PACKAGING WORLD®

Intelligence Report

Data Management and Artificial Intelligence

- AI Opportunities and Obstacles in Manufacturing
- The Role of Generative AI and Causal AI
- The Value of Enterprise Asset Management
- How AI Can Enhance Your Existing Workforce

Table of Contents

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Ad Index

New Ways Artificial Intelligence Can Improve Your Operations

Data management is no small task. AI holds the promise to help not only with those mountains of data, but to use that data in any number of ways to address all the other challenges in your operations.

Aaron Hand › *ProFood World*

Today's CPG companies are faced with mounting challenges in their manufacturing operations—challenges in the supply chain, a shortage of skilled labor, and pressures toward sustainability, to name a few. In most cases, there are mountains of data available that could help to alleviate these issues. But too often, that data—how to manage it and how to extract meaningful knowledge—just adds to the challenge.

Artificial intelligence (AI) holds the promise to help not only with those mountains of data, but to use that data in any number of ways to address all the other challenges in your operations.

"We have access to data from operations—lots of operational data, time series data, we have access to maintenance data, we have access to even

New Ways Artificial Intelligence Can Improve Your Operations

financial data," notes Rashesh Mody, executive vice president of business strategy and realization at Aveva, whose Connect industrial cloud platform brings multiple types of data together for sector-specific insights. "If we can put all those data together and put a model with a semantic knowledge, then providing a very seamless user experience and train the model with the customer's own data, that would be a unique way to help our customers. And that's how we really want to do humans enabled by AI. It really helps to provide them better efficiency, better productivity, and help them in a sustainable journey as well."

AI has long been used to enable predictive maintenance and even prescriptive maintenance, but as AI evolves, there is potential for the technology to improve performance in many other areas.

"AI is definitely changing foundationally how we apply technology, and how we help customers and users with a better knowledge base," Mody says. "Can we create better simulation? Can we provide help to the person on the plant floor? Can we provide a human enabled by AI by giving it a decision process system—giving the right information to the right person with the right data and right context?"

> *"AI is definitely changing foundationally how we apply technology, and how we help customers and users with a better knowledge base."*

Moving beyond 'nice to have'

The past 40 years have seen digital technologies changing the manufacturing landscape dramatically—from the personal computer, on through to the internet and smartphone, cloud computing, and now artificial intelligence.

ARC Advisory Group, a technology research and advisory firm, conducted a survey at the end of last year, asking about the most impactful technologies changing manufacturing. "Artificial intelligence tops the list," says Greg Gorbach, vice president of ARC. AI topped the list the previous year as well, but this time garnering more than 50% of the results compared with 35% the previous year. "All the hype about generative AI is certainly driving some of that, but there's a lot more about AI that we're going to be dealing with over the next couple of years."

Generative AI, a subset of AI that has the ability to learn from data and

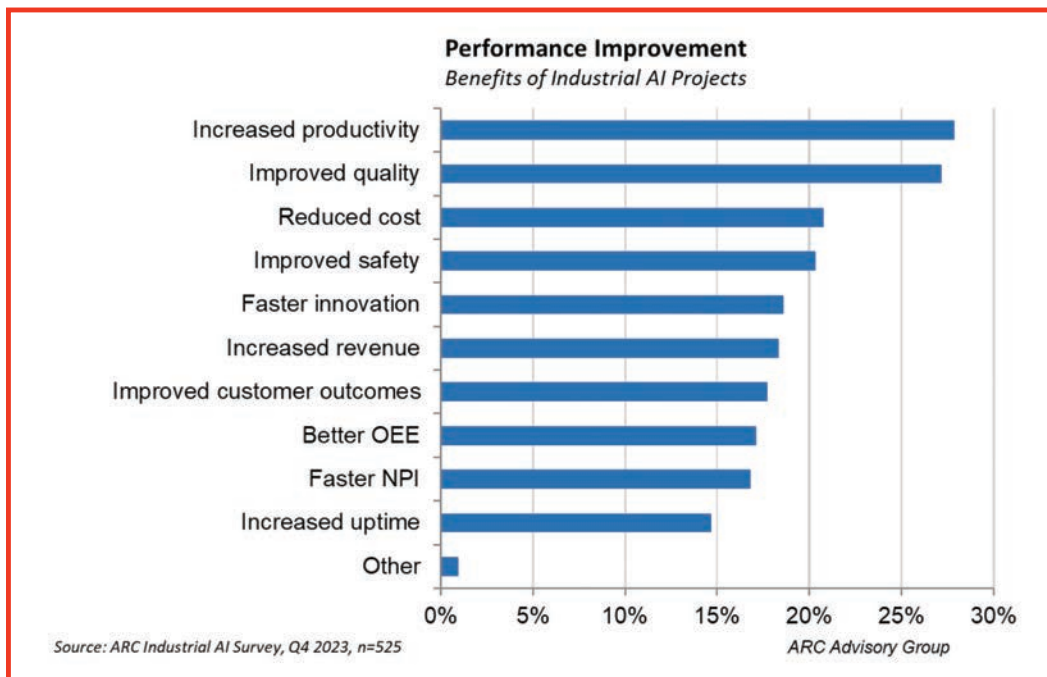**New Ways Artificial Intelligence Can Improve Your Operations**

generate content autonomously, has recently become a hot topic in all walks of life, with all disciplines looking at how they can use the technology to make jobs easier.

AI was an important topic at this year's ARC Industry Forum, where executives from throughout the manufacturing ecosystem discussed the applications—and implications—of adopting a technology that's growing not only in popularity but also in its capabilities to turn data into knowledge.

But don't be fooled by the hype into thinking that the technology isn't an essential step forward for your operations. "Your competitors will deploy AI and other digital technologies to gain a competitive advantage wherever they can," Gorbach notes. "They're going to be reducing costs, and improving their products, and reducing their emissions, securing their supply chain, reducing the time to market, and attracting new and better workers. And they're doing all this to compete with you. They're doing it across various dimensions within their operations as well."

The digital transformation journey

Throughout the ARC forum, speakers emphasized the need for crawl, walk, run sensibilities.

Performance Improvement
Benefits of Industrial AI Projects

Source: ARC Industrial AI Survey, Q4 2023, n=525 — ARC Advisory Group

SOURCE: ARC ADVISORY GROUP

In its latest industrial AI survey, ARC found that increased productivity and quality lead the way in key areas where AI must deliver measurable improvement.

New Ways Artificial Intelligence Can Improve Your Operations

"A lot of us come from backgrounds and experiences where we try to jump to the end," says Mike Tomasco, who until recently led Pfizer Global Supply's digital transformation. "Maybe you have a CEO who, in the last couple months, got really hyped up about gen AI. And all of a sudden, every senior executive in your corporation has a gen AI or two goals to completely transform your company and operations with the magic of gen AI. And then you have to go figure out how to deal with that."

That was a very real scenario at Pfizer between September and December 2023. "Every senior executive at my former corporation had two gen AI goals, and they had to deliver them and show results in that short period of time," Tomasco says. "We actually did do it, but at the expense of what? You're demonstrating things can work and scale up over time, and it's very exciting. But some of the more basic ideas and the basic foundational building block things and just good old-fashioned analytics are actually much more beneficial to long-term sustainability of your operation before you do some fun stuff."

Artificial intelligence is certainly not the first step in the digital transformation journey and in plenty of cases, is not yet part of the discussion.

At Post Consumer Brands—which makes well-known cereals like Fruity Pebbles and Honey Bunches of Oats—the addition of several plants with acquisitions of Peter Pan peanut butter and various pet foods has added to the complexity of the digital transformation.

"A big piece of this journey that we're on is because we have this patchwork technology at all these plants because we acquire and then we move on to the next acquisition, and the synergies aren't there yet."

"The last four years, we've added actually seven plants," notes Jamie Hansen, senior director of IT for Post Consumer Brands. "A big piece of this journey that we're on is because we have this patchwork technology at all these plants because we acquire and then we move on to the next acquisition, and the synergies aren't there yet."

Post began working on a reliability program about three years ago to better realize synergies among its manufacturing plants. "For us to get the synergies, our plants need to be able to produce what we plan for them to produce," Hansen says. "And if we can't do that, it creates a lot of turmoil within all the plants, and OEE and everything comes way down, there's a lot of turnover

New Ways Artificial Intelligence Can Improve Your Operations

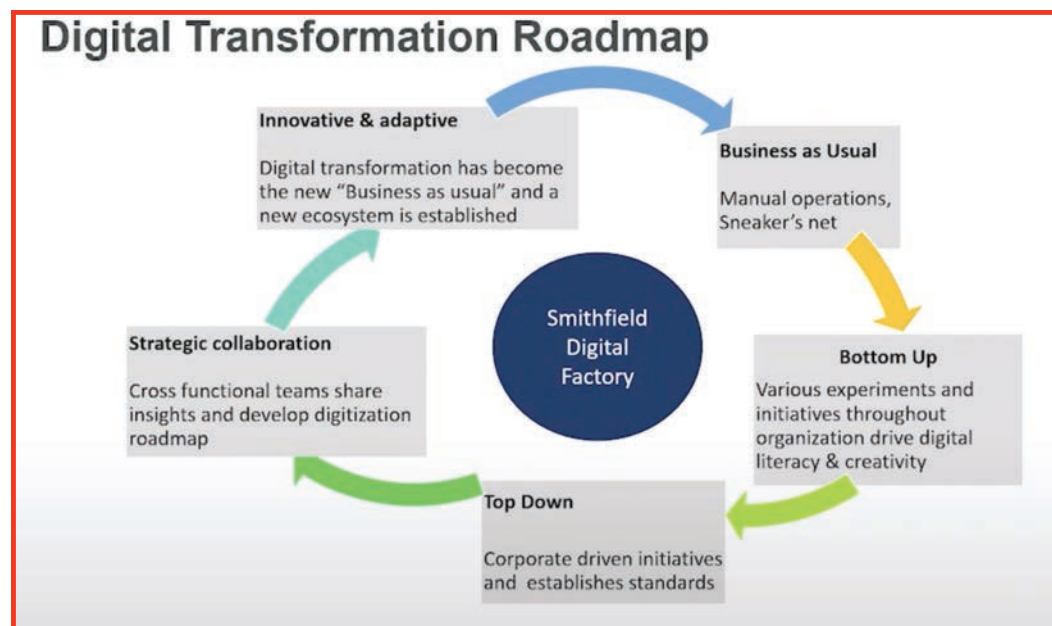and downtime, and all that kind of stuff that we just need to avoid."

Enterprise asset management (EAM) was the No. 1 focus for Post, and it began working with Hexagon to streamline assets and processes. They began with two small plants to get their feet wet and start seeing results, but are going live in April with their big production facility in Battle Creek, Mich., and then some pet food plants by the end of the year.

Though Post is using EAM software from Hexagon, Hansen emphasizes that it's a program they're on and not just software implementation. "I know 'transformation' is well overused, but this is a piece to it," he says. "There's also what we call standard work rollout, which is not just the process of using the system, but all the processes around how the planners are going to plan, how the maintenance crew is going to maintain. It's not just how the system is going to be used, or the data is going to be used, or the reports or analytics are going to be used. It's everything."

Post has seen significant improvements in its OEE numbers, one plant going from the mid-40s to almost 70% and continuing to move in the right direction.

But Hansen is still a bit leery about AI. "I think we're a couple years away from that," he says.

To help explain where Smithfield Foods is on its digital transformation

Digital Transformation Roadmap

Innovative & adaptive
Digital transformation has become the new "Business as usual" and a new ecosystem is established

Business as Usual
Manual operations, Sneaker's net

Strategic collaboration
Cross functional teams share insights and develop digitization roadmap

Smithfield Digital Factory

Bottom Up
Various experiments and initiatives throughout organization drive digital literacy & creativity

Top Down
Corporate driven initiatives and establishes standards

SOURCE: SMITHFIELD FOODS

In a typical digital transformation roadmap, business as usual begins with paper on clipboards. It moves in a circular motion because the journey will require multiple laps around the circle.

New Ways Artificial Intelligence Can Improve Your Operations

journey, Lin Gu, who leads IIoT and digital transformation strategies and implementations across the company, first gives a look at what digital transformation means for the protein industry overall. Though secondary meats like sausage, bacon, and ham are similar to other products in terms of manufacturing, fresh meats add a different type of complexity to digital transformation. "It's taking one unit and disassembling it, and this unit has all different kinds of attributes. You know you don't grow two wheat plants the same and you don't grow two pigs the same, so then you introduce a lot of complexity," she says. "So you can see their dedication to operations performance data is more advanced."

When companies think that they are well on their way on the journey, they might need to think again. "The pie is big, the journey is long," Gu says. "We've just started."

Smithfield has been stepping its way past clipboards with papers that get filled out by hand, increasing digital literacy, and experimenting with various initiatives from the bottom up, later gaining sponsorship from executives to move to a top-down approach.

"Here you see this roadmap is kind of a circle because it really is multiple laps around the racetrack. You do one layer and you do the next layer."

"And now we start to talk, we start to develop additional initiatives. With that, the culture starts to change. People start to use data, people start to see the investment is worthwhile, there's ROI here. Then, innovative and adaptive will become a new business as usual," Gu says, pointing to Smithfield's digital transformation roadmap. "Here you see this roadmap is kind of a circle because it really is multiple laps around the racetrack. You do one layer and you do the next layer."

Change management is a big part of the journey, and employees need to be onboard to make new data management systems work for your company. "They're oftentimes tradespeople, and their desire is not to carry around an iPad and enter information. They just want to go do and fix their stuff," Hansen says. "So it's convincing them that, hey, if you can do this, and we can get good at this, maybe you don't get the call at midnight to come in and fix a boiler. Or maybe you're not fixing the same thing on the boiler five times. Because when you fix something, the last thing you want to have to do is fix it again."

Employees must see the value in the data, says Jeff Erwin, vice president

New Ways Artificial Intelligence Can Improve Your Operations

of manufacturing and quality operations at G&J Pepsi. "The quality of the data is critical, and have a companywide strategy for your digital transformation," he says. "And I would challenge that digital transformation is not just about technology, but it's about people, behaviors of people, accepting."

G&J Pepsi, a family owned Pepsi bottler, implemented a system with Sage Clarity Solutions across all production sites in just three months. "Digital transformation initiatives can stall out because they take too long and people get tired and give up on it," Erwin says. "Accelerating implementation can overcome the stalled shortening."

Erwin had seen what Sage could do at his previous company, so he was quick to implement it at G&J Pepsi when he joined there.

G&J was averaging 22,000 stops a year on its equipment, equaling 6.4 hours of downtime. "That's capacity you're not utilizing. That's about a 30% downtime on your equipment," Erwin says. "For best in class, you're going to see nine times improvement, and then seven minutes of downtime. I've seen that achieved in my previous company. I'll see the changes in my current one."

"And I would challenge that digital transformation is not just about technology, but it's about people, behaviors of people, accepting."

The knowledge leaving the building

Much of the conversation about why AI and other digital tools are so needed is around the difficulties that manufacturers are having, in fact, with the people factor. Not only is it difficult to find the workers needed on the manufacturing floor, the length of time they are likely to stay and really understand their jobs has become much more limited.

"There's a skills mismatch between what we need and what we can find," Gorbach says. "There's an increasing need for us to have our workers be more and more connected—to each other, to the business, to the operations, to the technology, to the assets, and so forth. AI is going to impact the workforce. And if we do it well, then it's going to enhance the workforce."

Productivity levels have seen a plateau in the U.S. over the past several years, corresponding with an increasing number of Baby Boomers retiring. Our human minds—which are predisposed to faulty factfulness—make

New Ways Artificial Intelligence Can Improve Your Operations

the connection and assume today's workers lack the knowledge to be productive. But Mike Carroll, vice president of innovation at Georgia-Pacific, challenges that assumption.

Productivity saw an uptick in 2020 at the start of the pandemic. The rate of workers retiring was just a distraction, Carroll argues, and made industry more vulnerable to the distraction. "Productivity got better because we stopped distracting the organization."

Just as Tesla and Edison's battle over AC vs. DC ultimately ended in revealing a need for both AC and DC to create an electrical ecosystem, Carroll argues that industry needs both data AI and knowledge AI for a real AI ecosystem.

As you think about how AI might change the world, think about AI's ability to learn. "It has the ability to take what it's learned and what it's been taught, predict outcomes, and discover its own counterfactuals, and combine that acquired knowledge, and the ability to reason," Carroll says. "In that reasoning, now you have agency to make decisions on behalf of other things or for people."

Bringing the discussion full circle, Carroll points to the ability of AI to overcome the fact that so much knowledge is leaving the building. "Being good at generative AI is the end of the beginning of your journey. You need to be good at it," he says. "What's generative AI for? It allows you to
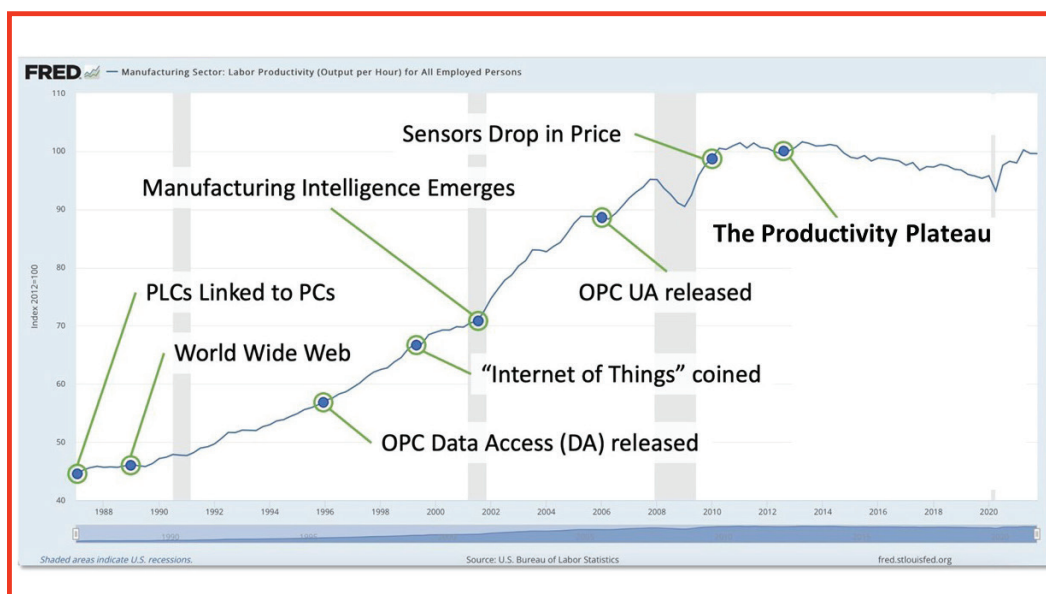
SOURCE: FRED, FEDERAL RESERVE BANK OF ST. LOUIS

Though people might naturally assume that the productivity plateau seen in the U.S. is caused by an inexperienced workforce, Mike Carroll argues that it has more to do with distraction. He advocates generative AI as a possible solution.

New Ways Artificial Intelligence Can Improve Your Operations

communicate with technology, for technology to communicate with you, and for you to harness and harvest the cumulative knowledge that exists in your company while it's still there."

AI provides a way to learn to be exponential, Carroll says. "You create value at some exponential rate to which you create data," he says. "What you're doing is you're unleashing the cumulative knowledge in your organization to look at the data for evidence that the knowledge and the hypothesis in the knowledge exists to solve your problems. You're not looking for the magic in your data; you're using your knowledge to use the data to validate that what you're doing is right."

AI's growing potential

Kence Anderson, previously director of autonomous AI adoption at Microsoft and now CEO of his own company Composabl, has designed over 200 autonomous AI systems for a long list of manufacturers, including companies like PepsiCo and AB InBev. One thing he's learned from that experience is the depth of knowledge and skill it takes to make decisions in manufacturing operations. "In almost every use case I've ever worked on, it took a human being one to even 10 years to learn how to make these decisions in real time," he says. "And no matter what automation system was in place, there was always a human being that had to step in when the automation system wasn't able to correctly handle the nuances."

"What's generative AI for? It allows you to communicate with technology, for technology to communicate with you, and for you to harness and harvest the cumulative knowledge that exists in your company while it's still there."

He came to realize that the human skills were so nuanced, no single algorithm or AI model could possibly reproduce them. "That's when I really started thinking about what I now call intelligent autonomous agents," he says. "If you combine the right AI technologies with traditional automation techniques and machine learning in the right ways, you can actually store skills digitally. A lot of what digital transformation has been about so far has been storing documents and data, which is a fantastic foundation. But I learned that it's actually possible to build AI that can control equipment and optimize processes in real time by sensing and responding with more human-like decision-making."

New Ways Artificial Intelligence Can Improve Your Operations

Foundational models will significantly change the usage of AI for two key reasons, according to Axel Lorenz, CEO of Process Automation at Siemens. "They will be much more accurate. Before, someone had to put a lot of effort into that one model we often use later on. And number two, they will be scalable, which they're not enough today without foundational models," he says.

"Generative AI will help us to use a much broader base of knowledge," Lorenz says. "This is going to help us in order to really generate knowledge. A large language model will completely change the way we interact with technology."

The role of causal AI

Further down the line on the AI journey is causal AI, which focuses on understanding cause and effect. "We see a lot of talk about gen AI, but gen AI doesn't do cause and effect," says Mark Sen Gupta, director of research for ARC. But causal AI is not an easy thing to implement. "It requires a bunch of different AI technologies, so there's a lot of skills involved in actually implementing a causal AI model."

While generative AI is probabilistic, depending on the question that you ask it, causal AI is deterministic. It's trainable and repeatable, and will allow you to close the loop in your AI model.

"The whole promise is to be able to look at multiple factors instantaneously and spitting out a decision much faster than a human is able to do."

Causal AI shows promise for these reasons:
• Causation and context among data and expertise
• Combination of AI techniques
• Dynamically pair human knowledge and machine
• Impart reasoning and knowledge—i.e., machine cognition

"The whole promise is to be able to look at multiple factors instantaneously and spitting out a decision much faster than a human is able to do," Sen Gupta says. "Once I've got this causal AI model, I have captured the knowledge of an expert, and that expert is not going to retire."

For a pharmaceutical company like Pfizer, working in a highly regulated industry, causal AI provides explainable AI. "Being able to explain what you're doing to a regulator is one of the more important things that you have in front of you. If you're going to make decisions based upon what an AI

New Ways Artificial Intelligence Can Improve Your Operations

tells you, you have to be able to justify that," Tomasco says. "In our world, if we want to leverage AI and try to build a closed-loop ecosystem for driving manufacturing processes, we have to explain what we're doing. And today, it's actually really hard to explain things."

There is not a lot of causal AI being used in production facilities because there are still significant challenges with the data, but proponents say that it will be worth the effort. "It's going to take an ecosystem of customers, supplier, integrators to make this happen," Sen Gupta says. "If you're an end user, this isn't going to be created without your participation. And you need to be proactive about it. You have a problem you need to solve. You know the problems."

Some inherent risks with AI

Many of those working with AI are working to identify and effectively mitigate the risks that come with it. One of those risks is the threat to employees. Wade Maxwell, vice president of engineering for ExxonMobil Technology and Engineering, acknowledges the anxiety felt about AI and what it means for people's job security, but he questions the validity of that concern considering the challenges faced by industry. "We're going to need all of our engineers, we're going to need all of our scientists," he says, pointing to the value—both potential and already realized—of AI. "It's going to liberate and continue to liberate our people from spreadsheets, from data wrangling. It's going to high-grade the data that they've currently spent a lot of time either finding or manipulating into insights better, with faster decisions."

"I actually think it's going to be a whole lot more fun for our employees in a more AI-capable world than it is today."

Putting AI on a closed loop and taking the human out of it, manufacturers can improve cycle times and quality, and can make better decisions, Maxwell adds. "You get a more direct line of sight in the creation of delivering value."

Maxwell urges, however, the need to develop staff to make better use of AI capabilities. "I actually think it's going to be a whole lot more fun for our employees in a more AI-capable world than it is today," he says. "Part of that, of course, at all levels in our organization, is not just investing in AI, expanding on our capabilities. We also need to expand our literacy and help people connect with what the value proposition of artificial intelligence is. There's a pretty strong cultural and education development dimension to what we need to do in the artificial intelligence space."

Future-Proofing CPG Supply Chains: Nulogy CEO Jason Tham Discusses Real-World Benefits of Network Collaboration

JASON THAM
Co-Founder and CEO
Nulogy

What is the primary goal of your cloud-based, multi-enterprise platform for CPGs?

While many CPGs invest in supply chain transformation strategies, most of these initiatives stay within the four walls of their organization, and neglect to account for the value of digitally transforming their external chain.

In a supply chain executive survey conducted by McKinsey, almost 80% of respondents stated that they "need to improve and to invest in digital planning to increase supply chain visibility."

To this end, it is Nulogy's goal to enable more resilient and sustainable external supply chains that allows brand manufacturers and their external supply chain to leverage real-time data visibility for stronger collaboration.

What are the real-world benefits to increasing real-time visibility with external supply chain partners?

Research by PwC shows that investments in supply chain visibility generate 8% additional revenue and reduce costs by 7%.

From Nulogy's global customer base comprising of brand owners and their external supply chain partners, enabling greater visibility between the buyer and supplier has led to more agile response to shifting customer requirements, and better allocation of materials and labor to service production needs.

What's the ROI on adopting the Nulogy cloud-based platform?

Leading brand manufacturers have achieved the following through Nulogy and its Supplier Collaboration platform:

- **Network-wide Visibility:** One of the world's fastest growing CPG brands adopted Nulogy for its ability to give them network-wide visibility of their external partners and collaboration capabilities to streamline production execution processes across 100+ contract manufacturers globally.
- **Order Collaboration:** One of the world's largest cosmetics brands adopted Nulogy's Supplier Collaboration Solution for improved order tracking and collaboration, materials planning and network visibility, and shop floor performance management, achieving:
  - Revenue increase from improved on-shelf availability due to improvement in OTIF.
  - Increase in efficiency in number of PO line items per user day.

  25% decrease in late PO items despite 14% increase in volume.

What's your advice for someone just getting started on a digital transformation journey?

Building truly mature supply chains requires a shift in thinking from linear supply chains to ecosystems propelled and supported by digital technologies. Supply chain maturity evolves as enterprises gain capabilities, moving from stages of "manual" to fully "orchestrated ecosystems."

As a first step, conduct a comprehensive audit of existing systems and data flows—where does data flow within the enterprise, and how is data shared beyond the four walls of the enterprise? Where do existing tools or integrations fall short in providing data granularity or visibility?
Once an overview has been established, leverage existing tools and resources to accurately gauge your enterprise's stage of supply chain maturity.

nulogy

Rise of the Multi-enterprise

In 2024, companies won't win – supply chains will. With continued shipping delays, rising costs, economic downturn, and ongoing disruptions hitting the market, you need to be equipped with the following to win:

- Real time data of what's happening in your extended supply chain network

- High fidelity collaboration capabilities with your strategic suppliers

- AI and machine learning capabilities to enhance efficiency, optimize processes, and improve decision making

Nulogy's multi-enterprise collaboration platform powers the world's leading consumer brands and their external supply chain networks – **see what we can do for you.**

nulogy.com

How ERP Software Is an Ally for Growth and Profitability for Food Manufacturing & Packaging Companies

VISH PUTTAGUNTA
Founder & CEO
Power Central

Tell us about the Power Central enterprise resource planning software. How does it work?

Power Central is a specialized enterprise resource planning (ERP) software meticulously crafted for Food Manufacturing and Packaging companies, built on industry-standard tools & technology from Microsoft. Our mission is to empower businesses in this sector to scale profitably by providing a comprehensive suite of applications.

Addressing Profitability challenges is at the core of our approach. Power Central delivers precise Cost-Per-Pack calculations, factoring in raw material, labor, and freight costs, providing a clear financial overview for informed decision-making.

What sort of companies would benefit from this solution?

Our solution is ideally tailored for Food Manufacturing and Packaging companies that have outgrown the limitations of basic accounting software, such as QuickBooks, often coupled with disjointed Warehouse Management and Production tools or reliant on cumbersome Excel sheets.

Why should these companies adopt it?

In the fiercely competitive landscape of Food Manufacturing and Packaging, where margins are razor-thin, the pressure to increase productivity is palpable. Compliance challenges, fluctuating raw material, freight and labor costs add to the complexity. The critical avenue to not just survive but thrive involves enhancing productivity and slashing overhead costs through workflow automation and strategic task delegation. This imperative calls for the immediate integration of an ERP system.

Having walked the same path as small food packaging owners, we intimately understand the urgency. An affordable and scalable solution is not just a convenience; it's a survival imperative.

What's your advice for someone who is unsure of adopting digital solutions in their plant?

Navigating the myriad of ERPs and solution providers can lead to analysis paralysis, causing overwhelm in the digitization journey. When seeking vendors, prioritize those with deep expertise in the intricacies of the food industry. Look for partners who move beyond mere presentations, opting instead for practical demonstrations of their solutions.

Choosing a collaborator with industry understanding, coupled with a shared risk approach, alleviates the perceived expense and complexity. The essence lies not just in adopting a solution but in forging a reliable partnership for a seamless transition toward heightened efficiency and innovation.
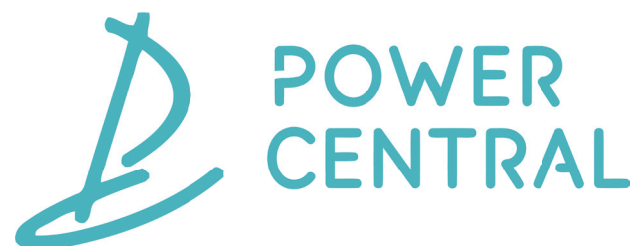
POWER CENTRAL

POWER CENTRAL

INTELLIGENT ERP FOR FOOD & PACKAGING INDUSTRY

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Business Central

Microsoft Partner

SQF / BRC Compliance

Eliminate data entry errors with easy-to-use Mobile-Barcode Apps for better SQF/BRC compliance & Inventory tracking

Cost-Per-Pack

Capture Precise Cost-Per-Pack that includes Freight and Human Labor cost for better Profitability

Production & Procurement Planning

Plan Production & Procurement with a fully visual scheduler that hightlights stock outages weeks in advance