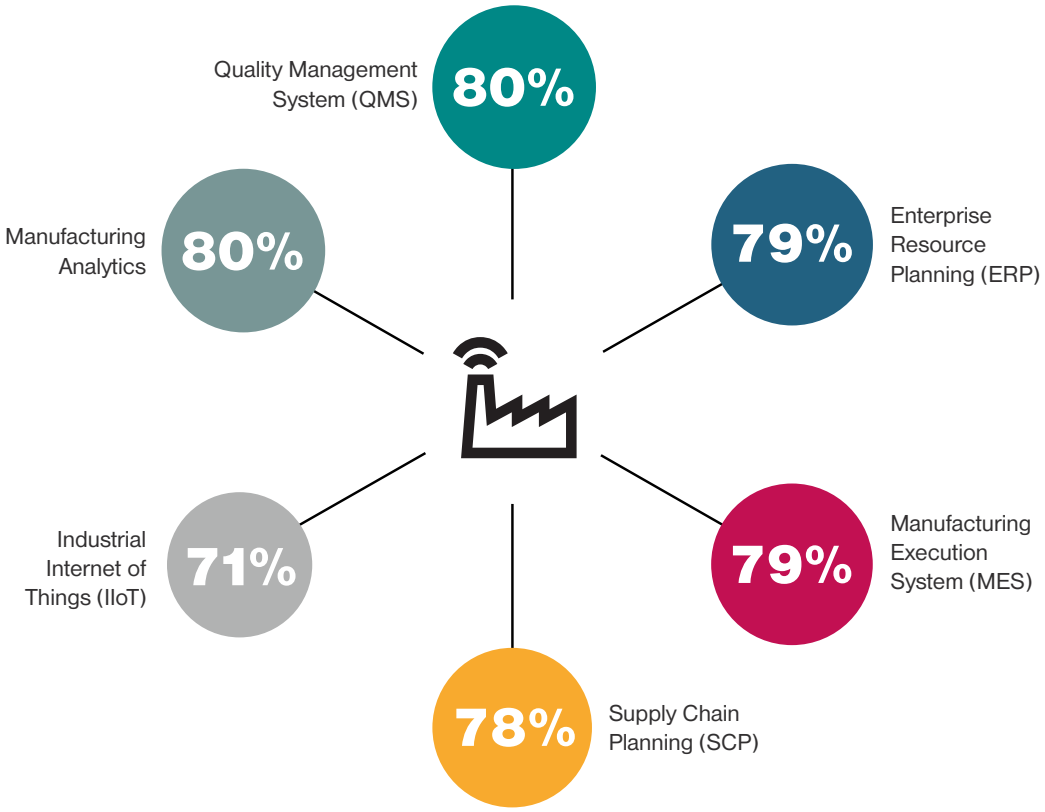
Manufacturers see the value and ROI potential of smart manufacturing and consider it key to their success, thanks to a broad scope of capabilities.

How important are the following smart manufacturing features or capabilities?



Manufacturers generally find all solutions of smart manufacturing valuable.

How valuable are the following smart manufacturing solutions to your operations?



PROOF POINT: G&W PRODUCTS

"Plex gives us faster access to all the metrics that affect the direction of our business. We went from gathering and sharing our quality metrics once a week to posting them every day. That alone has a huge impact on the measures we can take to deliver reliable products that satisfy our customers."

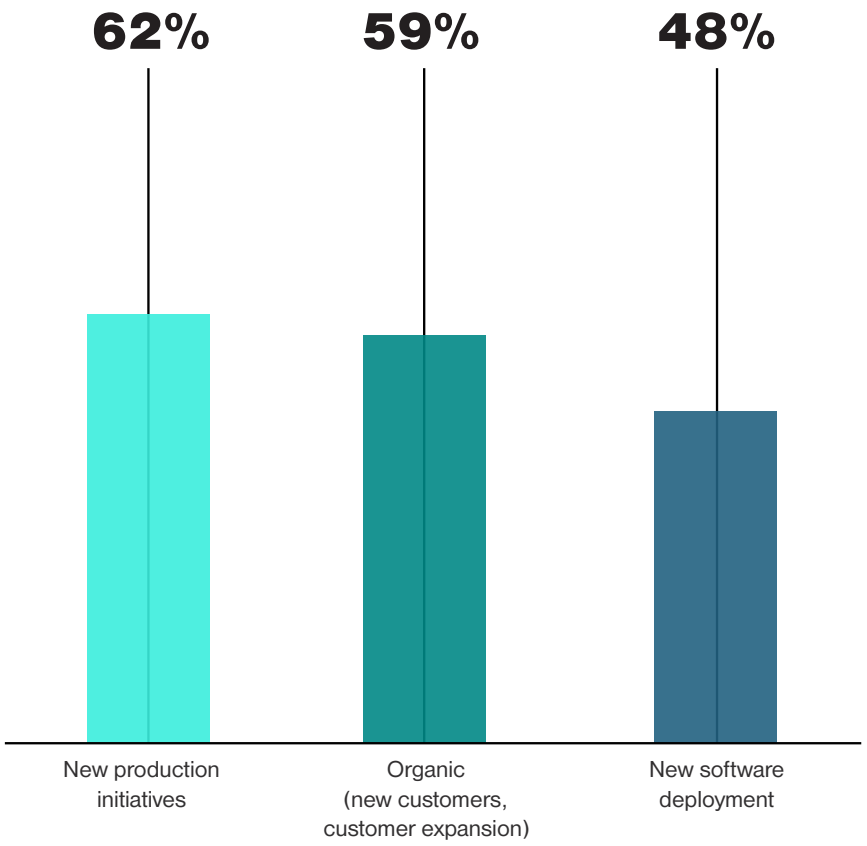
Jeff Karan
*Director of IT at **G&W Products***

1.5X improvement in inventory accuracy

Up to **15%** improvement in delivery rates

The top three factors driving future growth suggest manufacturers are ready to adopt new technologies that enable greater control of their business.

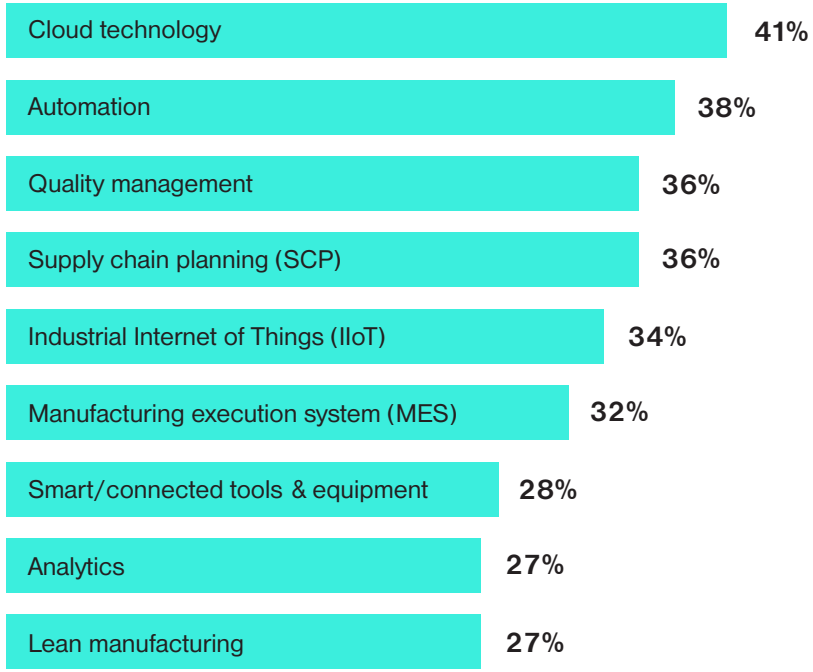
What is currently driving or facilitating growth within your organization?



Companies are prioritizing new initiatives to enable:

- Greater connectivity and visibility into their business
- Supply chain agility to respond to unexpected challenges
- Skilled workforce with technology to work from anywhere efficiently

To support these initiatives, manufacturers are adjusting their investment strategies in order to increase their spend in several critical areas:



TAKING ACTION

ADDRESSING BUSINESS CHALLENGES WITH SMART MANUFACTURING

Manufacturers were able to overcome significant challenges and drive their business forward in 2020 using smart manufacturing technology and processes:

- Pivoted to meet rapidly changing market conditions
- Enhanced visibility and agility across the enterprise
- Enabled rapid remote work shift using cloud-based technology
- Identified challenges and gaps that need to be addressed

PROOF POINT: ACCURIDE

"Certain states that we operate in shut down non-essential businesses. There was an exemption if you could prove you served the trucking industry, but you had to apply quickly. All of the data we needed was in Plex, at our fingertips. Because of that, we were able to validate our essential status and keep our plants running."

Devin Burke
*Director of Applications & Corporate IT, North America at **Accuride***

THE WAY TO MANUFACTURING SUCCESS

Smart manufacturing is essential for future success. Manufacturers will be able to adapt in a changing market and unlock long-term opportunities by connecting and automating their business.

- Incremental adoption of smart technologies can help manufacturers gain value over time.
- Many possible entry points to smart manufacturing exist, and manufacturers should weigh their options and prioritize improvements that will yield the greatest value.

STARTING YOUR SMART MANUFACTURING JOURNEY

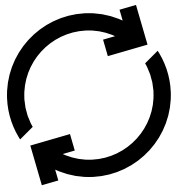
What are the operational challenges you're trying to solve?
Identify challenges with the greatest financial and productivity impacts, then prioritize those that are highest in value and attainable through technology.

Where are your information gaps?
Identify the essential information you need to solve your operational challenges and develop key use cases to collect and analyze that information.

Which use cases offer the right balance of value creation and time-to-value?
Invest in the smart manufacturing solutions that deliver results for your highest-priority use case.

MAKING THE BUSINESS CASE FOR SMART MANUFACTURING

Smart manufacturing provides the following key benefits:



Efficiency

- Production efficiencies through process automation
- Human resource efficiencies from a single source of accurate, trustworthy data
- Continuous operational improvements driven by real-time, data-backed insights

Achievable ROI

- A pragmatic, stepwise approach lowers adoption risk while providing returns to fund future smart manufacturing initiatives

Risk Mitigation

- Reduced exposure to IT vulnerabilities including system downtime, security breaches (cyber attacks), and application currency

Making a business case for smart manufacturing can help communicate the benefits, gain approval, and accelerate adoption and time-to-value. Plex can help.

ABOUT PLEX

Plex is the leader in cloud-delivered smart manufacturing solutions and has been helping manufacturers improve their businesses for decades. Plex has resources and deep industry expertise in defining business value from technology, and we're ready to assist manufacturers in adopting smart manufacturing technology and processes to achieve their business goals.

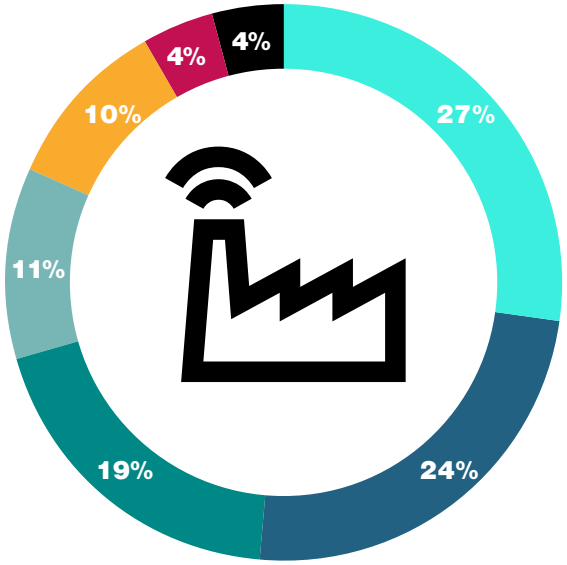
Learn how to achieve your business goals using smart manufacturing at Plex.com

APPENDIX

SURVEY DEMOGRAPHICS

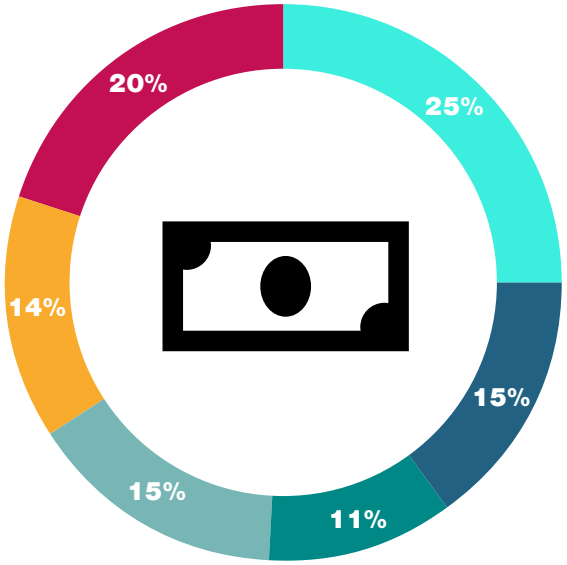
290 manufacturing professionals participated in this survey.

Industries



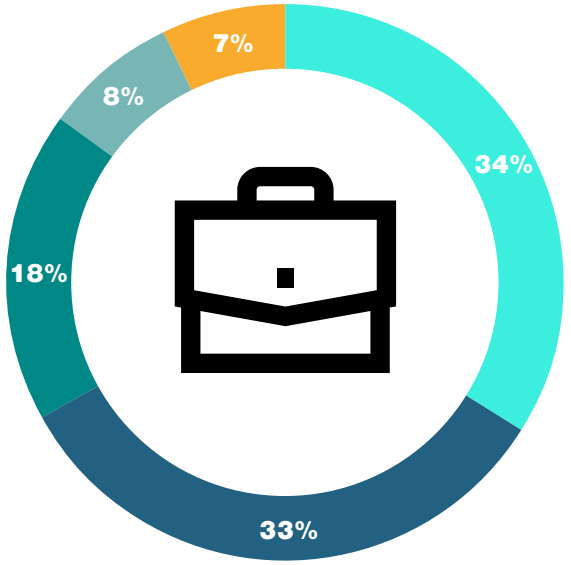
- Automotive
- Consumer packaged goods
- Industrial machinery
- Aerospace
- Food & beverage
- Precision metalforming
- Plastics/rubber

Revenue



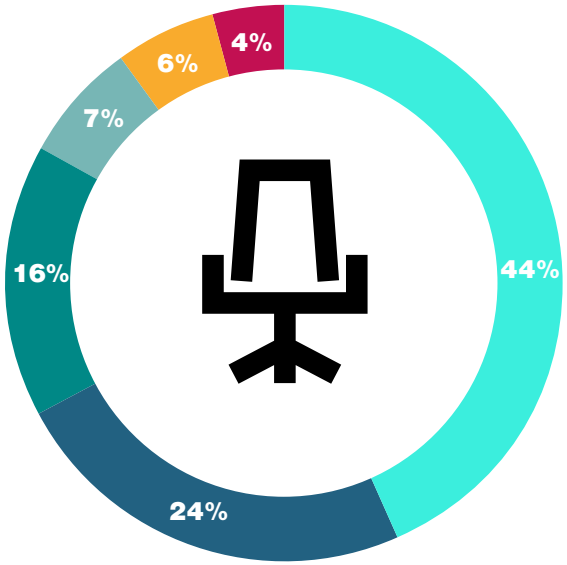
- < $100 million
- $500–999 million
- $100–149 million
- $1 billion or more
- $150–199 million
- $200–499 million

Title



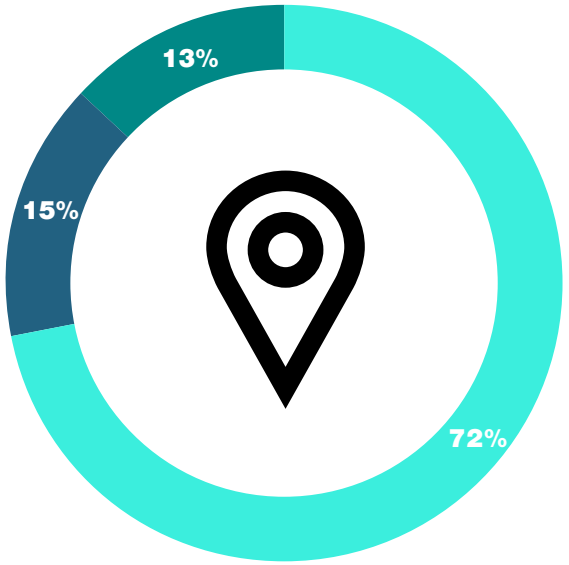
- Director
- Vice President
- Manager
- Department Head
- C-Suite

Department



- IT
- Operations
- Manufacturing
- Quality
- Engineering
- Supply Chain/Logistics

Geography



- United States
- Canada
- Mexico

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