

The State of Manufacturing 2021

Weathering the Perfect Storm



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Introduction

“We’ve seen two years’ worth of digital transformation in two months.”
- Satya Nadella, CEO of Microsoft

The manufacturing industry has gone through tremendous change in the last 18 months. The early part of the pandemic came with uncertainty and shutdowns for most, along with new ways of working and a new element to employee safety. The industry had been looking at digital transformation for years leading up to 2020, adoption however was varied.

Fast forward a few months from the start of the pandemic, the industry is now experiencing unprecedented supply chain disruptions and increases in demand that creates more headaches than joy. Changes in consumer behavior like remote working and food delivery is driving real changes in demand as well as need for product innovation. COVID has also made a lot of people rethink their careers and priorities, turning everyone’s attention to attraction and retention of the workforce. In the midst of all of this is the digital transformation that has become front and center with it’s promises and challenges.

In this report, you’ll learn about key trends revealed in our survey of nearly 800 manufacturers, including:



Disruptions in the supply chain and how manufacturers are addressing them



Gaps in the workforce and strategies for managing them



Technologies that offer the shortest path to value for manufacturers



How manufacturers are adapting to surges in demand

Introduction Continued

The rising tide lifts all boats, and in that spirit we wanted to take the pulse on the industry, find best practices and create an opportunity for peers to learn from each other about what's working and what isn't. We conducted a comprehensive survey of a diverse cross-section of the industry. We also spent time with industry executives to get their perspectives with one-on-one interviews to gain insights into what they see as the risks and opportunities in 2021.

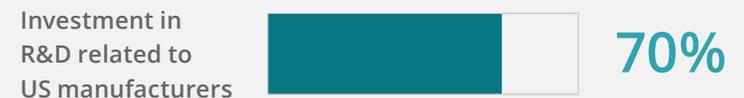
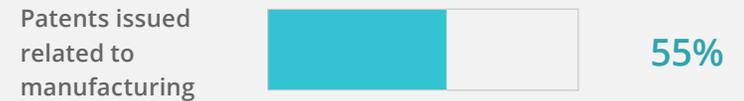
Before diving into the survey results, consider some context provided in [a report on U.S. manufacturing from McKinsey Global Institute](#) (McKinsey & Company's research group). Although manufacturing only accounts for just 8% of the overall workforce and 11% of GDP, it drives 35% of productivity growth, behind 55% of patents issued, 60% of exports, and a whopping 70% of total investment in R&D.

But despite the outsized impact of the manufacturing sector, the industry faces many significant challenges: supply chain disruptions, rapid demand fluctuations, technology rollouts and workforce shortages to name four key themes.

Our survey of nearly 800 leaders from a diverse range of manufacturing companies across the U.S. and Europe was fielded in July/August, 2021.

The Impact of Manufacturing

The manufacturing sector has an outsized impact on several key drivers of the overall economy.



Demographics Breakdown

The 792 respondents were primarily from North America (89%), with 11% from Europe. The split by gender was 64% male/36% female. The most typical age range among the respondents was 35-44. Over half of the respondents were C-level executives or owner/partners.

The most common primary organizational focus among the respondents was IT. The size of the companies represented ranged across a wide spectrum; the combined revenue of the survey respondents was well over \$645 billion, with companies ranging in size from under \$10M in annual revenue to over \$15 billion.



Survey Findings



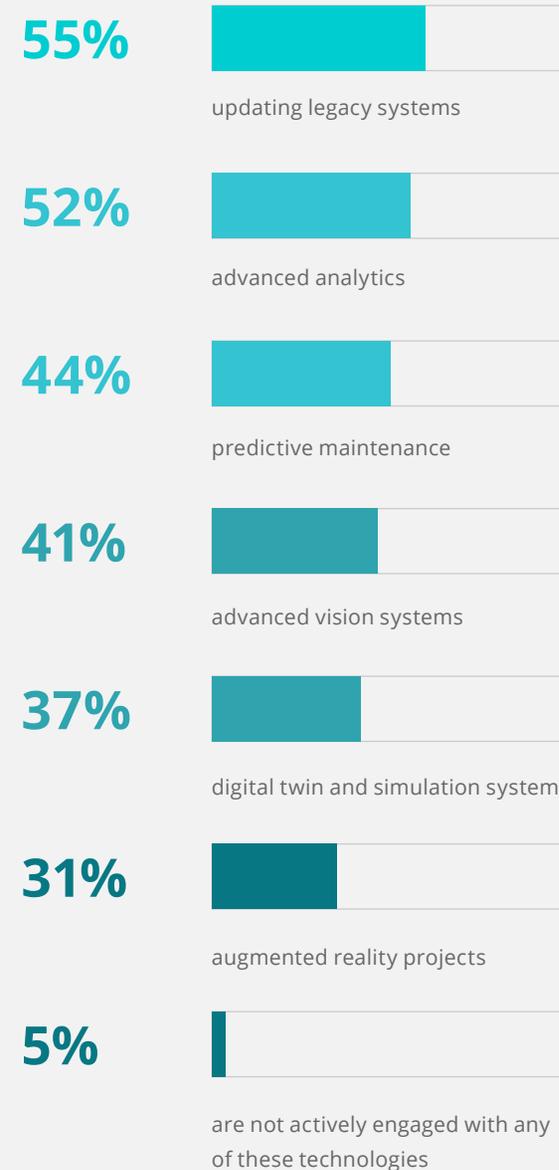
Technology Priorities

More than half of survey respondents have prioritized advanced analytics and upgrading legacy platforms such as MES, ERP, and MRP systems.

Predictive maintenance and advanced vision systems are priorities for over 40% of respondents, while digital twin, simulation, and augmented reality projects are active for about a third of respondents. Only 5% aren't actively engaged with any of these technologies.

Technology integrations are the most common challenges cited (by 64% of respondents) arising from making changes to supply chains. And 55% note that the resources needed for technology rollouts are a challenge that makes it harder to make changes to their supply chains. Roughly half report that sourcing and certifying new suppliers also pose significant challenges.

What technologies have manufacturers implemented in the last 24 months?



Survey respondents shared their thoughts on several key topics, including:

- Supply Chains**
- Market Disruptions**
- Workforce Challenges**
- Technology Solutions**

Rethinking and Revamping the Supply Chain

Given recent supply chain disruptions, are manufacturers still waiting to see how things shake out, or are they rethinking their ecosystem? Just over half of all respondents are already making significant changes across their supply chains, while another 11% are implementing selected changes on a regional basis. About a third are still in wait-and-see mode.

Supply Chain Initiatives

Among the overwhelming majority actively engaged in retooling their supply chain, the most popular initiatives (71%) involve the use of technology to drive greater flexibility. Well over half are expanding their supplier base and demanding more transparency from their suppliers. Almost half (45%) are re-shoring or nearshoring their suppliers.

Historically, in my experience, the majority of supply chain disruptions are driven by disruptions on the supply side. But with the pandemic, we're seeing disruptions in both supply and demand – a perfect storm. Understanding the whole supply chain can be very challenging, especially if businesses sell through distribution where it's difficult to see all pieces of the demand puzzle.



Valerie Young

*CEO, Young Supply Chain Consulting, LLC
and former Supply Chain Executive, 3M*

Rethinking and Revamping the Supply Chain Continued

Ongoing Challenges

Respondents were asked about what they viewed as ongoing obstacles to the smooth functioning of their supply chains (as opposed to challenges that they might view as one-time implementation challenges). Certifying suppliers, ensuring quality, onboarding new suppliers, and balancing supply with demand were all cited frequently as ongoing challenges the respondents expect to be contending with in the future.

Forward-Looking Investment Plans

Over the next three years, over 40% plan to prioritize supply chain investments to bolster sustainability and new product introductions. Only 16% identified resiliency as a key investment for that timeframe. However, the challenges they highlighted and the technology priorities they identified reveal that agility and resiliency is what they are striving for.

In one-on-one interviews with respondents, the importance of agility in the manufacturing ecosystem surfaced frequently, with many comments highlighting the value of flexibility, agility, and nimble responses to sudden business disruptions.

Respondents noted the following ongoing obstacles to smoothly functioning supply chains:

71%

Technology to drive more flexibility in supply chain

58%

Increasing supplier base

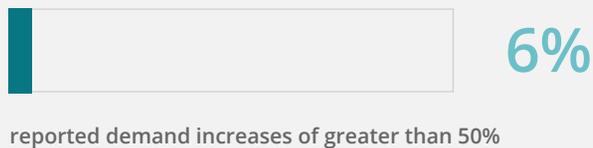
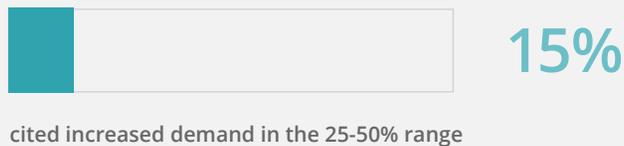
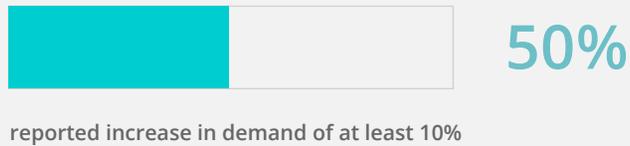
55%

Demanding more transparency from suppliers

45%

Re-shoring / 'nearshoring' supply chain only

Manufacturers have experienced a range in surges of demand:



Trends in Demand

An overwhelming majority of manufacturers are experiencing a surge in demand, with about half of respondents reporting an increase in demand of at least 10%. Many are experiencing even higher surges, with 15% citing increased demand in the 25-50% range, and 6% reporting even higher demand growth.

Only 11% are experiencing a decline in demand, with another 9% reporting that demand remains flat.

Less than half (46%) expect this increased demand to be a short-term phenomenon lasting less than a year, presumably reflecting pent-up demand from periods during the pandemic when manufacturing was shut down or greatly reduced. But a solid majority (54%) expect the increases they're experiencing to last for the foreseeable future, continuing for at least another two years.

How are manufacturers planning to adapt to these heightened levels of demand? They're embracing a wide range of strategies, with new technologies to streamline production (such as data analytics) being the most popular (65%), followed by optimizing production based on existing tools (60%). Adding equipment and additional shifts to the production schedule—traditional linear approaches—is also a popular tactic, embraced by 55%. Only 3% plan to do nothing and simply ride out the increased demand, waiting for the situation to stabilize.

However, those traditional linear expansion tactics are also responsible for the biggest headaches as manufacturers attempt to manage their new challenges. Over 25% cited problems getting new equipment to desired performance and quality levels. Almost as many said that gaps in their technology were making it difficult to meet increases in demand. Supply chain issues were noted by 21%. Other challenges included having a workforce that lacked the skills needed to leverage advanced analytics (17%), as well as workforce training in general (13%),

To keep pace with increased demand, manufacturers are boosting capacity by:

65%

Streamlining production with new tools

60%

Optimizing production with existing tools

55%

Adding equipment and shifts to schedule

3%

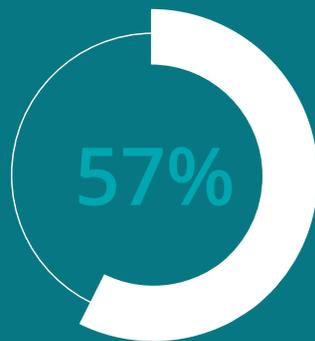
Riding out increased demand

Trends in Capacity

Many manufacturers reported that they were experiencing surges in demand in the range of 25-50%. And many expected these increased levels to continue for at least a few years. Despite these robust scenarios for demand, plans to build capacity lagged far behind these numbers. Only 11% reported capacity increases above 10%, with the overwhelming majority (57%) experiencing far more modest capacity increases in the 6-10% range. And nearly a third reported capacity increases of less than 5%.

The top tactics manufacturers look to for tackling this gap between the surge in demand and the more modest gains in capacity are technology-based solutions such as advanced analytics and machine learning (cited by 45%). Workforce training to drive consistent production was a tactic mentioned by 23% of respondents.

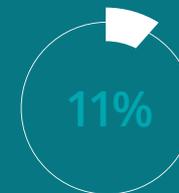
Manufacturers are Increasing Capacity to Keep Up with Demand



increases between 6-10%



increases of less than 5%



increases above 10%

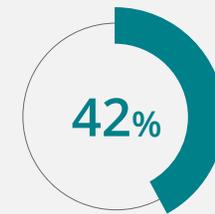
Talent

That 23% figure for workforce training as an approach to capacity building may seem low, given that 42% of respondents identified workforce shortages as a long-term challenge, with an additional 43% citing these shortages as a significant, but short-term, challenge.

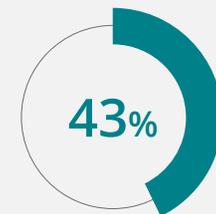
Not surprisingly, this shortfall is coupled with higher rates of turnover. More than two thirds (68%) of respondents reported experiencing higher turnover over the past 12 months. The most common gaps are in IT (reported by 56%), plant floor operations (46%), and engineering (41%).

The most common approaches to bringing new talent up to speed include digital technologies (62%), specific training methodologies (61%), and partnerships to develop a funnel of talent (54%).

Workforce Challenges and Strategies:



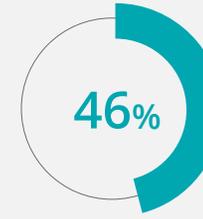
Workforce shortages perceived as long-term challenges



Workforce shortages perceived as short-term challenges



Rates of turnover: IT



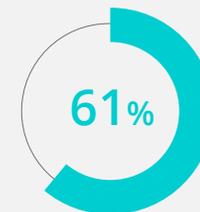
Rates of turnover: Plant Floor operations



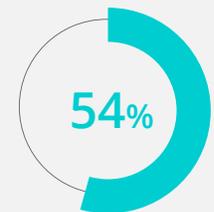
Rates of turnover: Engineering



Use digital technology to bring new talent up to speed



Use specific training methodologies to bring new talent up to speed



Use partnerships to develop a funnel of talent

We are constantly staying connected with employees, whether they are in-person, remote, or hybrid. Our employee engagement went up significantly during COVID. We've focused on engaging employees and fostering a culture of care and holding people accountable for performance. We don't do it because it's nice to do—we do it because it's the right thing to do to keep productivity up.



Bala Sathyanarayanan

*Executive Vice President & Chief Human Resources Officer
Greif, Inc*



In 2021, we had to continue to grow and be flexible about how we serve our customers, and be more nimble about how we do that. Our customers lean on us to find creative solutions in a rapidly changing market.



Ted Jackson
*Executive VP, Operations -
Food & Delivery
Novolex*

Deploying and Scaling Technology

Respondents have been actively deploying a range of technology solutions to help mitigate challenges and leverage emerging opportunities. Within the previous 24 months, over half (55%) have upgraded existing technology systems. Over half (52%) have also invested in technologies for advanced analytics. Other widely deployed technologies include predictive maintenance (44%), advanced vision systems (41%), digital twin and simulation technologies (37%), and augmented reality systems (31%).

Not surprisingly, the most widely deployed technologies also have the highest confidence among respondents for achieving the strongest ROI for respondents' organizations (32% confidence in upgrading existing systems and 26% for advanced analytics).

As manufacturers seek to scale new technologies across their organization, the most common challenge they face is data integration (cited by 50% of the respondents). Sustaining the necessary level of investment to scale and determining the appropriate and expected ROI were also commonly reported challenges (46% and 45%). Change management—along with the related challenges of securing buy-in from leadership and at the plant level—were all cited by over a third of the respondents.

These concerns may be related to the length of time respondents generally expect an investment in technology to pay for itself. The most typical response was 2-3 years (36%). A similar percentage (35%) expect a 1-year ROI, with 18% expecting payback within 6 months.

In the past 24 months, manufacturers have deployed a range of technologies:

55%



upgraded existing
technology systems

41%



deployed advanced
vision systems

52%



invested in
advanced analytics

37%



engaged digital twin and
simulation technologies

44%



deployed predictive
maintenance technology

31%



deployed augmented
reality systems

Change Driven by CEO

The deployment of new analytics and performance optimization solutions requires overcoming a number of barriers within the organization, many of which are financial in nature. “Resource constraints” were the most commonly cited barrier (54%), with the related issues of cost overruns (50%) and unclear ROIs (43%) also high on the list of hurdles. Over half of the respondents (51%) also cited the challenges created by fragmentation across systems and data. As mentioned earlier, difficulties hiring and retaining talent also add to the challenge of deploying new systems.

Despite all of these challenges, there’s a broad group of stakeholders advocating for the adoption of new technology. The top source pushing for new technology? It comes straight from the CEO, cited by 34% as the top driver for technology initiatives. The CFO and board of directors (each coming in at 15%) are also often technology champions. CIOs at 12% are slightly frequent as the key drivers, and lastly 9% of business unit leads are the source for new technology.

Barriers to deploying new technology:

54%



Resource constraints

51%



Fragmented systems and data

43%



Unclear ROIs

Takeaways



The Double-Edged Sword of COVID-19

The pandemic has introduced a wide range of economic challenges and uncertainties into the manufacturing arena, as well as a host of personal trials and tribulations. But it has also created a number of new opportunities. Many manufacturers have found that their customers are now aggressively pursuing new strategies that, in turn, are driving significant increases in overall demand throughout the supply chain. And that increase appears to be more than merely pent up demand to catch up for lost months of production; 49% of respondents expect surges of at least 10% to sustain for at least the next several years, while 20% anticipate sustained growth of more than 25%.

That rosy outlook, however, is coupled with an understanding that significant business disruptions—whether from future COVID variant outbreaks or from the ripple effects of a tumultuous economy or from the impact of lifestyle changes (such as the rise of remote working) that have yet to fully unfold—may well be in the offing. So the ability to respond quickly to changes in demand—whether scaling up, ratcheting back down, or moving in entirely new directions—is crucial.

In short, agility and resiliency have become—and will continue to be—primary factors that determine whether manufacturers are able to dodge the next bullets and how well they're able to leverage the next opportunities.



As our customers required more innovation to meet the new requirements driven by COVID, we were constantly asking how do we optimize across the existing manufacturing footprint?



Ted Jackson

*Executive VP, Operations -
Food & Delivery
Novolex*



Every business today is a technology business. For example, when you can't travel, you sell differently—using technology. You can apply for a job by texting. We use technology to make it easy for our employees to get whatever they need on a self-service basis.



Bala Sathyanarayanan
*Executive Vice President
& Chief Human Resources Officer
Grief, Inc.*

Linear Expansion

In earlier times, manufacturing expansion was driven less by technology and more by what you might think of as linear expansion. The best tactics for scaling up and ratcheting down production were much simpler; you could add or subtract people, or shifts, replace equipment, or build new facilities and retire the outdated ones. Data analysis was mainly reactive.

In their own ways, the levers of linear expansion tactics were fairly agile. Especially flexing the workforce based on demand, but in this competitive labor market manufacturers are a lot more careful about the impact that has on their employer branding.

It's clear in the data that there is a mismatch between how much demand has risen and how much manufacturers have been able to increase their output. On top of that, the traditional methods of linear expansion have a lead time that's much longer than the market needs. In a lot of industries, lead times on new equipment is 12-18 months. Even increasing capacity by 10% by expanding your footprint with new lines would take too long and the opportunity to capture the increased demand may be lost to a competitor.

Expanding your output non-linearly is critical for manufacturers, today and tomorrow. In a more volatile world, long lead times and high capital expenditures are not a good idea. Thinking nonlinearly is good business fundamentals, and it will also make you more equipped to deal with future volatility and uncertainty.

Technology to make the process less people-dependent in the first place, improved digital tools to speed up onboarding, data analytics tools to improve efficiency all have the opportunity to drive nonlinear growth for a manufacturer as well as deliver results faster than the supply chains for capital goods can recover.

Back to Basics

There are two main gaps that are causing headaches for manufacturers:

- ✓ **Between the demand in the market and their current output**
- ✓ **Between the skills they would like to hire and the available talent**

One thing that came through in one-on-one interviews is that the solution to a lot of our current challenges is to focus on fundamentals. In order to attract and retain people in a competitive market we need to reassess compensation, recognition programs, training and career opportunities. All things that are fundamentals of how you create an engaged workforce.

Similarly with supply chain challenges, working closely with both customers and suppliers and making sure you minimize single sources of failure will help, again a basic fundamental of supply chain management.

In simpler times, you could get by without the basics, but in the competitive market of today you need to double down on the fundamentals.



We have been hit by a tsunami wave of demand that nobody saw coming. Everyone in the supply chain is racing to keep up with demand. Even finding real estate for new expansion is a challenge—an order for a new metal roof has a 14-month lead time. At the end of the day, we're focused on growing our capacity and accelerating our plans as much as possible.



Elad Shmulevich

*Global Vice President of Operations
Dura-Line*



Digital projects are a different kind of animal, one that requires a different approach. You need to treat them differently and be much more aware of how to justify those projects, how to guide them, and how to ultimately decide on them. And that's a new skill set that finance and other executives need to be educated about.



Stephanie Holdt
*Senior Vice President
Chief Financial Officer
USG Corporation*

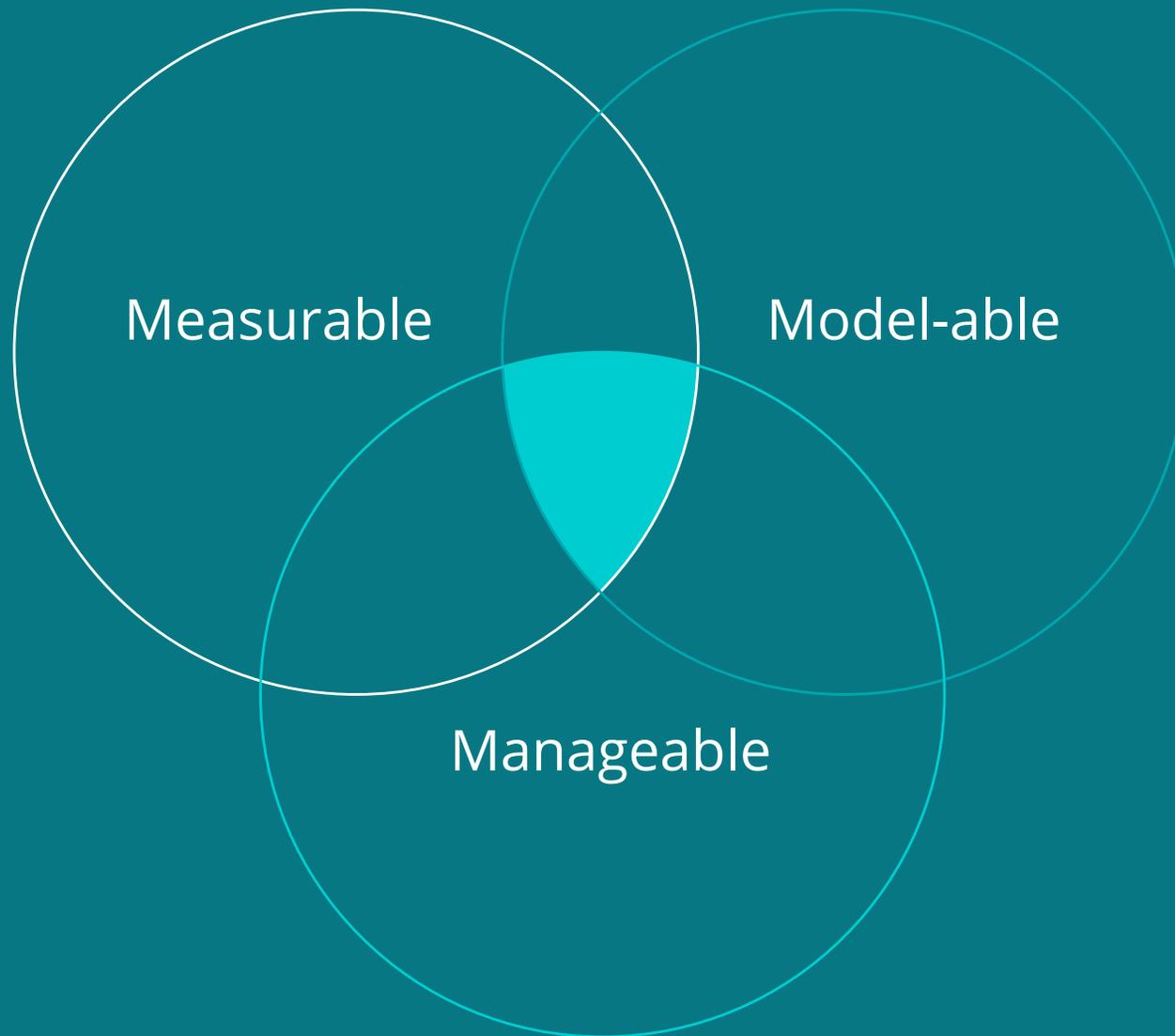
Optimizing for Time to Value and Interoperability

Most respondents recognize that deploying new technology is an essential aspect of their strategies for leveraging growth opportunities, optimizing their operations, and operating in a more agile fashion in general. For example, 71% are deploying technology to improve the flexibility in their supply chain. But they're dissatisfied with many of the traditional avenues for bolstering their technology capabilities; 65% cite technology integrations as a barrier to implementing those changes.

One thing we have learned so far from digital transformation is that scattered point solutions often become data traps. On the other hand, "boil the ocean" initiatives often end with a longer lead time and higher price tag than anticipated.

The lesson is to concentrate on time to value and scalability with a focus on critical business goals while keeping interoperability as a requirement. We can't predict what solutions we may want in the future, but we can predict that we will want to leverage prior investments and continue to build on our capabilities. In the larger digital transformation for manufacturers, there will not be a one-stop-shop, you should be striving for an ecosystem that functions well.

Finding the Fastest Path to Value





Conclusions

Conclusions

COVID-19 has manifested the fragility of our global supply chains and accelerated the need to invest in building resilience. The combination of demand surges, changes in consumer behavior and workforce shortages to keep up with demand are the challenges of today, the challenges of tomorrow may be completely different.

A lot of the difficulties manufacturers are experiencing have been brewing for a while. There have been discussions about the skills gap in manufacturing for many years. We have known about the brittleness of our global supply chains for longer than that. COVID created some new challenges for manufacturers, it also uncovered the severity of a lot of old ones. It has also uncovered one of the most significant themes of the next manufacturing age. The intersection, or symbiosis, of people and technology.

Technology is seen as a crucial element to alleviate some of the workforce challenges, increase transparency and collaboration with suppliers as well as optimize existing assets. Whether it's purely automation, upskilling workers or AI, scaling successful solutions is contingent on highly skilled people and those are in short supply.



Digital capabilities aren't just some kind of interesting science experiment for these companies—they're an imperative. And this will be something they can achieve with a technology strategy in their own backyard. For the past ten years, digital technology has been a game of "what if?"—wouldn't it be cool if we could do X, Y, and Z? But now it's become a matter of survival: "We won't survive if we don't do this."



Jordan Reynolds
*Principal, Global Director
of Data Science
Kalypso*



We don't always need the sophisticated skill sets of electrical engineers or data scientists to figure out how to optimize manufacturing processes if we can use persona-based data analytics. We can leverage our very best manufacturing technicians, wherever they happen to be in the world. Maybe they're in a plant in Kalamazoo, Michigan, but they don't need to be on-site or on-shift where and when a challenge crops up. Using augmented reality tools, we can institutionalize and share their wisdom across the enterprise.



Jane Barr

*Vice President Global Industry
Rockwell Automation*

Conclusions Continued

The labor market for IT and OT talent will continue to be competitive for years to come and we as an industry have to look to both upskilling and attracting new talent into the industry in order to achieve our goals.

The path to resiliency is not linear, manufacturing leaders need to embrace the intersection of people and technology in order to build a supply chain that is agile. This begins with articulating a clear vision for the future and enabling an organization to get there. With the right people and support you can unlock driving a cohesive transformation strategy focused on time to value iterative solutions that are scaled quickly to augment your existing workforce and attract new talent.

Solve Your Problems
Today To Drive
Excellence Tomorrow.



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