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# **Digitalization Gains**

## Manufacturers Forge Ahead with Digital Transformation

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"If a business case is solving a customer problem, we're actually open to disrupting our own current product line. Our philosophy is, if we're going to be disrupted, we'd rather be the first to do it."

- Manufacturing executive



### Manufacturing Sector Continues to Invest in Modernization

U.S. manufacturing, buoyed by the strong economy, continues to make investments in resiliency and modernization. Manufacturers are focused on expansions and upgrades of existing factories and machinery. They're also cutting ribbons for greenfield sites at an unprecedented rate. Investment in factory construction hit record highs of more than \$100 million per month throughout 2022 before doubling in May 2023 to \$200 million per month and leveling off at about that amount ever since, according to the latest information from the St. Louis Fed. Government grants from the 2022 CHIPS and Science Act are starting to flow at substantial levels with the spring 2024 awards of \$8.5 billion to Intel and \$6.6 billion to Taiwan Semiconductor Manufacturing Company for their

Digitalization investments are pivotal to this growth and modernization landscape. Manufacturers are deploying new technologies and architectures to prevent disruptions like rapid fluctuations in demand, glitches in supply chains, and shortages of talent. Each manufacturer will take a unique approach to digitalization based on their products, markets, and company culture. All manufacturers will encounter obstacles along the way, but the true test will be how quickly they respond to those challenges.

operations in Arizona.

To gain a better understanding of the digital transformation state of play, the Manufacturers Alliance Foundation studied where manufacturers have made progress and where they are stalled in their digitalization journey. We surveyed 199 U.S.-based midCap to large-Cap manufacturing companies and interviewed executives representing a variety of company sizes and industries to gain a deeper understanding of how digitalization is affecting manufacturing in 2024 and fertile areas for progress. We captured a wide range of perspectives including those from manufacturers that are just starting their digital journey to those that have been at it for a decade or longer.

### **Top-Level** Findings

- >> Manufacturers have made solid progress, especially in supply chains, business intelligence, and product development
- >> Progress is fragmented in silos with highurgency projects beating out those offering long-term impact
- >> Digital transformation roadmaps exists but they lack specificity and are disconnected from tangible business cases
- >> Near unanimity on the requirement to align product development and manufacturing, but achieving that vision is falling short
- >> Teams struggle with collaboration across functions
- >> Building ecosystems to solve problems is challenging, but manufacturers that have started working with partners are reaping the rewards



### Manufacturers Have Started the Digital Transformation Journey

As every manufacturer agrees, digital transformation isn't a "one and done" exercise, but rather a journey. By its very nature, digitalization threads together the entire value chain of manufacturing, from external supply chain partners upstream to aftermarket services downstream and everything in between.

Thus far, manufacturers have made the most progress upstream. This is

not surprising given the disruptions in supply chains and rapid swings in demand that plagued most industrial companies over the last few years. As a result, more than half (51%) have already deployed predictive analytics for data-driven supply chain planning, and some are using digital twins for dynamic scheduling. Another 29% are in the process of implementing those same tools.



They have also upgraded their business intelligence platforms and made them smarter by using predictive analytics for data-driven planning and optimization. Mark Paradowski, Sr. Vice President of Information Services and Chief Digital Officer at Columbus McKinnon, explained that his company's digital transformation, now underway for about a decade, has corrected what used to be a "splintered process" involving multiple websites, lead management systems, and portals used by channel and distributor partners to select, quote, and order products. "We started with two focal areas – product information

management and content management because we wanted to focus externally first," Paradowski said.

One manufacturer shared that artificial intelligence (AI) is also beginning to play a role. For companies with products that have a long lifecycle, customers continue to need parts 15-20 years after purchase. Al is being utilized to understand the product history and provide insights.

Manufacturers are building more digitalization into product planning and development as well as production.

### **Digital Transformation Takes Shape**



Organizations' progress in implementing digital transformation technologies

Many (46%) have completed projects to integrate robotic automation and Al into manufacturing processes, and another 34% are in the process of doing so. More than three-quarters (79%) are already using or rolling out digital twin technology for product planning and development, including real-time quality monitoring.

Compared to upstream and midstream, manufacturers have made slightly less progress in digitalizing the later stages of the manufacturing value stream. Less than half (41%) have deployed Internet of Things (IoT) for advanced operational sensing and detection of inventory and warehouses. Half are still working through implementations or pilots, and 9% have no plans to deploy digital solutions in this space.

Continuing to the end of the value stream, aftermarket services are the area where manufacturers have made the least headway with digitalization. While 28% say that they have already optimized their aftermarket services with Al-powered tools or integrated Customer Relationship Management (CRM) systems, 40% are still working through implementations, and another 21% are in the pilot phase. The rest have no plans for aftermarket services, despite the intelligence and/or revenue that such a channel may be able to deliver.

### Customer App Feeds Product Development Team

The maker of a popular paint sprayer developed an app that tells the owner of a paint contracting company things like where the sprayer is located geographically, how many hours it was used in a day, and its pressure. It was really developed as a management tool to keep tabs on teams, but through the app, the manufacturer also discovered that users never exceeded a certain number of gallons of paint in a year with the sprayer. Any effort to develop a sprayer that could handle substantially more would be unnecessary. "We can save ourselves money by not putting that much technology into the product," an executive from the company told us. The app also helps the manufacturer provide ongoing communications with its customers such as providing alerts when the sprayer requires maintenance or a new filter.

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## Projects are Siloed and Progress Is Fragmented

The overall picture painted by our survey and interviews is that digitalization efforts are often fragmented and isolated in pilots. Projects that address a single pain point in one factory, for example, are much easier to launch because the problem is obvious. "Easy alignment happens when you have a specific problem you're trying to solve. You can get people on board very quickly when you are trying to solve problems such as lead time reduction and turnover." Joseph Abdo, Vice President of Manufacturing at **JTEKT** North America told us. "The more difficult part is developing and investing resources into those strategic projects geared toward longer term return or competitive advantage for the future," Abdo continued.

Similarly, manufacturers often struggle to secure funding for prevention. This is especially true of quality management. As one executive at a large durable goods manufacturing company told us: "There are a lot of nice-to-haves and things that provide real benefits in the unlikely event that you have a big quality spill. But when you're looking at opportunities on any given day, there may be more prioritized activities on the productivity side of things versus quality."

Making quality a pillar of the overall digitalization strategy is important. It is all about bringing more process and quality control upstream in the value chain versus defect detection downstream. It is also critical to determine the cost of poor quality, how it can be communicated from a business value perspective, and how it fits into the overall digitalization strategy.

Identifying the business value of new digital strategies is a sticking point for most manufacturers. When we asked them to describe their current challenges related to digital transformation, difficulty in measuring the ROI of their digital transformation

### **Top 3 Digital Transformation Challenges**



Source: Manufacturers Alliance Foundation study 2024



topped the list. Things get even more difficult when manufacturers complete a pilot successfully but full deployment stalls because of too much complexity. This is particularly difficult in environments with legacy infrastructure, often from multiple manufacturers.

Siemens advises customers to consider the ROI of digitalization based on their relevance and ability to add value quickly. "Twenty years ago, I remember having to convince company leaders to embrace new technologies," said Del Costy, President and Managing Director, Siemens Digital Industries, US. "That's not the case anymore - leaders know how important this is. At the same time, their expectations are higher. Rightly so, they require technologies that quickly add value to their existing operations. They can't afford to pause production or embark on a project that will take many months if not more than a year. As one customer told me, they need to adopt technology at the speed of relevancy. They need technologies now. And frankly, I would advise all customers to expect nothing less than that from

a partner. They deserve a partner that can help them deploy technologies that address key pain points," Costy said. "They need to be adopted quickly, effectively, and at scale, without ripping and replacing existing technology that still has years or decades of remaining life. I take it as my challenge to make this real for customers."

"As one customer told me, they need to adopt technology at the speed of relevancy. They need technologies *now*."

> Del Costy, President and Managing Director, Siemens Digital Industries, US

The second greatest challenge manufacturers are experiencing right now is lack of alignment between functions. Digital transformation is inherently a collaborative endeavor requiring trust as well as common vocabularies and goals. In addition to the well-known friction between many IT and OT teams, different functions possess highly specialized skillsets. If teams don't have a common understanding of requirements, they might be talking past each other. Lack of shared visibility into data is a common pitfall between different functions. Without a clear, shared view backed by data, the digital journey can slow or fail.

Data is the throughline for every digitalization story. Given the quantity of data produced in the manufacturing environment, perhaps it is not surprising that the third greatest current challenge identified by manufacturers is the inefficient use of data analytics. Reluctance to share data is sometimes a problem. In many cases, though, it's simply a matter of one department not realizing the value of that data to another part of the organization. As Jennifer Nemeth of MSA Safety put it, "In the past, I might have thought some of the data would affect only manufacturing, but then you realize that same data you're capturing may be good for product development or HR." There is a clear connection between good collaboration and efficient use of data analytics.

### From Safety Manufacturer to Safety Technology Company

MSA Safety started its digital transformation about 10 years ago when they repositioned themselves from providing purely manufactured products to offering a broad range of safety solutions. Heiko Will, Chief Digital Officer, explained how much this transformation was driven by customer demand: "Customers told us, 'We don't want just your product, we also want the data that comes with your product. We want to use MSA's product to understand our own processes better instead of just buying a safety product.' We were relatively lucky that we experienced this customer demand so early because it helped us to make this strategic decision to deliver more data holistically and digitalize our processes."

The model for MSA's journey was its R&D department, which pioneered a cloud-based, connected solution designed to meet the specific needs of their customers. "We've built this whole R&D organization to be able to provide that complete, connected solution to the customer," Tom Salapow, Executive Director of Research and Engineering, told us. "We realized we needed a technology portfolio that extends beyond R&D and across the whole organization, building on the R&D portfolio. We've been doing portfolio work in R&D for more than 20 years, so our processes were quite mature," Salapow explained.

Collaboration has been a key theme of MSA's journey. Jennifer Nemeth, Leader of Global Advanced Manufacturing and Industrialization, talked about how MSA avoids the problem of silos and fragmentation: "You have to think not only about the technology and the customer but also your own organizational structure. We've made changes, such as having pieces of IT, OT, manufacturing, and R&D all working together to break down silos and have that cross-functional collaboration. We also have a Global Technology Council with members from all parts of the organization. We set priorities based on corporate strategy, customer needs, technology needs of the enterprise, and resources, so that everyone is working toward a common set of goals."

## No End in Sight to the Talent Crunch

Finding talent with the specific skills to support the digital transformation adds a new twist to the perennial talent shortage in manufacturing. Companies are having difficulty moving forward because they can't acquire specific skillsets such as data scientists and architects. "As far as the talent resources are concerned, acquisition and retention are tough. If we were able to find associates with the right skills, that would be very beneficial to the organization and help us grow. It's kind of a Catch-22, right? And if I had the talent, then I could probably utilize the technology today to get what we need," one large durable goods manufacturer said.

Talent has been a challenge for manufacturers for decades because of the difficulty of attracting workers to environments that are perceived as dirty and dangerous. Now, as factories become smarter, the image problem can often be less of an obstacle, but the skills needed are often the same as those being used in other, potentially more attractive industries such as toptier technology brands. "In some of our locations, big companies are moving in and hiring 3,000 or 4,000 people. It's tough to find people in a lot of places," one executive said.

According to a recent PWC survey, 71% of industrial products companies believe that talent acquisition and retention difficulties pose an organizational risk. It is easy to understand why. Job seekers are attracted to companies that embrace the latest technology. Winning the talent game means having a core digital bench in-house and not simply outsourcing to smart partners. This bench of technologists develops a stronger understanding of the core manufacturing business and how digital strategies can be applied.

One manufacturing company's digitalization strategy revolves around solving customer needs. "We are focused on making sure we're developing the right solution instead of just building what the marketeers and engineers want," said one manufacturing leader. "If a business



"Our organization is beginning to look outside and evaluate opportunities with educational institutions to help us bridge the talent gap."

Manufacturing executive

case is solving a customer problem, we're actually open to disrupting our own current product line. Our philosophy is, if we're going to be disrupted, we'd rather be the first to do it. We take some risks, but we're set up to move quickly. We want to avoid having a bad project live on in perpetuity just because we all thought it was a good idea at first," they continued.



# Strategic Roadmap Is Disconnected from the Business Case

Making sure that the digitalization roadmap dovetails with the business case is vitally important. As our survey made clear, many companies struggle here, basing their strategy on quick wins and pain points, not on an overarching vision of how to create long-term competitive advantage. In many engineering-dominated organizations, the lure of problem-solving is strong and the "what" (solution) takes precedence over the "why" (business case).

Agreeing to a high-level vision of digitalization's goals is something that many manufacturers have achieved, but having a strategic roadmap that is specific and operationalized is much more difficult. As one durable goods manufacturer told us, "We focus on specific solutions, but we need to look at the long-term strategy as well. Otherwise, we'll always be behind and never catch up. So, the question is: How do we focus on both the tactical and strategic at the same time?"

Significantly, manufacturers report a weak connection to the business case even in areas where digitalization is most advanced, such as upstream. While 61% say they have a comprehensive business case for supply chain optimization, the rest report the business case lacks detailed justification or is not clearly defined

While 61% of respondents say they have a comprehensive business case for supply chain optimization, the rest report the business case lacks detailed justification or is not clearly defined to begin with.

to begin with. It is easy to imagine a situation in which companies moved forward without detailed justification to support the supply chain optimization business case because the pain was so obvious, even if they didn't have the data to quantify it precisely. The digital transformation business case is weakest downstream. Only about 45% have created a comprehensive business case for aftermarket services optimization. This is an area requiring manufacturers to re-imagine their business models, possibly even branching out into areas such as data-as-a-service or directto-consumer channels. As one durable goods manufacturer told us, "What it comes down to is basically seamless collaboration with our customers and supplier base. That's the big vision. How we get there is not defined in detail yet." Another weakness in manufacturers' digitalization strategies is the mapping of new processes and creation of solution architectures. Some companies are leery of simply transposing old processes into digital and view this as a recipe for failure. Others have taken the "lift and shift" approach to move as-is data to the cloud so that it can at least be shared while optimization moves forward. Whatever the approach, this space is still under construction for many manufacturers with mapping in various stages of completion.

#### **Connections Between Business Case and Strategy**

How robust is the business case supporting manufacturers' digital transformation initiatives?



Source: Manufacturers Alliance Foundation study 2024

## Aligning Product Development and Manufacturing Is Critical

If there is one area of widespread consensus, it is that product development and manufacturing must be aligned. Nine in ten (91%) manufacturers agree that their product development teams are working closely with manufacturing teams to integrate digital technologies into production processes.

Time to market has become a key driver for this alignment. Manufacturers have already experienced significant gains by being able to test and reconfigure in the digital world, without the time and expense of prototyping. As Joseph Abdo told us, "In the EV market, we're seeing very short development cycles and much more frequent model changes – both major and minor. We're looking at product development cycles and improved communication, including better ways to share information about successes and failures."

### The Challenges with New Strategies

To what extent have organizations mapped out a process and solution architecture strategy?





Alignment between product development and manufacturing is really about connecting teams and individuals who have different types of expertise. To achieve the inherent value of digitalization that comes with connecting data, systems, and processes, the human element must also become more connected through greater sharing of knowledge and expertise. More than three-quarters (84%) of manufacturers expect this collaboration to build cross-functional expertise between product development and manufacturing. This expertise is the basis for increasing visibility across different roles and functions within the organization and sharing information. Continuing progress in this area will be key to addressing manufacturers' challenges with lack of alignment between functions and insufficient use of data analytics, discussed above.

When manufacturing and product development are not aligned, productivity, guality, and competitiveness suffer. As one durable goods manufacturer told us, "The disconnection between product development and manufacturing creates a lot of difficulties and churn. We have learned some painful lessons in this area. We tried to solve the labor issue by automating too quickly. But we didn't adapt the product strategy to match the automation and encountered problems because robotic systems can't manipulate the product as well as our human labor could."

### **Getting Into Alignment**

Technologies being used for quality monitoring to support alignment of product development/R&D and manufacturing processes



Source: Manufacturers Alliance Foundation study 2024

### Digital Transformation Depends on Building Ecosystems

By any measure – quality, time to market, throughput, etc. - improved collaboration between manufacturing, product development, and other functions across the value stream will make manufacturers more competitive. The next step for many will be taking that collaboration outside the walls of the company into a larger ecosystem. Ecosystems allow organizations to tap into new types of capabilities by sharing and collaborating rather than developing these capabilities in-house. Unlike supply chains and partnerships, ecosystems are alliances based on the idea that companies working on common challenges will produce better results than any individual company can on its own.

Some common issues that manufacturing ecosystems might address are how to accelerate digital transformation or how to expand the pool of skilled talent. Co-creation and co-innovation are key benefits. especially in terms of working with external partners to achieve new business models and revenue streams. As we learned in our **2020 ecosystems** study with Deloitte, manufacturers that take an ecosystem approach are able to increase the pace of introducing new digital products and services, expand innovation, accelerate the digital maturity of their organization, and reduce operating costs through greater efficiencies.

Manufacturers have historically struggled with making progress with ecosystems compared to other industries. Business-to-business (B2B) manufacturing ranks dead last among all industries, including public sector and local government, in terms of collaborating though ecosystems. According to an **EY study**, only 55% of B2B manufacturers are actively engaged with an ecosystem (versus 63% in the public sector and government). By contrast, businessto-consumer (B2C) manufacturers, especially consumer packaged goods companies, are more engaged in their ecosystems because of the business value of early insights into changing consumer trends.

Manufacturers told us their top challenge in terms of building ecosystems is finding partners with the right digital skills. Other impediments include concerns about cybersecurity, regulatory hurdles, and technical complexities in ecosystem integration.

### Automotive Ecosystem at Work

A great example is the Catena-X automotive ecosystem, which grew out of a collaboration launched by Siemens, SAP, BWM, Robert Bosch, and ZF Friedrichshafen. There are now nearly 200 members including large and small companies, academia, and government entities. A key principle of the consortium is the reliance on open-source collaboration and software development. Practical activities are centered around use cases affecting the automotive community such as sustainability, demand and capacity management, and modular production. Significantly, many of the obstacles to building ecosystems are entirely internal. Manufacturers told us they are blocked by integration challenges with existing systems, resistance to change among employees, and lack of buy-in. They also cite the limited awareness and understanding of ecosystem benefits.

Jennifer Nemeth talked about MSA Safety's experience working with their ecosystem partners, **Digital Foundry** and **CESMII**: "When we started working with the Digital Foundry and using their space, it created an off-campus environment for us to gather and build a growth mindset across a crossfunctional team." She stressed the

importance of having an environment where there are no bad ideas. Bringing the vocabulary of IT and OT together is paramount. "Sometimes IT and OT were saying the same thing but saying it differently. So having ecosystem partners facilitate that discussion helped us align much more quickly. The CESMII framework gave us common ground through a common language and structure where folks from IT, OT, engineering, and data, were all working on this exact same roadmap, within the same framework, and using the same language. If I had one piece of advice for a manufacturer struggling with their digital transformation, I'd say be ready to collaborate, have a growth mindset, and be open-minded," Nemeth said.

### Leveraging the Manufacturing USA Ecosystem

"The task of achieving digital transformation at scale in American manufacturing cannot be accomplished by one company or organization," said Del Costy of Siemens Digital Industries, US. "It demands an ecosystem of partners with complementary capabilities. For Siemens, one of the ways we engage in this network is through the Manufacturing USA innovation spaces. These enable us to showcase the art of the possible and strengthen ecosystems. We partner with approximately half a dozen institutes in this network."

Siemens' collaborations with Manufacturing USA institutes range from projects with ReMADE on methods to recycle and upcycle chemicals, to work with NextFlex on integrating electronics more seamlessly into products with localized manufacturing, to creating an automated tracking and traceability solution for parts with the ARM Institute. LIFT and MxD are leveraging the power of digital twin tools and spotlighting energy-efficient, smart technology on the factory floor in their demonstration facilities. The RAPID institute is focused on energy efficiency and decarbonization breakthroughs for the traditional emissionsintensive chemical engineering processes.

Costy added: "This is an important time for all companies to engage in the Manufacturing USA network – and not only large ones like ours, but especially small- and medium-sized enterprises. Leveraging Manufacturing USA resources can help companies participate in ecosystems that ultimately lower the barriers to entry for digitalization. It can help small- and medium-sized firms afford and adopt new technologies faster."



Many of the challenges that manufacturers face in their digital transformation journey can be addressed in full or in part by expanding their ecosystems. A maker of snack foods may have traditionally included only suppliers, distributors, and regulatory agencies in their ecosystem. But an expanded ecosystem might include social media influencers, meal kit providers, nutrition consultants, celebrity chefs, and thirdparty delivery aggregators such as Doordash and Uber Eats.

As the pace of technology advancement guickens, ecosystems will take on more significance. In our survey, nine in ten (91%) said they have concerns about whether their organization can quickly anticipate and adjust to obstacles in evolving ecosystems. As one manufacturing executive pointed out: "Technology development cycles used to be 18 to 24 months. You could actually take a breath before diving into the deep end. Now that cycle is more like 12 to 18 months. It's moving so quickly that we're continuously evaluating what's out there just to understand what are some of the best practices or even key practices that companies are reaching for with this new technology."

Heiko Will summed up the situation manufacturers face at this stage of the digital transformation: "Our core processes and core functions in the digital journey have been centralized over the years. This enables us to react more quickly and drive change more rapidly. This is critical because one thing that we cannot control strategically is the pace of change. The world around us is constantly changing. When we started

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Manufacturing executive

this journey a decade ago, it was all about connectivity and radio. And then came IoT. And once we had data accessible everywhere, AI advances and we have to react to that. Because we were set up to address these challenges, the process was much easier."

## About this Research

Manufacturers Alliance surveyed 199 leaders in manufacturing to better understand how digitalization is affecting the industry in 2024. We have highlighted some statistics about the respondents.

#### **Primary Industry**

Over \$10B

20%





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