**Manufacturing Leadership Council**

# All News & Insights

# Video on the Factory Floor: A New Poka Yoke Tool for Operators

July 11, 2018 3:09pm

On May 21, Jeff Moad wrote an article entitled, _Should Manufacturers Video Plant Floor Performance?_ In it, Jeff described the technology coming out of my company, Drishti, which uses video-based systems to observe human activities for automatic validation and measurement. Think of it as an automatic time study performed on every cycle.

As Jeff rightfully pointed out, within most plants, the vast majority of value creation and the vast majority of variability are both traceable to human sources. And, as he further pointed out, it's in everyone's interest—management and labor alike—to simultaneously improve productivity, quality and safety.

We believe that Drishti is among the first of what will surely be many companies using video to help manufacturers observe and quantify processes that have been heretofore unmeasurable and, thus, invisible to analytics.

I also believe that video-based tools have the potential for the sweeping improvements that Jeff speculates. In any factory, there are countless issues that arise due to combinations of product design, process design and operator factors. Often these problems are clear to the human eye, if only there were enough humans to observe the system at all times. (Of course, there never are.)

Video-based computer vision will be used by manufacturers to direct a factory's scarcest resource—human attention—to its most pressing issues as well as to generate descriptive statistics from the videostream that lets people trace the issue back to the root cause and, ultimately, solve the problem.

I also fully agree with Jeff on one other key point: introducing a video camera is not just a technical challenge, but a cultural one.

In particular, Jeff raised three very salient points about the ramifications of the camera as an input device. His points are well-conceived and I eagerly accepted his offer to respond in this forum.

The first point he raised:

"Plant workers and their front-line supervisors may well object to having their every move on the job recorded and analyzed."

This would be the case, if not for one condition: Those working under the cameras benefit from the process improvement driven by a video system, too. This is a critical point. Operators read the news. They see the headlines about the inexorable march of robots and AI into the factory. They worry about the long-term viability of their jobs. It's understandable that they might be suspicious of video.

What convinces an operator otherwise is the understanding that a video system takes the technologies typically used for displacing people (computer vision, machine learning) and applies them to enhance humans, not to surveil them. It's actually providing in-station operator assistance as the next generation of _poka yoke:_ a judo move on robotics that lets human operators leverage technology that originated with robots as their "second brain and third eye."

It is also the natural extension of what Toyota Production System developers Taiichi Ohno and Eiji Toyoda recognized: One has to empower the line operator with the tools and the authority to act on their insights in order to identify and solve issues.

Consequently, whenever Drishti begins an engagement, we insist that line operators are a part of the initial design team. They help us understand the challenges on the line, and we help them understand the purpose of the cameras. A well-designed video-based system, used appropriately, can help humans break the ceilings in productivity and quality that managers assumed were immutable and thus change the ROI calculation of an investment in machines—in the human's favor.

Once operators understand this, we often see them engaging with the system as much, or even more, than the engineers behind the scenes.

Jeff's second point:

"Manufacturers that turn to technology such as Drishti's will need to reassure operators that the purpose is not to identify and get rid of poor performers, or those who may just be having a bad day—but to improve process performance overall"

I couldn't agree more. The true purpose of Drishti's system is make these human-powered systems competitive by marrying man and machine in three powerful ways.

1. To help each operator break through perceived quality and productivity limits;

2. To help the business identify the star performers in their midst who currently work diligently but with little measurable evidence of their work ethic or potential for advancement; and

3. To identify specific opportunities for individual improvement that, with a little spot training, can turn a poor performer into a superstar.

Manufacturing is currently facing a labor shortage. The last thing any supervisor wants to do is fire an under-performer. The better course of action—for everyone—is to surface the path to improvement. And to retain these operators who understand the processes well.

Finally, his third point:

"At a time when many manufacturers are working hard to increase engagement with shop floor workers to drive cycle time improvement and reduce waste, the last thing they should want to do is to send the message that workers are not trusted."

I'll propose an alternate interpretation: The operators typically know the process far better than even the engineers who designed it. A truly collaborative system, video-based or otherwise, is designed to surface the wisdom these operators possess and, for the first time, give them the tools to prove the value of their ideas.

We call these the "brilliant outliers," and they are perfectly capable of identifying faster, better, and safer ways of doing their jobs.

With video-based  systems, operators will now possess statistical evidence to have their experience recognized and their ideas heard. We believe this should deepen the trust between the company and its workers.

In closing, we believe that video will enable the two key organizational features of a true lean plant as defined by Womack, Jones, and Roos in their iconic book, *The Machine that Changed the World*: Transferring responsibility to the workers actually creates value, and enables a mechanism for identifying defects and tracing them back to their root cause.

Video is the means; lean is the ends.

*Prasad Akella led the industry/university team that built the world's first collaborative robots at GM ("cobots", projected to be $12B market by 2025). He's the founder and CEO of Drishti, a company deploying AI to collaborate with and enhance humans on the factory floor.*

Blogs

# Crystal Ball: A Futuristic Workforce Odyssey

For humans and machines to work together by 2030, the workforce evolution must start now

By Kim Curley    April 26, 2023 1:22pm



*Extrapolating from the results of NTT DATA's recent research report, Innovation Index: Shifting from Disruption to Growth, Kim Curley, NTT DATA's Digital Evolution Leader and Vice President of People & Organization, shares her insights about the future of the manufacturing workforce in the first of our Manufacturing in 2030: Crystal Ball series.*

Picture this: the year is 2030. Across the U.S., the manufacturing workforce has evolved into a symphony of humans and machines working in harmony. This dramatic transformation has made the workforce a technology-enabled powerhouse. Artificial intelligence, robotics, and virtual reality lead the charge, transforming the factory floor into a buzzing and orchestrated hub of activity.

Workers use advanced technologies to perform their tasks more efficiently and safely, collaborating seamlessly with their robotic counterparts. The shop floor thrums with the smooth whirr of precise machinery and the hum of advanced systems. Augmented reality displays guide workers through complex tasks. And to make this possible, the workforce has become a melting pot of diverse talents and skills that is continuously learning and developing

It is a rosy view of the future, but realistic based on current data and trends that illuminate a path to this future state.

## Changing Skillsets for 2030

The 2030 manufacturing workforce will be doing things quite differently than they do today. Four in 10 manufacturers have already



begun leveraging augmented or virtual reality devices, and that will only increase. That usage will expand to support workforce instruction and training. One example of this could be teaching workers to switch over a production line. Providing that training in a virtual reality environment would mean the company doesn't need to shut down real-world production.

As the usage of advanced technologies rapidly expands, the skillsets of the manufacturing workforce must expand, too. In addition to physical technical skills, workers will need to strengthen their understanding of technologies as well as problem solving, critical thinking and leadership skills. To build that workforce over time, you must start by expanding the skillsets of managers and leaders now. Starting today is critical to being successful in 2030, indeed, 39% of manufacturers report that they have already increased their investment in leadership development.

## A More Resilient Enterprise

The evolved workforce will enable significant benefits. The big one is resilience. An augmented workforce better enables the company

to respond to changes in the marketplace. With such a workforce, companies can train faster, reset the lines, and change worker skillsets more rapidly. Paving the way for this evolution, upskilling and reskilling programs for new and/or existing workers are underway today at 54% of manufacturers. More broadly, making your workforce future-ready entails steps such as improving safety, productivity and talent; incentivizing workforce agility; teaching new leadership skills; engaging the workforce; and maintaining a future-focused mindset. We'll look at each in turn.

## Improving Safety, Productivity, and Talent

The NTT DATA 2023 Innovation Index survey showed that businesses are increasingly addressing potential disruptions in strategic plans because these events present opportunities for those businesses that can act with resilience and speed.

So, it is not surprising that manufacturers are placing increased importance on their workforce and the workforce's ability to adapt and move quickly. The more connected and engaged the workforce is, the better it can shift and flex when the unexpected happens.

Three vital areas come immediately to mind when considering how these coming changes address the problems facing today's manufacturing industry. The first is safety. As noted earlier, one of the best commercial applications of virtual technologies is training. Training workers to complete physically demanding or potentially hazardous tasks in a completely safe environment — without the cost of physically constructing such simulated environments — is a game changer. Fully 77% of manufacturers report plans to use these technologies within the next two years. That's well ahead of the cross-industry average of 64%. Using these tools for ongoing training programs helps ensure that workers know exactly what they need to do and how to do it. And it does that while protecting their safety and the safety of the products they manufacture.

A second area of lift is in productivity — specifically, decreasing production errors and downtime. The proliferation of sensors enabled by 5G, advanced computing and machine learning technologies gives us better insights than ever before. These insights enable us to better plan and use scarce resources, another game changer.

The third area is talent. Emerging technologies in the factory call for a new-collar workforce that understands both manufacturing and Manufacturing 4.0. As the industry increases its use of and innovation with advanced technologies, more visionaries will be attracted to manufacturing. At the same time, advocacy initiatives like the Manufacturing Institute's Creators Wanted program help spread information about this shift in manufacturing work so the next generation of young talent is aware of these opportunities to work with technology. This shift in the reputation of the industry overall can help bring the best and the brightest talent into manufacturing. The workforce will transform from the outside in as it changes from the inside as well.

## Incentivizing Workforce Agility

For people and technology to align more closely, it will be important that the workforce sees the benefits of change. Many additional technologies come into play with a technology-enabled workforce. Remote collaboration tools and digital twins can allow manufacturers to assess and optimize processes virtually. These tools may require their users to have specific skills, such as a familiarity with the way data is used to create digital twins, to realize their full value. An agile and augmented workforce will be prepared with those skills or will be readily able to develop them.

The heightened importance of the workforce will call for momentous changes. Historically, manufacturing has considered the human as a component of the manufacturing line. The concept of human capital itself came from the manufacturing industry. Shifting our thinking changes how we develop people and give them desirable career progressions. It also impacts how we pay and incentivize people.

Adopting practices for compensation, rewards, and training from other industries to attract and keep the best and brightest can be beneficial. In high tech, for example, companies such as Google, Apple, and Facebook prioritize employee development and learning opportunities. They offer training programs, mentorships, and career advancement pathways. Some 84% of manufacturers have at least piloted investments in training for employees in areas such as factoring customer behavior into decision-making. To date, though, just three in 10 manufacturers report adjusting total rewards packages to increase their competitiveness when searching for new talent or retaining existing workers.

## New Leadership Skills

The path to a future-ready workforce will include overcoming hurdles. One of the biggest is the need for a radically new style of leadership. Leaders in-house today often have massive institutional knowledge and a long history of viewing the workforce in a particular way. Having such leadership has often led to success. But going forward, that will need to change. That is a challenge. You have to teach the most senior leaders to see the workforce — both its potential and its needs—differently. But even incremental change comes slowly. Presently, for example, only 13% of manufacturers report being highly effective at delivering on worker-centric policies such as flexible working options and schedules.

Certainly, you cannot change a whole company's culture unless you're working from the top down as well as the bottom up. But once you do, you are positioned to develop and sustain a culture of innovation, experimentation, and resilience.

## Engaging the Workforce

The workforce can and should be an active part of its own evolution. First, engage with your workforce – truly engage. Understand who your people are and what is important to them. Find ways to connect them to your company's purpose and the impact you want to have on the world around you. The stronger those connections are, the more powerful a force your workforce can be in driving the transformation you'll need over the coming years.

Second, expose more of the workforce to technologies and how these tools can help them and the business. Manufacturers are slightly behind the cross-industry average at the use of updated tools and technologies, with only 29% considering it important to employee satisfaction and engagement. Our Innovation Index shows that the best ideas to advance the business most often come from the individuals who already know the most — your workforce.

## A Future-Focused Mindset

Mindset is everything. Without a growth mindset at every level of your organization, you will struggle to accomplish a transformation that will drive success between now and 2030. This mindset must be pervasive, encompassing everything from policies to hiring practices, investment decisions and the employee value proposition you put into the marketplace. When you embrace a mindset that says we are going to try new things and grow, and your workforce embodies it every day, you will create a resilient organization that is comfortable pushing boundaries to create the future.

Learn more about NTT DATA

## About the author

Kim Curley is Digital Evolution Leader and Vice President of People & Organization at NTT DATA.

Blogs

# Hannover Fair 2023: It's Not Technology Anymore. It's All About Data, Data, Data.

By Paul Tate, David R. Brousell    April 25, 2023 6:38am

*Whatever advanced technologies manufacturers adopt, future transformational success will ultimately depend on data, from powering the latest digital tools to deliver more value, to creating entirely new industry-wide data ecosystems, to the foundation of enticing new Industrial Metaverse applications for the future, reveals this year's Hannover Fair in Germany.*

Emerging from three years of COVID disruption, the world's largest industrial fair in Hannover, Germany, began to bounce back this year with a renewed sense of optimism about the future of digitally enabled manufacturing, hosting more than 4,000 exhibitors from 62 countries showcasing their latest innovations, and over 130,000 visitors from around the world.

Many of the impressive and varied transformational solutions on display, however, also revealed a fundamental change of emphasis from years gone by. This year, Hannover was a lot less about promoting individual products and technologies, and much more about the underlying power of data to fuel those

advanced digital tools in order to drive greater efficiencies, resiliency, value, and sustainability, for both internal operations and entire manufacturing value chains.
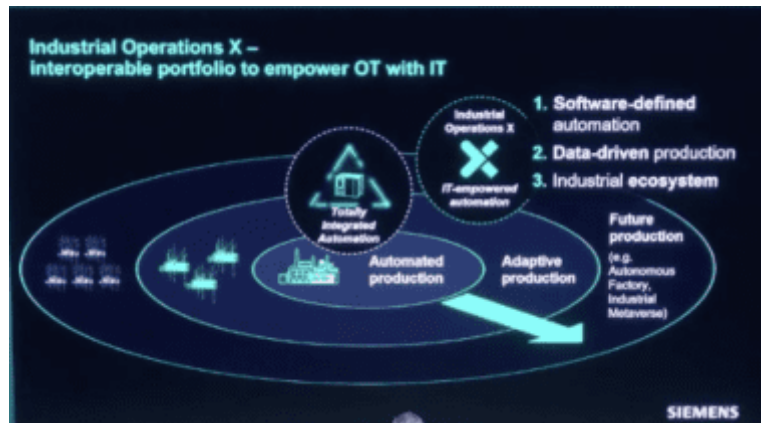


"Without data, we will never take manufacturing to the next level and scale," declared Rainer Brehm, CEO of Factory Automation at Siemens, launching the company's new Industrial Operations X approach, which is based on the three pillars of software-defined automation, data-driven production, and access to an open, industry-wide data ecosystem.

## Manufacturing X

The use of the letter X in the Siemens' nomenclature is highly significant. It echoes a new and rapidly emerging industrial data sharing initiative in Europe called "Manufacturing X", an approach showcased by multiple companies throughout the 17 busy exhibition halls at this year's event.



Manufacturing X aims to create a safe and agile next generation data infrastructure for manufacturing industry players to network, share, and exchange key product and other information with approved partners and customers in a compliant, standardized way, solving many of the current issues companies face in creating end-to-end real-time visibility across supply chains and making it easier for manufacturers to drive and scale transformational change.

The concept envisages a federated cloud-based "data space" where companies can upload dedicated "data containers" housing fully detailed, standardized information on any manufactured product or service, whether that is a factory machine tool or a wind turbine. Each data container can include key information ranging from authenticated product documentation (sometimes known as a Product Passport) to full maintenance and service manuals, compliance details, lifecycle frameworks, performance data, CAD files, ready-made digital twins, and even details of the carbon footprint of each unit or component.

In the same way that standardized freight containers revolutionized the freight transport industry, explained the team at German automation company Phoenix Connect, Manufacturing X aims to create an industry-wide data ecosystem where standardized containers of data can be easily accessed and securely shared across qualified partners and customers within a manufacturing value chain.

Easy access to the digital twin of each manufacturing asset, for example, can make it far simpler for companies to build plant-wide virtual digital twins, or train service engineers to troubleshoot equipment issues, and detailed production specifications can be instantly shared with key manufacturing partners to help cut time to market for new products or mitigate sudden supply chain disruptions.

Based on open standards and interoperability, Manufacturing X also aims to break industry dependency on today's proprietary systems and networks by building an open and trusted framework that allows all industrial companies, automation providers and manufacturing customers alike greater control and sovereignty over their data in the future.

Many examples of this new X data space concept were already in action at the Fair, including the advanced Production Level 4 ecosystem created by German research group SmartFactory KL, in which a rapidly reconfigurable, modular, shared production line harnesses interconnected machines and technologies from multiple suppliers, combining advanced digital process tools, AI, collaborative robotics, its own implementation of the data space concept called SmartMA-X, and the Asset Administration Shell (AAS) specification, which creates detailed standardized descriptions of each individual asset.

"Manufacturing X represents the next stage of Industry 4.0," Dr. Gunther Kegel, President of the German Electronics and Digital Industry Association, ZVEI, told German Chancellor Olaf Scholz and the packed audience of senior industry leaders and dignitaries at the Hannover Fair's high-profile Opening Ceremony on the eve of this year's Fair. Manufacturing X, he continued, is an important element in the creation of a safe and secure industrial data economy of the future that fosters increased networking, resiliency, sustainability, and climate protection among all industry players.

### Foundations of a Future Data Economy

Manufacturing X is only one implementation of a much broader data ecosystem concept called Gaia-X, initially conceived as a European initiative in 2019 but now with evolving



*Dr. Gunther Kegel, President, ZVEI*

global ambitions.

Gaia-X aims to build the foundation of a future data economy across multiple industry sectors based on the same idea of a shared and secure data ecosystem, explained Gaia-X CEO Francesco Bonfiglio, in an interview with MLC.

Other implementations include Catena-X, designed to support auto industry companies to share data on products and parts across their value chains. It has already attracted many leading auto industry partners, including BMW, Mercedes Benz, Volkswagen, Ford, Volvo, Renault, and tire maker Continental, plus technology innovators including Microsoft, IBM, SAP, Siemens, Fujitsu, Hewlett Packard, and many more. A health industry X-version for the pharmaceutical and medical devices sector is also preparing to launch in the near future, with future plans for similar data ecosystems covering other sectors including aerospace, agriculture, energy, logistics, and more.



*Gaia-X CEO Francesco Bonfiglio talks to MLC Co-Founder David R. Brousell*

## Ecosystem Challenges

Such next generation industrial data ecosystem initiatives are both innovative and ambitious, but they are still in their early stages and there are many challenges yet to be overcome, from political infighting among European members, to the practicalities of sector-wide implementation.

In a panel discussion entitled "Towards a Federated Industry Data Ecosystem", representatives from the Industrial Digital Twin Association (IDTA), Gaia-X, BMW, and German automation company Festo were candid about a host of challenges ahead for companies, as well as the industry as a whole, in building data ecosystems.

Chief among the challenges the group identified were establishing trust among participants; assembling a critical mass of participants to make an ecosystem work properly; understanding and adopting a common legal framework to enable intellectual property protection, an important foundational element of trust; and dealing with the technological complexities of such elements as data spaces and data containers.



But perhaps the most significant challenge voiced by the panel was bringing along small and medium size manufacturers, a group that often doesn't have the focus, expertise, and financial wherewithal to undertake what by any measure will be a significant effort to adopt and operate data ecosystems.

To help bring the small manufacturers along, the panel recommended the development of technology tool kits to simplify the development of new business models based on the data ecosystem idea. One such example already exists within the *Catena-X* group.

*Data Ecosystem Panel*

The other emerging consideration for any manufacturers adopting the data ecosystem idea is how it will affect their competitive profile as well as the competitive landscape of the markets in which they do business. Will participation in such ecosystems, should they take hold in a substantial way, become essentially a requirement in order to remain competitive? By establishing a common data playing field, will manufacturers then be able to compete on higher level factors such as more targeted products and services?

And what of potential legal issues? Will such data ecosystems be viewed in some countries in an antitrust light, prompting challenges by non-participants and government bodies? There will clearly be more developments to come in the months ahead.

## Inspiring Innovations

There was certainly no shortage of inspirational technologies on the stands at this year's Hannover Fair, of course. Advanced digital twins were everywhere; AI is being embedded into almost every kind of offering; 5G is now the connecting technology of choice; and systems specifically designed to support sustainable operations – from advanced energy efficiency algorithms and on-site hydrogen production units to digital threads and twins supporting full circular economy strategies from initial product design to end of life reclamation.



## AI Everywhere: Now It's Time to Scale

The critical importance of data to drive these ever-advancing digital tools is perhaps most evident with AI systems, which were extensively showcased across the Fair this year.

*Beckhoff's Hermes Innovation Award finalist: Atro modular multi-axis cobot*

While a decade of adoption of M4.0 technologies has made data better organized and more available than ever before, "An estimated 80% of data in industry remains unused," noted Philippe Rambach, Chief AI Officer at Schneider Electric. "So, the time for AI in industry is now," he continued, "and the next stage is to scale."

A number of suppliers admit, of course, that overcoming the challenges of adopting and scaling AI is still a learning journey for many manufacturing companies, so products like Altair's RapidMIner or Festo's Automation Experience (AX) AI platform for predictive maintenance, among others, are designed to provide easier entry points for companies new to the AI arena.

Schneider Electric, meanwhile, is already applying AI in multiple ways across the company, explained Rambach, from energy optimization to driving an increasingly self-healing supply chain that supports a network of around 14,000 suppliers and 150,000 order lines a day. He identified three key areas of business focus for AI the company – to enhance customer facing services, to improve internal process efficiencies, and as an advisory tool to provide monetized consulting services in areas such as energy management and industrial automation.

Based on his experience, Rambach advises manufacturers to approach AI adoption with three key considerations in mind. First, don't start with AI; start with a use case that can deliver value and then ask if AI can help. Secondly, build a joint AI team made up of data specialists merged with people who have real front-line domain knowledge. In fact, Schneider's AI team is not allowed to launch any new product in the company until it has been tested and verified by workshops of domain experts and frontline workers. Finally, to help build trust and support in AI adoption, socialize successes within the company to get all levels of employees engaged.



And to help companies ensure the AI systems they develop deliver meaningful and unbiased results, the Fraunhofer Institute was also showcasing its "Trustworthy AI" toolset on a nearby stand. This provides companies with a framework to test the quality and worthiness of their AI solutions, especially in human-dependent applications such as plant safety, medical advice, chemical processing, or even traffic management. Such formal testing and approval criteria will become increasingly essential, says Fraunhofer, with the rapid emergence of popular new generative AI tools like ChatGPT.

*Philippe Rambach, Chief AI Officer, Schneider Electric*

## Omnipresent Digital Twins

While AI permeated many areas of activity, there is also little doubt that digital twins have become a primary foundational technology in driving the future of digital manufacturing across multiple application areas. Almost every digital solutions provider at the event had one or more digital twins on show, from digital versions of individual products or factory assets to full plant floor planning and monitoring systems, to end-to-end lifecycle process and circular economy applications.

Many of those digital twin examples were built around the rapidly dominating Asset Administration Shell standard, which allows greater compatibility and interoperability between different digital twins and is backed by a collaboration between the OPC Foundation's Open Architecture standard and the IDTA. In fact, digital twins are now so commonplace that many suppliers are proactively including digital twins of their products with every purchase so customers can more easily integrate them into their own systems for maintenance, plant floor planning, and other key use cases. These include companies like Siemens, Festo, or Harting with its product life-cycle digital twin.
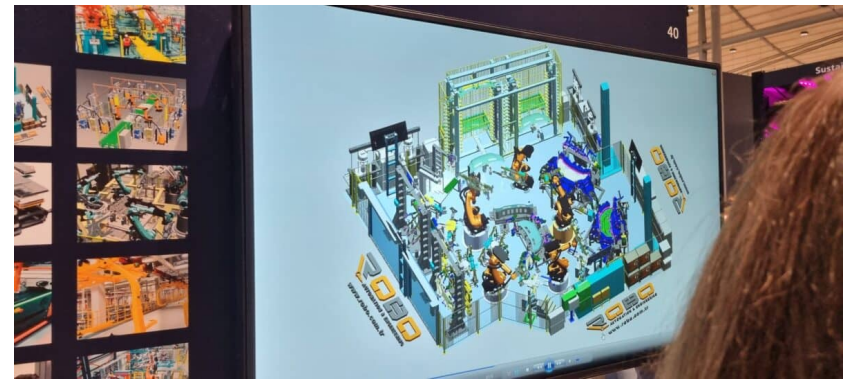


*Plant floor digital twins*

## The Sustainability Imperative

With Germany's ambition to become the world's first climate neutral industrial economy in the world by 2045, the presence of digitally enabled green industrial solutions was also far more in evidence than at any other previous Hannover Fair. Every company either had an explicit focus on energy reduction or showcased green energy production and infrastructure innovations – from improved plant-scale energy management applications to digitally supported processes for battery production and on-site energy storage, new low-scale green hydrogen production systems, systems for easier monitoring and reporting of Scope 3 supply chain partner emissions, and circular economy lifecycle digital twins with precise details of reclaimable content and dismantling procedures for recycling key materials and components.



*Green Hydrogen production system*

One other innovative green-energy focused display was SEW Eurodrive, which has developed a family of automated guided vehicles (AGVs) that know when their power is low and can autonomously replace their own power packs with new hydrogen fuel cells as needed.

Siemens, meanwhile, showed an impressive example of how combining multiple digital technologies including AI, robotics, and visual inspection can autonomously manage vertical farms capable of delivered 300 times more fresh food yield on a comparable area of ground, using 95% less water than traditional farming methods, but without the need for any harmful pesticides or fertilizer run off.



*Siemens Vertical Farm*

## The Dawn of an Industrial Metaverse

But perhaps the most forward-looking and engaging displays at this year's Fair, and there were many of them, were multiple examples of emerging Industrial Metaverse applications in action. These combine multiple technologies including advanced digital twins, embedded AI, VR/AR visors, and rapid 5G communication to show how early Metaverse use cases could create collaborative virtual spaces for training, e-commerce, remote operations, factory design, product maintenance, and troubleshooting.

Once again, it is data that will drive this latest digital evolution, believes Charlie Sheridan, Technical Director of Industry Solutions/Manufacturing at Google Cloud. "Data is the foundation of the Industrial Metaverse journey", he believes.

On Microsoft's stand, for example, partner Kawasaki was using an advanced digital twin, combined with embedded AI and engineers wearing HoloLens mixed reality headsets, to show how they could work together remotely from anywhere in the world using a collaborative mixed real world/virtual environment to exchange expertise in real time to troubleshoot and fix equipment problems. "It's the beginning of a new era," predicts Kawasaki.



*Troubleshooting in the Metaverse*

Early Industrial Metaverse applications are not all just pilots either. Real life projects are already in place at auto companies such as BMW and Renault where they are being used to create virtual factory and plant floor environments, while global chemical giant BASF is reported to have 20 Metaverse projects underway, and Norwegian battery maker Freyer is now using Siemens Metaverse technologies to help scale production capacity at both existing and new plants in rapid time to meet the predicted 700-fold increase in global demand by 2030. "We are already paving the way into the Industrial Metaverse of the future," asserted Siemen's Brehm.

The momentum around Metaverse developments is certainly growing fast. The recently launched Metaverse Standards Forum, noted Dietmar Laß, senior researcher manager at the Fraunhofer Institute, already has over 4,000 members and is expanding fast. "We are only getting a glimpse of what may be possible now with the Industrial Metaverse, but the basics are already in place", said Laß.

Perhaps the promise of an immersive world for future production operations, where virtual and augmented realities take digital twins and collaborative cultures to a new level, is closer than many industry leaders may think.



*The next level of industrial manufacturing*

### The Future of Data

When Stephan Weil, Minister of Lower Saxony, officially began the opening of the Fair on the Sunday evening, he hoped that the 2023 event would reveal how the power of innovation can help solve some of the world's toughest problems, help companies balance sustainability with growth, and help foster an equitable balance between people and machines working together.

Yet, as the days went by, there was clearly more to the event than just a series of high aims this year in Hannover. There was also a fundamental sea change of emphasis across the Halls that revealed a new focus on data and perhaps a more mature ecosystem direction for future innovation and adoption to enable industrial companies to truly accelerate transformation and drive greater value.

As German industry 4.0 pioneer, founder of the German SmartFactoryKL research initiative, and former MLC Board member Detlef Zülkhe reflected: "Hannover is not about technology anymore. Today, it's all about data, data, data."

## About the authors

*Paul Tate* is Co-Founding Executive Editor and Senior Content Director at the NAM's Manufacturing Leadership Council.

*David R. Brousell* is Co-Founder, Vice President, and Executive Director at the NAM's Manufacturing Leadership Council.

Business Operations

# How a Nearly Century-Old Textile Maker Went Digital

April 21, 2023 10:58am

It's no easy feat to transform a struggling family business into a thriving digital enterprise, but that's exactly what Cooley Group President and CEO Dan Dwight is doing.

**Change for the better:** Cooley Group was formed in 1926 as a family-run textile manufacturer in Rhode Island. In 2011, Dwight, a member of the NAM Board of Directors, joined the company as president and CEO to navigate the ship through a new age of manufacturing and market demands.

• Today, the private equity-backed extrusion and textile manufacturer is the leading global maker of polymer-coated textiles. Applications range from single-use blood-pressure-cuff materials, to proprietary urethane combat raiding crafts for U.S. special forces, to liners and covers for some of the world's largest water reservoirs.

**How they did it:** "As a family-run business, Cooley inherited aging equipment and an aging workforce," said Dwight, who also serves as vice chairman of the Manufacturing Leadership Council's Board of Governors. (The MLC is the NAM's digital transformation arm.)

- "We not only modernized our equipment and infrastructure to compete in the digital age, but also revolutionized our culture. Hierarchies slowed us down."
- "Digital transformation isn't only beneficial for the advancement of our physical technologies; it's also critical to develop a more collaborative company culture that empowers employees at all levels to take action."

**Starting small:** "Digital transformation—the integration of digital technology into all facets of an organization—can seem daunting at first," Dwight said. "But that can't deter an organization from jumping in."

- "I advise companies, particularly mid-sized manufacturers like Cooley Group, to approach digital transformation incrementally," he said. "Don't expect the cultural, institutional or technological benefits of digital transformation to manifest overnight as some mega-solution."
- "Think strategically about the areas of your business that are the first movers. Once one aspect of the business is modernized, the digital insights and team's enthusiasm for change will build momentum to push the remaining pieces into place."

**Gaining momentum:** The transformation of this firm of 300 people is ongoing. "Ten years ago, we had trouble keeping our equipment operating for any period of time," Dwight said. "Now everything in all our factories is digitally [Manufacturing 4.0]-driven across a single operating platform."

- The company plans to do the pilot phase of an artificial intelligence implementation later this year.

**Figuring it out:** The MLC was key in Cooley Group's remarkable transformation, according to Dwight.

- "I'm not sure we would have figured it out on our own," he admits. "I'm an avid reader; I was born excited to build things. I read a lot about manufacturing and leadership. But even if I could have figured out M4.0 strategy, actually implementing it on the plant floor would have been difficult without the support of MLC members to share best practices and to encourage the Cooley team to embrace transformation."

**Get involved:** Companies can jumpstart their own digital transformation by attending Rethink, the MLC's premier event for manufacturing executives, in Florida on June 26–28. Check it out here.

Business Operations

# Small Manufacturers Win Big with Digital Transformation

April 14, 2023 10:13am

For small and medium-sized manufacturers, digital transformation can seem like an especially harrowing task. But smaller organizations can be uniquely positioned for success in implementing firmwide digital strategies.

**Small but mighty:** Just look at Graphicast, a 25-person precision metal parts company in Jaffrey, New Hampshire.



- "Because the cost of data collection and analytics is getting lower and lower, even as a small company we can collect data at a rate that gives us meaningful information we can act upon," said Graphicast President Val Zanchuk. "For example, we created a linear programming model of our business. If we're growing at a certain rate, I can use it to determine the most economical next steps, such as whether we should hire more people, work overtime or purchase more equipment."

**A workforce solution:** Graphicast, which counts Fortune 100 companies among its clientele, has used cloud computing, AI-based systems and more to help it succeed, according to Zanchuk.

- The manufacturer is also looking into the use of collaborative robots as a potential solution to the labor force shortage.
- "When it comes to Manufacturing 4.0, we think about what our customers will be looking for from us in terms of digital collaboration," said Zanchuk, adding that some of the business's larger customers are "transforming at a different rate than we are." That means it's up to Graphicast to consider client expectations and see how best to meet them given "what's financially and operationally feasible" for the company.

**The MLC helps out:** To aid in Graphicast's digital transformation, Zanchuk joined the Manufacturing Leadership Council, the NAM's digital transformation division.

- "The MLC is the only place I know where I can discuss broad industry trends in an open fashion, where small companies like mine and large companies like Ford or GM can all be involved in the discussion," said Zanchuk, who serves on the MLC Board of Governors.

- "Being part of the MLC lets us know if we're on the right track and how we can make adjustments," he continued. "It connects us to a group of incredibly talented, intelligent and experienced people who are focused on many of the same operational challenges we face."

Plant Tour reviews

# Witnessing World Class Manufacturing at Whirlpool Corporation

By Jeff Puma    April 14, 2023 9:33am



When Whirlpool Corp.'s Findlay Operations began its World Class Manufacturing (WCM) journey in 2018, the effort was envisioned as a standardized way to drive out waste and loss while keeping their customers in mind.

In March, the Whirlpool team welcomed guests for the Manufacturing Leadership Council's sold-out tour of the company's Findlay, Ohio, factory, where visitors learned about the WCM methodology, witnessed the facility in action, and heard directly from company leaders. The visit included information about automation efforts, sustainability programs, training programs, data collection and use, maintenance procedures, and kaizen and other continuous improvement processes.

The nearly 2,200 employees at the Findlay facility manufacture thousands of dishwashers each day including stainless steel and plastic tub varieties. The factory first opened in 1967 and has seen several additions, growing its footprint to one million square feet today. It is one of five Whirlpool manufacturing centers in Ohio and among 56 manufacturing and technology centers worldwide. In 2022, Whirlpool recorded $19.7 billion in net sales.

**About World Class Manufacturing:** Whirlpool Corp.'s Findlay Operations transitioned from a system based on the Toyota Production

System to WCM in 2018. WCM features 10 Technical Pillars that are built on top of 10 Managerial Pillars. Both are essential to achieve WCM status. WCM's primary goal is to increase quality while reducing production costs. The operating model focuses on driving out waste and loss by demonstrating successful pilot processes that are then spread broadly via standardization.

The WCM audit system has revealed significant progress at Whirlpool, Findlay Operations. Two times per year, the plant is audited by external parties to assess their progress against the WCM methodology. As pillars progress and meet specific criteria, they are awarded points. In the fall of 2022, the Findlay plant scored 53 points during their WCM audit. A score of 50 or more results in being awarded the Bronze-level award for WCM. The next milestone is at 60 points which is a Silver-level award. This scoring is standard for those using the WCM methodology.

**What They Saw:** For the nearly 100 MLC attendees, the highlight was seeing Whirlpool Corp.'s operation in action.

To make their way around the bustling factory, attendees were broken into seven tour groups, each named after a Whirlpool brand: Maytag, KitchenAid, Amana, JennAir, Swash, Gladiator, and the flagship brand Whirlpool.

During the seven-stop journey, tour leaders shared concrete examples of how standard work is put into practice and how continuous improvement, Kaizen activities and the Plan-Do-Check-Act (PDCA) cycle affect processes and help the company balance safety, quality, and costs. In fact, at the Workplace Organization stop, participants learned how the plant's Kaizens have saved the plant millions of dollars since 2019.

Along the route, participants saw Automated Guided Vehicles (AGVs) deliver supplies to workstations and heard from tour leaders and frontline leaders. At one stop, guests learned how flipping the dish rack when installing rack clips had saved time, avoided awkward hand and head angles, and decreased worker frustration. Elsewhere, a new lever – 3D printed on site – allowed workers to reduce the force necessary to install the dishwashers' sump pumps, resulting in a five-year period without a reportable incident and two years without any first aid incidents.

At yet another tour stop visitors saw an automated cell completing a foam-in-place process featuring a robot that has run millions of cycles to date. The company uses automation like this to avoid the 3Ds: tasks that are dull, dirty, or dangerous. Automation allows the company to avoid these 3Ds while providing safer and more interesting work to take place.

Off the factory floor, tour stops included a visit to the Compass Room where data on every machine and process is analyzed so the company can ensure safety and quality while reducing waste. The room provides a place for company leaders to look at the full picture, tie waste back to its root cause, and figure out priorities to address the top losses. From there, the groups also stopped for an overview of the company's sustainability efforts, which include a pledge to achieve net zero by 2030 with the help of two on-premises wind turbines.

Finally, tour groups visited the Manufacturing Training Area (MTA) where the company demonstrated the training process that employees go through to learn new skills or brush up on existing capabilities. Every new hire starts their Whirlpool experience in Findlay's MTA. In this training area, staff assess employees and then assign them to stations on the factory floor where they can operate safely and efficiently while measuring up to Whirlpool's quality

standard. To avoid monotony and repetitive stress injuries, Whirlpool workers each have at least three jobs they can do in the factory. Each worker rotates his or her position on the line to undertake these approved job functions during each shift. In fact, some workers are certified in as many as nine frontline jobs.

**Diving Deeper During Breakouts and An Expert Panel:** The plant tour concluded with three breakout sessions followed by an open



question and answer session with Whirlpool leaders. The breakouts allowed participants to learn more and ask questions about WCM, the Kaizen Management System, or MTA and People Development.

The tour contingent reconvened for an expert panel moderated by David R. Brousell, MLC's co-founder and executive director. During a lively session, participants were able to pick the brains of some of Whirlpool's brightest minds including Kristin Day, Findlay Operations Plant Leader; Ramsey Aljahmi, Operations Excellence Lead, NAR; Scot Blommel, Senior Manager, Global Sustainability; and Brent Schnipke, Ottawa Operations Plant Leader.

**Award-Winning Leaders:** There is no shortage of industry expertise and award-winning talent at Whirlpool's Findlay plant. Kristin Day was recognized as a 2020 STEP Ahead Honoree by the Manufacturing Institute (MI), the nonprofit workforce development and education partner of the National Association of Manufacturers, MLC's parent. Additionally, Industrial Engineering Manager, Tyra Woodruff, was honored with a STEP Ahead award in 2022, while Amy Doroff, Senior Manager, Material Control and Logistics, was honored as an MI Emerging Leader that same year. Now called the Women MAKE America Awards, the program recognizes women who have achieved success within their companies and proven to be leaders throughout the entire industry. MI's Emerging Leaders are young women who have demonstrated exceptional accomplishments as they begin their careers.

MLC's next plant tour will be at The Hershey Company on May 1-2. For more information about upcoming MLC plant tours: https://www.manufacturingleadershipcouncil.com/event/plant-tours/
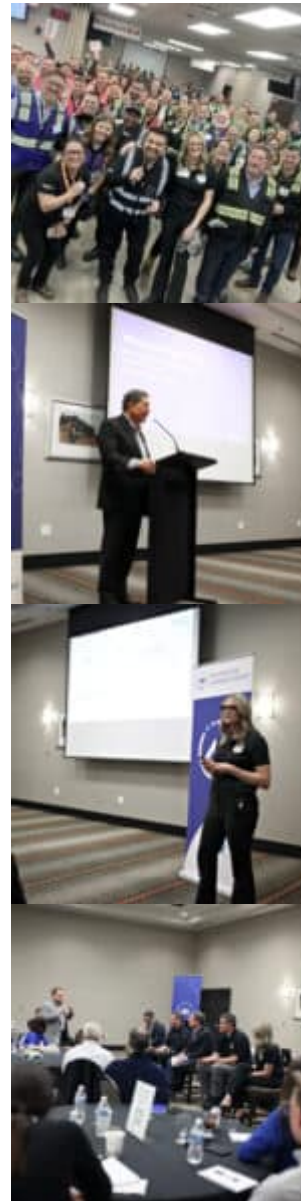
News

# Announcing the 2023 Manufacturing Leadership Award Finalists!

By NAM News Room    April 6, 2023 12:14pm

The Manufacturing Leadership Council—the NAM's digital transformation division—has announced the finalists for the 2023 Manufacturing Leadership Awards, the industry's premier awards program for achievements in digital manufacturing. You can read the complete list of finalists here.

**The ceremony:** The finalists will be honored at the Manufacturing Leadership Awards Gala in Marco Island, Florida, on June 28.

- Also announced at the gala will be winners for all project and individual categories, winners of the Manufacturing in 2030 Award, the Manufacturing Leader of the Year, the Small/Medium Enterprise Manufacturer of the Year and the Large Enterprise Manufacturer of the Year.

**Rethink:** Certain award winners will also present at Rethink, the industry's leading event for exploring manufacturing's digital era, which will also take place in Marco Island on June 26–28.

**The categories:** The awards are divided into nine project categories to recognize company achievements:

- Artificial Intelligence and Machine Learning
- Collaborative Ecosystems
- Digital Network Connectivity
- Digital Supply Chains
- Engineering and Production Technology
- Enterprise Technology Integration
- Operational Excellence
- Sustainability and the Circular Economy
- Transformational Business Cultures

Additionally, individual leaders are recognized in the Digital Transformation Leadership and Next-Generation Leadership categories.

**The last word:** "As more manufacturers extend digital's reach onto the factory floor and throughout their operations, we are witnessing transformative performance improvements that would have been unthinkable just a few short years ago—and that are improving life for employees and customers alike," said MLC Co-Founder, Vice President and Executive Director David R. Brousell.

Press Releases

# Congratulations to the 2023 Manufacturing Leadership Award Finalists

Finalists and winners to be recognized at gala on June 28

April 6, 2023 9:00am

**Washington, D.C.** – The Manufacturing Leadership Council, a division of the National Association of Manufacturers, today revealed the list of world-class manufacturing companies and individual leaders recognized as finalists for the 2023 Manufacturing Leadership Awards, the industry's premier awards program for achievements in digital manufacturing.

"As more manufacturers extend digital's reach onto the factory floor and throughout their operations, we are witnessing transformative performance improvements that would have been unthinkable just a few short years ago—and that are improving life for employees and customers alike," said MLC Co-Founder, Vice President and Executive Director David R. Brousell. "The finalists recognized for this year's awards represent the pinnacle of those achievements and exemplify possibilities for digital manufacturing."

Select award winners will present their projects at Rethink: The Manufacturing Leadership Council Summit, the industry's leading event for exploring manufacturing's digital era. "Rethink is a must-attend for any manufacturer who wants to know more about digital transformation, whether they are just starting the journey or are much further along," Brousell said. "It's an unparalleled opportunity for manufacturing leaders to connect and learn from each other and then apply those learnings to their own businesses."

**Background:** All finalists will be recognized on stage at the Manufacturing Leadership Awards Gala, which will take place at 7:00 p.m. EDT on June 28, 2023, at the JW Marriott Marco Island Beach Resort in Florida.

Also announced at the gala will be winners for all project and individual categories, winners of the Manufacturing in 2030 Award, the Manufacturing Leader of the Year, the Small/Medium Enterprise Manufacturer of the Year and the Large Enterprise Manufacturer of the Year.

See the complete list of 2023 Manufacturing Leadership Award finalists here.

The 2023 awards feature nine project categories to recognize company achievements:

- Artificial Intelligence and Machine Learning
- Collaborative Ecosystems
- Digital Network Connectivity
- Digital Supply Chains
- Engineering and Production Technology
- Enterprise Technology Integration
- Operational Excellence
- Sustainability and the Circular Economy
- Transformational Business Cultures

Additionally, individual leaders are recognized in the Digital Transformation Leadership and Next-Generation Leadership categories.

Rethink will take place at the JW Marriott Marco Island Beach Resort in Florida on June 26–28, 2023. Details are available here. Nominations for the 2024 Manufacturing Leadership Awards will open in August.

ML Journal

# Survey: Data Mastery is Slow to Mature but Essential

By Jeff Puma    March 29, 2023 11:42am



**Manufacturers show some progress with data mastery efforts, but much opportunity for growth exists.**

**When MLC last fielded its Data Mastery survey in 2021,** senior content director Penelope Brown wrote of the results, "Manufacturing data mastery is in its tween years for most enterprises – certainly past its infancy, but still awkward and gawky and not quite fully formed."

If data mastery was a tween then, the effort is on the final stages before becoming a teenager now. Like a tween, there has been some maturation but also some regression in how companies are accessing and using data and analytics. Likewise, companies can see dramatic development in specific areas of data utilization, but each organization seems to mature at its own pace while encountering a wide array of challenges and pursuing various desired outcomes and focus areas.

Why is progress slow? To further the tween metaphor: perhaps it is growing pains. More than one-third of respondents tell us that the volume of data they're collecting has at least doubled. Nearly 20% say the amount of data has at least tripled. Before this exponential growth came into play, companies were already dealing with an uphill climb to verify and analyze data. Given this rapid growth – like in tween years – there's bound to be some awkwardness and slower progress.

Still, it is clear from the 2023 MLC Data Mastery and Analytics survey that mastering manufacturing data will be essential to future competitiveness. Presently, 91.1% of respondents report that data has allowed for more accurate or timely decisions, both of which are essential to overcome the pressures that businesses face now and those they will face as their data mastery skills continue to mature.

Read on for key findings and selected graphs from the 2023 Data Mastery and Analytics survey.

## Part 1: Data Strategy and Governance

**The majority of respondents have a formal data plan and guidelines in place,** but there has been little change since the last time we fielded this survey in 2021. Currently, 56.5% of respondents say they have a corporate-wide plan, strategy, or formal guidelines for how data is collected and organized. This number sat at 55% in 2021.

**Q:** **Does your company have a corporate-wide plan, strategy, or formal guidelines for how data is collected and organized across the enterprise, including manufacturing operations? (select one)**

**For those with a formal corporate-wide data strategy,** nearly all (90.5%) see at least some alignment to overall business strategy, but only 52.4% say it aligns entirely or very closely.



No 40.3%
Yes 56.5%
Don't know 3.2%

**Q:** **If your company has a corporate-wide plan, strategy, or formal guideline for how data is collected and organized, how closely do you feel this data strategy is aligned to your company's overall business strategy? (select one)**



Very closely 42.9%
Partially 23.8%
Only in certain functions 14.3%
Not at all 3.6%
Don't know 6%
Entirely 9.5%

**Measuring data's value is still elusive to many organizations.** However, there's been increases in assigning monetary value and measuring revenues of data-driven services in the past two years. In fact, 22.6% of respondents now say they measure the value of data in monetary
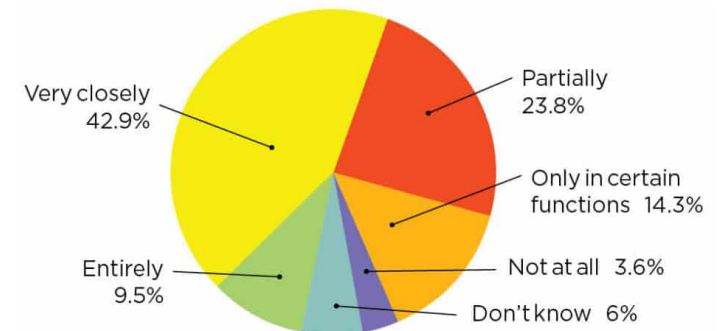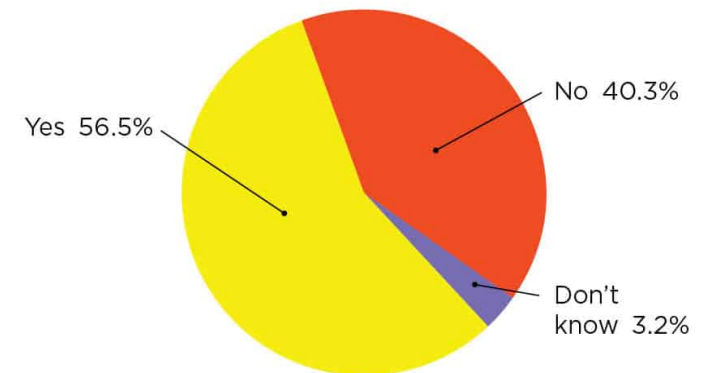
terms compared to 4% in 2021. Meanwhile, 12.1% say they measure data's value by revenues of data-driven services compared to 3% in 2021.

## Q: How do you measure the value of the data in your organization? (select all that apply)

- By impact on operational performance  46%
- We do not have a measure for data value  38.7%
- In monetary terms (assigned $ value)  22.6%
- By revenues of data-driven services  12.1%
- Don't know  10.5%

**Manufacturers see a slight positive shift in their ability to collect the right data the business needs.** In 2021, 16% of survey respondents ranked their company as highly able to collect the right data. In the latest survey, that number has climbed over 20%. On the low end of the spectrum there was only minimal change moving from 26% in 2021 to 26.8% in 2023.

## Q: How would you rank your company's ability to collect the right data the business needs from your manufacturing operations? (select one)

## Part 2: Data Collection, Use, and Analysis

**The ability to analyze manufacturing operations data is an opportunity for growth.** Just over half of respondents report their company is moderately able to analyze the data, while 30.4% say they have low competency.

Moderate 52.7%
Low 26.8%
High 20.5%
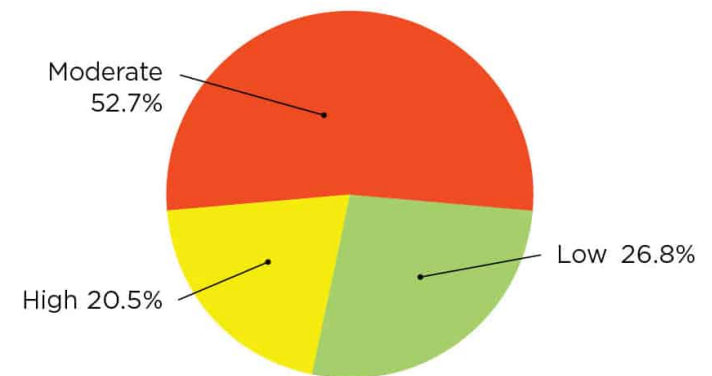
## Q: How would you rank your company's ability to analyze the data from your manufacturing operations? (select one)

**Shop floor systems and ERPs remain the primary data sources.** In fact, shop floor systems use increased from 79% in 2021 to 88.4% in 2023, while ERP systems increased from 77% in 2021 to 83.9% in 2023. Quality control systems, equipment maintenance systems, supply chain systems, and robotics systems saw similar increases since the previous survey, but product development systems fell 16 percentage points to 22.3%.
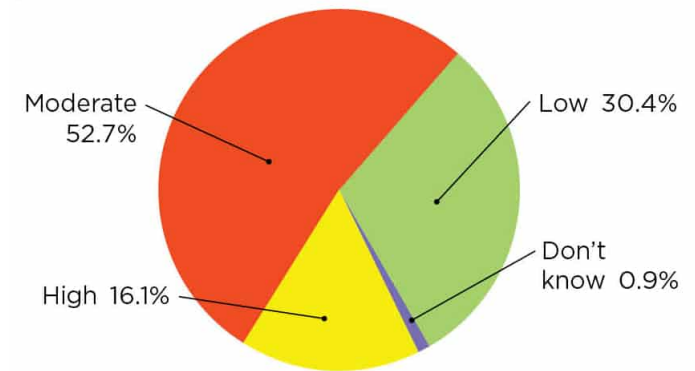
**Q:** **What are the primary systems that generate your manufacturing data today? (select all that apply)**

- Shop floor systems (PLCs, DCSs, SCADA) 88.4%
- ERP systems 83.9%
- Quality control systems 70.5%
- Equipment maintenance systems 57.1%
- Supply chain systems 46.4%
- Robotics systems 24.1%
- Product development systems 22.3%
- Edge computing systems 21.4%
- Embedded systems in products 10.7%

**The survey revealed that there is considerable room for growth** in real-time data collection. Less than half of respondents report their company's data is comprised of 51% or more real-time or near real time data.
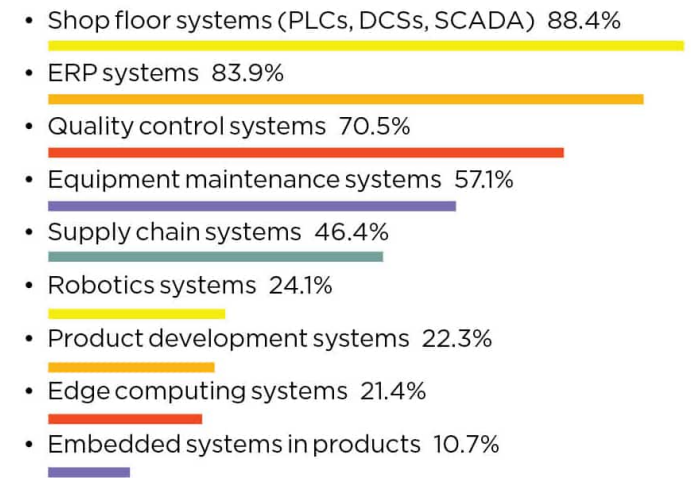
**Q:** **What proportion of the data you collect today is real-time or near real time, not batch or historical? (select one)**

**In the past two years, companies are collecting more manufacturing data.** Eighty percent report they've seen at least some increase in the amount of data collected. Meanwhile, more than one-third of respondents say the amount of data has at least doubled in that time.

**Q:** What has been the percentage increase in the amount of manufacturing data you are now collecting compared to two years ago? (select one)

- Above 500%  5.4%
- 201-500%  13.4%
- 101-200%  17.9%
- 51-100%  20.5%
- 0-50%  23.2%
- No increase  7.1%
- Don't know  12.5%

51-75%  18.8%
26-50%  16.1%
Up to 25%  27.7%
76-99%  24.1%
None at all  1.8%
100%  4.5%
Don't know  7.1%
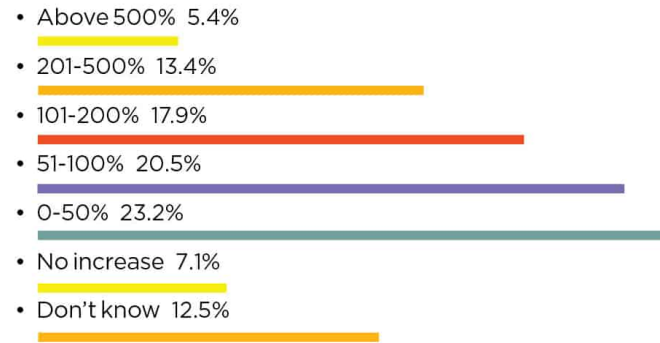
**Looking ahead at the operational focus for data projects in two years,** respondents foresee a varying shift from manufacture, quality, maintenance, inventory, logistics, and assembly to process control, supply chain, track and trace, inspection, security/data protection, and tooling.
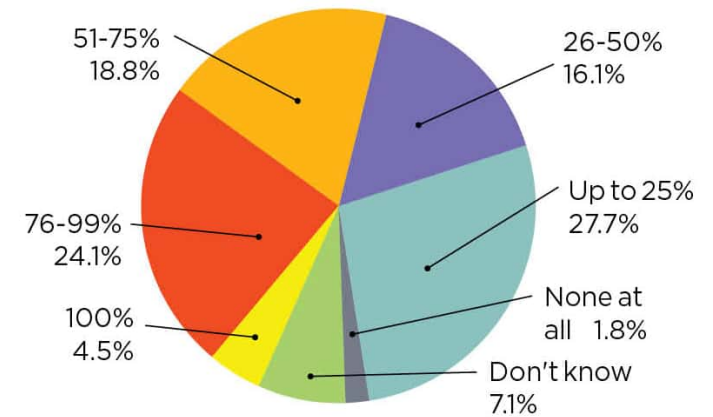
**Q:** What are your primary areas of operational focus for data projects today and what do you expect the primary focus will be in 2 years' time? (select top three)

**Microsoft Excel remains the reigning champion of data analysis tools.** In 2021, 71% of survey respondents reported that Excel was in their data analysis toolkit. That number rose slightly in 2023 to 72.3%. Statistical analysis programs of standard BI systems jumped from 47% in 2021 to 60.7% in 2023. This moved it from the fourth most used tool in 2021 to second place this year. Meanwhile, manufacturers are increasingly outsourcing analytics, with 24.1% utilizing external analytics partners this year compared to 14% in 2021. Somewhat surprising, the use of AI systems has decreased from 48% (when taking in-house, cloud and external AI partners in aggregate) to 41% in 2023.

**Q:** What systems do you use to analyze the manufacturing data you collect? (select all that apply)

**Respondents' companies are evenly split** when asked about verifying the accuracy and quality of raw data. About 46% report they have a process while approximately 45% say they do not. In the 2021 survey, for comparison, 49% reported they had a process while 46% reported they did not.

- Microsoft Excel 72.3%
- Statistical analysis programs of standard BI systems 60.7%
- Shop floor analytics 55.4%
- Corporate analytics systems 53.6%
- Cloud analytics 42.0%
- External analytics partners 24.1%
- In-house AI systems 22.3%
- Cloud AI systems 12.5%
- External AI partners 6.3%

Now   In Two Years

- Manufacture
  60.7%
  52.7%
- Process control
  50%
  54.5%
- Quality
  44.6%
  39.3%
- Maintenance
  35.7%
  32.1%
- Supply chain
  26.8%
  33%
- Inventory
  18.8%
  16.1%
- Logistics
  16.1%
  14.3%
- Track and trace (materials/components /finished products)
  16.1%
  18.8%
- Assembly
  12.5%
  10.7%
- Inspection
  9.8%
  14.3%
- Security/data protection
  7.1%
  10.7%
- Tooling
  1.8%
  3.6%

**Q:** Does your company have a process to verify the accuracy and/or quality of the raw data before decisions are made on it? (select one)

Yes 46.4%   No 44.6%   Don't know 8.9%
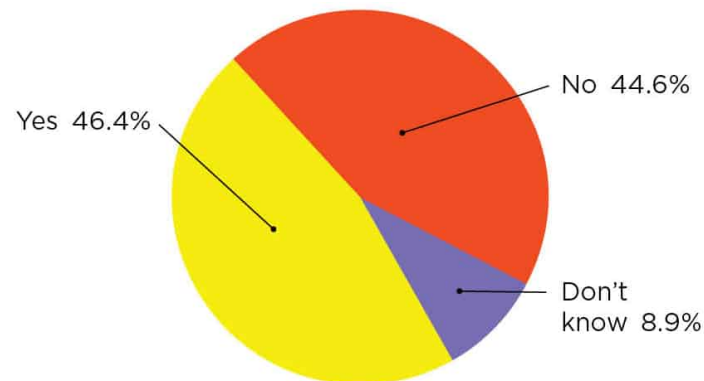
## Part 3: Outcomes and Challenges

**Increased data access has resulted in a variety of operational improvements.** Leading the charge are cost reductions, productivity improvements, efficiency, quality, and uptime – all of which were cited as an improvement seen by 50% or more of survey respondents.
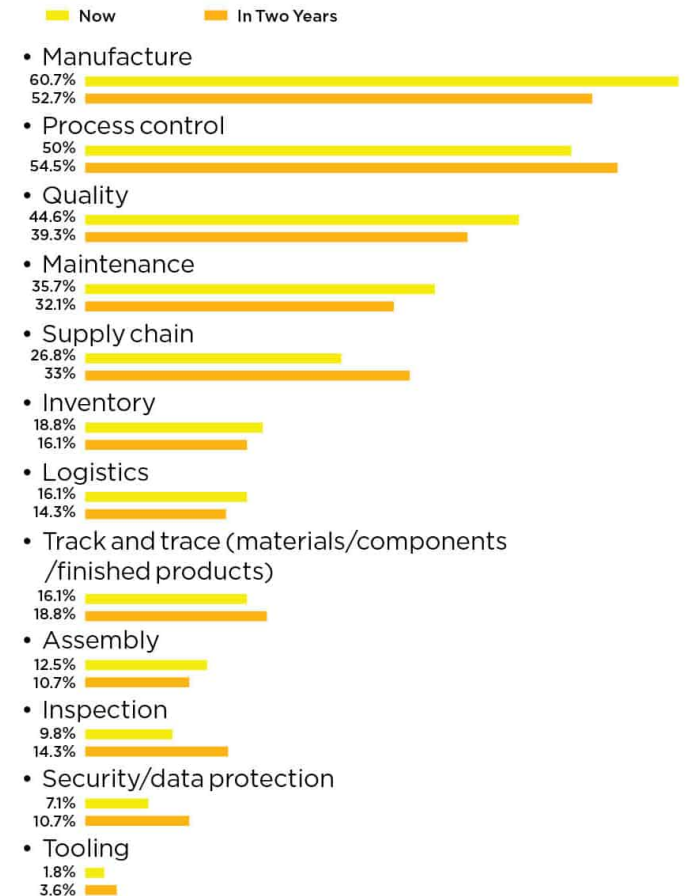
**Q:** In what ways has increased access to manufacturing data helped you to improve your manufacturing operations? (select all that apply)

- Cost reduction 75.7%
- Productivity 74.8%
- Efficiency 72.1%
- Quality 66.7%
- Uptime 50.5%
- Speed 47.8%
- Operator performance 42.3%
- Innovation 17.1%

**Cost reductions are the primary motivator for new manufacturing data projects now,** and this is expected to remain constant in two years. In fact, 65% of 2021 survey respondents anticipated that reduced costs would be a key business outcome objective this time around – a number that tracks closely with the 67.6% that listed reduced costs on this year's survey. While reduce costs is anticipated to lead the charge again in 2025, the number is anticipated to decrease by 10 percentage points in that time. The biggest upward movers by 2025 are expected to be improved production speed, integrated processes, improved supplier network effectiveness, improved security, and monetizing data.
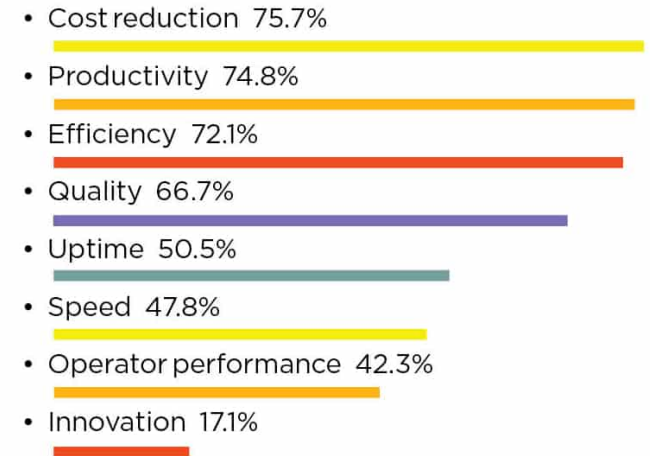
**Q:** **What are your key business outcome objectives for embarking on new manufacturing data projects today and what do you expect the outcome objectives will be in 2 years' time? (select top three)**

**Data improves accuracy and speed of decisions.** Half report that decisions have been more accurate and 40% point to more timely decisions. Only 6.3% of respondents report that there has been no change in their company's decision-making because of data availability, while less than 2% of respondents, respectively, cite slower or worse decisions as the most prevalent way that data has affected their decisions.

**Q:** **What is the most prevalent way that data has affected your company's decision-making? (select one)**

**Survey respondents report that many challenges or obstacles** are hindering their company from making more data-driven decisions. The leading challenges – each cited by 39-49% of respondents – are extracting data from legacy systems, lack of skills to analyze data effectively, and integration of data from different sources.



Pie chart:
- More timely decisions 39.6%
- No change 6.3%
- Slower decisions 1.8%
- More accurate decisions 50.5%
- Worse decisions 1.8%

Legend: Now (yellow) — In Two Years (orange)

- **Reduce costs** — 67.6% / 57.7%
- **Boost capacity** — 39.6% / 38.7%
- **Improve quality** — 39.6% / 35.1%
- **Improve uptime** — 36.9% / 29.7%
- **Reduce waste** — 34.2% / 30.6%
- **Improve customer delivery times** — 25.2% / 25.2%
- **Improve visibility across functions/roles** — 22.5% / 20.7%
- **Improve production speed** — 13.5% / 18%
- **Integrate processes** — 13.5% / 18%
- **Improve supplier network effectiveness** — 3.6% / 11.7%
- **Improve security** — 2.7% / 7.2%
- **Monetizing data** — 0.9% / 7.2%

**Q:** **What are the most important challenges or obstacles hindering your organization from making more data-driven decisions? (select top three)**

- Extracting data from legacy systems 48.6%
- Lack of skills to analyze data effectively 40.2%
- Integration of data from different sources 39.3%
- Lack of systems to capture the data 20.6%
- Lack of quality data 20.6%
- Lack of data stored in a useful format 19.6%
- Lack of accessible data 17.8%
- Lack of useful data/the right data 16.8%
- Scaling pilot data projects into production 15.9%
- Lack of management direction 12.2%
- Lack of management ability/willingness/trust to use data in decision making 10.3%
- Lack of evidence that data-driven better decisions (ROI) 10.3%
- Cybersecurity concerns/risks 8.4%
- Lack of timely data 5.4%
- Cost of starting data projects 5.4%

**Three out of four respondents report that data mastery** is essential to their business competitiveness in the future. This 75%/25% split remains consistent with responses to the 2021 survey.

**Q:** **Looking forward, how important will mastering manufacturing data become to your**
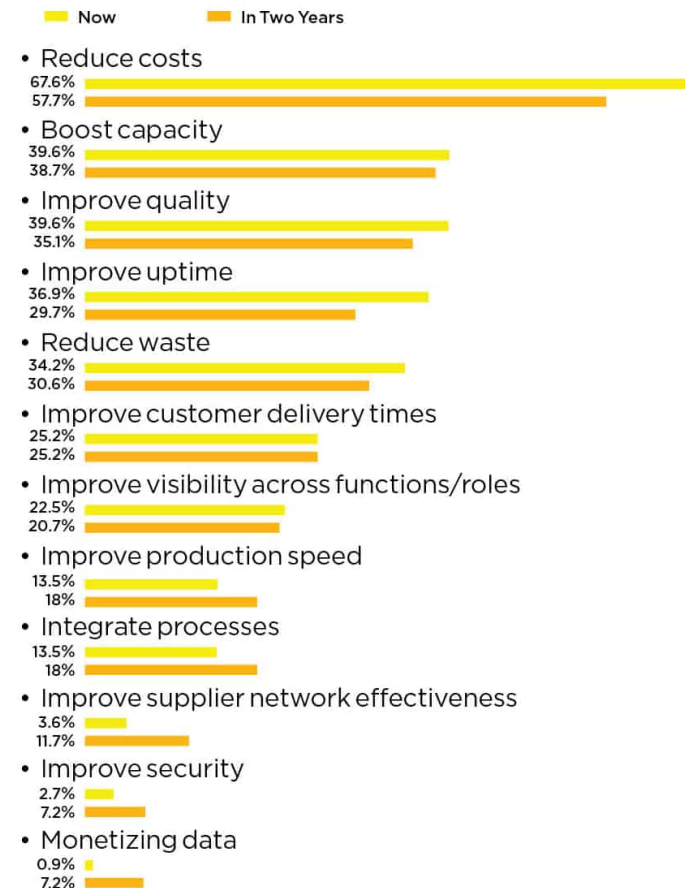
**competitiveness as a future business? (select one)**

About the author:

*Jeff Puma* is Content Director for the Manufacturing Leadership Council

*Survey development* was led by **Paul Tate**, with input from the MLC editorial team and the MLC's Board of Governors.

ML Journal

# Dialogue: Developing Pella's Data Driven Culture

By Paul Tate    March 28, 2023 11:25am

**Creating a culture where all employees understand the importance of data to driving operational improvements and value is crucial to the future of manufacturing, believes Pella's Head of Advanced Analytics, Jacey Heuer.**

*"What drives me is being part of that blank canvas and having the opportunity to create something with data analytics that is so game changing not only to Pella, but to the whole industry."*

*Jacey Heuer, Head of Data Science and Advanced Analytics, Pella Corporation*

*Pella Corporation was founded in 1925 when lumber business owners Peter Kuyper and his wife Lucille acquired a small manufacturer of roll-up insect screens called the Rolscreen Company and moved the business to Pella, Iowa. As Pella approaches its centenary in 2025, the company has now grown into an award-winning $2 billion enterprise, with 10,000 employees, 17 manufacturing plants across the U.S., and one of the largest window and doors manufacturers in the U.S.*

*In our latest interview with an industry thought-leader, Pella Corporation's Head of Data Science and Advanced Analytics, Jacey Heuer, talks to the MLC's Executive Editor Paul Tate about transforming a mature corporation in the digital age, the need to build a solid data foundation to help reimagine traditional processes, harnessing data analytics and AI technologies to create new insights, and creating a culture of ownership where every employee understands the true value of data to improving the future of the organization.*

**Q: What excites you most about your role at Pella?**
**A:** It's the nascent nature of data and analytics in the manufacturing industry, especially in advanced data science and machine learning AI environments. Historically, there have been data and statistics and optimization initiatives in many different forms, like Six Sigma, Lean, and traditional business intelligence systems, which have been around for decades. That's the precursor to what we're trying to create now with the next generation of data driven solutions.

My focus is on how we accelerate to that next level of leveraging our data at Pella to drive greater economic value and greater impact across the enterprise – from customer experience and marketing, to improving the P&L and optimizing throughput capacity in manufacturing operations.

**"The challenge is how do we tear the traditional processes down to introduce a new data solution that drives improvement? That's the greatest part in all this. It's re-imagining the way things are done."**

A lot of this stems from how we collect data. In the past, there's been almost a taboo around adding individual transactions to data resources. Traditionally we've tried to eliminate that transactional data to create more efficiencies and productivity. Yet, all those transactions are data rich sources of what's really happening as materials or products go through a facility.

This is one area where my team is now helping to change that perspective because, in a data-driven world, those transactions are valuable to us to help us continue to develop greater optimization, more insights from AI and machine learning, and better outcomes. What drives me is being part of that blank canvas and having the opportunity to create something with data analytics that is so game changing not only to Pella, but to the whole industry. There's a lot of excitement and opportunity in that.

Q: How are Pella's data analytics and data governance activities structured within the organization?
A: The corporate Data Analytics and Insights team, which I help to lead, is around 14 people right now and it spans core roles in data science, data analytics, data engineering, data governance, and data quality.

Our vision is a hybrid model where each plant still owns some of their data and analytics, but we at least have a governance role or advisory role in how those plants and different facilities are leveraging and using that data. I fact, we prefer to use the term data enablement, as opposed to governance, because it has a more positive connotation.

We've also established a corporate Data Council, and a layer of data stewards who are the front-line owners of data analytics in different facilities and are our main conduit to make sure that we're developing and rolling out solutions in an effective manner.

The Data Council meets on a quarterly basis and includes directors and senior level leaders who provide executive sponsorship and buy-in, oversight, guidance around prioritization and what's most important, and help steer how we drive forward. These leaders act as a megaphone for us and go down into their functions to help drive the change in mindset around data generation and use.

Further down, we also have the layer of data stewards. These are people on the frontline who may have developed a legacy system, or are in our continuous improvement environment, or in our engineering space, and are the true data owners who interact with data day-to-day. We have a roster of these data stewards, and we meet with them on a monthly basis to continue to develop a culture of data ownership and an understanding around the importance that data needs to play as move to the next generation for Pella as a data driven organization.

**Q: What are the main data analytics initiatives now underway at Pella?**
**A:** There are two key initiatives, both targeted ultimately on improving the customer experience. The first is a smart factory initiative. We have two plants that are developing different elements of a smart factory. One plant is focused more on automation, so autonomous vehicles, robotics, and those kinds of technologies. The other plant is focused more on process optimization. There's a lot of cross-over between those, but that's they're starting focus.

The other key initiative is reliable delivery. We have a goal of "industry best" reliable delivery at Pella. So, we are working on how we ensure on time delivery by fully leveraging the data and applying predictive modelling using AI and machine learning technologies.

**"If you don't have a focused diligent investment into the type and frequency of the data you're collecting, your AI and machine learning outputs are likely to struggle and perhaps fail."**

Within both of those initiatives is a focus on people, understanding individual capabilities and skills so we can optimize the role they are working on in the factory and make sure they are placed in the best position to help drive optimization.

**Q: How are you integrating the data generated by legacy systems into the new analytics framework?**
**A:** Legacy systems historically tend to be production databases where the data only exists for a short length of time before it's purged out. We're now applying more event-driven monitoring technologies where we can monitor each system in more detail and anytime a new event occurs, we're taking that data out and moving it into our data lake environments to create a history of all the data. We've introduced technologies using application interface layers (API) that essentially provide one entry point for all those legacy systems. This helps us gain greater access to the legacy systems and move the data more easily to locations where data scientists can then work with it, or machine learning can happen, which is mostly in our cloud environment.

On top of that, from a front-end consumption standpoint, we're developing our own internal applications so we can take the output of our AI data science models and feed it into those applications where we have more control over the user interface and experience for the people who need the information. That helps bridge that gap from the legacy to the modern, and helps develop the people, the resources, and the skills we need to make the transition occur.

**Q: Once you've gathered all this data and analyzed it to give you new insights, how do you then operationalize those insights to drive better decisions?**
**A:** That's a great question. This is where the network of data stewards and the data council becomes crucial. Ultimately, they're the people who are helping us connect with the users on the shop floor, the line managers, and the production managers, who are going to be consuming these outputs. And it's also about how we deliver that information to the users. Think about your phone, or Facebook, or Google. There's a whole team of individuals focused on your user experience. Historically, when you are getting a model or AI solution into production, a lot of its downfall can be because of the user experience. It can make a cool prediction, but as a user, it's not always intuitive to use. Or there's other reasons that might limit a person's willingness to adopt it. We're now leaning into that aspect of how we actively engage with our users to make sure we're creating the right user experience so that our outputs are meeting that need. That's helping to drive a lot of consumption and adoption.

**Q: How are you harnessing AI technologies to help drive this data-driven transformation?**
**A:** AI and machine learning are fueled by data. Like a car, or a tractor, or any big piece of machinery, it's the fuel that makes it productive. It's the same with AI. That data foundation is where a lot of our focus has been initially and on how we continue to influence the type of data we're creating. I mentioned event driven technology solutions, for example. That stream of event data coming in means that we've now got much more clarity from when an order enters our system, to every event along its journey, to when it exits. We can see the timing and the context around that journey. We're now able to build predictive models that are much more accurate on when an order reaches different milestones to ensure it can be delivered on time and in full to the customer. That's an area that we've had a big initial impact in building predictive models that drive scheduling and the decision points along the way. On the smart factory side, for example, we've got a big focus on process optimization. There can be somewhere between 1,000 and 5,000 carts moving around our door facility at any time, which is where our automation focus on smart factory is happening. We've now applied RFID tags to the carts so we can collect passive signals as they move through the facility. We're then leveraging that data to improve route optimization within our plants because we

are able to establish see a clear linkage between the impact of delays at certain points in that process to lost units created that day. There's clear value in that use case. The next stage is to understand how we can best scale that across our 17 plants.

**"One of the key leadership skills for the future is greater trust in the individuality of all the team members, all the workforce and allowing them the freedom to create, to think, and to make decisions."**

It's that kind of data foundation that's going to fuel many more AI use cases for us as we go forward. Of course, understanding the intrinsic value of having a strong data foundation is something that's not always intuitive for everyone to grasp. That's an area where our storytelling has continued to evolve for our leadership and our plants about why investment in those technologies is going to serve us in the long-term. If you don't have a focused diligent investment into the type and frequency of the data you're collecting, your AI and machine learning outputs are likely to struggle and perhaps fail.

Q: What key challenges still keep you awake at night?
A: One of the core challenges is cultural. We're trying to change the mentality so that everyone in the company has a greater understanding that every point of data, every action that someone on the shop floor or in manufacturing takes, either does, or will eventually, generate some data point that's going to be crucial input to helping improve their lives, improve the P&L, and improve our impact as an organization as we go forward.

Another challenge, but a good challenge, is how we solve some of the technical aspects of creating a data-driven organization and re-imagine the processes that currently exist. We can develop models, develop solutions, push them to the five-yard line and are ready to hit the end zone, but then we come up against a wall of the way things have always been done. People say, "Well, this is the process". The challenge is how do we tear that traditional process down to introduce a new data solution that drives improvement? That's the greatest part in all this. It's re-imagining the way things are done. In a hundred-year-old organization with a hundred years of legacy and processes in place, that's what keeps me up at night in many ways.

**"Eventually, anybody who interacts in the organization and takes an action will be able to understand how it impacts the bigger network of what's happening."**

**Q: Looking ahead, what would you highlight as the greatest challenges and opportunities for manufacturing industry as a whole for the rest of the decade?**
A: I think there's a great opportunity to create a truly connected network of data within a manufacturing organization, so that if a decision is made on one side of the business, people can see the impact that decision has way over on the other side. Eventually, anybody who interacts in the organization and takes an action will be able to understand how it impacts the bigger network of what's happening. For example, if I make a decision to reorganize some physical part of a plant, I can see the expected impact on the other plants that are outside my immediate location. It's a connected network of understanding, supported by a focus on the data foundation and driven by investments and front-line engagement in creating that data foundation.

**Q: What key leadership skills, attributes, and roles do you feel that senior industry executives now need to lead successfully in an increasingly data-driven world?**
A: One of the key leadership skills for the future is greater trust in the individuality of all the team members, all the workforce and allowing them the freedom to create, to think, and to make decisions. As people get more transparency and more understanding of the connectedness of every decision they are making, their knowledge of the true scale of impact is going to increase, so they should be able to make better informed decisions and take better informed actions. In an established legacy organization, it's a different mindset to allow individuals that freedom and capability. From a leadership standpoint, it's about being okay with that flexibility and that freedom.

**Q: Finally, if you had to focus on one thing as a watchword or catchphrase for the future of manufacturing, what would that be?**
A: It's intelligence augmentation. I like that term because I think it captures, in those two words, the role that artificial intelligence and machine learning and

data should play, and will play, in organizations in the future. It also highlights that humanity, people, are not going to go away, and that we need to ensure there's teamwork between those people and the new technologies that will come our way. Intelligence augmentation captures that well.  **M**

**FACT FILE: Pella Corporation**
**HQ:** Pella, Iowa
**Industry Sector:** Windows and Doors
**Revenues:** $2.17 billion
**Net Income:** *(Privately held)*
**Employees:** 10,000+ Employees
**Presence:** USA
**Production Sites:** 17+ Manufacturing Sites
**Website:** www.pella.com

**EXECUTIV PROFILE: Jacey Heuer**
**Title:** Head of Data Science and Advanced Analytics, Pella Corporation
**Nationality:** American
**Education:** BA degree, Business Administration – Finance & Economics, Wartburg College; Masters' degree, Business Analytics and Data Analytics, Iowa State University; MBA, Iowa State University
**Languages:** English
**Previous Roles Include:**
– Data Scientist, Pella Corporation
– Data Science Author, Pluralsight
– Data Scientist, Brownells, Inc.
– Senior Pricing Strategist, MidAmercian Energy
– Assistant Vice President, Situs RERC
– Financial Analyst, The Members Group
**Other Industry Roles/Awards/Board Memberships**
– Golden Key International Honour Society, Iowa State University
– Iowa Technology Leadership Institute member

**About the authors:**

*Paul Tate is Co-founding Executive Editor and Senior Content Director of the NAM's* Manufacturing Leadership Council.

ML Journal

# Case Study: The Future Starts with Citizen Data Scientists

By Sue Pelletier    March 28, 2023 8:23am

**How IBM is developing the next generation of transformation-drivers by turning supply chain SMEs into Citizen Data Scientists**

## Company Fact File

**Name***:* IBM Corporation
**Sector***:* Information Technology and Services

**HQ location:** Armonk, NY
**Revenues***:* $10 billion plus
**Employees:** 5,000 plus Employees
**Web url:** www.ibm.com

**When COVID-19 hit, IBM Supply Chain found that its digital transformation journey** had enabled the resiliency needed to tackle major disruptions. That awareness led to the decision to further accelerate their digital transformation projects. To keep up with the demand of exploiting emerging technology while preparing for future, IBM launched a first-of-a-kind transformational upskilling initiative designed to democratize data while empowering individual business technologist (SMEs). This transformative initiative is a prime example of the mantra Ron Castro, IBM Vice President and Chief Supply Chain Officer, constantly challenges his organization with "innovate anywhere, use everywhere."

The initiative, dubbed the Citizen Data Scientist (CDS) Certification program, was designed to help supply chain SMEs develop the data science skills they need to make data-driven decisions in a fluid business environment — and then roll it out to the rest of the company to engage employees in successful process improvement throughout every part of the organization.

In just the first year, the CDS program developed by IBM Supply Chain, in partnership with the IBM Data Scientist Profession Team, the company already was seeing results. The first supply chain SME cohorts to go through the program's data science, data wrangling, and data visualization upskilling and reskilling structured learning program resulted in more than $1.6M in efficiency and productivity improvements and inventory savings from improved decision-making.

All this in just six months, and with zero financial investment. And the program has only continued to grow ever since in both the breadth of its content and its reach across the company.

## What Is a Citizen Data Scientist?

**As manufacturing moves into M4.0, the role of big data is only getting bigger** — and more ubiquitous throughout operations. Data scientists, who usually have a master's or PhD, are essential. However, there may not be enough of them to go around, and even if there are, their level of business expertise may not be sufficient in a specific domain.

Hence the rise of the Citizen Data Scientist. According to Gartner, a citizen data scientist is "a person who creates or generates models that leverage predictive or prescriptive analytics, but whose primary job function is outside of the field of statistics and analytics. They bridge the gap between those doing self-service analytics as business users and those doing advanced analytics as data scientists."

IBM's Citizen Data Scientist digital credential is designed to create more of these data-savvy employees so they can bring the power of data analytics to aspects of their daily jobs without having to rely on those who call data science their profession. At IBM, the CDS certification also is integrated into the company's career path, so it serves as a starting point for those who might be interested in becoming a full-fledged data scientist.

## Starting with an Innovation Foundation

**The CDS certification program was established** on a foundation of innovation that would encourage continuous transformation. One bedrock of this foundation was to reimagine and transform people's analytical skills using IBM and open-source technology to retain and create a high-performing, engaged culture. Another was to leverage the reskilled SMEs to reimagine processes, then apply AI and Cloud technologies to implement new processes to accelerate transformation.

**"The CDS certification program was established on a foundation of innovation that would encourage continuous transformation."**

"We wanted to certify people who could really work on data to bring our broader population into IBM's digital transformation," says Matthias Graefe, IBM's Director of Supply Chain Transformation. But it isn't enough to just offer one-off classes in, for example, Python programming, which would likely result in the creation of isolated applications and solutions. The company also wanted to ensure that its latest crop of Citizen Data Scientists has an understanding of cybersecurity, because a talent in programming doesn't automatically mean the person understands how to ensure the programming, they're creating is also compliant, Graefe says. "We knew we wanted to achieve both sides of it — enabling people in a supportive way, while also creating a community and governance around what they are doing."

## Taking the CDS Challenge

Brenda Berg, CDS Program Manager, advises that the CDS program requires more than just watching some videos and taking a test to earn the digital credentials. It may not be as difficult as becoming a full-fledged data scientist, but the Citizens Data Scientist certification still is no walk in the park. In fact, only 70% of the first year's CDS trainees made it through the program. The nature of the learning, uninterrupted time commitment and demanding day jobs are what makes the program challenging.

To help keep candidates on the learning path, the program is highly structured and includes having a technical leader, a program manager, and a project manager agree to facilitate the process. Each candidate also is assigned a mentor to help them develop the data scientist mindset and build the new ecosystem together with professional data scientists. Employees who chose to participate could leverage their allocated IBM global training program learning hours to gain data science knowledge and skills.

CDS candidates initially were chosen by their managers because it takes a true commitment on both the participant and their managers, says Giovanna Benetti, Digital Supply Chain Transformation Leader. The self-paced training is done in parallel with participants' day-to-day jobs, so both their managers and the participants need to ensure that they can complete the program while still getting their daily work done.

The data science mentor role also is a key one, she adds. They meet regularly with CDS participants to assist with coursework understanding, application, and provide guidance on the required Citizen Data Scientist project plan to complete the certification. Now that the program has an established, and growing, bank of certified Citizen Data Scientists, the idea is that some of those who have been through the program can now turn around and assist new trainees within the CDS community. Or, as Anita Toth, Global Supply Chain Manufacturing Operations and Integration Manager, says, "We now have started to eat our own cooking. The people who have graduated from the CDS program are now applying their skills back to the business, either vertically in their own domain or cross-organizationally. We have some Citizen Data Scientists who just graduated one year ago who now are guiding people who are currently in the program."

**"A key component to the program is that participants also must apply what they are learning to real-world projects."**

Another key component to the program is that participants also must apply what they are learning to real-world projects. These projects generally fall into three buckets. One is what IBM calls "big rocks," which are multidomain, large-scale projects that are important to the organization overall. "It's a benefit for employees to work on these big rocks projects, because they can both experience different functional areas, and are able to contribute on projects that have a big impact," says Graefe. Then there are smaller projects, or "pebbles," which generally fall within a specific business or functional area, and even

smaller, more specific "sand" projects. Of course, the big rocks projects result in the most material savings — and the highest visibility. As an example, a 2020 CDS participant's pebble project resulted in a $50K inventory savings for his business unit. After CDS graduation, he partnered with CDS multidomain colleagues to drive a services and manufacturing synergy project. Over the past two years this advanced deep learning-machine learning model contributed over $10 million in inventory savings and cost reductions.

The key to successfully completing the program is for the candidate to have the support of their manager or supervisor, and their entire team. Erin Thalacker, CDS Project Manager, also advises it's vital to connect early and often with their data science mentors so everyone understands what business problem they're trying to solve through data science, and also make sure they have access to data and that they understand that data, as well as for help navigating any roadblocks they may hit along the way.

The program still is tough, but those who make it through feel more prepared to be the technologists IBM will need for a future in which automation and data analysis will continue to be increasingly key for most job roles. Having a mentor also is a big boost for many who go through the program, as is having a community of fellow Citizen Data Scientists who not only understand what they are doing, but also can share solutions to common challenges across functionalities. Another perk? Added visibility. "We have a strong sense of community across Supply Chain, and to be able to make an impact in that community is a strong driver within the program," says Graefe.

## Scaling Up

**As important as it was to quickly reinvent the supply chain,** the program also was designed to be scalable throughout the company by basing the CDS on data science methodology, tools and data trainings that were domain-agnostic. This means that the program can be replicated for any other part of the organization that wants to jump-start its transformation journey with reskilled, resilient, Citizen Data Scientist SMEs.

This is already starting to happen. The original Citizen Data Scientist certification program has been leveraged to pilot additional Citizen Process Designer, Citizen Automator, Citizen Front End and Backend Developer programs.

There was a strong use case already built-in for expanding the program, says Graefe. For example, as IBM continues its drive toward automation, there is a need to create more bots. But those bots need to be programmed so that they add to the greater good — otherwise, they could just create chaos. Also, he says, there was a need to use a common platform and tool set so people can share successful components as they scale up the automation. "If we want to eliminate, simplify and automate, and to drive automation everywhere into our workflows, we need to expand the Citizens program," he adds.

**"The program was designed to be scalable throughout the company by basing the CDS on data science methodology, tools and data trainings that were domain-agnostic."**

"If you need to develop an application, you need people who understand the business requirement, can write the code, and you also need people who can design the UI for the application on the front end. Then you have the automators on the back end. Also, now it's not just about developing code; it's about working on platforms, often with low-code applications — you often don't need deep coding skills now. We wanted to bring all of them under one Citizens umbrella."

Next up is a pilot program with another business unit that works closely with Supply Chain to see if they can "lift and shift" to make the CDS program work for their specific needs. The team also is close to implementing an overall system to manage the projects the prospective Citizen Data Scientists will be working on so innovations can be shared on platforms with communities who could link those innovations to other areas.

"Our next step is to scale up the CDS to Innovation Technology and get through the pilot, then open it up to the broader IBM community," says Graefe. "We are creating a community of those who finish their projects and graduate, who then are offered the opportunity to become Citizen Technologists and work across transformation projects to co-create across the supply chain and, hopefully, across IBM in the future." **M**

**About the author:**

*Sue Pelletier,* *a contributing editor with the Manufacturing Leadership Journal, is a seasoned writer/editor with experience in online, social media, e-newsletter, tablet app, book and e-book, and print publications.*

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**MANUFACTURING**
**Institute**

733 10th Street NW

Suite 700

Washington, DC 20001

Phone: (202) 637-3000

Fax: (202) 637-3182

**mlcinfo@nam.org**

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