Machining

Automation Nation: Reduce Setups and Repetitive Stress Work in Manufacturing

Don Sears | Dec 10, 2019

Looking for new ways to give your shop's production output a kick in the pants? Automation may be a force multiplier. It might also free up your most experienced and ambitious machinists' time for mentorship, learning new systems and leveling-up machine programming skills. And it could help lower insurance premiums.

The use case for automating many functions in a job shop is very different from a large automotive plant or other high-volume manufacturing facility. But automation *can* return positive and productive outcomes that help simplify repeatable and time-absorbing tasks for shops of every size.

What are the correct applications of robots and cobots? What technologies can move quality checks closer to the process? Where should shop owners and manufacturing operation managers focus?

We explore some of the ways manufacturers are having success with automation today—and what you need to know when planning for change.

Automation in Manufacturing Gives Time Back to Workers and Helps Shops Stay Competitive

The talent crunch in manufacturing is real. Today's manufacturing capacity demand is larger than the labor supply—and it's expected to increase. A 2018 Deloitte and Manufacturing Institute ***study*** finds that the skills gap may leave an estimated 2.4 million positions unfilled through 2028 with a potential economic impact of $2.5 trillion.

"It's not getting any better," explains John Hicks, owner of Kilgore Manufacturing, about the skills delta his company has seen in an ***article***.

Job shops may find it difficult to compete with larger machine shops for more experienced and expensive talent. But automation, in theory, can reduce the impact of a skills shortage by reducing the most rote, manual tasks—and increase the machine-to-person ratio wherever possible.

A robot can often tend multiple machines. In some cases, a single operator can tend multiple robots—and each robot could be handling multiple machines at a time.

"That frees up operators to perform secondary operations, like deburring parts, assembling or spending more time on quality checks," explains Steve Alexander, vice president of operations at Acieta, an automation integrator, in the ***SME article*** "Automating Job Shops? You Bet!"

The Top Use Case for Automation in Job Shops: Changeovers

There is no magic wand for becoming automated. There are also different and new skills in managing automation systems—including different software, sensors and safety. Often, the most effective use of automation is focusing on pre-part and post-part changeover and setup activities.

"Automation best suited for job shop needs will not only emphasize fast and easy setups and reduce job change-over times to 15 minutes or less, but also be adaptable for use from one type of machine to the next, especially for change-over tasks," writes Chris Felix, editor in chief of Production Machining, in the ***article*** "Job Shop Automation: Fast, Simple and Agile."

Experienced machinists might appreciate spending less time on changeovers and loading blanks—and more time focused on completing large jobs and resolving precision manufacturing issues.

In 2018, Hicks of Kilgore Manufacturing used an automated manufacturing cell that ran eight hours a day unattended and helped to ship 3,500 units of a flange part every week—but it was only for one part. To help become more automated and free up time for more senior machinists, Hicks added a load assistant machine.

The load system connects a robotic arm to a turntable for staging workpieces within a single workloading unit that can be stationed beside and relocated to any CNC lathe or milling machine.

Hicks outlines how the increased automation has made an impact including:

- Getting more work from Kilgore's existing customer base.
- Saving important space on a tight shop floor.
- Seeing an increase in part quality because machinists had more time to spend on quality checks.

The ability to win more business from competitive bidding spurned from more predictable machine scheduling.

Careers in Manufacturing: Recommended Skills and Programming

Advancing their technical skills can help machinists earn more. What does it take to ***earn more today and in the future***? More advanced skills.

Robots, cobots and loaders can have easy interfaces, but there are nuances to understand when systems have issues.

"I think one of the biggest challenges that CNC technicians face today is trying to integrate automation into the process," ***says*** Ronnie Brittain, a CNC instructor at NASCAR Technical Institute. "So maybe you have a robot or a gantry loader that's loading or unloading a machine moving a part from here to there. It has to also be able to communicate with a CNC machine tool. Those two programming languages are quite a bit different."

Hence, understanding a range of programming languages and how they interact and integrate is valuable on many levels.

"A highly skilled employee with a great amount of technological knowledge becomes a huge asset to most shops, not because the owner is itching to dump money in your pocket; far from it," writes Colin Gilchrist, a Mastercam consultant and CNC programming expert, in a post on ***LinkedIn's Pulse***. "You become an asset to them by making them more money. And you make a shop more money by producing parts better and faster than the shop next door."

How to Approach Automation in Manufacturing: Part Volume Matters

Will automation work in an environment where part volume varies tremendously? It can, contends Ed Sinkora of SME.

Imagine a medium-volume part-making environment scenario where changeovers happen a few times a week. "With proper planning a cell could be changed over on the manned shift, allowing for a nice amount of unattended production on the following shift," explains John Lucier, automation manager for Methods Machine Tools, in an ***SME article***.

SME says that the required speed of the robot would depend "on the machining cycle time of the parts produced. The shorter the cycle time, the faster the robot needs to be and the less likely one robot can support several machines."

But shops with lower volumes can also be good candidates for automation, Lucier explains.

"The most important consideration is reducing changeover time or even totally eliminating setup time. People get caught up on cycle time and load/unload time, but if your volumes are so low that half your time is spent changing over, then attacking the changeover time, even at the expense of cycle time, may make sense," says Lucier.

Setup can essentially be eliminated by automation. Robots can be programmed to change both their own end-of-arm tooling and the workholding in the machine or load pallets from a carousel "regardless of the part being produced, eliminating the need to change robot tooling or to program different

load/unload moves for different parts."

There are a host of other important tooling, clamping and part stability areas to evaluate too, including workholding, gaging, cycle times, end-of-arm tooling, unattended processes—and lights-out machining.

Automation and Workholding

"If the workpiece requires positioning in the chuck or fixture or needs to be aligned in the secondary operation based on features created in the first operation, vision systems or touch probes may be required to complete the task," ***writes*** Felix. "***Workholding solutions*** must also be designed to allow for proper clearance between end-of-arm tooling and clamps when loading and unloading."

Automation and Gaging

"If an unautomated process requires the operator to measure the workpiece during or after machining, automating the ***gaging process*** should be considered," Felix explains. "Several in-process or post-process options are available, including touch probes, periodic artifact calibration or even use of a post-process gage or coordinate measuring machine."

Automation and Cycle Times

When considering automating a process, "cycle times will determine the capacity/size of the queue tables and infeed/outfeed conveyors for finished workpieces," writes Felix.

Cycle times need to be sequenced in coordination of tasks "required of the robot/automation, such as loading to gages, coordinating measuring machines, wash stations or turn-over stations" or in managing pallets.

Using Automation to Improve Workplace Safety and Worker Health

Worker health and shop floor safety are not the primary reasons that manufacturers invest in automation, but they are a beneficiary. Carpal tunnel syndrome is not uncommon in manufacturing jobs.

"Something as simple as loading a part into a lathe chuck can quickly turn into a repetitive stress injury for an operator when that process is repeated hundreds of times a day. Between lost time and claims, these injuries cost companies billions of dollars each year," Alexander explains.

There are a few areas in manufacturing work where automation has improved or eliminated dangerous work—and helped reduce unsafe environments. One is in lifting and moving heavy objects. The other is in close exposure to chemicals, particulates and extreme temperatures, explains Jim Vinoski, a senior manufacturing leader and former plant supervisor and systems engineer at Seagrams and General Mills, in an ***article*** for Forbes.

"Back injuries are one of the most common ones in manufacturing work, and these kinds of activities are a key contributor. Automated solutions include robotic pick-and-place systems, automated palletizers, vacuum hoist systems, and the like," writes Vinoski.

"Today it's unusual to have workers lifting more than 50 pounds, and for repetitive lifting even that much is becoming progressively rarer."

*To what level has your shop become automated? Talk about it in the **metalworking forum**.*