

## The Smart Industry 2023 Crystal Ball Report

The digitalization of industry is rapidly evolving. That's a good thing, but it makes predicting future trends particularly tricky and particularly important, because "the future" can come as quickly as "tomorrow."

Here in our annual Crystal Ball Report, we gather predictions from dozens of industry thought-leaders on the immediate future of manufacturing.



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# Four quick wins for manufacturers in 2023

By Louisa Lu, senior industry marketing manager at Cloudera

Like many other industries, manufacturing faces growing economic headwinds. With inflation and world events putting pressure on manufacturers, data leaders should leverage digital technologies to maximize value from all manufacturing data—in any format—to achieve operational excellence, increase efficiency, and accelerate business results.

Looking ahead to 2023, as a data platform provider for large global manufacturers, we've observed four quick wins that help organizations respond, adapt, and set themselves up to weather the storm:

## 1. MANAGE UNCERTAINTY WITH PREDICTIVE MAINTENANCE

Although investment in plant and equipment and automation has been the trend for many years, the pandemic-related labor shortage will continue to drive accelerated automation and investment in new manufacturing equipment, ERP systems, and robotics in 2023. Increased automation is likely to drive productivity but also lead to uncertainty of anomalies. One quick win is to prioritize more data and advanced analytics capabilities that help make more-informed

decisions and mitigate the risks associated with unexpected disruptions or failures. For example, a leading commercial truck manufacturer uses a hybrid data platform to collect, consolidate and analyze sensor data in real time. The platform includes integrated machine learning and advanced analytics that help them automatically detect engine problems early and predict maintenance requirements. Using more data and advanced analytics has helped them reduce fleet downtime by more than 30%.

## 2. DRIVE OPERATIONAL RESILIENCY WITH REMOTE MONITORING AND CONTROL

Operational resiliency and agility are foundational for manufacturers to differentiate. Investments in the right technologies to remotely monitor and control assets can help manufacturers pivot quickly. For example, a building-material manufacturer uses a hybrid-data platform to enable remote asset-condition monitoring on various production lines. The data platform helps them quickly collect and consolidate machine data and run analytics-anomaly detection. Using more data for remote

monitoring and control processes helps prevent costly downtime and enables manufacturers to remotely adjust and adapt their operations, further increasing their ability to maintain resiliency.

## 3. IMPROVE QUALITY CONTROL WITH REAL-TIME ANALYTICS

Reducing defects is another quick win, as cost-savings will continue to be a priority for manufacturers in 2023. Companies can identify defects and improve overall product quality by collecting more data, and implementing real-time analytics with machine learning and AI. For example, a leading medical-device manufacturer uses quality analysis to rapidly collect and process data at over 700K records per second. By analyzing and alerting in near-real-time, they've been able to reduce scrap and failures and associated costs.

Additionally, the experimental trend of using digital twins and metaverse technology to improve quality control will continue in 2023. Using data from IoT sensors, it will be possible to build increasingly realistic digital twins and use new, experiential metaverse technologies to understand product

quality. Ultimately, this could decrease return rates for defective products and reduce costs.

#### **4. REDUCE ENERGY COSTS AND FOCUS ON ESG COMMITMENT**

Due to high energy prices and the quickly evolving environmental, social, and governance (ESG) landscape, manufacturers are

making operational changes across their value chain to bring their energy use under control. Manufacturers are investigating alternative energy sources, such as hydrogen and renewables. However, none will make a big difference in the short term. One quick win that delivers faster value is tracking and managing energy use. That can

help optimize operations to use the least energy to produce the highest yields possible. Frontrunners who have invested in foundational technologies such as data platforms, IoT sensors, connectivity, and analytics are in an excellent position to put the technology to work in measuring and optimizing their utility bills. For example, a

“ I think we are going to see the sector tone down its competitive perspective in the face of a looming recession. I see some rationalization in the market and a back-to-basics approach becoming the norm for 2023. Instead of spending cash to grow the business, we’re seeing businesses slow their growth to preserve cash and waiting to see what’s around the corner. We’re not seeing a reduction in business, but instead, maintaining the status quo until we know what’s in store for 2023.

It may seem a bit of a contradiction to my first prediction, but my second is we’re going to see investment in technology increase in 2023. The investments are going to go there. Automation is a huge trend that continues to have momentum as businesses look for ways to replace the people they’ve lost to the Great Resignation. Businesses are already open to the idea of adopting tech to fill in the gaps.

I lived and worked through the economic downturns of 2000, 2008 and now 2022. What I see is that we are much more digitalized today than 14 years ago. In 2008, if a business needed to research the value of a particular technology, the CIO was at the heart of the conversation. Today, we’re all technology practitioners and see the value of how tech drives revenue and increases profit.

Finally, I would say 2023 will see momentum shift toward the repatriation of manufacturing. Due to the supply-chain challenges of the past couple of years, we’re already seeing it as businesses are rethinking where they source raw materials for their products and what changes are required to expedite the process of getting what’s needed for their businesses and for their customers.”

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Ray Grady, CEO of Conexiom

global steel-mining manufacturer is working toward net-zero goals by implementing a machine-learning solution to reduce waste and energy usage.

In the year ahead, manufacturing companies should consider the following:

- Collect, consolidate and store data from as many manufacturing devices and processes

as possible, as a foundation for future analytics and machine learning.

- Increase innovation, and embrace more data and analytics use cases to increase quality, productivity, and connectivity.
- Invest in advanced technologies to help mitigate risk and develop agility. Don't wait, or competitors may quickly outpace you.

- Implement intelligent-operations initiatives to achieve cross-enterprise visibility and control capabilities; focus on ESG commitments and driving energy optimization.
- Streamline data collection, storage and analytics architectures to get the most out of all types of manufacturing data. ▣

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## Sustainability and profitability will further intertwine

By Morgan Bowling, Seeq industry principal

▣ While sustainability and profitability were once at odds, with the continued adoption of digital initiatives in 2023 and beyond industries will soon realize the two are more intertwined than ever before.

In past years, organizations have struggled to achieve sustainability gains because they lacked the means to track progress without a method of measurement. Reporting was retrospective and infrequent, hampered by time-consuming manual calculations, visualizations and validations performed in spreadsheets. Without a method to quantify outcomes and ROI, sustainability initiatives

were rarely allocated the required resources to be successful.

Moving into the new year, organizations will turn to digital solutions that enable them to tap into a valuable asset already at their disposal—time series data—to drive measurable impact.

As more organizations transition to the cloud via cloud-based, SaaS applications (such as advanced-analytics solutions) in 2023, teams will gain live access to data from many sources, they will gain the scalability required for complex calculations, and develop the ability to seamlessly integrate with other cloud-based tools, enabling teams to develop end-to-end workflows. These capabilities will empower

organizations to realize the full potential of their investments in digitalization and begin progressing toward more sustainable practices to achieve key milestones, including net-zero pledges, regulatory reporting goals, and energy, water and materials reduction.

For example, by leveraging advanced-analytics software, teams gain visibility into current emissions levels at each production facility, empowering local operational teams to continuously monitor entire processes to identify and mitigate environmental excursions in a timely manner. A variety of techniques to validate process parameters in near real time and adjust for known disturbances

(such as fuel/gas composition changes and combustion efficiencies) are being developed. By aggregating these process parameters, organizations can create enterprise-level reports that update frequently based on rolled up data from many units or plants while maintaining a historic audit trail of changes.

The adoption of advanced analytics platforms that aggregate disparate data sets and empower analytics in near real time will improve the efficiency and impact of existing operations. This will lead to increasingly proactive production systems that help preemptively identify and mitigate emissions events. Furthermore, the ability to

certify sustainability credentials of individual facilities, product lines, and product deliveries will create opportunities for differentiation and competitive advantage—especially in the areas traditionally considered commodity markets. □

“Data is vital to good decision-making and there is a need to democratize data—in other words, to make data available across the entire enterprise with as few restrictions as possible. The notion of ‘data models’ or a ‘single source of truth’ is now being realized by the cloud-service providers. Both Azure and AWS offer services that can be used to realize data models built on the edge automatically with ‘no code’ required. Data models built at the edge are automatically discovered and created in the cloud from MQTT Sparkplug data pipelines. Then real-time data is securely and efficiently delivered to time-series databases for big-data analytics, ML and AI. These IoT platforms enable you to create a digital representation of real-world things, places, business processes and people. They help you gain insights to drive better products, optimize operations and costs, and create breakthrough customer experiences.

To meet the demands of today’s data-intensive environment and enter Industry 4.0, enterprises must work to align OT and IT. MQTT and Sparkplug help bridge that gap. By having access to a greater quantity of high-quality data, every person in an enterprise can make better decisions more often.”

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Travis Cox, Inductive Automation chief technology evangelist

# Opportunities for agile visionaries

By Tony Schneider, director of sales—supply chain logistics for LeverX

As we enter 2023 with uncertainty around our economy, companies could find themselves in a dogfight competing to preserve narrowing margins. But the businesses that can adapt will find a rich environment of opportunity to take advantage of and even seed future growth into 2024 and 2025.

We are seeing some common challenges across the industry like production issues, visibility issues, new tracking regulations, quality inconsistencies, and logistics disruptions. Historically, transportation costs accounted for 2-4% of the overall product, now that figure has grown closer to 6%. This affects the bottom line for any manufacturing company. 2023 will require executives to focus on creating agile systems supported by well-organized data all while producing short-term wins.

Here are four ways to digitize your manufacturing business in 2023:

## **MIGRATE TO THE CLOUD**

In 2023, many in manufacturing will continue the trend of moving to the cloud, and rightly so, as it has so many advantages. Not only is it the most efficient practice long term but it can save the enterprise

a lot of money. Practically speaking, upgrades, which used to take prolonged periods of time, can be reduced drastically due to cloud innovations, enabling businesses to take advantage of annual upgrades with quick turnarounds.

There are even innovative solutions like the seasonal buy-time cloud approach. A particularly successful example was where a company ran at full capacity for their two busiest months, then switched to a much smaller capacity for the remaining 10 months. It saved them a significant amount of money.

## **COME BACK TO STANDARDIZATION**

In 2023, businesses will move away from custom solutions and come back to standardized ones. This trend has already been progressing for the last four to five years, and it is due to many businesses getting burned by large, clunky customized programs that make it impossible to upgrade. Manufacturing companies will look to adopt software solutions in the cloud that covers 75-80% of their standard functionality. And the good news is, standardizations are created with best practices in mind.

## **HARNESS YOUR DATA'S VALUE**

Data management and planning for the data future of the business should be on every CIO's roadmap for 2023 and beyond. Even though data is valuable, it can be costly when it is disorganized. The C-suite should be thinking about how to harness the data's value, especially considering the costs to collect, store, retrieve, and—most importantly—analyze it.

This will also impact the adoption of the use of AI in 2023, which many businesses are already considering or have implemented. In order for AI to function well, it will need to be supplied with reliable data-capture to continue to self-optimize, and develop more effective solutions for the future.

When it comes to data management, the C-suite should be thinking about their mid-term, long term objectives over the next two to three years. They should consider data capture, collection, storage and retrieval and factor in AI's role when designing a plan for their company.

## **CREATE RESILIENCY WITH TRANSPARENCY**

With the ongoing manufacturing and supply-chain challenges, businesses need a way to see and

respond to disruptions in 2023 to stay competitive. SAP, for example, leads with their approach to intelligent spend management. The concept they use is based on collaboration with your trading partners, which gives tremendous visibility into your extended network. It's ideal for looking into your supply chain, and giving you the ability to respond quickly to issues like changing customer demands or market disruptions. It's also an end-to-end approach so it can have an

impact across the enterprise from forecasting to production to operations. In this competitive industry, gaining transparency will enable you to stay resilient. This is exactly the solution to overcoming the challenges that 2023 will bring.

#### **OPPORTUNITIES FOR AGILE VISIONARIES**

2023 will be a challenging year but there are opportunities for leaders with a clear vision for the future and strategy for agility. The C-suite will

need to focus on both long-term planning and short term wins. They will need to be smart with their investments and select solutions that will bring efficiency and cost savings like cloud adoption or standardized software. A data-management strategy should be established that looks out to the next few years and aims to optimize the data's value. The executives that set forth with strong strategic plans in 2023 will also set themselves up for growth in 2024, 2025, and beyond. ▣

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## Finances and transformation

By Dr. Paul Turner, COO, Raven

▣ As manufacturers start to take stock of the macroeconomic headwinds facing them in 2023, questions around prioritizing digital-transformation investments are being raised. As energy prices rise and consumer demand declines due to increasing cost of living and interest rates, aggressive cost cutting is right back on top of the business agenda. This has the potential to seriously impact spend on Industry 4.0 both from an infrastructure and technology perspective.

The high failure rate of Industry 4.0 projects to date, the often eye-watering costs of building comprehensive data infrastructures and the pilot purgatory experienced

by manufacturers trying to figure out which Industry 4.0 technologies will deliver maximum ROI in the shortest amount of time will also incentivize teams to hold out on further investments until the headwinds subside.

But what if the headwinds don't? What if it's the new normal?

Many of the innovative Industry 4.0 technologies are developed and owned by tech start-ups and scale-ups that have historically enjoyed a venture-capital market supporting "hire and spend to scale" strategies strengthened by impressive valuation to ARR ratios. This is no longer an accurate representation of the financing markets. In anticipation

of a global recession, venture-capital markets are no longer chasing growth to secure blooming opportunities but are taking a more conservative approach. We're entering a "survival of the fittest" economy and financing strategies will adapt to take advantage.

So, what does this mean for both manufacturers and the companies serving them in the next year? Firstly, it means that manufacturers will want to sweat their existing assets, reduce costs, consolidate production, and maximize productivity—all within budget constraints. This means expenditure will be focused more on short-term investment gains with rapid impact



and payback. High-risk analytics projects involving armies of data scientists generating actionable insights and failing to deliver value on the shop floor will be put on hold if not shut down altogether. For smart manufacturing in 2023 and beyond, the top-down approach will need to embrace the bottom-up approach or step to the side. Frontline engagement is key to delivering tangible gains quickly. It doesn't matter how smart the technology is, if the operations teams don't use or act on it, then the digital solution is identical to shelfware.

In the new year, manufacturing tech companies also need to understand that they're operating in a "survival of the fittest" environment. This doesn't mean the biggest and strongest survive. This means that those able to adapt will. Requests for proposals inviting four or five vendors to pitch against each other for massive digital transformation projects will be rare. The failure rate, expense and risk of these "one-size-fits-all"

deployments are too high for the climate we'll face in 2023. Instead, the industry itself needs to collaborate as a best-of-breed ecosystem with modular components that seamlessly work with each other towards a common goal of delivering maximum ROI to manufacturers as rapidly as possible. Competition will need to segue to co-competition with an understanding of who plays where and to what strengths. The tech partners that adapt to this new environment will survive and those that don't will struggle to compete against it.

There are huge opportunities for manufacturers and technology partners that adapt to the 2023 conditions. A best-of-breed ecosystem that plays to the individual strengths of each player will be far more effective at delivering overall value than a sub-optimal end-to-end solution that doesn't. The main challenge facing a best-of-breed ecosystem is that manufacturers don't want to be dealing with various independent companies. The key to success here will be

balancing extra costs with efficiencies of scale, and the added value of a best-of-breed modular architecture.

By adopting a best-of-breed ecosystem, manufacturers can crack the code of driving standardization at scale while simultaneously providing flexibility and customization to the individual client needs and wants. Industry 4.0 history has shown that vendors focused solely on standardization get frontline rejection because of the "one-size-fits-all" myth. But those that focus too much on flexibility and customization create a collection of unsupportable features. In the best-of-breed ecosystem, the sweet spot is baseline and scalable standardization plugged into technology that specialize in local customizations.

In 2023, manufacturers who 1) adapt to the "survival of the fittest" environment, 2) spend smart on I4.0 technologies with fast ROI and, 3) collaborate with tech partners in a best-of-breed ecosystem will stay on top and prosper. ▣

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## The future of predictive asset-performance management

By Ilangovan R, Honeywell director of product management and Rahul Chillar, Honeywell chief product officer

▣ Within the next five to ten years, the predictive component of asset-performance management

(APM) is poised for transformative disruption. Strategies to close gaps and build an enduring, world-class

solution will resolve the predictive side of APM and link with the maintenance side.

- Solutions must bypass the need for connecting into existing sensors and historians, and the associated cumbersome deployment process.
  - Expediting through do-it-yourself ordering and installation by the user will result in reduced project cost and minimal to no service cost.
  - A convergence of technologies will bring about wireless sensors with much greater capabilities, encompassing financial and environmental health and planning. In addition to monitoring traditional critical parameters, a wireless solution will aid in energy and emissions management, as well as asset investment planning, including decisions regarding replace or repair strategies.
  - As part of a SAAS model, end users will no longer own the sensors/devices, demanding substantial CAPEX and time resources. The market is shifting to providing equipment, installation, maintenance, and the IoT Tech bundled into a monthly service fee.
  - Prebuilt analytics models can be deployed remotely by OEM engineers, with minimal services effort.
- Technology gaps will need to be addressed to realize the full potential of an APM solution. Sensors will include additional parameters such as flowrate and pressure, and solutions must include assets for which vibrations don't play a significant role in fault or performance monitoring. New technology will enable quicker, easier procurement and encompass APM, energy-emissions monitoring, and fuel optimization. Advanced APM will be deployed in a fraction of the time and deliver value at a fraction of the cost. □

“The current economic landscape is forcing decision makers to scrutinize budgets and digital solutions. Some disruptive technologies like blockchain, metaverse and augmented reality garnered a lot of attention in 2022, but in 2023 we'll see the shift toward practical applications that help workers anticipate tomorrow's challenges. Tech leaders will be motivated to invest in hybrid intelligence-based solutions, a technology that combines artificial intelligence (AI) with human intelligence (HI). An HI approach enables businesses to maximize existing infrastructure, face talent constraints and pursue deeper business intelligence and data-driven decision making.

Notable benefits of HI include empowering executives to solve complex issues through analytics and optimization with near real-time data, leveraging AI for more robust and accurate insights alongside human workers, and introducing new tech roles where humans facilitate training AI solutions for ongoing applications. In 2023, HI solutions will become ingrained throughout business processes across industries as AI takes on a co-pilot role, equipping employees to deliver better and insightful work. We'll also see the manufacturing sector, which has historically been perceived as a laggard, lead the way in deploying the biggest AI breakthroughs armed with hybrid intelligence.”

Artem Kroupenev, vice president of strategy at Augury



# A FLEXIBLE FOUNDATION FOR DATA-DRIVEN INTELLIGENT OPERATIONS IN MANUFACTURING

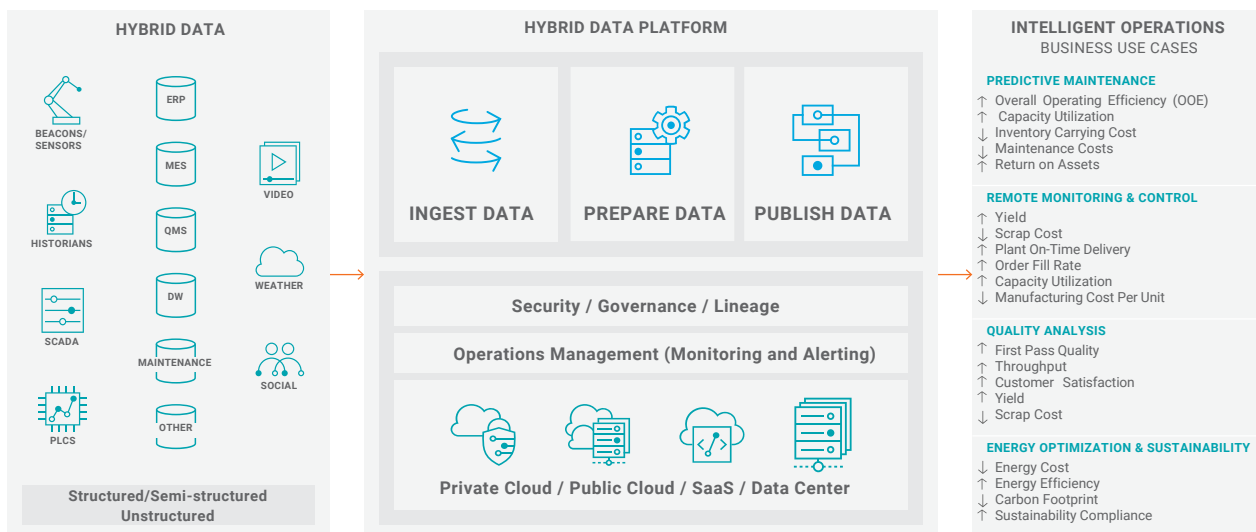
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# Five key enablers for autonomous operations

By Kevin Finnan, advisor, market intelligence and strategy, Yokogawa

□ The main issue with predictions about emerging technology is separating futuristic, hypothetical concepts (that might never come to fruition) from those that are now in practice, at least in proof-of-concept form (and will soon produce results).

With that in mind, here are five technologies that in 2023 will take major steps forward from conceptual stages to points where they will prove themselves. The common bottom line is that they all enable sustainable, autonomous industrial operations.

## #1: AUTOMATIC LOOP CONTROL WITHOUT PID

PID control is perhaps the most enduring paradigm in the automation world. In his paper, “A Brief History of Automatic Control” (IEEE Xplore), Stewart Bennett of the University of Sheffield, UK observed that “automatic feedback control systems have been known and used for more than 2000 years.”

While PID will endure for many years to come, there is room for improvement. In particular, engineers continue to grapple with controller tuning.

As companies in the process industries pursue autonomous operations, manual loop control and even the occasional need for manual intervention when automatic controls encounter problems are inhibitors.

Among the most promising improvements to PID-controller tuning have been applications, which use artificial intelligence (AI) and analytics. Meanwhile, it appears that another, emerging AI application can replace PID altogether.

Earlier this year, Yokogawa Electric Corporation and JSR Corporation announced the successful conclusion of a field test in which an AI-based solution autonomously operated a chemical plant for 35 days—a world first. This test confirmed that reinforcement-learning AI could be safely applied in an actual plant; it demonstrated that the technology can control operations that have been beyond the capabilities of PID and advanced-process control (APC).

In a distillation column, the AI solution reacted rapidly to process upsets, stabilized quality, achieved high yield, and conserved energy. Produced products were shipped to

customers. The participating companies are firmly convinced of a bright future for AI-based control.

## #2: 5G WIRELESS COMMUNICATION IN THE CONTROL LOOP

The initial reaction among experienced operators and process engineers is likely to be, “Now let me get this straight. You want a wireless, wide-area network *in the loop?*”

As audacious as that idea might seem, the trend to locate production facilities in remote, hazardous areas in recent years is fueling a growing demand for autonomous operations and transforming how people work. While today’s standard practice is to install a control system or edge devices with control capability physically in the plant, another possible solution is to use much simpler and more reliable edge gateways, which communicate using high-speed, wireless communications with AI-based autonomous control in the cloud.

Yokogawa Electric Corporation and NTT DOCOMO Inc. have recently conducted a proof-of-concept (PoC) test of such a combination. The PoC used an



autonomous, AI and cloud-based control solution, developed by Yokogawa and the Nara Institute of Science and Technology, and a 5G mobile-communications network provided by DOCOMO. The test successfully controlled a simulated plant-process operation and demonstrated that 5G is suitable for remote control of actual plant processes.

5G proved to provide the reliability and security to make such remote control feasible. A key characteristic is that it can operate on private networks. The technology is poised to further prove itself, much like the technology for remote work recently did during the COVID-19 pandemic.

### **#3: AI-ENABLED MOBILE ROBOTS OPERATE AUTONOMOUSLY AND COLLABORATIVELY**

The mobile-robotics field is emerging as a key technology for remote, industrial autonomous operations. In hazardous areas or difficult-to-access remote locations, which present many risks to human presence and high transportation costs, autonomous mobile robots, categorically including drones, are proving to be very effective.

Mobile robots can simulate operator rounds with many human-like capabilities such as hearing, sight, smell and tactile feel, enabling them to read gauges, record sound signatures, detect hot and cold spots via

thermal imaging, and determine valve positions. Robotic-sensor arrays also offer advantages such as much wider spectrum ranges than human hearing and sight. Their autonomy and mobility make the robots very cost effective when compared to the vast arrays of fixed-location sensors and video cameras required to provide comparable monitoring.

### **#4: OPEN PROCESS AUTOMATION PROVES ITSELF IN THE REAL WORLD**

Most process companies are burdened with integrating multiple proprietary systems in almost every process plant and facility. These include manufacturing execution systems, DCSs, PLCs, and their respective human-machine interfaces and inputs/outputs (I/O). The result is elevated capital costs on new projects and a high total cost of ownership. An open process automation (OPA) system is designed to remedy these challenges by supporting the integration of best-in-class components from different suppliers through configuration and application portability. This enables optimization of the total cost of automation systems.

### **#5: CARBON-NEUTRAL TECHNOLOGY TURNS THE CORNER**

With goals set for the year 2050, carbon-neutral technology might seem futuristic—but significant

progress is underway now. An inter-industry collaborative study project for the achievement of carbon neutrality is in process at an industrial complex in the Goi district of Ichihara City in Japan's Chiba Prefecture.

The study is examining the feasibility for collaboration by companies in different industries in a carbon-recycling business and involves surveys on the current status of the energy balances of their industrial plants and the capture and reuse of the carbon dioxide (CO<sub>2</sub>) emitted by them. The goal for this project is to lay the groundwork for a business that will aim to achieve net-zero CO<sub>2</sub> emissions for the entire industrial complex by 2050.

### **CONCLUSION**

An autonomous future will require digital infrastructure that spans an entire enterprise and integrates data, smart devices, and robust hardware and software that deliver the necessary levels of flexibility, adaptability and resilience.

Autonomous operations are considered essential to sustainability because they lead to a symbiosis between industry and society in which those entities function with autonomy yet in a coordinated manner. Early collaboration, such as the work in process in the Goi district, is necessary for the symbiosis.

The new technologies—mobile robots, artificial intelligence, 5G communications, and open process automation—enable unprecedented levels of

automation, including remote and unmanned operations, which lead to fully autonomous operations. Over the next year, these technologies will take major steps toward

enabling autonomous operations and will contribute extensively to sustainability initiatives that include carbon capture and carbon neutrality. □

“ We are looking forward to better, more predictive supply chains that can anticipate what customer demand cycles will be, as well as anticipating what likely supply chain risks will be and ways to overcome them. Advances in AI and machine learning move quickly, and we believe that supply chains will benefit from these developments in a very significant way in the coming years.”

Diego Pantoja-Navajas, vice president, AWS Supply Chain, Amazon Web Services

## Forecasting for digitalization in the manufacturing landscape

By Francisco Almada Lobo, CEO and co-founder of Critical Manufacturing

□ Modular enterprise solutions, including manufacturing-execution systems (MES), have evolved. They are no longer huge, cumbersome systems that have spread and been patched beyond recognition, leaving companies scared to change any aspect for fear of creating devastating issues for manufacturing operations. Instead, they offer agility, adaptability, and complete flexibility to meet business needs today and into the future.

### **FLEXIBILITY AND ADAPTABILITY TO MEET INDIVIDUAL SITE NEEDS**

Working through decentralized logic to readily enable the inclusion of Industry 4.0 manufacturing concepts, a future-ready MES platform can model all areas of production and offer the infinite scaling capacity to meet changing business needs. Supported by advancing container technology, these platforms enable customers to

select the most appropriate infrastructure solution for each plant or manufacturing scenario, whether that be on the cloud, on-prem, or a hybrid of the two. They can operate across multiple, global sites and bring enterprise-wide operations into a single, holistic view to enable better strategic decision making and adoption of best practices.

When it comes to complex manufacturing needs, each site has its unique requirements. While

advanced MES systems offer high levels of configurability and, through their modularity, incorporate much of the functionality needed ‘out of the box’, there will inevitably still be a need for some customization and, of course, the systems need to be maintained once they have been deployed. One of the biggest traditional challenges this presents to manufacturers is the need for often scarce, high-skill software resources. However, the provision of low-code technologies has enabled so-called ‘citizen developers’ to easily create and manage solutions.

#### **DATA, DATA...INTELLIGENCE**

Understanding manufacturing processes is key to driving efficiency, increasing productivity and enhancing quality. Alongside a new era in the architecture of enterprise

solutions come IoT technologies, Big Data, and increasingly distributed intelligence throughout the shop floor. Modern MES solutions employ advanced data platforms and analytical tools, including machine learning, to open the door to harvesting the vast amounts of data generated and turning it into crucial intelligence about all aspects of operations. Such capabilities offer the route to huge benefits, including increased efficiency, continuous process improvements, enhanced quality, and reduced waste, and provide a backbone for better strategic decision making to drive business growth and resilience.

Modern MES systems provide agile solutions that remove the traditional obstacles to complex upgrades of systems that have

evolved and been patched over time. Instead, companies are presented with platforms designed from the ground-up to adapt to changing business needs, readily embrace new technologies, and scale to match production demand. They offer rich, modular functionality; advanced configurability; easy deployment and maintenance across multiple sites and are designed for customization to match specific manufacturing needs without the need for highly skilled software personnel.

None of us has a crystal ball to see how technology will develop in years to come, but rather than fixing or limiting businesses based on the decision they make today, these systems open the door wide to future advances in technology and digitalization. ▣

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## Boundless automation: A new industrial technology-architecture paradigm

By Peter Zornio, Emerson chief technology officer

▣ There is a huge paradigm shift happening as industry grapples to predict what happens next. At the same time, technology developments are transforming operating models. Manufacturers today increasingly seek software and cloud technologies to operationalize

vast amounts of data designed to help them run their facilities with optimal performance. They are turning to these same advanced automation technologies to track emissions and energy usage while accelerating new energy options like hydrogen and biofuels—all

critical to meeting their aggressive net-zero targets.

More than ever, manufacturers need a better architecture to help them collect, manage, analyze and make good use of the valuable operational data that is stored at facilities and across enterprises.

We predict that the next industrial architecture will empower manufacturers to connect, manage and integrate highly contextualized data in what we call “boundless automation.”

This vision for a new industrial-automation architecture is software and data-centric, flexible, and secure-by-design, providing a cohesive software platform to unleash the power of valuable manufacturing data without the constant pain of constant data transformation and alignment. It will democratize critical data from smart sensors, intelligent devices and modern edge-based control systems, securely moving it between the field, edge and cloud-based enterprise for analysis, trending and forecasting.

As the industrial sector faces this pivotal moment, intersecting priorities of safety, productivity and sustainability are forcing a crossroads between “the ways things have always been done” and the

tech-powered vision of tomorrow. Critical to realizing the promise of digital transformation, the shift to boundless automation will be significantly more interoperable, extensible and scalable than past technology trends.

This next-generation architecture will empower companies to manage, connect and deliver data freely and securely across OT and IT domains—from the intelligent field to the edge and cloud—enabling operational and business-performance optimization across the enterprise. It will have common, consistent data models and application program interfaces (API) that provide ease of use, data access among domains and a zero-trust security architecture that delivers dynamic functional zones of authorization and have functional systems for control, reliability and other tasks that manifest as software suites distributed across the common computing infrastructure.

The new paradigm will be based on a modular yet cohesive software platform, unburdened by data barriers, unlocking data so it can be used across a facility or an entire enterprise for complete optimization. A common data model, published APIs, standards and secure-by-design capabilities will unify the software applications executing across these domains into a secure cohesive environment, enabling data democratization, solution-level security certification, unrestricted innovation and unlimited scalability.

This future industrial-automation architecture will give companies unprecedented flexibility to generate, manage and use the exponential amount of data plants generate. And moving this data freely and securely across OT and IT domains—when and where it’s needed—will create boundless automation opportunities to optimize operational, business and sustainability performance. □

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## Decade-defining Industry 4.0 trends

By Rajaneesh Kini, Cyient senior vice president and CTO

□ We are transitioning into the next era of the digital technology-driven world. Software is steering the wheel, while data-driven insights are powering their growth. Over the

next decade, we expect a magnitude of change in the business landscape. These changes will be equivalent to probably what happened in the last hundred years.

Digital engineering and spend on technologies such as data analytics, AI, ML, the IoT, 5G, cybersecurity, and AR/VR will account for much of this growth, as



enterprises invest in these technologies to digitalize their products, meet rapidly evolving customer expectations, and increase operational efficiencies.

The role of digital technologies in the future are highlighted across five megatrends of the future:

- Industry 4.0 and smart operations
- Intelligent and meta mobility
- Digital healthcare
- Sustainability
- Space systems

The global space economy is estimated to be worth more than

US\$350 billion and is expected to grow at a CAGR of about 5% over this decade. The market includes revenues from upstream activities such as satellite manufacturing and launch, ground equipment, and satellite operations, as well as downstream opportunities in satellite services. □

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## Advances in accelerated computing and AI reshape the manufacturing landscape

By Gerard Andrews, NVIDIA senior product-marketing manager

□ Supply-chain disruption brought on by the pandemic has catalyzed manufacturing across diverse industries to look toward a future quite different from our recent past. The pursuit of lower costs drove the previous era of mass globalization. Our next era of manufacturing will be driven by a desire to ensure more resilient, sustainable supply chains that can deliver the mass customized products we all have become accustomed to.

Try ordering a new car today and consider all of the options available; you'll get a feel for how this presents unique challenges and opportunities for manufacturers moving forward. The options are staggering from the type of engine and vehicle's aesthetics to a range of infotainment choices and more.

Fortunately, a host of digitization technologies have emerged powered by AI and accelerated computing, including photorealistic simulation of 3D worlds, robotics, 5G/6G communications, cloud and edge computing. These advances enable manufacturers to move closer to their customers—physically and virtually—while still delivering the new required levels of customization. These AI-enabled processes will streamline supply chains, increase efficiency by orders of magnitude, improve safety, and enhance product quality while reducing costs, latency and downtime across diverse, distributed manufacturing environments.

Of all the aforementioned technologies, 3D physics-based simulation is poised to make the

biggest leaps in terms of adoption in 2023. The idea of modeling a complex manufacturing facility in the industrial metaverse, complete with mobile and pick-and-place robots, is gaining traction as the benefits of doing so become more apparent. In the industrial metaverse, factories can be designed and optimized, virtually, before anything is actually built in the real world.

The virtual factory will also be useful in training the next generation of workers on how to program and work alongside the various robots/cobots that will be deployed to assist them. Sales teams at automation-technology firms will also embrace 3D simulation to perform virtual demonstrations that aid in the procurement process.

These virtual factories will ultimately connect to a range of sensors in the real factories and we will enter the age of digital twins. The promise of digital twins is continued innovation and experimentation in the virtual world that will yield safer and more efficient

manufacturing facilities. This innovation will not be constrained at the factory scale. It will also be useful for more adaptable robot design, better sensor choices, and faster automation deployments.

But even as we approach this holy grail of digital-twin

deployment where manufacturing environments in the real world are connected to the virtual, there is much value to be had along the way in factory planning, workforce development, increased functional safety, energy efficiency, and sales enablement across industries. □

## In 2023, think circular supply chains

By Bart De Muynck, project44 CIO

□ 2023 will bring more and different cost considerations, including:

- Changes to regulatory requirements with a focus on sustainability reporting
- Escalating labor costs as workers struggle to cope with persistent high inflation
- Social and economic impacts from inflation, recession and other factors
- Increasing weather disasters and the impacts of climate change
- Flaring geopolitical tensions placing increased pressure on global economies

Some of these factors will also influence the decisions supply-chain companies make around near- and off-shoring. While near-shoring might be the more popular solution in the short term, it is likely to have knock-on effects on regional networks and could

put added pressure on local labor, transportation capacity, and existing infrastructure.

To face these challenges, companies should no longer think in terms of linear supply chains where things happen step by step, one after the other, but rather in a circular fashion where everything constantly moves and evolves, taking into account real-time data as things occur. To achieve this circular supply chain, companies need to look toward new technologies that assist their digital transformation journey. This will help them become more dynamic and more resilient.

Visibility is one such technology companies should leverage to increase agility and help manage risk. Advanced visibility provides companies with transparency to navigate through the many challenges across all modes of

transportation on a global basis.

Visibility platforms also provide advanced analytics—yet another technology that helps in the digital-transformation journey. Through the use of advanced analytics, organizations can leverage analytical insights to sense the disruption, comprehend its magnitude and the impact on the supply chain, then quickly and with a high degree of accuracy formulate a response.

Furthermore, companies should look toward collaboration to make their supply chains more connected, which will also help with resiliency. By analyzing multiple shippers' data in a connected platform, shippers can efficiently collaborate, improving load percentages and reducing empty miles and transportation costs.

Lastly, companies need to focus on acquiring the right digital talent

that can support this digital transformation. Technology is one way to attract and retain this talent, which is in high demand. After having spent time this year with students at different universities, I can attest that the new talent coming into the supply-chain

industry is nothing short of amazing. But there is big competition for this talent; organizations need to make sure they set the right culture and working environment to successfully attract it.

2023 brings many challenges to the manufacturing industry that

will test its agility and resiliency. But it will also bring supply-chains opportunities. If companies take the right measures, they have a way to differentiate themselves from the competition. This, in turn, will drive revenue while increasing efficiency and reducing costs. □

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## Looking west for inspiration: Lessons learned from California's adoption of EVs

By Stefan Zschiegner, vice president of product management at Itron

□ Energy companies based out of California are acutely aware that demand overtaking supply is a real possibility. They've seen it happen during heat waves that caused rolling black- and brown-outs, and don't want the same to happen when electric-vehicle adoption skyrockets.

Good for the environment, bad for the grid? Not so.

While the benefits of EVs are clear, utilities are faced with an unprecedented level of complexity. If these complexities are not managed, it can tip the delicate balance of supply and demand in the wrong direction.

An increase in EVs would be bad news if utility companies continue with the status quo. Our grid is a part of critical infrastructure, and a significant increase in demand from residential and fleet depots could be a recipe for disaster. However, the good news is that with technology such as distributed intelligence (DI), our aging grid can keep up with demand.

DI combines smart endpoints (meters, devices, and other sensors) with peer-to-peer connectivity and provides the ability to solve value-based use cases at the grid edge. It can even have a financial

benefit for the utility company. In an industry that has seen years of stagnant growth, capturing extra revenue from increased demand for electricity is essential.

We all can do more—including utilities. While California is at the forefront of EV adoption and clean energy initiatives, more states will start to follow suit. It's great to see utilities around the country starting to prepare and embrace next-gen technology to support their customers' transition to EVs, but in many cases, more can be done. The time is now to ramp up efforts, as EV mass adoption is just around the corner. □

“ CISOs will be required to connect cyber-risk to the broader business to keep their jobs. It’s no secret the economic downturn has meant significant budget cuts for many companies. As cyber-threats escalate, cybersecurity investments are either staying put or increasing in 2023—that is, only if security teams can rightly prove the value of their cybersecurity programs to senior leadership and the board. However, the majority of CISOs are struggling to effectively express the business impact of cyber-risks to their board. In 2023, this ability will go from a nice-to-have to a must-have, and we will see an influx of CISOs losing their jobs if they can’t adapt.

With the economy remaining uncertain next year, CISOs will feel increased stress from their board and senior management to justify the spend on their cyber-tech stack. To ensure their security program is well-financed, CISOs will need to set specific management-level cyber-metrics that can help them properly articulate whether the cybersecurity products and tools they have purchased provide a sound return on investment.”

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Aleksandr Yampolskiy, CEO and founder of SecurityScorecard

“ Attackers will seek out the next Log4j vulnerability and will likely become successful. The impact of the Log4j flaw has been widespread and far-reaching, with countless organizations still reeling from its massive ripple effect. Log4j has underscored the level of difficulty in patching vulnerabilities within commonly used libraries, as almost every vendor within the software supply chain has been responsible for fixing it. Attackers have become well aware of this and have continued taking advantage of unpatched Log4j vulnerabilities. In 2023, we’ll not only continue to see the breadth of Log4j’s exposure increase, but we’ll also see threat actors focusing on exploiting open-source libraries. To mitigate the impact of a vulnerability as critical as Log4j, organizations must adopt a risk-based vulnerability-management program that can help them prioritize patching the vulnerabilities that are most at risk.”

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Sadik Al-Abdulla, CPO of Onapsis



“The current economic landscape is forcing decision-makers to scrutinize budgets and digital solutions. Some disruptive technologies like blockchain, metaverse and augmented reality garnered a lot of attention in 2022, but in 2023, we’ll see the shift toward practical applications that help workers anticipate tomorrow’s challenges. Tech leaders will be motivated to invest in hybrid intelligence-based solutions, a technology that combines artificial intelligence (AI) with human intelligence. This HI approach enables businesses to maximize existing infrastructure, face talent constraints and pursue deeper business intelligence and data-driven decision making.

In 2023, HI solutions will become ingrained throughout business processes across industries as AI takes on a co-pilot role, equipping employees to deliver better and insightful work. We’ll also see the manufacturing sector, which has historically been perceived as a laggard, lead the way in deploying the biggest AI breakthroughs armed with hybrid intelligence.”

Artem Kroupenev, vice president of strategy at Augury

## Advanced AI, better batteries and generative models

By Michael Krause, senior manager of AI solutions at Beyond Limits

**□ DALL-E AND GENERATIVE AI** Generative models, like the one used to create DALL-E, analyze data and interpolate to create something brand new. But they’re not just good at creating weird art—generative models can be used to discover new materials for battery design, carbon capture, and loads of other innovations.

Generative models will reach new heights in 2023 as solutions like DALL-E are adapted to the

younger generation’s desire for video over audio and pictures. We can also expect to see generative models continue to infiltrate the healthcare space for vaccine modeling, drug discovery, and even personalized medicine supported by training data generated from electronic medical records.

**DEFINING HYBRID AI IN 2023** 2023 will be the year we define what hybrid AI really is. Hype

for hybrid AI has grown exponentially, but there’s been some debate over what it is. Some say it’s a physical simulator tied to machine learning; some say it uses a hybrid cloud—as of late, no clear definition has emerged. In the new year, the industry will reach a consensus, and once it does, an explosion of new tools will emerge as organizations take action.

## THE FUTURE OF CHARGING— AI FOR NEW BATTERY COMPOSITIONS

Batteries are about to get a whole lot better, thanks to AI. By incorporating AI into the R&D process, companies will streamline their battery design processes in 2023. AI can analyze data and constrain

physical experiments, turning limitless chemical compositions into a few plausible options. These tools are accelerating and adding intelligence to the battery-design process, making boundless possibilities tractable by telling scientists what they shouldn't waste their time on.

In 2023, we'll see faster R&D cycles with incremental improvements to batteries at lower costs, and improved sustainability as companies leverage AI to identify greener options by potentially reducing rare metal or hazardous material usage. ▣

“Capital-intensive industries have been gathering massive amounts of data for decades, but data is only as useful as an organization's ability to manage and realize the true value of that data. In 2023, unlocking high value use cases to leverage industrial data—for things like production optimization, machine learning, or emissions tracking—will require new data-management strategies that are scalable, contextual and maintainable. As the industry evolves with digital transformation, enterprises will empower their teams, from the plant floor to the executive suite, with connected, actionable industrial data via these strategies.

In the next year, capital-intensive industries will implement industrial-data foundations that can collect, organize, contextualize, and securely transport large amounts of data. These industries have already been prioritizing ways to manage emissions and reduce waste, and this will only intensify in 2023 as the world inches closer to 2050 net-zero targets. In 2023, it will be important to have a strong data-management strategy that can help prove sustainability commitments are being met and show measurable progress over time.

Capital-intensive industries have a critical role to play in addressing the dual challenge of meeting the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. With the right data-management strategy, they'll be able to harness huge amounts of data to become more efficient and make progress toward sustainability goals.”

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Nicole Rennalls, AspenTech vice president and general manager of AIoT

# Standardized data poised to drive the future of closed-loop manufacturing

By Harpuneet Singh, Jabil vice president of global engineering

□ The future of manufacturing is linked inextricably to ongoing advances in automation, analytics and artificial intelligence (AI). Production processes and operating models are being transformed by the adoption of digital technologies that empower companies to move

with elevated levels of speed, precision and agility while reducing cost, risk and time to market. Over the past year, global manufacturers increasingly have deployed automated processes, robotics and AI solutions to improve how products are designed, made and delivered.

In the year ahead, we expect to see accelerated deployment of hardware and software automation using standard yet flexible modules that can be reconfigured and redeployed easily and economically. Additionally, the use of digital twins will gain

“The IIoT is evolving. It’s no longer only about sensors with state-of-the-art connectivity, but innovative ways to integrate them to connect older equipment to the cloud. This will enhance asset and energy-management strategies, as well as condition-base monitoring, which will mature further in 2023.

We see the energy usage of complex manual and automated processes being measured at a granular level by digital tools focused on performance and efficiency to drive sustainability. This is due to continued progress in connectivity at the edge and successful efforts to accelerate IIoT adoption. This connectivity, paired with the increasing appetite for business and operational Intelligence, will enhance the ability to narrow down where energy is being lost and the causes of downtime, which will provide a better understanding of the overall efficiency and contribute to asset-management strategies that enable us to achieve sustainability goals.

The concept of ‘data centrality’ is flourishing as unify dataflow architectures are centralizing the raw data in the cloud, which creates data lakes. Companies will shift to the data-centrality model, making information easily available for more informed decision-making. Moreover, this will encourage the developing of other operational improvements, like incorporating robotic-process automation.”

Mauricio Casares, Schneider Electric smart factory improvement manager

momentum as companies realize the many benefits of using digital replicas of potential and actual physical assets to verify early-stage design concepts, reduce design modifications, decrease machine commissioning time and expense, as well as achieve faster performance optimization.

As digital twins and AI evolve, it will become easier to create models that measure the impact of people, places and processes on operating efficiencies and economics.

Expect to see AI algorithms become smarter and more

beneficial as they tap relevant data from equipment and sensors on production and assembly lines. The same can be said for augmented reality/virtual reality (AR/VR) solutions, which are among the early manifestations of the industrial metaverse. As the pace of developments in AI and AR/VR quickens, there are high expectations for solutions to drive major productivity improvements. Remote training and predictive maintenance will continue to gain traction, but it will take time for these technologies to take on

broader roles in transforming manufacturing operations.

As an intermediate step, AI cameras are being used in manufacturing environments to help improve line balancing and operator productivity. Still, AI and machine learning require massive amounts of data to be processed, requiring robust IT infrastructure with strong computational processing and storage capabilities.

The common denominator in these emerging digital manufacturing solutions is the overarching demand for standardized data. ▣

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## How smart manufacturing automates, optimizes and drives innovation

By Grace Nam, strategic solutions manager with Laserfiche

▣ After several years of building smart manufacturing processes, it's clear that smart manufacturing is crucial for the future of the industry. However, there are still challenges that organizations face. Here's a quick look at some of them:

### **DATA OPACITY AND BURDENED EMPLOYEES STYMIE PROGRESS**

Supply chain disruptions and workforce shortages have magnified some of the obstacles business

leaders must overcome on their way to improving operational efficiencies. For one, despite years of investment, many firms are still just scratching the surface of a smart manufacturing state. And as organizations march toward intelligent operations, program measurement remains underdeveloped.

Digital transformation is a continuous effort requiring collaboration between people and technologies to improve business strength, process capabilities, and to better scale data usage

to increase productivity. But if these efforts are not quantified, it becomes difficult to justify digital transformation activities.

### **AUTOMATION, TRAINING BREAK OPEN PROCESS BOTTLENECKS**

Digital transformation is challenging, especially when it comes to measuring results in a short span to justify ROI. Business leaders can begin wrenching open some of their bottlenecks by re-evaluating business strategies and setting

“The manufacturing industry has become increasingly automated in the last year, requiring an entirely new set of skills that aren’t taught in typical manufacturing spaces. To be a leader in manufacturing, specialized knowledge of artificial intelligence (particularly for process-control purposes) and machine-learning algorithms is essential. Top actors will need to obtain double the skills to understand the entire industry from a holistic perspective, moving from the bottom up as opposed to top down. These skills open a new door for those working in manufacturing and will be the norm in the coming years.”

Dr. Matthew Putnam, CEO of Nanotronics

goals with a top-down approach. This resetting allows the firm to focus on common goals rather than department-specific projects. Once leadership sets clear, overarching objectives, it can then invest in technology to drive the firm toward those goals.

The technology industry is also evolving quickly and placing increased emphasis on integration, which helps connect new advanced technologies and business strategies. Integration-heavy technology environment can be dizzying, so technology vendors are also building low-code tools such as cloud-based integrations, which can do much of the weight-lifting in complex industries like manufacturing.

Low-code tools enable hyperautomation. Low-code hyperautomation harmonizes robotic process automation (RPA), machine learning and AI to redefine how technologies integrate and scale automation across functions to create enduring operational sustainability. For example, hyperautomation can turn incoming unstructured data into structured information, route and store critical documents, manage retention cycles and simplify the way people collaborate across departments. Hyperautomation bridges the gaps between scattered automations and business processes. Unifying different processes in this way creates an end-to-end process to accelerate the high-level initiatives, decrease

operational costs and support ROI measurement for the organization.

### **SMART MANUFACTURING PROVIDES ENDURING OPERATIONAL BOOST**

Manufacturers must reassess their digitization processes. Leaders should set top-down mandates, adopt cutting-edge technology tools, train their workforce and measure progress toward a smart-manufacturing end state. Leveraging these transformation tactics can help leaders not only justify their investments, but also achieve the lower operating cost and better on-time delivery needed to drive ongoing innovation and competitive edge. □



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# Expectation vs. reality

By Jason Andersen, Stratus vice president of business-line management

□ Last year, we predicted trends like the lines between IT and OT teams continuing to blur and the continued interest in advanced analytics, both of which unfolded in 2022. So far, there is not a set of best practices or a blueprint for how businesses can have their IT and OT teams work together, but we've seen this trend unfold in 2022 and expect it to continue in 2023 as businesses find new ways for these teams to collaborate, especially as requirements and roles evolve.

When it comes to advanced analytics, we have seen continued interest from our customers, but it is starting to morph into the background of different solutions. For example, this year, we'll see customers purchase platforms or devices that include advanced analytics, instead of buying a dedicated analytics platform.

While technologies that involve cybersecurity, 5G wireless, artificial intelligence and machine learning will continue to be some of the biggest priorities for new build-outs, there will also be rising interest in modernizing the existing applications that are driving current processes. In 2023, there will

be more application updates and deployment via containerization as well as an uptick in networking and connectivity. Lastly, as each of these new requirements call for more powerful solutions at the edge, there will be more edge deployments next year—which is supported by research we recently conducted that found that the demand for mission-critical edge computing is projected to grow by almost \$10 billion through 2026.

We'll continue to see an uptick in companies adopting more advanced system-automation technologies next year. While most companies have some degree of the technology already, there are two big questions companies will need to answer to fully realize the benefits of automation and take a temperature check of their current compute operations to ensure processes are running smoothly: 1) Is what I have healthy? 2) Is what I have enough?

There are many new capabilities in automation—like orchestration, remote monitoring, etc.—that are needed as the relationship between company, workers and the work itself evolve.

Unfortunately, a recession is looming, but that won't stop companies from leveraging edge computing to ensure operational resilience in the new year. Advanced edge-computing platforms with virtualization and containerization capabilities can help businesses rein in costs and enable operators to accomplish more remotely. The more businesses trust these platforms in difficult times, it is critical that these platforms are resilient.

With remote work and finding the new normal, there has already been a shift in returning to pre-pandemic operations with some more flexibility; in the new year, remote operations will not be the new normal. In fact, we have seen major interest in remote monitoring of the compute nodes, which is being facilitated by greater connectivity options and fewer humans where the machines are deployed.

As manufacturers look to modernize and recession-proof their business, they'll continue to adopt edge-computing platforms to help them automate processes and find new processes for their IT and OT teams to work together. □

“Clean energy is a major topic, and the government will continue backing these industries for investments for the future. Likewise, investment into the US semiconductor industry will continue as chip production helps mitigate supply risks by shortening supply lines and simplifying logistics.

With the Inflation Reduction Act investing billions via tax credits, grants and, and low-interest loans, we'll see a new market opportunity and new solution availability to communities who otherwise may not be able to afford to invest in efficient and sustainable options. The IRA will provide multiple options for low- and middle-income residents to reduce the burden that energy costs have in their lives.

Energy independence=national security. As critical supplies are now an issue of national security, we'll start to see growth trends across domestic output for oil and gas, critical minerals and rare earths, as well as energy prices. This greater demand will incentivize investments in infrastructure and high energy prices could accelerate renewable generation, leading to more efficient solutions for consumers and businesses.”

Cory Lichtenberger, Schneider Electric vice president of US strategy

## IIoT-enabled cloud is key to managing the digital supply chain in the manufacturing industry

By Andrew Burton, IFS industry director for manufacturing

□ The ability to adapt to supply-chain disruptions across the manufacturing industry is no longer progressive, it's vital for economic survival. In 2023, industrial-grade, IIoT-enabled cloud manufacturing will redefine the supply chain, building in resilience at every stage as shortages of truck drivers, rising fuel prices, and finite raw materials continue to play

their part in ongoing disruptions. Forward-thinking companies won't just be able to weather the storm; their cloud platform will help them stay ahead of impending challenges, providing a technology backbone and infrastructure that enables them to quickly pivot their business, whenever disruption occurs across the manufacturing network.

For digital-first manufacturers, the combination of cloud-based management platforms, such as ERP systems, with IIoT technology will provide the perfect platform to enable them to improve essential supply-chain flexibility across three key areas—product redesign, the need for sustainable processes, and the growing requirement for stronger cyber-defenses.



“ In 2023, the manufacturing landscape will see some of the most profound changes in planning, maintenance and distribution of manufacturing materials because of the advancements with digital-twin technology. Developments in digital-twin modeling have presented businesses with new ways to remain efficient in the development process, eliminating unplanned shutdowns by minimizing the main causes of operator mishap in manufacturing or in buildings.

The manufacturing industry’s greatest digitization benefit comes from seeing the end product visualized in real time, like a fully modeled virtual building for example. By using digital-twin technology to improve the digital infrastructure available to operations, maintenance and development teams, the end-to-end process of manufacturing is made easier. In 2023, the process will only continue to be streamlined, enabling manufacturers to adhere to the exact modeling that customers request, which provides an entirely new level of flexibility and efficiency in operations and maintenance.”

Manish Kumar, executive vice president of digital energy at Schneider Electric

IIoT-enabled cloud manufacturing will drastically change the traditional product-design process, particularly when it comes to delivering high-tech products made to a customer’s specification or made following a customer’s own drawing package. Yes, manufacturers need the flexibility of cloud technology to manage this time-consuming and labor-intensive process, maximize valuable resources, and improve supply chain flexibility. But the right IIoT-enabled cloud ERP systems can provide manufacturers with demand-planning and mixed-mode manufacturing capabilities

to make it easier to alter the logistics equation for parts production. This allows organizations to develop faster prototypes and source parts quickly as demand dictates, in order to avoid buying an excessive inventory and to navigate ongoing disruptions.

Sustainability will continue to be at the top of the business agenda in 2023; manufacturers must show a willingness to adopt a more circular business model. The impact of distribution practices is a key area where cloud-enabled manufacturing will help companies take sustainable action one step further,

particularly when it comes to the industry’s heavy reliance on shipping and road freight. For instance, cloud-enabled manufacturing supported by IIoT technologies can capture, catalog, and share granular data such as distance traveled, geographic coverage, and the number and length of breaks across the entire value chain to help manufacturers optimize their loads and make necessary supply-chain adjustments.

As software and applications improve at a rapid rate, so too does the threat of malicious attacks. For manufacturers, the need to

constantly maintain and update security measures will be integral to ensure supply-chain stability—here cloud deployment ticks all the boxes. Manufacturers with a

single-tenant architecture can benefit from greater management control and higher levels of isolation. In the event of a cloud neighbor becoming compromised by a cyberattack,

a single-tenant architecture can ensure that the customer remains isolated from the threat, their data is left intact, and supply chains remain undisrupted. ▣

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## Industrial intelligence: The future for digitization

By Peter Harding, Kelvin founder & CEO

▣ What does the future hold for industrial operations? That's the billion-dollar question for decision-makers around the globe as we start 2023. Investments in digital technologies must yield real results that improve efficiency. We can do more with less.

While it's challenging to predict what 2023 will bring, it is likely we will see more shocks to the markets. These shocks force companies to be both nimble and resilient. If you don't adapt quickly, you will not survive.

Optimizing existing operations is critical to survival. To do this, you need to clearly understand your own best practices and then determine how to make them better. This allows you to use your own industrial intelligence to reach your full potential. By embracing industrial intelligence you can meet evolving customer requirements while cutting costs, inefficiencies and emissions.

Industrial intelligence has tremendous potential to drive real operational impact. Research shows that key sectors such as energy, oil, and gas will continue to invest in the latest technology that helps organizations hyper-optimize and automate in the coming years. A recent Frost and Sullivan report revealed that digital investments into power distribution and retail will top \$33.42 billion by 2030. Those investments can improve industrial intelligence and deliver real impact.

Energy and manufacturing facilities must invest in solutions that show real results, faster than ever before. Delivering value at speed will determine who survives in 2023.

### **DIGITALIZATION IS THE KEY TO SUSTAINABILITY**

If you want to find your inefficiencies, you need to start with a clear map of your existing operations. By capturing physical systems in a

digital form, we start on the path to sustainability. Once we can measure how our systems are performing relative to their potential, we discover the inefficiencies in our industrial operations. Now it becomes much easier to find problems.

As governments worldwide focus on cutting greenhouse gas emissions, organizations will increasingly turn to solutions such as industrial intelligence to find their problems and fix them faster. The critical step in any industrial-optimization process is to unify and demystify data streams so that teams can understand what is really happening and make the right operational decisions to improve. In doing so, industrial intelligence can enable companies to realize value faster than ever before.

Today, cutting-edge collaborative-control software demonstrates real impact by empowering engineers to make better decisions together. And better decisions yield better results. ▣



“ In 2023 I expect to see IoT being applied most often to three application segments: quality control, tracking products, and safety and compliance. The drive is now there, and so is the technology to make that possible. Connecting any individual links in the supply chain though IoT is possible. The opportunity is in staying focused on how you turn your data into meaningful and actionable information that quickly drives business outcomes.”

Sudhir Mehta, Lexmark global vice president, Optrax engineering and product management

## Unlocking innovation from your supply chain

By Travis Miller, general counsel at Assent Inc.

□ The distance—both geographic and the arm’s-length management style of globalization—between suppliers and manufacturers presents challenges to understanding one’s compliance and sustainability risks. 2023 industry innovations will be grounded in bridging this distance by engaging more directly with suppliers to uncover, analyze and solve for business risks. Global supply chains hide risks, including product-compliance issues and brand-reputation threats. Businesses that proactively seek out risks in their supply chain by centralizing, digitizing and standardizing supplier data can access the business intelligence that unlocks innovation.

To gain efficiencies, improve products, and reduce overall

spend, executives are shifting focus to develop resilient and sustainable supply chains. A sustainable supply chain is one that can stay in operation indefinitely through sound resource management and risk mitigation. In the past, this definition of sustainability tended to ignore externalities. However, post-COVID, companies understand that risk management includes ensuring their supply chains do not hold compliance risks, like forced or child labor which could cut off market access and damage their brand value. In 2022, manufacturers witnessed increased regulatory restrictions on goods from China under the Uyghur Forced Labor Prevention Act (UFLPA), and in 2023, the trend

will continue with the German Supply Chain Due Diligence Act (SCDDA) and a proposed blanket ban on all goods containing forced labor in the EU. These regulations will require manufacturers to perform continuous and ongoing due diligence on supply chains to demonstrate compliance.

These types of evolving legal requirements have the potential to cause significant supply chain disruptions. But businesses that are able to proactively engage their supply chains are the ones able to accelerate innovation in 2023 and beyond.

From a technology standpoint, what is required for this type of innovation and market protection in 2023? Supply chains are undergoing a digital transformation that

enables companies to see deeper into their supply chains to evaluate supplier behavior, product composition data, and performance metrics like on-time delivery and price per unit. Executives seek the ability to analyze cross-topical data and connect the dots between that data and regulatory requirements. Digital transformation means providing your supply chain

a standardized mode of digital communication to share product component data and other types of sustainability data paired with automation to match data collection frequency with business requirements throughout the year.

Businesses operate in a world of continuous change, from evolving regulations to growing sustainability pressures, and a digital

transformation is a must in order to innovate at pace. Yet, the ability and core tenets of innovation and market access have changed and are now locked in our globalized supply chains. The executives who will emerge as leaders in 2023 are those who focus their growth investments in supply-chain sustainability management and unlock their ability to innovate. ▣

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## Predictions for smart manufacturing in the coming year

By Claire Fallon, executive director of the International Society of Automation (ISA)

▣ Here are some predictions made by the ISA's Smart Manufacturing and IIoT Division in each of the eight subject areas around which we have organized our work:

### **INDUSTRIAL CONNECTIVITY**

Going forward in 2023, we expect a substantial number of manufacturers to see the benefits of investing in a private 5G network—think of it like a central nervous system of a digital-physical factory campus or facility. As consumers, 5G makes us think of speed and streaming our favorite shows, but in a manufacturing context, the privacy, performance

and security of the network is also critical.

### **VIRTUALIZATION TECHNOLOGIES**

You have probably heard of AR and VR, especially if your kids play Pokémon Go or Beat Saber. But in a manufacturing context, virtualization is no game. In the case of AR, or augmented reality, we expect to see increased usage of smart glasses, which can serve up machine and system information to operators. With VR, or virtual reality, operators can train for dangerous situations, or on remote equipment and facilities. The two scenarios can even

interoperate: imagine an operator in the field wearing smart glasses, which transmit visualization and data to a remote technician working in a virtual environment.

### **INDUSTRY CYBERSECURITY**

One of the biggest challenges facing the OT-cybersecurity space is legacy equipment that cannot easily be integrated, particularly at the state and municipal levels, or with SMEs. OT-specific security equipment and platforms are becoming increasingly prevalent in the market to address this challenge, but not all of these are created equal. For greatest security and interoperability, asset

“Looking forward to 2023, I foresee more collaboration in the industry through partnerships to complement existing project-management solutions and extend workflow processes through client-interaction workspaces. This will ultimately streamline customer-facing business processes and client interactions. By leveraging integrations that enable workflows to transcend over multiple solutions (rather than having to transition communications to channels such as email or phone) there will be less friction in the customer journey and customers will be more satisfied with their experience.”

Subrah Iyar, CEO and co-founder at Moxo

owners should look for equipment that is compliant with recognized international standards like ISA/IEC 62443.

#### **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

If you've marveled at how quickly TikTok got to know that you like content about baking cookies and gardening, then you have an AI-driven algorithm to thank. But understanding customer and industry trends is just one piece of what AI can do. Going forward, I believe we will see more manufacturers

reliant upon AI to identify process bottlenecks and save costs through process automation. AI may even make contributions to greater workplace safety and efficiency by mitigating repetitive and dangerous tasks or conducting preventive maintenance analysis.

#### **INDUSTRIAL INTERNET OF THINGS**

Digitalization enabled by the IIoT has been increasing rapidly during the past decade and is expected to grow to 1.11 trillion USD by 2028. Most critically, as we move

forward into 2023, we will see advances in sensor technology and usage—gaining more context about equipment, processes, and operations, and informing every other area outlined here.

#### **CLOUD AND EDGE COMPUTING**

Going into 2023, I believe we will see more reliance upon the hybrid-cloud model, where proprietary internal-process information is stored locally by manufacturers, and resource-intensive applications like machine learning are moved to the public cloud. □

## Tough problems, smart solutions in 2023

By Charlie Neagoy, senior vice president of customer success at Librestream

□ We see in the coming year that manufacturing organizations

(and adjacent industries including supply chain) will start to address

the need for digital-knowledge networks. Companies can capture

the knowledge that exists in its best workers before they leave. At the same time, they can embed that knowledge in a digital platform that never disappears and can bring highly relevant and contextualized knowledge to a worker at the exact time they need it—whether to continue their work, re-skilling / upskilling newer workers.

The biggest challenges for digitization are integration and humanization. The integration challenge is gathering all the disparate data and information that exists within a manufacturing enterprise and correlating and contextualizing it into a usable knowledge.

The humanization side is presenting that knowledge to

workers in a human-centric interface. One that truly makes their job easier. In 2023, we see manufacturing organizations focused on addressing these two in the interest of enhancing their operations.

Every year, a greater percentage of the manufacturing workforce is “born digital,” meaning workers who have never known a world without constantly connected devices.

This familiarity with digital assets naturally results in greater adoption of technology, in fact it has opening the door for a new term: the new-collar worker—one that is looking forward to implementing new technologies in their day to day.

When it comes to the adoption of field-specific tech, history shows that consumer uptake tends to precede that of commercial. For example, we saw smartphones and wearables first appear as personal devices, before their widespread adoption in enterprise.

In the coming year and beyond, we expect to see newer technologies such as AR, AI, natural language processing and many more to start making an impact. Not only on the tech side, but workers will soon request these types of assets. Due to their familiarity and ease of use, they will become a bigger part of manufacturing digital solutions. □

“ In 2023, manufacturers will shift more of their technology and data management to the cloud, but will still be reluctant to part with hybrid models altogether. Manufacturing professionals are well versed in some of the cloud’s inherent advantages over on-prem servers, but their preference for hybrid all boils down to availability. When manufacturers’ businesses and livelihoods are at stake, they value the immediacy and assurance that on-prem data can provide. Even with today’s advanced manufacturing technology, business leaders will continue leaning into hybrid models throughout 2023.”

Ryan McMartin, product marketing manager at Parsec Automation

# Changing the customer value chain

By Mike Giresi, Molex chief digital officer

Transitioning to a more collaborative, agile operating model is a heavy lift, which often is hampered by the difficulties of integrating disjointed, disparate data sources. That's why effective digital transformation is a multi-year journey that takes into consideration every department and job function across the organization, encompassing new product development, final commercialization and ultimately, customer fulfillment. The amount of work

that needs to be done from a cultural perspective far outweighs what is required on the technology front.

But we cannot lose sight of the critical role engineers of all types play in embracing these new tools to elevate customer engagement. Engineering capabilities are a manufacturer's greatest asset, so the focus should be on how digital technologies, modern IoT infrastructures and the industrial metaverse can help them achieve

deeper, richer and more productive customer experiences today, tomorrow and well into the future.

Clearly, the way people do their jobs today is very different from how those functions were performed five years ago. Moreover, the massive disruptions caused by the pandemic and persistent supply-chain shortages have dramatically altered the manufacturing landscape. More and more manufacturers will become proficient in using the industrial metaverse to

“The whipsaw experiences of the past three years are unlikely to be forgotten by managers and front-line workers. Thus, while automation will continue to play a role in the efficiency and quality of products produced in the US, the lessons recently learned will form a new lens for gazing into the future. Applying these lessons will require truly systematic views on what integrates work cells, factory floors, plants, enterprises, and entire supply chains.

While workers are dependent upon what is happening upstream and downstream to their inputs and outputs, a bright future for manufacturing will depend upon a revised sense of data and data flow to those who need it and can use it. The value of data is in its usefulness, and this usefulness surfaces in the minds of front-line workers to make agile decisions at the deepest levels of the organizational hierarchy. Manufacturing data up and down the supply chain is needed to nurture insights and on-the-floor decision-making. In 2023, we'll see companies that embrace a sense of democratized data rise as winners despite the flux of our unpredictable world economy.”

Louis Grice, vice president of digitalization and government relations at Phoenix Contact USA



better serve their customers while widening their competitive advantage. As the future unfolds, we'll see more fluid information flow between devices, which will be impacted by megatrends, such as miniaturization, software-driven functionality and cloud-based services. All these advancements will enable us to extract more value from our

capabilities and deliver more impactful solutions to our customers.

Having a clear vision of what it means to be modernized from a technical capability is an important step forward but being able to embody that transformation from a cultural perspective is the true litmus test for long-term success. To borrow a baseball analogy, we are

in the middle of the third inning of a nine-inning game, so persistence along with a well-coordinated team effort and proven gameplan are required to deliver the winning outcome of unprecedented customer value starting with product design and ideation all the way through to manufacturing, sale, service and maintenance. ▣

“ Digitalization has taken a rapid path from IoT to AI and now real-time communication between machines, production management, ERP and IT/OT. It has allowed manufacturers in discrete, process and even warehouse/distribution sectors to drive KPIs to a much higher level, beyond those capable only with automation systems. These range from the AGV to edge technology, cloud-based information gathering and a marriage of metrology and part production.

Three factors are influencing this trend and they are all moving at a very rapid pace in both American and global eco-systems.

First, from a global perspective, competition is increasing, thus creating considerable cost pressure for manufacturers not only to operate more efficiently, but also to take a proactive posture in responding to market conditions and operational realities.

Next, an ongoing challenge, the shortage of skilled labor who can bring the necessary skills to the market, as the skill sets needed to operate effectively in a highly automated and data-driven manufacturing plant are often missing, even at multi-national corporations with intense training and retraining protocols in place.

Finally, the instability of supply chains, exacerbated by the pandemic and the fundamental change in requirements faced by manufacturers and processors alike for custom orders. This has caused a compression in, for example, a machine shop or large production department, where assorted new parts create the need for highly flexible, rapid response in CNC programming, tool changes and machine utilization. This scenario further affects machinery and equipment builders, who must adapt to these changing customer needs and bring the appropriate solutions to market before the competition.”

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Vivek Furtado, head of machine-tool digitalization with Siemens Industry, Inc.

“ Looking ahead to 2023, we agree that the manufacturing industry is poised for more growth, surpassing expectations from the prior two years despite continued challenges and supply chain issues. A few major trends to watch include:

- **Increased emphasis on reshoring and nearshoring:** As organizations begin to explore bringing their operations closer to consumers to meet ongoing demands of the supply chain, reshoring and nearshoring efforts are taking center stage. Some industries are exploring this with government support—the long-term semiconductor shortage has prompted the US government to create the CHIPS Act, spurring semiconductor manufacturers to explore the possibilities of bringing production closer to demand. As part of this, there is an opportunity for organizations to build new, true Industry 4.0 facilities from the ground up to maximize visibility and unlock new decision-making and performance-optimization capabilities.
- **Customization will be in demand, forcing companies to work smarter:** As companies look to differentiate themselves in the market, technology is making it more possible than ever before to give consumers exactly what they want via personalized offerings. This demand will continue to rise over the next year, and also provides manufacturers with the ability to make the right amount of inventory at the right time. AI, digital twins, machine learning, and more will continue to grow as this trend takes hold.
- **Talent will be key to unlocking untapped potential:** The manufacturing skills gap will continue to drive company decisions in 2023. With companies digitizing, they will need to simultaneously upskill their workforce to make the most of what new technology has to offer.
- **Corporate social responsibility (CSR) will be a big focus:** With renewed efforts to implement operational changes and work towards ESG (environmental, social, governance) commitments, the new year is all about better managing waste and product recycling, elevating smart buildings for carbon neutrality, and electrifying industrial fleets.

In sum, working smarter, greener, and with a focus on closing the skills gap will help manufacturers grow in 2023.”

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Jason Bergstrom, Smart Factory go-to-market leader and principal, Deloitte Consulting LLP

“An under-the-radar war is raging on the cybersecurity front. When it comes to industrial-control systems (ICS) and the supply chain, one cannot exist without the other. These are critical systems whose protection is integral to product fulfillment and achieving an organization’s mission. This is why securing industrial assets is so important and should be a high priority for all manufacturers in 2023.

In the news, we often hear the term ‘misinformation.’ We see similarities regarding the IT/OT conundrum of ownership, responsibility and who should be leading the charge to protect OT systems. In almost all cases, protecting these systems falls outside the scope of IT departments.

For digital transformation to be successful, there must be an organizational realignment between the OT space and IT space. In 2023, I would encourage your company to open the dialog about this topic with internal stakeholders, including those in the c-suite, members of your board of directors, OT engineers and IT personnel. Having these OT safety conversations will help your organization understand where it’s at within the process of fully safeguarding its ICS.”

Dino Busalachi, Velta Technology CTO

## Digitalization trends in the coming year

By Richard Phillips, PE, PMP, director of smart manufacturing with Polytron’s Smart Manufacturing Group

■ **Going paperless**—Paper-based data collection and reporting still exists out there. The issues with this are well known. It’s truly the low hanging fruit for improving efficiency with data collection/reporting, reducing data entry errors through error proofing, providing automatic context (who collected the data, when, on which line, etc.) and reducing data manipulation for reporting. Reducing the use of Excel and replacing it with data entry directly

into a database allows for real time dashboards and reports. We have seen projects funded based on the ROI from labor savings alone.

**Automatic data-collection**—Smaller manufacturers still struggle with collecting real time data from the plant floor (from PLCs, etc.). Industry 4.0 has brought with it IIoT smart sensors that leverage mesh networks to collect this data at relatively low cost, without the need for such infrastructure. Adding a few of these

data collection points provides key insights and allows users to develop an appetite for the value of such data.

**Digital workflow**—Digital workflow provides real-time visibility of all manufacturing workflows and allows for true democratization of manufacturing information. This applies to workflows in production, quality, shipping, receiving, warehouse and across all functions. It is becoming the first phase of digital transformation for discrete

manufacturing industries such as semiconductor fabrication, electric vehicle final assembly, furniture assembly, waste processing, and others. Anything that requires step by step instruction is a good candidate. The more complex the work instructions, the greater the benefits of digitalization.

Common platform for digitalization—Digitalization projects using different digital tools results in islands of information with no easy way of relating the data and understanding the context. Leveraging a manufacturing-operations platform to do all of this and more is the bigger opportunity. IT has been

implementing this concept for years using ERP platforms. The ability for manufacturing to do the same using a manufacturing-operations management (MOM) platform is providing similar benefits, in addition to serving as an enabler for Industry 4.0 solutions, such as machine learning. ▣

“ With the growth of data and the latency between edge devices and the cloud, apps have begun to move away from uses like gaming, web browsing, and social media, and into the real world to drive our cars, operate heavy machinery, augment our senses, and make decisions in real time. In this burgeoning scenario, speed matters. Connecting things, sharing data, and making decisions must happen dynamically, between different devices and computers, in real time, everywhere. It’s here that P2P will be truly transformative. If you thought peer-to-peer computing was a thing of the past, look around and think again.”

Delano Seymour, CTO of EDJX

## Cybersecurity is key to success in the digitalization of manufacturing in 2023

By Pete Lund, vice president of products and OT security at OPSWAT

▣ As manufacturers introduce artificial intelligence (AI) and machine learning into their environments, many manufacturers continue to struggle to ensure cybersecurity in environments that have a complex mesh of legacy software,

portable media, removable devices, and difficult-to-update OT networks. Cyber-attackers are increasingly targeting industrial-control systems (ICS), causing unplanned downtime, missed financial targets, and loss of consumer

confidence. Adopting security controls that address these challenges will be key in 2023, as it is critical to ensuring that manufacturers can continue to adopt new technologies and meet changing customer expectations.

Similarly, the addition of more third-party vendors and contractors introduces supply chain risks, including vulnerable software updates—sometimes unintentional vulnerabilities, but sometimes intentional ones coming from countries with ties to malicious actors. This might allow attackers to exploit those vulnerabilities once an attack occurs, something we may see increase in

2023. Scanning for vulnerabilities and applying patches is essential before applying software updates or using potentially vulnerable removable media.

Likewise, internal teams use laptops, power system simulators, and other transient cyber-assets to monitor, manage, and diagnose issues on the ICS, but these assets may be infected with malware and cause widespread infection or

stolen to make unauthorized and unwelcome changes to the ICS. Without visibility into OT assets, cybersecurity teams in ICS/OT environments have difficulty planning out a security system that meets the unique needs of the manufacturing industry. With that in mind, we predict OT security teams will heavily invest in OT-asset visibility and management in the coming year. ▣

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## Find your hidden plant in the new year

By **Andreas Eschbach**, CEO at Shiftconnector

▣ Manufacturing has been experiencing an upheaval over the last few years. With the lingering effects of the pandemic and the war in Ukraine upending supply chains, sourcing has become a major challenge for chemical and process manufacturers.

A key to the strategic solution will be to ‘find the hidden plant’ within a company’s global manufacturing operations—identifying those processes that represent the untapped efficiencies of each plant and to make the most of capacity and productivity as

sourcing needs change throughout the year. With fuel and other costs rising worldwide, some manufacturers will opt to move elements of their global operations back to the United States.

Having the right data from all sources to make optimal decisions represents a significant competitive advantage. Incorporating software and agile processes as part of a digital-transformation strategy will pinpoint those production assets that are under-performing, identify recurring costs that can be lowered,

and find safer ways of performing a plant process.

A collaborative people-centered approach to digital transformation takes this one step further by providing a central digitized knowledge bank for all levels of plant personnel to access. This can spark inventive ideas that lead to improved efficiencies or cost-saving ideas and set them in motion—truly leading to resilience with a united manufacturing team. ▣



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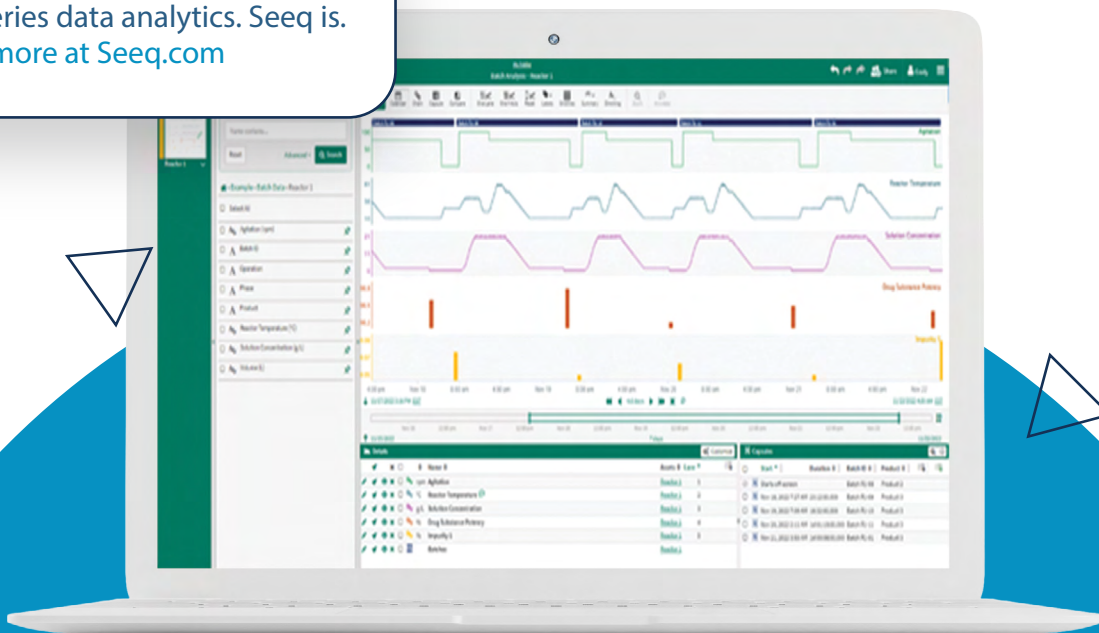
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# Time-sensitive networking going mainstream in 2023

By Tom Burke, global director, industry standards with CC-Link Partnership Association

□ Where TSN was formerly applied in closed systems, where plug-and-play products simply leveraged TSN as the new higher performing solution, we will be seeing many more applications that are truly leveraging all the benefits that TSN has to offer. These benefits include the combination of high performance and deterministic gigabit speeds for OT purposes with IT traffic for asset management, diagnostics and troubleshooting and information management.

TSN based machines will benefit in the following ways:

- Higher performance through deterministic communications—faster Ethernet and the ability to prioritize operational communications over informational communications through the use of TSN will enable richer communications and smarter machines.
- Expanded asset management is achieved by enabling communications with all control elements with analytics to perform runtime calculations, start, stop, load monitoring, etc. The health of the machine, both large and small components, will now be visible to the user.
- Troubleshooting of the entire machine, even control elements, can be performed with common IT tools.
- Architectures will become easier and more cost effective to create and manage.

Switching to Ethernet for industrial communications was the first step in accelerating access to information and enabling a digital transformation. Enhancing that Ethernet with TSN is extending the reach for information into the components of a machine. This second step is the new competitive advantage that OEMs and machine-builders will be able to leverage. □

“Manufacturers have already begun changing how they work, using a more distributed, location-agnostic approach to production, meaning they can make better products in nimbler, smaller, and more sustainable factories. One can sense a future where products are made on-demand, closer to customers. But I’m most excited about this approach’s potential to speed up innovation. As factories become more digital and distributed, they become more transparent and accessible. Today’s technology will enable anyone to build anything anywhere on demand, bringing about the true democratization of innovation.”

Justine Crosby, vice president of marketing at Bright Machines

“Top-line headwinds will increase scrutiny of investments, including in technology. To balance cost pressures in the face of a difficult market with the need for digitization, executive teams will focus digitization efforts where most strategic—supplier management. Clear visibility into suppliers and supply chains and efficient, effective collaboration with suppliers are critical to the top business challenges of fighting inflation, ensuring supply resilience, and improving sustainability. Businesses have felt the pain from poor supply chain visibility and ineffective collaboration, so will prioritize digitization initiatives related to supplier management.

We also predict that artificial intelligence will play a greater role in 2023 as companies look to do more with less. This is particularly true with things like contracts and invoices, where AI can capture and analyze contract data to improve a company’s contract management. AI is also helping companies reduce their search for suppliers from several months, to a matter of days. More integrations of AI in the supply chain will help facilitate transparency, trust and visibility for manufacturers and suppliers at all levels of supplier relationships and result in greater industry collaboration.”

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Alex Saric, smart-procurement expert and CMO at Ivalua

“Companies will continue to rely on outsourced expertise for the implementation and ongoing maintenance of digitalized systems in 2023. Without the current manpower or resources to implement and maintain increasingly advanced systems, it has become necessary to outsource to third-party services and integrators.

While granting remote access through screen share technology, like Teams, Zoom, or another web-hosted meeting platform, is sufficient for a quick fix or few hours of support, longer term support requires other strategies. One method used by some is to issue company laptops to select outside partners, but this is cumbersome to manage as the number and use cases for third party access grows.

Another approach is allowing data to be stored off premise in the cloud. By allowing data to move off premise into third-party platforms, companies create an extension of their team, gaining specialized expertise and leveraging resources without driving up their head count.”

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Heath Stephens, Hargrove Controls + Automation P.E. digitalization leader

“ In 2023, manufacturing leaders will look to digitalize their operations with traceability and vision software for improved sustainability, productivity and transparency in their supply chains.

A volatile global economy is putting pressure on manufacturing leadership teams to save money. As this pressure grows, manufacturers are looking to traceability software to curb inefficiencies, waste and machine downtime within their operations. While many manufacturers are still effectively blind to a staggering percentage of events on the factory floor and in their supply chains, traceability software will prove a promising solution in the next year while weathering the economic storm.

Increasingly complex supply chains have made real-time traceability a vital risk-management tool and a key to successful strategies for manufacturing leaders. Through the use of IoT devices such as camera sensors around the shop floor, manufacturers will look to leverage traceability technologies to rapidly identify issues when they happen and take quick, proactive measures to find solutions, saving themselves untold time and dollars.”

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Doug Lawson, CEO of ThinkIQ

“ The focus to date has been on how to build digital twins. However, what is becoming increasingly important is how organizations keep those digital twins accurate. How do those organizations connect to their supply chains, maintain an open choice in tooling and working effectively on a global scale? Openness, collaboration, reality modeling, and a single source of truth are catalysts for this change, and digital twins are at the forefront to help drive a longer term and sustainable approach to manufacturing.

The other axis of change will be connectivity between the digital twin and operational and transactional systems. The legacy approaches of copying data and building warehouses cannot handle modern volumes or velocities; new approaches to federation and integration are essential.”

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Richard Irwin, Bentley Systems senior solutions marketer

“2023 will be a year of achievement. As we predicted last year, companies large and small are recognizing the inherent limitations of traditional approaches and protocols to achieve secure, robust data communications on large-scale deployments. Instead, they are favoring a secure-by-design approach. For the coming year, we will continue to see fewer abandoned pilots and more successful digital-transformation projects.”

Bob McIlvride, director of communications with Skynet and a CSIA partner member

## A greener and more efficient future

By Dan Hollenkamp, COO of Toggled

□ **Energy storage and distribution will become #1 priority**—The impacts of electricity-grid failures stemming from extreme weather (i.e., super storms, heat waves, etc.) and just-increased consumption in general, are a significant vulnerability to our economy and well-being. The key to managing this is to store energy produced when renewable generation capacity is high and take advantage of smart building and smart-city networks to work with utilities to better manage the distribution of available resources. In the year ahead, we’ll see tremendous investment in new approaches to maximizing energy-storage capacity and bringing intermittent renewables into the grid and

effectively managing electricity generation to meet peak demand.

**Machine learning will lead to energy upcycling in buildings**—

As machine learning becomes more advanced, we will see buildings work smarter by receiving and storing power from electricity generated onsite, automatically giving excess electricity back to the grid, and drawing from stored sources as needed.

**Buildings will become active citizens of the smart grid**—What’s truly needed to meet growing energy demands is better distribution based on the availability of renewable energy sources, and for smart buildings to help monitor energy consumption and distribution. For example, the building will actually tell the utility how

much power is needed and/or when loads are high enough that it can coast through points in time when there is higher demand. This is the grid of the future, where buildings are as smart, or even smarter than utilities.

**We’ll see a rise in micro-cities**—Amid a cascade of widespread layoffs and a year-long struggle to attract employees back to the office, developers and building managers are beginning to reimagine the potential of the ‘traditional’ office building. For instance, in Chicago, the Willis Tower has been redesigned to include public amenities such as restaurants and event spaces; in Manhattan, former office building 55 Broad Street is being redeveloped into nearly 600 apartments to aid in the nationwide housing crisis. With

these changes, there is a need for more intelligent building-management systems that not only create bespoke environments for building occupants, but also can automatically make adjustments to building-energy utilization during periods of peak demand. As extreme weather events and demands for power continue to increase, the value of these systems will continue to grow.

**EV adoption will prove to be a boon (not a bust) for the grid**—As the early adoption of electric vehicles gets closer to mainstream demand, many worry this could overload the electric grid. With the rise of new vehicle-to-grid (V2G) technology, EVs could actually make the grid more resilient by giving electricity

back when not needed for travel. Taking this one step further, by connecting EVs to smart building and smart home networks, AI/data-driven apps can kick in to dictate how much energy the car needs for the night when it comes back home. Having an IoT ecosystem that merges intelligent EVs with electric storage and data repositories will lead to a more sustainable grid.

**New legislation will boost smart buildings and “smart mindsets”**—Recent government initiatives like the Build Back Better Framework, the Clean Energy Act and more recently the landmark Inflation Reduction Act all promise to make sustainability a top priority in the coming years.

With these commitments in place, now is the time to drive business owners’ interest and investment in connected buildings with smart LED lighting, HVAC and heating systems that drive down operating costs and improve energy efficiency. But even more crucial is a change in mindset, and getting everyone on board (businesses, local governments and consumers) to build a better and more sustainable tomorrow. Fully integrated IoT networks that connect smart everything (lighting, heating/HVAC, air filter systems, sensors, devices, etc.) and leverage AI and machine learning to better optimize their use, is what will bring us closer to a greener and more efficient outcome. ▣

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## Two forces working in opposite directions

By Jose M. Rivera, CSIA CEO

▣ I view two forces working in opposite directions. Both impact the future of digitalization in the industrial sector:

- A hot economy is driving inflation while the Federal Reserve is trying hard to cool it down through significant rate hikes. The impact is beginning to show in some areas (e.g., housing market), and it will eventually make its way to the industrial sector. It is definitely adding uncertainty.
- The economy is still recovering from a period of unsustainable, explosive growth and adjusting to a post pandemic reality of labor and talent shortages, supply chain issues, and drive to re-shore or near-shore some manufacturing.

No crystal ball is required to predict that 2023 will be another year of significant transition for most of the manufacturing and process

industries. The normal inertia built into these segments will translate into continuous growth, probably through the recession that some economists predict for mid to late 2023 or early 2024.

Automation provides a way to deal with labor shortages and deliver competitiveness in the re-shoring process. What will be new?

- The pandemic forced significant changes in the way we work. There is wide acceptance of remote/



hybrid work for the office workers. At the manufacturing and process floor there has been an expanded tolerance for remote access of plant assets (e.g. for monitoring, analytics, etc.), after implementing cybersecurity-protection measures. Some manufacturers have been demanding that regular project meetings and sales calls be conducted remotely. It is becoming more common to have site acceptance testing (SAT) be replaced by a remote version of it.

- In the past years some manufacturers and processors have invested to extract data from the plant floor and make it visible to operators within the right context. While this is not necessarily

glamorous, it is the first step in delivering digital transformation. I anticipate in the near future those who invested early in data acquisition to move toward the next steps and deliver true digital transformation. Peer examples provide credibility and encourage others to follow, creating momentum for a much wider deployment across the manufacturing base.

- Deployment of digital transformation will have an important side benefit. Until recently manufacturing had not been viewed as an interesting sector to join, particularly for recent graduates. Digitalization and the significant investment inflows are making

this segment attractive and desirable, increasing the talent pool. This talent is required to deliver true digital transformation at all levels (not just technology deployment).

In summary: while some lament that the US lags other countries in the deployment of industrial digitalization, I'm encouraged by the important boost the post-pandemic reality is providing. We need to remember that the manufacturing and process segments are traditionally risk-adverse and slow to change when we are setting timing expectations for mass adoption. Adoption is nevertheless already taking place. ▣

“Time flies. More than a year has already passed since the metaverse’s big bang moment—Facebook’s commitment to a new platform of computer-generated augmented reality, mixed reality, and virtual reality. That’s a lot of realities, but as 2022 drew to a close, the jury was still out on how real the metaverse is.

While the world continues to sort out what the metaverse is exactly and why it matters, it’s worth noting that companies in industries from retail to commercial real estate are busy exploring metaverse applications. Sony recently launched a product in Japan that uses six motion-tracking bands worn around the body for creating videos or operating avatars in real time. And, naturally, Facebook is doubling down on its metaverse play.

What this all means, I think, is that we’ll know a lot more by the end of 2023 whether the metaverse indeed is the wave of the future or just overhyped.”

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Andy MacMillan, UserTesting CEO

“The concept of security-by-design will be a major factor for product vendors and technology providers moving forward. Security measures will no longer be an afterthought or extraneous addition—they will be a mandate or required integration. This follows the overall trend of tool consolidation in the cybersecurity market, which is essential for reducing analyst burnout and streamlining coverage.”

Lalit Ahluwalia, CEO and global cybersecurity head at Inspira

“Industry 4.0 currently involves a lot of outsourced expertise, but enabling these outsourced and contract workers securely will be paramount to success in the next wave of business. Particularly given the macroeconomic climate, having centralized platforms to monitor and implement least privilege and zero trust will take center stage for industrial and manufacturing organizations. Leveraging automated intelligence and identity analytics sits at the center, and managing all identities (regardless of their working locale and employment type) is critical. We see Industry 4.0 as having a lot of opportunities for growth and changing perception that security comes at the expense of productivity, and that by placing identity at the center of cybersecurity strategies, industrial businesses can simultaneously make great strides in digital transformations and meet evolving regulatory mandates.”

Rod Simmons, vice president of product strategy at Omada

## The digital-employee and digital-customer experience

By Henrik Reif Andersen, chief strategy officer at Configit

▣ Prediction 1: Manufacturers will give greater weight to sustainability and build this into their operations

As the push toward greater sustainability gains traction, this will undoubtedly influence how manufacturing is conducted. This

is the direction of business, and organizations must prepare for it. As a result, we expect that more businesses will continue to try to

include more sustainable strategies into their processes. That means more companies will try to integrate sustainable practices into their operations. This has been a struggle so far; but it's something that customers are asking for and

need guidance on in terms of how to make sustainable choices. Implementing software that can guide you through this process is key, and we expect to see higher demand for it.

Prediction 2: Employee digital experience will become an integral component in manufacturers' business processes

When speaking about digitalization, most people automatically think of the customer experience,

“ One major cybersecurity trend that I think we'll see in 2023 is the widespread implementation of zero-trust standards. With the new Pentagon plan that mandates that all defense agencies must convert their networks to zero-trust by 2027, this upcoming year will be very telling in how agencies adapt to this becoming the default as opposed to the exception. While it hopefully will make systems more secure, it will be interesting to see how threat actors react. Similarly, in order to better prevent attacks, we believe there will be a shift toward earlier recognition of systems being compromised. After countless examples of systems getting hacked without anyone noticing, we think there will be a shift toward technology identifying 'normal' vs. 'abnormal' systems behavior. Code running close to the hardware (hypervisors or secured applications) will be used to recognize meaningful changes in system behavior and, as a result, notify breaches sooner.

DevSecOps, the collaboration framework that adds security practices to the software development and delivery process, will continue to broaden its adoption. The combination of continued pressure on shrinking development schedules for increasingly complex systems, continued number and severity of cyberattacks, and the need for IT leaders to ensure their company data is as protected as possible has caused many changes across industries in their approach to system development.

It is also likely that containers will become one of the top methods for breaching connected systems during 2023. Although container technology is an extremely useful approach to delivering software updates to platforms, the access that containers have to critical system details creates a vulnerability that bad actors are likely to exploit. Developers will want to make sure they have architecture in place to protect their software so that critical systems are not attacked.”

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Ian Ferguson, vice president of marketing and head of sales at Lynx Software Technologies

but it's also important to consider digital employee experience.

If you're an employee of a manufacturing company who is responsible for part of the value chain and bringing products to market, then you are most effective if you also have a solid digital experience. Having digital access to the next version of products, what the next features are and what options you can offer to the market creates a better experience for customers in terms of what they are interested in, what they are buying, what you end up delivering and perhaps what went wrong in the process.

The digital-employee experience concept is essentially a similar concept to digital-customer experience, but from the employee perspective. Manufacturers will put more emphasis on the digital-employee experience and make greater strides toward this.

Prediction 3: The digital employee experience will

help address present supply chain problems.

In the face of disruption, you want to be able to react quickly, and if you don't have good connected systems where you can see the effects of adapting to the changes in the supply chain, then you will have issues. Manufacturers who implement configuration tools will see benefit from a greater customer experience due to being able to react very quickly and confidently, knowing what the effect is going to be on downstream systems. The digital-employee experience will gain popularity as supply-chain issues persist.

Prediction 4: Module architectures will become more common as manufacturers seek to maximize the advantages of new technologies

Companies are looking for platforms for their IT. How do you rip off the benefit of new technologies coming out like 3D visualization, augmented reality and so on,

without having to repeatedly reinvest in your IT?

You need a platform, a solid backbone where you'll have access to product and customer data. This is a much smaller endeavor than getting your data in digital form, where it's widely accessible in the enterprise. You need your data in a spot where you can have a shared view on the product data and utilize it from different channels and access points; getting to this platform thinking will be necessitous going forward.

Prediction 5: The acceptance of servitization will grow within the manufacturing sector

We are seeing a trend of more products being sold as-a-service. In fact, most of the software we buy, and probably what you use in your company these days, is bought as a subscription, where you pay a monthly fee to get access to it. This is also happening for physical products as well. We anticipate businesses increasingly using this approach in the coming year. □

“ We are looking forward to better, more predictive supply chains that can anticipate what customer demand cycles will be, as well as anticipating what likely supply chain risks will be and ways to overcome them. Advances in AI and machine learning move quickly, and we believe that supply chains will benefit from these developments in a very significant way in the coming years.”

Diego Pantoja-Navajas, Vice President, AWS Supply Chain, Amazon Web Services

“Trade disputes, labor shortages, supply-chain disruptions, and a global pandemic contributed to companies evaluating options to reshore and nearshore production to mitigate future risks. In 2023, economic uncertainty will put additional momentum behind the technology that makes reshoring possible. In creating a distributed network of factories, automation offers a better handle on costs and enables a high level of flexibility that makes scaling easier. In addition, unlike manual labor, the cost of implementing an intelligent automation solution varies little across geographies, allowing the industry to move production from low to higher labor-cost regions to build closer to where they sell and mitigate future risk. As a result, the rise of resilient, software-driven automation mitigating the barriers to reshoring will continue in the coming years.”

Paolo Avagliano, COO at Bright Machines

## Vehicles driving digitalization in 2023

By Stefan Zschiegner, Itron vice president of product management

1) EVs will be the catalyst of the energy transformation.

Though just three million electric vehicles were sold in 2020, the global market is expected to skyrocket to 233.9 million by 2027. On top of that, if every motorist in the US switched to an EV, utilities would have to find a way to generate 25% more electricity. Adapting to these surges with resilience will be the biggest challenge for utilities moving forward—we can expect EVs to be a key focus area for government funding in 2023.

2) While the accelerated adoption of EVs will introduce unique

challenges to the grid, it will also provide opportunities for new revenue streams in the utility space.

Many utilities foresee major distribution challenges over the next five years. Consumers are catching onto this as well, as a leading concern with EV adoption is the availability and reliability of charging stations. Switching to an EV makes more sense for a California resident with access to charging stations every few miles, compared to a person living in more rural areas. In 2023, utilities will be met with both a challenge and an opportunity to install

charging infrastructure that meets current EV adoption rates.

Utilities are reaching an inflection point, with countless opportunities for new revenue streams. Many businesses will begin to view EV-charging stations as a way to differentiate themselves from nearby competitors, with hotel chains across the country already making these investments. We will begin to see charging stations replace gas stations. Capitalizing on these industry changes will require education across the industry, leading to many more planning initiatives, pilots, testing,

“Next year, enterprises will continue to recognize that process intelligence is the missing link in this evolution of intelligent automation. The key challenges faced in any automation program are the discovery of processes, diagnosing the root causes of problems, and the ability to measure the ‘before and after’ KPIs to demonstrate the impacts created by automation. Process intelligence addresses all of these underlying challenges hindering the acceleration and ROI of automation adoption. That said, enterprises that are adopting automation as a strategic initiative will invest in ‘Process Excellence and Automation Centers of Excellence’ to create repeatable value management, process excellence, scalable delivery, technology governance, business continuity, and change-management capabilities. This democratization of intelligent automation and process-excellence skills will thus be driven by concentrated efforts on training, enablement, and certification at different levels of employees, resulting in more pervasive adoption of human-machine workforce models.”

Vinay Mummigatti, executive vice president of strategy and customer success at Skan AI

validating and scaling over the next year.

3) The low-voltage network will change everything.

The low-voltage network will be at the center of all business opportunities in the utility space in 2023. In today’s dynamic energy industry, the low-voltage network plays a critical role through the increased adoption of EVs and distributed energy resources (DERs), including wind, solar and battery storage. What was once a one-dimensional flow of power from generation to customer homes is becoming an interactive, two-way transaction with more unpredictable variables than ever.

In 2023, forward-thinking utility companies will redefine what’s possible with low-voltage network management by leveraging the power of distributed intelligence (DI), continuous insights, analytics and control. Equipped with these actionable insights, utilities will gain real-time visibility of endpoints across the network, ensure grid reliability, lower operating costs, extend the life of vital grid assets, foster the adoption of DERs and EVs, enhance customer engagement and create new revenue streams. Localized improvements to the low-voltage network will be implemented in the next 10 years to drive greater

adoption of new DERs and strengthen the two- transaction.

4) Real-time data analytics will become a business imperative.

Now more than ever, the utility industry needs real-time insights to tackle our biggest challenges. More than 9 out of 10 utility executives view real-time data analytics as very or extremely important. Predicting how much energy load certain areas will require at certain times is generally done using historical data, but all this will need to change to make sense of emerging technologies.

Adopting real-time data tools will enable utility companies to merge demographic and economic



data to predict future electrification needs based on a variety of factors. These advanced insights will provide numerous possibilities for improvements and efficiencies, supporting grid resiliency in the face of increasingly severe natural disasters and rising energy demands. Ultimately, without a flexible, robust infrastructure built on real-time intelligence, the questions utilities will be asking in 2023 will remain largely unanswerable.

5) Distributed intelligence will equip utilities to engage with

customers in new ways, taking the integration and adoption of distributed energy resource (DER) programs to new levels.

Striking the balance between consumer expectations and utility priorities depends on intelligent, real-time data. Personalized insights are such a priority to consumers that half say they're willing to pay extra to receive them. This data equips consumers with the tools they need to lower their energy consumption and reduce their bills, while also supporting

utilities in reducing operating expenditures and developing new revenue streams. However, nearly one-fifth of utilities provided with at least some analytics technology aren't currently using it. This presents a unique opportunity for utility providers to invest in real-time analytics in 2023. In engaging with customers through real-time data, utilities will create new revenue streams, improve operational efficiency and accelerate adoption of DER programs. ▣

## Energized and resilient in 2023

By Matt Smith, senior director at Itron

### ▣ 1. UTILITIES MODERNIZE INFRASTRUCTURE TO ADDRESS GROWING DISASTERS

Wildfires, heatwaves, hurricanes and other extreme weather events wreaked havoc on the power grid in 2022. These events will only continue in 2023 and beyond. Many utilities—especially smaller, regional ones—are employing legacy infrastructure that isn't fully equipped to withstand the rising number of disasters. Next year, utilities will increasingly modernize their infrastructure to improve grid resiliency, with a particular focus on adopting smart grid solutions

that speed recovery times. Money from the recent Infrastructure bill will help fund these upgrades.

### 2. DISTRIBUTED-ENERGY RESOURCES HELP STRENGTHEN THE GRID

Grid resiliency has become more important than ever. In 2023, utilities will make an effort to better integrate distributed-energy resources (DERs) to boost grid resiliency. Some of the more common DERs are EV and solar batteries that store energy generated by those devices. Utilities can leverage this excess energy to accommodate demand during

an extreme weather event and maintain power to critical community assets. Right now, utilities are mostly incorporating DERs from commercial sources. Looking ahead, they'll roll out more programs to integrate residential DERs.

### 3. POLICYMAKERS EMBRACE NATURAL GAS AS TRANSITION FUEL

States will lean on natural gas as a transition fuel to help in the shift toward 100% renewable energy. When properly extracted, natural gas is far cleaner and more efficient than traditional fossil fuels. The big

challenge is getting it out of the ground and distributing it without suffering any leaks. To solve that problem, oil-and-gas companies are employing accelerated IoT and analytics technology to proactively monitor pipeline infrastructure and address potential weaknesses before breaches occur.

#### **4. UTILITIES EMPLOY DEMAND-RESPONSE FOR DISASTER PREPAREDNESS**

Utilities will ramp up demand-response programs to help strengthen grid resiliency during extreme weather. Demand-response employs smart metering and load-control devices to conserve power and keep the grid working. During extreme weather, when

surging energy usage strains the grid, utilities automatically cycle power for their customers' air-conditioning or water heating, while keeping power on for essentials like refrigeration. Demand-response prevents the grid from being over-taxed and failing, ensuring that their customers' vital systems keep running when disasters strikes. ▣

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## Five edge-computing/IIoT predictions for 2023

By Jim White, IOTech CTO

### ▣ **EDGE PLAY TIME IS OVER**

Companies that are wanting to put edge/IoT solutions in place are making things clear to providers: research and play time is over. These companies are done "trying" things. Edge solutions have to work "now," they have to work at scale, and they have to work such that IT and OT teams can use them effectively.

Companies are growing impatient with solution providers that are not able to provide solutions that are already working at scale and immediately demonstratable. Edge elements must be fully integrated into their choice of technology (hardware, sensors, devices, network, cloud providers, data-visualization, analytics, security, management, etc.). Companies

want edge solutions that are easily installed and even easier to own and operate.

### **OT EDGE SECURITY BECOMES A THING**

Threats at the edge are becoming more publicized and known. Companies are reading about various attacks on the edge and they are becoming educated on what they want for solutions. Requirements are becoming clearer and more specific.

Companies are no longer under the illusion that closed-loop networks are truly closed, that obfuscation is good enough protection because "this stuff is complicated," or that "no one would bother to want to get access to this type of data."

Organizations want to know how to protect all parts of the edge solution, from sensor to cloud. They also want to know how to detect when something seamy or unexpected seems to be going on. Progress is being made with edge/IoT security capability, but much of that is related to protecting cloud-native environments and doesn't integrate well at the edge. Edge/IoT and security industries are starting to recognize this.

### **REINVENTION AND DISRUPTION OF HYPERSCALERS**

Cloud providers and the hyperscalers have tried to lure all that precious edge data into the cloud where AI/ML and other analytics were to operate on it. The challenge is that the vast transfer, storage,

and compute charges associated with moving all that edge data to the cloud is significantly expensive. Trying to sift through all that data for nuggets of commercial value doesn't always show an ROI...at least not yet.

Companies are beginning to wake up to this reality.

Hyperscalers know how to do scale. They just need to do edge at scale and in a way that adds value and lowers cost. They can and will figure this out, but they are going to require help from organizations, people and projects that know the edge. Watch for an increase in new product announcements, new partnerships and acquisitions

as the hyperscalers finally take on "edge native."

### **NOT EVERYTHING REQUIRES AI/ML**

AI/ML is revolutionizing numerous industries and spaces. But as with any supposed magical balm, it can be overapplied. There is a lot of edge processing going on—some of it might even require some sophisticated calculations and algorithms—but not all of it needs costly ML models and AI engines.

Simple rules engines and scripting engines can provide a lot of value at the edge—saving operational costs, improving safety and even generating new revenue. Edge solutions don't always require

advanced/complex skill sets to produce, nor do they require all sorts of compute power to operate.

There is still a lot of low-hanging fruit (aka money to be found) by measuring a few edge values and automatically actuating when things get out of range. Edge solution-providers that help keep it simple and harvest that fruit might become the new darlings of investors and companies looking to improve their companies' bottom lines.

### **KUBERNETES STILL NOT THE FULL ANSWER, BUT...**

Everyone's edge is different, so Kubernetes can be used to deploy, orchestrate and manage

“As manufacturers work to adopt Industry 4.0 technologies, the industry is ripe for accelerated adoption of IoT protocols. Manufacturers need the right data, at the right time, delivered to the right person in a manner that they can act upon, but they face many challenges. They're working to solve complex issues like heterogeneous devices and protocols on the shop floor, data silos, unreliable networks, and legacy architectures that lack bi-directional data connectivity.

This is where IoT protocols come into play: to solve these challenges and provide a seamless mode of communication for data from OT to IT so it can be used to increase operations efficiency, improve productivity, reduce costs and more. I'm a strong proponent of the open source MQTT and Sparkplug protocols as the ideal way to solve those challenges and enable data movement for Industry 4.0, and I believe adoption of these standard protocols will accelerate in 2023.”

Ravi Subramanyan, director of industry solutions at HiveMQ

containerized workloads at some edges. But Kubernetes does not solve all the issues around management at the edge and it struggles in resource-constrained environments or environments that aren't going to support containerized workloads.

There have been and continue to be more Cloud Native Computing Foundation (CNCF) efforts to extend cloud native—call them Kubernetes light—to the edge. Many of these have been attempts focused on shrinking Kubernetes at the cost of functionality. microK8s,

KubeEdge, K3s are all options that have been traversing this path.

There is growing recognition on the part of the CNCF community that Kubernetes-light isn't enough. Therefore, 2023 will experience an emergence of new approaches and architectures to help address edge management. □

## The 2023 top five

By **Dario Ambrosini**, chief marketing officer at **Propel Software**

□ As the new year begins, innovative businesses are setting their sights on how the global market landscape might change again. Top predictions include:

1. Standalone solutions are out. They will join dinosaurs, dodo birds and sensible American voters in the extinction pile. Companies will embrace speed and unified experiences and the workflow will be heavily connected. 2023 will bring more connectivity in the workforce.
2. Digital therapies will storm the medtech market. We will see prescribed therapies become commercialized as medical devices. For instance, cognitive behavior therapies (ex. for depression or mood disorders) could be treated with new

- technology, such as virtual reality eye tests or 3-D CAT scans.
3. Supply chain sustainability becomes table stakes. Customers are demanding it and technology will morph to meet their needs. Sustainability will also be a cost-reduction play, leaving shareholders and C-Suite executives to embrace it as well.
4. Net-zero 2030 / 2050 will gain momentum. Companies are putting the environment in focus because their customers demand it. The biggest companies will embrace brand marketing initiatives. However, change won't happen until there are compliance mandates with penalties and a few examples of offenders that get hit.
5. Quick work goes mainstream. In the new year, the best user

experience will be no user experience. This means enterprise technology providers will seek to weave their “special capabilities” into existing applications, rather than require casual users to adopt yet another tool. The resulting proliferation of quick work user experiences will help companies move faster and smarter.

Continuous transformation is vital for long-term success and businesses must innovate in order to optimize production and stay relevant with consumers. 2023 will be no different. Change is coming and innovative companies must always be prepared for the uncertainties ahead. Yet, with the proper technology in place navigating change will not be a headwind, but rather a place of opportunity to gain a competitive advantage. □