INDUSTRY HOW TO ACHIEVE GREATER OPERATIONAL RESILIENCY

A Playbook for Manufacturers Looking Ahead to the Future of The Shop Floor

PLAYBOOK 2020



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From the Industrial Internet of Things (IIoT) to machine learning, data-driven technological developments are transforming the way we design, deploy, operate and maintain manufacturing systems. This ongoing digitization of manufacturing produces invaluable operational benefits, particularly for organizations trying to become more resilient to disruptions and more efficient in production.

And there's no shortage of disruptions nowadays. Perhaps the most obvious example is the COVID-19 pandemic, which has revealed some fractures in operations that rely on the physical presence of human workers and supervisors. In these cases, someone still has to clock in every day and turn the bolts on the production machines or physically complete a paper checklist for a required inspection. What difference is digitization making for these workers on the shop floor? The answer-if not done in a way that focuses on the operator-is little to none, creating barriers to operational resiliency.

Coupled with these data-driven trends is the rise of the agile, more distributed workplace, which has been accelerated, but not directly caused by, the recent pandemic. This trend is transforming how companies operate, especially at a time when remote work is not just a nicety, but a public health priority. Although manufacturing organizations, like many other companies, are not immune to the trends of remote work, little thought is given to how this "anytime, anywhere" digital workplace of the future will affect the shop floor-or if it can at all.

But the truth is, managing complex manufacturing workflows via digital platforms is critical to providing operators and other frontline workers with the information, services and experiences they need to do their jobs efficiently. Examples include:

- Facilitating workers' ability to perform daily shop floor tasks regardless of where a supervisor is physically located via remote task assignment.
- Managing company-wide, employee lifecycle events like onboarding.
- Improving worker communication within and across plant locations using mobile interfaces.
- Streamlining task management with a mobile app that provides step-by-step instructions and/or easy access to information to complete a given task.
- Utilizing a defect handling tool to improve quality, uptime and overall equipment effectiveness (OEE).

With the right digital tools in place, you can create a system of action that extends these and other benefits of digitization to manufacturing in a way that optimizes your day-to-day processes, unlocking greater operational resiliency in the process. Not only do these tools improve your OEE, but they create a safer, more efficient work environment, enabling your personnel to manage and thrive in a rapidly evolving workplace.

FOUR WAYS TO IMPROVE YOUR OPERATIONAL RESILIENCY

- Digitize and create easy access to knowledge
- 2. Make all knowledge interactive
- Digitize task management to enable more remote work 3.
- Enable autonomous maintenance



MAKE KNOWLEDGE AVAILABLE FROM ANYWHERE, ANYTIME-AND EASY TO ACCESS

The first and perhaps most important way to improve your operational resiliency is to make all essential information available and easily accessible to your operators—a strategy that should lie at the basis of all your manufacturing and maintenance processes. As it stands, there is currently a high demand for new skills and capabilities in an ever-tightening labor market. At the same time, employee turnover remains high; even 10,000 workers a year is considered normal. Couple these trends with the effects of the recent COVID-19 pandemic, and we see higher numbers of staff calling in sick or social distancing, forcing manufacturers to do more with less.

Whether due to a labor shortage or sick day, any time personnel are absent, their knowledge and skills become inaccessible, leading to unnecessary yet inevitable downtime and costing industrial manufacturers an estimated \$50 billion each year¹. An absent supervisor can delay a line startup. An absent engineer can drive up the time it takes to repair or resolve machine errors. Some plants won't even start a line without the team's hypothetical expert present. No matter the scenario, the solution to keep your manufacturing lines running smoothly is to digitally capture knowledge using a Digital Manufacturing Operating System (DMOS), leading to the creation of an expansive knowledge base that encompasses both your employees' skills and expertise, as well as standard operating procedures (SOP), manuals, safety measures, one-point lessons (OPL) and out of control action plans (OCAP).

As operators register more deviations, defects and solutions, the knowledge base grows, and as a result, you don't have to rely as much on supervisors, specialist engineers and other key personnel if they can't clock in on a given day.

MAKE YOUR KNOWLEDGE ARTICLES INTERACTIVE

While the digitization of knowledge is nothing new, it has-until now-brought little value or learning opportunities to factory workers performing their daily operations. Operators often waste a lot of time searching and scrolling through endless PDFs, lists and other documents; meanwhile on the shop floor, workers struggle to find the information they need to perform a given task-if they can access digital documents at all.

For example, we recently asked two large food and beverage manufacturers if they had made their SOPs, OPLs and other knowledge articles digitally accessible for their shop floor workers prior to the COVID-19 outbreak:

- The first manufacturer admitted to having no digital documents available; rather, shop floor personnel printed them out as needed. And while the company did record and scan its machine manuals into the Cloud, no one on the production floor could access them.
- Similarly, the other said its OPLs, though digital, were not intuitive to search. At the same time, only 4-percent of the company's SOPs were made digitally available—although this number did increase to 23-percent during the pandemic.

That being said, it's not enough to simply translate your SOPs, safety procedures and other knowledge articles into digital documents. Rather, this knowledge becomes most impactful when it is intuitive, interactive and searchable. Effective digital workflow tools meet these requirements in the form of mobile friendly features that can be accessed on phones, tablets and even wearable devices. Some examples of these features include:

- User-friendly dashboards that provide a single overview of information.
- Simple click-through maintenance plans, inspection checklists and SOPs with interactive input fields and buttons that trigger next steps.
- Editable "how to" articles and equipment or procedural-related documents.
- An option to filter articles by work area, equipment, location and document type.
- · Keyword search and QR scan codes to quickly pull up the right information.
- · An ability to make documents local (site-specific) or global.
- An ability to translate all documents and content.
- The ability to communicate and collaborate with colleagues or management within a specific task.

Digital workflow tools even facilitate sending updates (push notifications) on changed standards or procedures to operators who are linked to a piece of equipment, are "following" that equipment or have previously opened and read that piece of material on their device. This capability ensures the operators know about, read and adhere to updated knowledge content-whether it's a "centerlining" document that provides best practice settings for a certain product, or new steps in a lubrication SOP. Supervisors can even generate reports or automatically send notifications to the operators, reminding them to read the new standard.

Having a comprehensive, interactive knowledge base enables manufacturers to overcome the communication challenges that can arise between shift changes or when key personnel are absent. Going one step further, this ability to share knowledge transcends shifts entirely-expanding to include all lines in a factory and all factories around the world.

In addition, effective digital knowledge-sharing methods not only increase OEE and productivity, but they decrease the time it takes to onboard new employees. These methods also enable companies to continue training on days when more seasoned employees are absent. Before committing to a digital knowledge base, for example, one manufacturer admitted it used to send its new hires home if more experienced personnel were absent.



Push notifications can be used to alert users, whether via a mobile or wearable device.

HOW SHOP FLOOR DIGITIZATION IMPROVES WORKPLACE SAFETY

Many manufacturers have accelerated the digitization of their factories to handle the impact COVID-19 has had on their operations. Digital operations can help you comply with these and other safety measures. For example, digital manufacturing operations, including an accessible knowledge base, lets you run a factory with fewer workers onsite and with more employees working remotely. Plant leaders can also monitor equipment performance remotely with tools like digital heat maps or sensors that detect deviations. And nally, digitized processes allow for greater remote collaboration, eliminating the need for physical interaction.

Other bene ts of digital manufacturing operations include:

- Enhanced workforce tracking. GPS and other location-based technologies enable plant operators to see where their employees are located to monitor social distancing. Combined with geo-fencing, automated work ows will notify the right people if certain areas exceed their worker density thresholds.
- Greater worker autonomy. The right knowledge at the right time lets workers do their job autonomously, decreasing the amount of physical interactions required. During times of higher absentee rates, this increased autonomy leads to a more productive factory oor and more cost-ef cient operations.
- Health checks. Making employees feel safe is key-not just during a pandemic, but at all times. 4Industry uses digital work ows to send out surveys, evaluating how employees feel and updating them with new information.

STREAMLINE TASK MANAGEMENT FOR OPERATORS AND **SUPERVISORS**

Another important step to improve operational resiliency is to have a system in place that can assign tasks remotely, enabling operators to perform their work even without a supervisor or engineer present. Unfortunately, for most factories, the prevailing "system in place" is a wall with ops boards outlining the day's assignments, production goals and safety guidelines. The way supervisors manage these various tasks is equally archaic, from creating paper-based checklists to crossing the often expansive factory floor to relay information in person. But again, what happens if a supervisor is absent? What if your workers aren't allowed to gather due to enforced social distancing? And is it any surprise that 60 percent² of an industrial worker's day is characterized as "nonproductive" time?

DMOS systems like App4Mation's 4Industry, which leverages the ServiceNow® digital workflow platform, overcome these challenges by creating a system of action for manufacturers, complete with digital task management tools that allow supervisors to assign and prioritize tasks-no matter where they are. 4Industry supports the following task types: tasks related to assessments, audits and machine- and linelevel inspections using customizable Smart Forms; tasks with simple checklists attached to them; ad-hoc jobs with interactive step-by-step instructions that are not part of the knowledge base; various continuous improvement and maintenance tasks; and defect countermeasures, which enable manufacturers to plan corrective and preventive actions (CAPA) after performing root cause analyses.

Many of these tools, which are accessible from mobile devices, draw inspiration from lean manufacturing, a production methodology that aims to reduce manufacturing waste without sacrificing productivity. These tools include:

- Kanban boards that visualize tasks in a single overview. These boards use a drag-and-drop feature to easily prioritize and assign tasks to workers, manage works in progress (WIP) and report progress.
- Obeya boards, which give operators, supervisors and directors access to all relevant data that is depicted in an easy, interpretable way.
- Floor visualizations that show real-time and historic equipment data in 2D floor plans, allowing operators to better understand where work needs to be done.
- · Work planners, which enable supervisors to define work shifts associated with work areas, assign operators and schedule tasks in a single overview. Planning can be done on schedules-every 90 days or every first Monday of the month, for example-or using running conditions by integrating 4Industry into an existing manufacturing execution or Internet of Things (IoT) system.

Having a more mature digital task management system in place is one thing an App4Mation customer wished they had before the COVID-19 pandemic. Such a system would have enabled this company to effectively plan activities, conduct inspections and complete SOPs-despite having less people physically present on the shop floor.

Enabling Workers with Mobile Work Processes

Worker mobility has shown to lead to 23% more productivity (Forbes)



Digital task management tools enable supervisors to assign jobs to individuals, supply on-demand knowledge and create standardized, digital, step-by-step work instructions.

²Enabling the Mobile Workers of the Future, Smart Industry

From the worker's point of view, jobs are displayed on the mobile interface in terms of predefined templates that include various interactive inputs and collected evidence from the knowledge base. The application even tracks how long each step took to complete. If there is an additional knowledge article connected to the task or assessment, the user can open the article simply by clicking an icon. Other helpful information includes listed materials and tools, required personal protective equipment (PPE) and safety information, steps with accompanying photos and interactive input fields that save relevant inspection or quality control data and, in some cases, trigger additional shop floor workflows.

These task management tools become all the more important as machines evolve to become more complex. Robots, for example, typically require the expertise of both electrical engineers and programmers, with each role unable to perform the work of the other. Digital workflow apps overcome this challenge by providing a single interface with multiple functionalities that support task execution, knowledge accessibility and deviation reporting, enabling programmers and other engineers to work together with greater speed and efficiency on the shop floor.

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=	Rostpone task

4Industry displays jobs on mobile interfaces, as well as safety information and required PPE.



ENABLE MORE AUTONOMOUS MAINTENANCE

Digitizing defect handling processes is critical when it comes to improving your OEE. Workers need to be able to register, analyze, validate and solve problems and defects as quickly as possible, especially considering that one hour of downtime can cost up to \$260,000³. The right digital workflow tools will make this data actionable—allowing you to continuously improve your operations.

Predict anomalies before they turn into deviations. The 4Industry platform gathers data from your IoT sensors and other smart devices. Using machine learning, it learns when operation is normal and also predicts if an abnormal situation or breakdown is imminent. If a datapoint deviates, the app's rule engine converts the datapoint to either a deviation, safety, health and environmental (SHE) issue or defect.

Manage deviations using digitized autonomous maintenance (AM) processes. The switch to using a digital system versus manual, paper-based processes allows workers to solve deviations much quicker and all from the palm of their hand. For example, after registering a deviation, 4Industry proposes countermeasures based on the knowledge base, as well as on historical data. If someone solves a particular problem in Belgium, that solution will be automatically suggested if the same type of issue occurs in Brazil, for example. It also includes various features, including checklists and chat functions, which are designed to resolve the issue quickly.

This ability to digitally register deviations further stimulates knowledge-sharing across lines and factories, decreasing the time it takes to resolve the deviation if it appears again. Because workers can operate machines more independently using digitized task management processes, they can—in many cases—even perform small maintenance tasks by themselves. In addition to boosting their confidence, this strategy frees up your more skilled engineers to focus on more complex technical repairs. It also cuts down on a typical maintenance worker's unproductive activities. As it stands, an estimated 21 percent⁴ of wasted time is due to traveling to different plant areas, while an additional 20 percent⁵ is the result of waiting for instructions.

Improve planned, corrective and preventive maintenance processes. Beyond just unplanned maintenance, scheduled maintenance has plenty of room for improvement, taking on average 19 to 30 hours a week⁶. With 4Industry, if your workers don't know how to solve a deviation, they're just a few taps away from requesting corrective maintenance from their mobile device. The engineer receives the request and can start fixing the problem right away by following his or her respective digital maintenance plan.

³The Real Cost of Downtime in Manufacturing, Machine Metrics. ^{4,5}2016 Maintenance Study: Seven Key Findings, Plant Engineering. ⁶2018 Maintenance Survey: Playing the Offense and Defense, Plant Engineering



Digital processes enable workers to register, analyze and solve deviations more quickly.

The 4Industry platform proposes deviation countermeasures based on historical data, using easy-to-use checklists. Using the entire IoT data set, combined with machine learning, natural learning processing (NLP) and analytics, 4Industry can even predict when maintenance is necessary. For example, it may recognize that two workers have requested the same corrective maintenance measure: the ventilator of a machine starts squeaking after 30 and 40 hours, respectively. The system automatically plans ventilator maintenance after 28 hours to prevent the issue from happening again. Such predictive maintenance measures can reduce machine downtime by up to 50 percent⁷ and increase machine life by up to 40 percent⁸.

Enhance quality management and control. You can easily create and extend automation workflows to inspection and other quality control processes. After adding an inspection via the Smart Forms application within 4Industry, you can set the interval based on time, running conditions or other criteria. By setting thresholds, you can also decide to automatically trigger an action-register a deviation or stop a line, for example-based on the outcome of the inspection.

LEARN MORE

Digital platforms with automated workflows can create the system of action you need to improve your operational resiliency-even beyond the immediate COVID-19 pandemic. In doing so, you can expect to reap additional benefits⁹, including higher OEE and productivity rates, as well as lower maintenance and safety costs, enabling you to keep pace with the changing workplace of tomorrow.

To learn more about 4Industry, please visit www.4industry.com.

To learn more about the ServiceNow digital workflow platform, please visit www.servicenow.com/ solutions/industry/manufacturing.html.

WHAT THE PANDEMIC IS TEACHING MANUFACTURERS ABOUT **REMOTE WORK**

The world of manufacturing is not immune to the rise of remote work. Due to the higher rates of absent or socially distant workers, as well as increased travel restrictions, many manufacturing organizations have begun to implement digital tools that enable remote work out of necessity. In many cases, they're discovering that these tools are just as ef cient as their previous processes—and in many cases, even more so.

"Although we haven't been able to conduct any site visits, we're still able to plan and execute various process improvements," one customer said. "Also, we no longer have to travel to perform certain basic engineering tasks, such as root cause analysis and early equipment maintenance. Nine months ago, travel for these tasks was required."

Similarly, another customer saw the bene t in virtual site visits. Before the pandemic, this company used to conduct frequent in-person visits; now, however, they don't do more than two a week. This has led to a drastic reduction in travel costs, all while accomplishing the same goal. "We've actually found it's more productive to conduct these visits using digital communication platforms like Zoom and Microsoft Teams," this customer told us, pointing to the greater need for manufacturing organizations to have more digital tools in their arsenal.

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⁷⁸ Manufacturing Analytics Unleashes Productivity and Pro tability, McKinsey & Company. ⁹ The Social Economy: Unlocking Value and Productivity Through Social Technologies, McKinsey & Company

¹ How Manufacturers Can Achieve Top Quartile Performance, Wall Street Journal partners.wsj.com/emerson/unlocking-performance/how-manufacturers-can-achieve-top-quartile-performance/

²Enabling the Mobile Workers of the Future, Smart Industry www.smartindustry.com/assets/Uploads/Tech-Report-Enabling-the-Mobile-Workers-of-the-Future.pdf

³ The Real Cost of Downtime in Manufacturing, *Machine Metrics* www.machinemetrics.com/blog/the-real-cost-of-downtime-in-manufacturing#:~:text=According%20to%20Analyst%20firm%20Aberdeen,much%20as%20%24260%2C000%20an%20hour!

^{4,5}2016 Maintenance Study: Seven Key Findings, *Plant Engineering* www.plantengineering.com/articles/2016-maintenance-study-seven-key-findings/

⁶2018 Maintenance Survey: Playing the Offense and Defense, *Plant Engineering* www.plantengineering.com/articles/2018-maintenance-survey-playing-offense-and-defense/

^{7,8} Manufacturing Analytics Unleashes Productivity and Profitability, *McKinsey & Company* www.mckinsey.com/business-functions/operations/our-insights/manufacturing-analytics-unleashes-productivity-and-profitability

⁹ The Social Economy: Unlocking Value and Productivity Through Social Technologies, McKinsey & Company

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About **4Industry**

4Industry is a digital manufacturing operating system (DMOS) aimed at increasing Operational Equipment Effectiveness (OEE). The DMOS is mobile enabled, highly customizable and equips organizations with the tools they need to take advantage of all that Industry 4.0 has to offer.

ServiceNow

With ServiceNow, manufacturers unlock the full benefits of digitization with a unified system of action. With one platform, manufacturers connect people, processes, and technologies, then reinvent manufacturing workflows and improve experiences across the value chain--operations, customers, employees and suppliers. Ultimately, they reduce costs and find new growth opportunities.



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