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The Connected Frontline Worker





The Problem

Manufacturers face structural labor challenges that limit growth and profitability.

Among the most formidable structural challenges facing the manufacturing industry is a significant and persistent labor shortage and a related rise in labor costs. The origins of the labor shortage are multifactorial, ranging from demographic realities and geographic population trends to introductory positions that lack appeal to younger talent.

A 2024 study conducted by Deloitte and The Manufacturing Institute forecasts that the U.S. manufacturing sector will require approximately 3.8 million new workers between 2024 and 2033.

However, it is projected that 1.9 million of these positions may remain unfilled due to persistent skills gaps and labor shortages. The study highlights that a significant majority of manufacturers continue to experience challenges in both attracting and retaining talent, citing a widespread "applicant gap" across all skill levels.

Concurrently, labor costs in the manufacturing industry continue to escalate. According to the U.S. Bureau of Labor Statistics, unit labor costs in the manufacturing sector rose by 4.7% in the first quarter of 2024, compared to the same period in the previous year.



4.7% increase in manufacturing unit labor costs

The Opportunity

Innovative technologies and inspired solutions offer a new way forward.

One of the most promising and effective ways to address the labor challenges facing manufacturers is to embrace innovative new technologies. Growing numbers of manufacturers are using automation and digital solutions to expedite training, efficiency, and productivity.

These solutions are powered by a new generation of technologies that combine lean manufacturing principles with Industry 4.0 advances, enabling an extraordinary and significant degree of connectivity and control.

The result of that connectivity and control is not just improved performance, but an entirely new vision for what a manufacturing professional can be: the Connected Frontline Worker. Connected Frontline Workers have access to, insight into, and often a degree of control over the digital infrastructure and connected systems and processes that power next-generation production environments.

Grand View Research estimates that the global market for connected worker technologies part of the broader digital workplace segment—will grow from \$48.8 billion in 2024, expanding at a CAGR of 22.8% through 2030. This growth is fueled by rising demand for real-time collaboration, wearable tech, and digital tools that enhance frontline productivity.





The Solution

Leveraging breakthrough tech to power game-changing applications that empower Connected Frontline Workers.

The best examples in an expanding ecosystem of new digital manufacturing solutions help provide what some consider to be the holy grail of manufacturing innovation: connected process control. Connected process control technologies power versatile, scalable, and holistic platforms that deliver comprehensive and ultimately transformative results. Connected process control systems boost efficiency, reduce complexity, improve quality, and significantly reduce costs. They allow manufacturers to bring new order and control to a virtually unlimited range of different production or assembly environments.

They achieve this, in large part, by giving frontline workers the tools they need to learn faster, access and process information more quickly, collaborate more effectively, and subsequently be more productive. Transforming frontline workers into Connected Frontline Workers and empowering them with new flexibility, facility, and responsibility leads to operators who are engaged, informed, adaptable, and able to solve problems faster, thus increasing quality and efficiency.

There are many connective digital threads tying Connected Frontline Workers into the systems and processes that power a production environment. The most essential technology and functionality include the following:

Digital work instructions and visual guidance

Digital work instructions and visual guidance (including images, text, GIFs, Videos, PDFs, and more) not only remove the need for antiquated paper-based work instructions, they ensure that the proper instruction is there for the operator at the precise moment when it is required—a critical time saver for increased productivity and quality. Digital work instructions remove the guesswork from decision tasks and can help improve accuracy and reduce defects, as well as accelerate training, onboarding, and reskilling.

Digital access to safety instructions and videos at the station level has been shown to reduce injury rates and meet OSHA compliance standards.

And because digitizing work instructions make expectations clear, it sets operators up for success. With greater control and clarity, digital work instructions lead to higher job satisfaction, improved performance, and reduced employee turnover.

Connected IoT (Internet of Things) devices

Connected process control systems can integrate a wide range of IoT devices with a correspondingly wide range of functionality. Connected or "smart" sensors and devices such as scales, gauges, cameras, and DC torque

tools can not only measure and verify correct assembly but can collect (and help provide) detailed information about each part and process. They allow a higher degree of automation, more detailed evaluation and precise measurements, allowing the Connected Frontline Worker to access critical information. For example, powered by connected devices, a more detailed interface can help provide not only basic counts but more nuance about each pick. Information can be passed down from the upperlevel system directly to the operator. Different devices may unlock a higher degree of process control and quality control by verifying correct assembly or tolerances before allowing the operator to move forward.

Alerts and notifications

Alerts and notifications are a critical piece of the digital puzzle. They allow Connected Frontline Workers to access critical information at the right time, to quickly identify problems and pain points, and to communicate immediately and efficiently with engineers, managers, and decision-makers. In that way, the best-connected process control systems create not just a connected environment, but a collaborative one. They integrate real-time feedback from Connected Frontline Workers. Operators can input notes at the station level and send and receive alerts and notifications as needed. Because those operators are often the first to know when things are working well—as well as when they are not—they are in the perfect position to help provide invaluable input and insight into potential process improvements, as well as opportunities to improve SOPs. This also contributes to a culture of operator value, which may subsequently reduce turnover rates for Connected Frontline Workers.

Visibility into upper-level systems

In a traditional manufacturing environment, each operator is essentially on an island at their station. There is no easy way to receive or exchange information without a tedious and time-consumingly inefficient process. The Connected Frontline Worker of today, however, is in a very different place. Each station is no longer an island, but connected to a larger whole in a manner that transforms the entire facility into a complete ecosystem.

Once integrated you can search, query, and find details you could not imagine before. For example, instead of waiting for a team leader, if they get faults outside of linear path and need to circle back for repair or replacement, the system can help provide direct guidance. This empowers operators to do more independently, while helping ensure proper steps are followed and documented.

Wearables and augmented reality (AR)

The potential to integrate wearables creates some intriguing possibilities for Connected Frontline Workers.

Emerging wearable tools and proven AR solutions are not just connecting manufacturers in new ways to the systems and processes they rely on, but also breaking down the barriers between human-powered performance and automated systems. Over time, already effective tools and tech in this space could help unlock new synergies that will further optimize performance for Connected Frontline Workers.

Business intelligence

By delivering real-time process and data insights and KPIs, operators can benefit from an overhead shop floor Andon or similar system that displays relevant and actionable information operators can apply to their work. With connected process control solutions, Connected Frontline Workers don't just get the data they need; they get that data in real-time, with a level of clarity and immediacy that can help provide an invaluable window into the operation. For example, these tools can display insights into progress at different stages of the build, productivity, and OEE (Overall Equipment Effectiveness).

By enabling station operators and management alike to monitor, analyze, and implement changes quickly, connected process control capabilities allow for continuous and intentional improvement. This is data-driven manufacturing at its finest: seamlessly integrating business intelligence into the beating heart of a busy production environment. In addition to Andon, manufacturing professionals can benefit from workin-process visualization and status reporting by serial number or other identifier, and integrated web-based reports that provides management level personnel with access to the historical and real-time data that yields new insights and drives continuous improvement efforts.

Turning data silos into powerful reports and dashboards

Leading connected process control solutions transform the formerly siloed nature of data gathering into a connected network of seamlessly shared real-time data and KPIs.

Information now available to Connected Frontline Workers includes:

- Station cycle times
- Quality summaries
- Torque tool data
- Repair, rework, and reject codes
- Process data reports
- Shift summaries
- Overall Equipment Effectiveness (OEE) and downtime data
- Genealogy and part history data
- Andon reports
- Production reports





Summary

Innovative technologies and inspired Modern technology investments for the plant floor are creating the Connected Frontline Workers that will power manufacturing's increasingly connected future.

We are living in a moment when manufacturers face very real structural labor challenges. At the same time, there is justifiable excitement about the game-changing power and pace at which cutting-edge technologies are transforming production environments—helping enable manufacturers to reach new heights of flexibility, efficiency, visibility, and control. In that context, it is ironic that some manufacturers are losing sight of the fact that it is in people, not tech, where they can not only potentially address those labor challenges, but simultaneously unlock some of the greatest opportunities for positive change. More specifically, it's the way in which new programs and platforms elevate and enhance the work of operators: not replacing them, but instead making them better at what they do—and more fulfilled and empowered in the process.

That empowerment is at the heart of some of the most exciting advances in this space. Because a big part of the promise of connected process control solutions is right there in the name: the connectivity that the best of these platforms facilitate

allows for a level of collaborative engagement that extends from the plant floor to high level decision makers. The seamless immediacy of information across the value chain can translate to a wide range of meaningful and measurable benefits: faster and better training to accelerate onboarding and relearning/reskilling; the ability to help ensure that quality and compliance standards are always met; new visibility into operations to make faster decisions and deploy improvement initiatives; and collaborative environments and automation that yield potentially significant cost savings.

Many of the most dramatic improvements in efficiency, quality, and consistency come from empowered operators: the Connected Frontline Workers who now have access to new tools, new agency, and new opportunities to contribute to a connected operating model. In a business where innovation is currency and connectivity is the new gold standard, those are the operators who will quite literally be on the front lines of this rapidly evolving industry.

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