Many companies have made ergonomic design guidelines and selection criteria an integral part of their planning of certain physical tasks.

BY MIKE WYNN

ROOM TO MOVE

Critical success factors for an ergonomics initiative

COMPANIES THAT ONCE THOUGHT THERE WAS A bottom-line trade-off between safety and efficiency now embrace ergonomics because they have learned that designing a safe work environment can also result in greater efficiency and productivity. In 10 short years, many companies have dramatically driven down their injury rates for work-related musculoskeletal disorders (WMSDs) while improving productivity and employee engagement. They have trained people to assess and improve jobs and have put procedures in place to ensure that anyone experiencing ergonomic issues knows how to report them. Ergonomics is no longer a mystery for these companies; it's a straightforward problem-solving process with solid results.

A recent review of ergonomics success stories shared by companies at industry conferences found that WMSD injury rates and lost workdays were reduced an average of 80 percent. In addition, companies reported that they were able to drive their workers' compensation costs down by 70 percent on average.

This article explores three critical success factors for an ergonomics initiative (with a bonus fourth item in the conclusion). A common definition of success is that goals are met, and since ergonomics goals may vary from company to company, let's use a description of a successful ergonomics initiative as one that is effective (significantly reduces ergonomics-related injuries), efficient (gets the job done with reasonable use of resources), and sustainable (gains are lasting, not just one-time improvements).

Common complaints among salespeople, machine operators, assembly line workers, and others whose jobs require prolonged standing have prompted various workstation designs.

Integration with continuous improvement

Continuous improvement, or kaizen, has been an active driver of shop floor change in some companies for decades. In the past few years, this trend has accelerated as more companies have adopted lean manufacturing methods, and those that have successfully integrated ergonomics with their continuous improvement activities have seen tremendous results.

The goal of continuous improvement is to drive out waste, with an emphasis on low-cost improvements. As described in James Womack and Daniel Jones' book, *Lean Thinking*, waste can be addressed at three levels of the production process:

- Value stream: Entire supply chain, from raw materials to final product in the customer's hands.
- Production flow: Value-added operations that transform the materials coming into your factory into the output that leaves it.
- Workstation: Value added at individual operations. This is where ergonomics is a natural fit.

The vast majority of ergonomic improvements can be implemented at a low cost or no cost at all. Here are some common examples of workstation improvements resulting from continuous improvement activities:

- Raising or lowering work heights to allow work in neutral postures. This may include conveyor heights, control locations, and fixture designs.
- Improving parts storage to reduce reach distances, including moving parts bins closer, lowering shelf heights, and providing additional storage within easy reach.
- Locating hand tools near the point of use. This may include welding tool holders to the work bench, onto the hand rails of work platforms, or to stools used by the operator.
- Providing stands to present parts within easy reach. Parts presented on pallets or in large bins are often located on the floor, requiring reaching and bending to get to the bottom layer. Fixed or powered stands (lift, tilt, or lift and tilt) can eliminate this problem at a reasonable cost.
- Replacing heavy tools and fixtures with lighter-weight versions that have similar performance characteristics. Fixtures can sometimes be modified to reduce their weight by using alternative materials or by simply reducing unnecessary portions.
- Providing positioning devices, such as hoists, portable lift carts, or even stationary stands, to support the weight of components as they are being machined or attached to a main assembly.
- Providing alternative manual hand tools. In many instances, a longer handle or a bend in the handle can significantly improve the operator's access and working posture.

Ergonomics and continuous improvement activities can be integrated to gain efficiencies. If continuous improvement activities are taking place in your shop, people are already looking at the workplace, identifying and acting on improvement opportunities. Giving them an added perspective of recognizing ergonomic issues is like giving them a whole new way to find improvement opportunities. Most lean or continuous improvement training focuses on seeing waste, as defined by Taiichi Ohno's "seven deadly wastes" (overproduction, waiting, transportation, overprocessing, inventory, motion, and rework). There is such an emphasis on materials and material flow that we can overlook the fact that operators are the source of value-added individual operations. With ergonomics, our

view is expanded to include the human operator.

Another benefit to integrating ergonomics and continuous improvement is the remarkable impact that can be made on employee engagement. For continuous improvement to thrive, everyone on the shop floor must buy into the initiative. Buy-in occurs quickly when there is a direct positive benefit, and ergonomics provides that benefit to the shop floor worker.

Adhering to *best practices* for improving ergonomics in your continuous improvement activities will help to maximize positive outcome returns. For example, while mapping process steps and identifying wastes, highlight barriers to human performance — process steps that could result in quality issues, production bottlenecks, or safety concerns due to job demands that exceed human performance limits. Try creating ergonomic risk maps in preparation for kaizen events. While measuring baseline performance of the current state, create an ergonomic risk map of the operations using quantitative ergonomics methodologies. Use the results of the risk map to establish goals for improving ergonomic risk during the kaizen event.

Include ergonomics awareness in standard lean training. While conducting training on the lean process and specific lean tools, include key ergonomics topics such as identifying ergonomic risk factors, job improvements, and ergonomic design guidelines. Identify ergonomic improvements while conducting standard work or 5S audits. While observing the workplace to ensure conformance with established standards, use the observation methods to identify opportunities for ergonomic improvement. Finally, conduct *point kaizens* to improve ergonomics quickly. One-day workshops can be conducted using the observation assessments to drive low-cost, high-impact improvements at individual work cells.

Ergonomic improvements take pain and fatigue out of a worker's daily regimen. The benefit is immediate and significant. Just as important, the benefit is sustained; there is no incentive to return to the old way of doing things. It's no wonder that many companies are making ergonomics an integral part of their continuous improvement initiative.

An example is Denso Corp.'s Long Beach, Calif., facility. Denso is a global automotive supplier headquartered in Japan that has embraced kaizen for decades. The Long Beach facility embarked on an effort to involve all employees in reducing motion waste through the integration of ergonomics principles in their routine kaizen activities. They reported significantly improved productivity and a 27 percent reduction in recordable injuries in just two years.

Ergonomic risk management

Continuous improvement efforts are critical to identifying and acting on opportunities for improving ergonomics. But what about those ergonomic hazards that can't be resolved with low-cost or no-cost improvements? Continuous improvement teams simply aren't equipped to address the larger issues. This is why ergonomic risk management is an important complement to continuous improvement.

Ergonomic risk management refers to the systematic identification and reduction of ergonomic hazards. The focus is on resolving those hazards that pose the greatest risk of injury to the operators. Quantifying ergonomic risk and prioritizing exposures are key to maximizing the impact of your investment.

Techniques to quantify ergonomic risk exposures have been around for decades. The NIOSH lifting equation was first published in 1981, more than 25 years ago. So why aren't more companies making the effort systematically to identify and reduce ergonomic hazards, often the top cause of injuries in their

Force and weight limits in pulling and pushing work activities are often the subject of ergonomic studies that aid product design.

An estimated 50 percent of people in the industrialized world suffer from some sort of back complaint and many of them are related to poor seat design.

workplace? Many times, it's simply a lack of understanding of how ergonomics-related injuries occur.

Where many safety-related injuries occur as one-time events, ergonomics-related injuries result from exposures over time. This makes it difficult to see the relationship between the hazard and the injury. For instance, if someone is struck by a fork truck, it's immediately clear what the hazard was and, in most cases, it's a pretty straightforward problem-solving process to ensure that another similar incident doesn't occur. But with something like shoulder pain, the operator was likely exposed to many different work tasks that contributed to the injury, sometimes over several years. A more sophisticated approach to problem solving is needed to prevent future similar incidents because the hazard is not easily identified and isolated.

Companies are beginning to implement ergonomic risk management by using risk factor surveys. These are easy-to-use methods of identifying ergonomic risk and the workplace factors that contribute to it. By mapping the shop floor (often using red, yellow, and green to signify high, medium, and low risk), they are able to prioritize their ergonomics problem-solving efforts.

The most powerful approach to ergonomic risk management is to adopt a policy of zero high-risk jobs. This is not a small step; it requires a commitment to quantifying risk exposures for every work area in the company and fixing those high-risk areas even if capital improvements are required. A multi-year effort is typical, with many departments working together to ensure that both parts of the job (assessing and fixing) are done efficiently. You may find that specialized tools are helpful for solving specific problems such as manual material handling tasks, but having a consistent initial method for risk mapping makes the most sense.

Remember that ergonomics is an improvement process, not an assessment process. Don't fall into the trap of assigning one group of people the task of completing ergonomic risk assessments and another group of people the task of reducing risk. Use a team approach, or engage the "improvers" in assessing ergonomic risk at the start.

Establish a goal for ergonomic risk improvement that will drive workplace improvement activities to those jobs with the highest risk exposures. For example, many companies set a long-term goal of zero jobs with high ergonomic risk and hold operations managers responsible for progress toward that goal.

An example of an ergonomic risk management approach is from Ligon Brothers, a small family-owned manufacturer based in Michigan. The company's initial project focused on a five-person work cell that was experiencing production challenges and numerous ergonomics-related injuries. They assessed the ergonomic risks and resolved to eliminate all high-risk tasks, a goal they accomplished with just seven specific workplace improvements. This resulted in the elimination of injuries in this work cell along with a 25 percent improvement in productivity. The company then set out to assess and fix all ergonomic issues systematically throughout the plant.

Design for ergonomics

Most workplaces are dynamic; new tools, equipment, products, and processes are routinely introduced and integrated with the existing workplace, and they all present opportunities to ensure that good ergonomics is "designed in" prior to launch, often at no additional cost.

Many companies have made ergonomic design guidelines and selection criteria an integral part of their planning process. They are achieving breakthrough improvements in health and safety metrics with relatively low investment, simply by anticipating ergonomic challenges and addressing them before injuries occur. There are typically three phases in which ergonomics is important to the planning process:

Phase 1: Identify challenges and alternative approaches at the concept stage.

Whether you are selecting seating for an office expansion or designing the next generation assembly line, you can often make considerable improvements just by seeking feedback on existing designs. Opening the communication channels between design (the future you are creating) and operations (the current reality) is best accomplished by formalizing user interviews as part of the concept review.

Phase 2: Review the proposed design to resolve "outages." Many companies use ergonomic design checklists as part of a formal design review. A few key areas to evaluate for good ergonomic design are listed below. Specific and measurable criteria are best, although descriptive characteristics are better than nothing.

- Horizontal work reach
- Seated workstation dimensions
- Standing workstation dimensions
- Visual envelope
- Sitting exertion
- Standing exertion
- Arm, grip, and hand strength
- Manual material handling
- Hand tool design
- Clearances and access
- Platforms, ladders, and stairs
- Screens, controls, and gauges
- Work environment

Phase 3: Institute a formal sign-off procedure to ensure that all user needs are being met. Ideally, this phase can serve as a final confirmation that the concept and design reviews were deployed effectively. More often, this final review is needed to identify design elements that slipped through the cracks due to miscommunication or accelerated timelines. The same key areas to evaluate as in the previous phase apply, and often operator feedback from initial run-offs is part of the process.

Align ergonomics requirements with your accepted design process. For example, many companies have a formal design review procedure to ensure that a new product or process design meets all requirements prior to build. Provide ergonomic design criteria in the format that your design team is familiar with, and make sure that requirements are not viewed as guidelines that can be ignored. Don't forget that ergonomics challenges can occur during tool changes and maintenance tasks, not just during normal production. Be sure also to address human-machine interface issues associated with these activities.

Apply ergonomic design guidelines whenever changes are made, not just to capital projects. Criteria for hand tools, part presentation, working heights, and many other aspects of workstation design can be applied even when changes are quick fixes that circumvent the formal review process. Provide different ergonomic criteria for product design and equipment design. While there is some overlap, there is significantly more information available at the equipment design stage.

An example of design for ergonomics comes from Lucent's Columbus, Ohio, production facility. Faced with rapidly increasing demand for a particular cell phone amplifier, the site recognized that replicating the existing production process would be inefficient and would potentially lead to ergonomics-related injuries. They set out to design an assembly line that would allow all tasks to be completed efficiently and at low ergonomic risk.

They applied ergonomic design criteria from the beginning and involved operators during the design, prototype, and production run-off phases. The new assembly line resulted in a 44 percent reduction in build time and a 61 percent improvement in first-time yield. Based on the success of the first assembly line, Lucent built five more lines just like it and projected its total savings at $1.2 million per year.

Ergonomics is an improvement process, and like many processes, improvements can be systematically driven and aligned with ongoing activities. The three critical success factors discussed — integration with continuous improvement activities, ergonomic risk management, and design for ergonomics — can all be deployed in parallel. Many organizations are tasking different groups with different parts of the effort. For example, continuous improvement may be driven by the lean team while risk management is driven by health and safety and production engineering.

One final critical success factor for an ergonomics initiative is simply to ensure that roles, responsibilities, and performance expectations are clearly defined for everyone involved in ergonomics. This is perhaps the most challenging aspect of a successful ergonomics deployment, as it requires a great deal of coordination and preparation. Once these elements are in place, companies typically have the systems established to train people in requirements relevant to their ergonomics responsibilities and to manage performance to ensure that expectations are met.

Mike Wynn is an ergonomics engineer and vice president of Humantech, a firm that has partnered with companies around the globe to accelerate workplace improvements. Wynn tries to deliver operational excellence, increased profitability, engaged employees, and reduced workplace injuries.