McKinsey & Company

Operations Practice

Digital collaboration for a connected manufacturing workforce

Fourth Industrial Revolution technologies provide crucial support for factory workers to collaborate effectively—an even more urgent requirement as physical distancing becomes the next normal.

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May 2020

Many experts predicted that with the coming of the Fourth Industrial Revolution (4IR), automation and advanced technologies would rapidly displace factory jobs and workers world-wide.

Thus far, this prediction has not panned out. In fact, our research with the World Economic Forum (WEF) reveals that leading factories ("Lighthouses") have invested significantly in people. And the importance of people has only intensified as the COVID-19 pandemic has swept across the globe.

The need to augment workers with technology stems in part from four major trends that are transforming the manufacturing landscape: retiring baby boomers, regionalization, the proliferation of shop-floor data, and now COVID-19. These forces are creating a workforce that is more spread out, less experienced, and more overwhelmed by data with untapped potential.

Manufacturers therefore need tools that help their workers collaborate and stay connected across geographies and functions—particularly as physical distancing and tighter employee-safety measures take hold. Digital collaboration tools are primed to play a critical role in enabling workers to tap into the collective knowledge of the enterprise, solve problems with experts remotely, and turn internet of things (IoT) data from the shop floor into lasting value.

We estimate that digital collaboration has the potential to unlock more than $100 billion in value—thanks in part to productivity boosts of 20 to 30 percent in collaboration-intensive work processes such as root cause investigation, supplier management, and maintenance.

The manufacturing landscape is changing

An aging workforce, regionalization, and data proliferation are changing the composition of the manufacturing labor force and how work gets done—with the COVID-19 outbreak compounding some of the effects. As a result, manufacturers face an urgent imperative to help less experienced workers build knowledge and capabilities, and take advantage of data through collaboration.

Aging workforce. In 2019, The United States-based National Association of Manufacturers estimated that one-quarter of the US manufacturing workforce was age 55 or older. It comes as no surprise, then, that one of the biggest concerns among US manufacturers has been "brain drain," with 97 percent of firms having expressed some concern. To prevent this loss of institutional knowledge as aging workers retire, manufacturers have intensified efforts to codify knowledge, so that they can pass on more efficiently and effectively to the next generation of employees.

At the same time, manufacturers have also reported difficulty in recruiting and retaining qualified workers, with recent college graduates seeming more inclined to work in businesses that were more obviously digitally oriented. Whether the very different economic conditions businesses and workers now confront will make a sustained difference in hiring is unclear. Yet the fact remains that these young workers neither share the same skillset as previous generations, nor have they been exposed to the same training and apprenticeship programs. Manufacturers can start to appeal to this new generation of workers by making it easier to train and help them learn. Collaboration tools allow factories to better leverage their experts across a broader group of people to help train the less experienced workforce.

Regionalization. Over the past several years, traditional offshore factory zones were becoming less attractive as transportation costs and labor rates continued to rise. In response, manufacturers were already beginning to relocate factories, either "nextshoring" to be close to the customer in developed markets or shifting to other regions, such as the MINT countries (Mexico, Indonesia, Nigeria, and Turkey). If, as appears possible in response to the pandemic, regionalization continues to disperse the workforce and alter the factory footprint, manufacturers will need new and improved ways to share learnings across geographical boundaries.

Data proliferation. Within the past decade, machine connectivity in factories has grown exponentially, generating vast amounts of new and enriched data. But many manufacturers have been challenged to help their workers use the data to maximum effect in solving problems and making better decisions. Tools that connect workers both to other workers and to data will help manufacturers turn the data into actions that generate real value: Imagine an operator who wants to troubleshoot a piece of equipment, and can share real-time machine data with a remote expert to get precise guidance.

COVID-19. The COVID-19 pandemic has resulted in major adjustments to ways of working and staffing models in factories globally. The physical distancing, worker (and customer) safety issues, and economic reality that companies now face will have lasting impact even in the post-COVID-19 world. Lasting structural changes to fundamental work processes such as shift handovers, daily huddles, and root-cause investigations may be required in order to minimize physical contact between factory workers and mitigate risk. Manufacturers are therefore looking for innovative ways to help these workers interact virtually while maintaining (or even increasing) productivity.

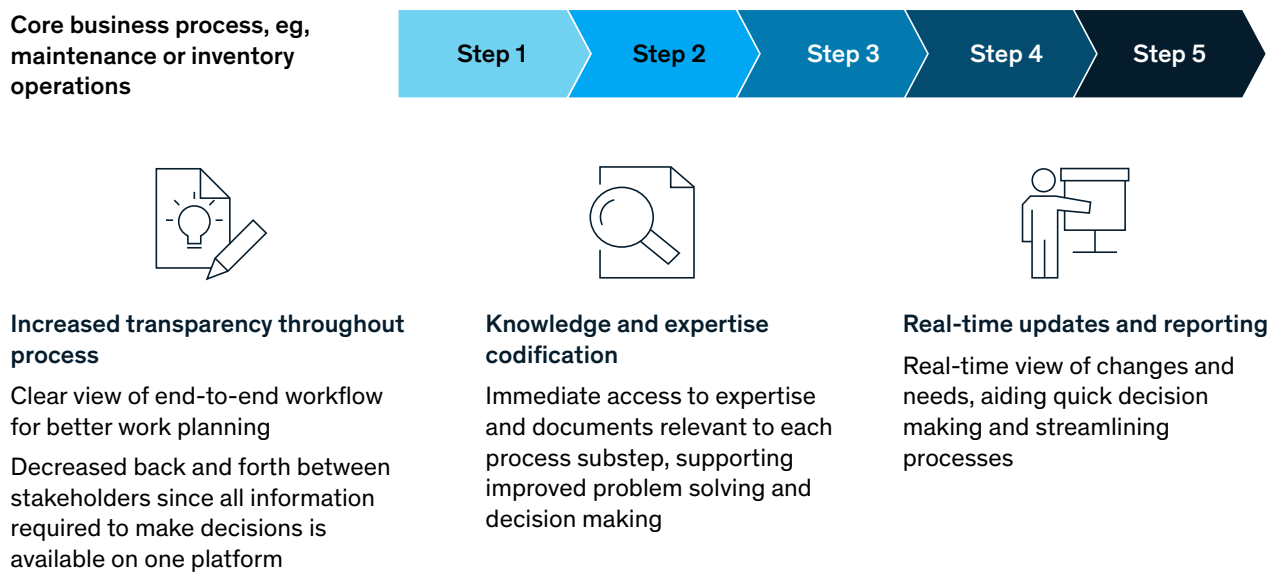
Embedding digital collaboration into workflows

The technologies available to most employees for collaboration thus far have been limited to basic communication tools, such as e-mail, chat, and text messages. These tools are typically disconnected from actual information flows related to business processes, resulting in back-and-forth status updates and complex handoffs that diminish employees' productivity.

Embedding digital collaboration into process workflows can enable faster, better decisions that improve key performance indicators (KPIs) and drive bottom-line value, as shown in Exhibit 1.

Exhibit 1

Embedding digital collaboration in process workflows generates a wide range of benefits.



To better understand how collaboration can be used to reimagine a range of business processes, we explored two examples with two different collaboration intensities: root cause investigation and maintenance. We found that the greatest value potential lies in processes that entail a large number of roles and daily interactions across roles (Exhibit 2).

Reforming root-cause investigation

In a manufacturing facility, the real cause of a production problem can usually be traced back to a series of events that caused it—a process called "root cause problem solving" or "root cause investigation." As the investigation of a particular issue proceeds, it usually requires a deeper level of expertise, so the relevant roles and parties involved continuously change—making it intensely collaborative. The topics typically investigated include safety and maintenance issues (machine failures, major breakdowns), quality issues (such as scrap and rework), and technical issues (product performance, material variance).

Exhibit 2

Some processes show higher potential for effective collaboration.

		Potential value that collaboration could unlock			Collaboration potential	
Process	**Activities**	Costs avoided	Working capital freed	Revenue generated	More unique roles involved in the process	More daily interactions across all roles
Maintenance	Routine maintenance checks on equipment Troubleshooting machine-part failures Responding to emergency equipment failures					
Root-cause investigation	Troubleshooting product defects due to production issues Addressing equipment failures on the line					
Product development and industrialization	Design iterations Rapid prototyping Aligning development and design					
Inventory operations	Setting optimal inventory levels Prioritizing shipping for aging inventory Shipping products					
Order processing	Receiving and entering customer orders Responding with delivery commitments Communicating changes to orders and commitments					

For example, an electronics contract manufacturer might find that its production line is generating too much scrap—waste that, over time, accumulates into substantial costs. At a high level, a root-cause investigation process would likely entail up to nine main steps, from capturing and coding issues through to analyzing data, initiating and conducting a detailed investigation, identifying and implementing solutions, and finally evaluating effectiveness, together with codifying and sharing best practices.

Solving poor coordination speeds problem resolution

Within each step, pain points arise from poor connectivity among workers and between workers and data. Finding a solution to a problem often requires multiple iterations across many unique roles—and can take upwards of 90 days from start to finish.

Just one step, the deeper investigation, illustrates these issues. The effort to identify experts and coordinate calendars can cause weeks of delay and spiraling costs in order to bring the right people to a specific location. Ineffective data capture can result in wasted time for multiple individuals during the problem-solving session. Inadequate coordination can result in redundant efforts or failure to take advantage of previously developed solutions.

Improved collaboration would not only facilitate the teams' efforts to find experts and coordinate across calendars, but would also save time and expense by allowing them to use virtual meetings and quickly search for relevant information. A reimagined process for root cause investigation uses technology to improve information collection, enable continuous collaboration, and share knowledge across all of the roles involved in a root-cause investigation.

Engineers can take and upload photos of production issues, fill out templates detailing important facts to record, and access equipment data from sensors or tools if applicable. The result is better data capture and categorization. The leader of the continuous-improvement effort can then easily pull and analyze the data to identify the highest-impact issues and automatically select a group of collaborators. From there, all collaborators, wherever located, can work together to digitally share images, files, insights, and discussions simultaneously. Collaborators can readily be changed as the core team shifts to a more specialized team of technicians. When the issue is finally resolved, the documented solution will continue to help future teams that may encounter similar problems.

The impact from better problem solving

For a hypothetical manufacturer with revenues of $10 billion, these sorts of changes can yield significant financial results due to better service and lower costs.

Improved service levels. Unexpected issues lead to factory downtime that depresses service levels for order fulfillment, potentially reducing customer satisfaction. If the use of collaborative and digital tools improve service level by 1 percent and decreases downtime by 1 percent, the resulting effect on revenue is an increase of 0.2 percent—or $20 million.

Reduced cost of quality (scrap rate). Quality issues can lead to significant costs for manufacturers in the form of scrap, rework, and warranty claims. Identifying and solving quality problems faster through collaboration tools has the potential to decrease scrap by approximately 25 percent, which translates to a 0.5 percent increase in revenue, or $50 million.

All told, re-imagining the root cause investigation process through digital collaboration could create $70 million of revenue for a $10 billion manufacturer.

Managing maintenance more effectively

For asset-intensive industries where the amount of invested capital is enormous and the value of a day's production is high, routine maintenance to maximize plant uptime is especially important. Yet typical maintenance work processes today are still paper-based and manual, with many handovers resulting in important information losses—or "leakage"— at each step.

Consider the example of a heavy-industry manufacturer. At a high level, the maintenance process—as with root-cause investigation—entails

about nine steps, starting with work identification, prioritization, and planning, proceeding to materials management, scheduling, and permitting, and then execution, close-out, and finally contractor invoicing.

The pain points with maintenance are familiar: poor documentation and knowledge sharing, inefficient communication between stakeholders, and long wait times due to manual checking and scheduling. Moreover, the maintenance process is even more complicated than root-cause investigation because of the need for transparent record keeping and the intensity of coordination required among stakeholders (both internal and external) to manage materials, staffing, and production schedules.

Reimagining collaboration simplifies maintenance process

The team that performs maintenance often consists of one or two internal employees and a handful of outside contractors. As the team begins fixing the issue at hand, secondary issues often arise. A seemingly simple problem with a fan motor can turn into a complex rewiring effort requiring team members return to the office, order more materials, and search for—and possibly fly in—an expert on wiring. And this long, costly process may end up addressing a maintenance issue that is not nearly important to production as a long list of other maintenance tasks.

The reimagined process leverages collaborative technology to help gather, prioritize, and track work orders, coordinate across multiple stakeholders, and share knowledge and expertise throughout the plant. Inspectors can check and gather information using a digital template, reducing paperwork in maintenance inspections. Plant managers can view work orders more comprehensively, allowing them to better prioritize work based on relevant criteria.

Managers can also easily decide which materials to order and which experts to pull in. Just within the "execution" step, digital tools can allow technicians to efficiently collaborate within their team and across the company with relevant experts to troubleshoot problems, allowing for fast access to specialists, information, and proven solutions in the field. That means less downtime for important equipment, and lower costs to address issues.

The value from maintenance redesign

Embedding collaboration into maintenance processes can reduce maintenance-applicable spending (excluding parts, equipment rental, and contractor costs) by 10 percent to 15 percent. But the effects are visible in other KPIs as well.

Overall equipment effectiveness (OEE). Reduced downtime increases OEE by 2 to 3 percentage points.

Wrench time. The amount of time workers spend performing value-added tasks versus increases by approximately 5 percent to 10 percent.

Maintenance cost as a percentage of replacement asset value (RAV). Annual maintenance spend as a percentage of RAV can decrease by approximately 5 to 10 percent.

All told, for a manufacturer with $10 billion in revenue, these results can equate to $110 million in revenue.

How manufacturers can capture this value

To capture the opportunity, manufacturers can take several tactical steps.

Map out processes with collaboration potential. Mapping out the most important processes within an organization reveals which ones involve the highest cost and the greatest collaborative friction. Typically, only a small subsection of processes is responsible for the majority of cost and complexity.

Identify an integrated set of responses. Understand which levers to pull to decrease cost and complexity—including increasing collaboration, improving data capture, or

eliminating manual work, among others. These translate to use cases that technology solutions can address, such as facilitating teamwork across distributed locations.

Detail the technical roadmap. For the top use cases, identify the technology and tools required to address pain points in the most inefficient processes and enable further collaboration. Prioritize tools that relate to overall strategic goals, rather than focusing on "sexy" technology solutions.

Embed collaboration into overall digital transformation plan. By embedding digital collaboration-enabled processes into the enterprise's overall digital transformation strategies and technical roadmaps, companies can better achieve scale and avoid wasting time on ideas that aren't likely to yield sustained impact.

Drive user adoption and instill a digitally focused culture. Foster a culture that stresses the importance of digital. Incorporate frequent training sessions to ensure that employees fully understand how to use technology and are excited about the changes.

Manufacturers face an urgent need to unleash the next wave of productivity in their operations. Ever-increasing cost pressure often leads companies to make short-term tradeoffs that compromise quality and reliability—trying to do more with a smaller or lower-cost workforce. Digitally enabled collaboration offers a solution. By digitizing processes to improve equipment management and optimize physical assets, digital collaboration tools give manufacturers ways to boost productivity while enhancing quality. Ultimately, these tools allow manufacturers to realize the vision of the "connected worker"—empowered by a continuous flow of real-time data from physical assets. The first manufacturers to fully capture the benefits of digital collaboration will achieve a significant competitive advantage.

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The authors wish to thank Stephanie Bao, Neha Jindal, and David Monteith for their contributions to this article.