

A LEAN LOOK AT ERGONOMICS

*Healthier continuous
improvement processes can
limit musculoskeletal disorders*

BY JACK KESTER

LEAN MANUFACTURING HAS replaced mass production for almost half of all U.S. manufacturers. Lean has helped employers improve operating efficiencies and retain manufacturing jobs in the United States. Unfortunately, many of these employers have seen their workers' compensation costs skyrocket after implementing lean concepts. For example:

- An automobile manufacturer experienced a 100 percent increase in musculoskeletal disorder (MSD) cases and received a citation from California's Division of Occupational Safety and Health for "insufficient attention to ergonomics" after implementing lean during a changeover of one assembly line.
- The U.S. aerospace industry began a lean initiative in collaboration with the federal government. Six years later, incidence rates for MSDs had more than doubled, while other U.S. manufacturers experienced 10 percent to 20 percent reductions in MSD rates over the same period.
- After implementing the lean manufacturing process, an auto parts manufacturer experienced an increase in the number of surgeries related to MSDs from 74 in the year prior to the lean initiative to 167 in the year following the initiative. Seven percent of the company's workers were scheduled for surgery after lean was introduced.

Increased injury rates seriously hamper the intended results for lean processes, since injured workers cannot work and replacement workers are not as efficient at completing the tasks. Fortunately, higher workers' compensation costs are not inevitable if lean manufacturing is implemented thoughtfully. Let's look at why higher injury rates occur and what can be done to manage risk in the lean environment.

Applying lean processes

Lean manufacturing processes seek to create value and minimize waste to achieve a higher return on your capital investment. Using multidisciplinary kaizen teams, lean companies evaluate workstations, production cells and entire assembly lines to streamline operations and eliminate waste. The seven key wastes that lean processes target are:

1. Correction: Repair and rework
2. Motion: Any wasted motion to pick up or stack parts, unnecessarily long reaching and walking distances, etc.
3. Overproduction: Producing more than is needed
4. Conveyance: Unnecessary movement of materials or finished goods into/out of storage or between processes
5. Inventory: Maintaining excess inventories of raw materials, parts in process or finished goods
6. Processing: Doing more work than necessary, such as redundant material handling, unnecessary grinding or finishing, etc.
7. Waiting: Any nonwork time, such as waiting for parts, looking for tools or reaching for materials

By reducing waste in these key areas, significant cost savings can be achieved. These cost savings enable U.S. employers to compete in the global marketplace despite this nation's higher labor costs.

Unfortunately, lean processes can make jobs highly repetitive, while eliminating critical rest time for employees. The repetitive jobs take their toll on employees as stressful postures and high forces are repeated over and over throughout the day. In the long run, the financial savings from the productivity gains and quality improvements are used to pay for the higher cost of workers' compensation claims for MSDs.

Integrating ergonomics into the lean

manufacturing process enables your stakeholders to identify potential risk factors and to design work flow, workstations and work methods that reduce or eliminate the risk to the workers. Since lean manufacturing and ergonomics share the goals of eliminating waste and adding value, there are natural ergonomics integration points in most lean processes. Ergonomics is simply another tool that can be embedded into lean processes to make them more successful.

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For example, the automobile manufacturer discussed in the introduction to this article implemented a lean initiative on a second assembly line model changeover and integrated ergonomics into the process. The result? The changeover was completed in 38 percent less time, achieved similar productivity gains and quality improvements, and reduced injuries on this line by 30 percent. Those are results that we all can live with.

Integrating ergonomics

Integrating ergonomics into the lean process begins in the planning stages. To ensure that ergonomics is a key component of the lean process, the lean team must make ergonomics and safety, just like waste reduction and value creation, core values of the lean process.

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All lean leaders and lean team members should understand the mission of the lean process and the role ergonomics plays in the successful implementation of lean manufacturing. Ergonomics metrics must be included in the lean process to evaluate how the lean “improvements” affect the MSD risk factors associated with the job or jobs that are changed.

Factors that should be considered to integrate ergonomics into your lean process effectively include:

Lean prioritization: Many companies use value stream mapping or other prioritization methods to visualize their operations and select work areas or production processes for lean analyses. Incorporating ergonomics risk assessments and quality metrics into the value stream mapping process provides a structured method for prioritizing lean opportunities. Production processes with high levels of MSD risk factors are leading candidates for lean design changes. Using scored risk assessments provides a method of identifying jobs with design flaws, while the assessment tool also can be used to validate the effectiveness of the new lean design. Then, risk factor scoring and quality metrics can be used as additional data points in the value stream mapping process to prioritize work areas for lean manufacturing interventions.

Ergonomics training: Training of the lean team leaders and kaizen team members is a critical component of any lean process. Basic ergonomics concepts and ergonomic design factors should be included in this training so that team members can recognize risk factors and apply these ergonomic design options as they develop conceptual designs. Lean team members may perform ergonomics risk assessments and evaluate how workers interface with workstations, parts and tooling. Training is critical to ensure that the team members are knowledgeable and comfortable with these tasks.

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Workstation and work flow design:

Focusing the lean teams on ergonomic design concepts will help them accomplish their lean goals as they consider how the employees interface with the workstation, tooling, parts and environmental factors. Applying ergonomic design concepts will reduce costly errors, improve productivity and reduce MSD risk factors that lead to higher workers’ compensation costs. Ergonomic design goals focus on creating strong, efficient body postures, reducing the amount of force required to complete a task and avoiding repetitive postures and motions throughout the work shift. For example, from an ergonomics standpoint, outward reaching causes stressful shoulder and back postures, and those reaches are also inefficient from a lean standpoint. Exerting force takes time, increases risk of strains and other injuries, and causes employees to fatigue – which slows their work pace and reduces productivity. Clearly, the goals of ergonomics design complement the goals of the lean process and can mitigate the risk created by some lean solutions.

Measuring leading indicators: Many ergonomics risk assessment tools result in a risk factor score, enabling the lean team to compare the level of risk presented by various production processes. Since the presence of MSD risk factors is a leading indicator for high incidence rates and higher workers’ compensation costs, the risk factor scores provide objective data points that can be used to identify potential ergonomics and productivity issues. Many companies use these risk assessments before and after implementing new

lean work flow and workstation designs. The assessments enable lean teams to confirm whether the changes have a positive impact on the level of risk or identify unintended consequences of the new design that may lead to increased MSD risks.

Stakeholder involvement: Involving users of the process to be redesigned (hourly employees, supervisors, maintenance, etc.) is critical to the success of any lean intervention. These stakeholders understand problems with the work flow, issues with incoming parts and equipment, and variances in production scheduling that may not be apparent to an external lean team. The lean team needs to collaborate closely with these stakeholders to capture these issues and production variances to ensure the new lean design is adaptable and efficient. The hourly employees typically provide some of the best design ideas, so it is essential to get them involved in the discussion.

Even more important, the employees may not use new tooling if they are not engaged in selecting and installing the equipment. Many manufacturers have invested in state-of-the-art material handling equipment only to find that the employees choose to lift the product rather than use equipment selected by management. Stakeholder involvement is crucial to the acceptance and effective implementation of the lean design modifications.

Quantify your impact: Measuring the financial impact of the lean ergonomics solutions is essential to attain continued support and involvement of senior management. Frequently updating management on the significant cost savings in productivity, quality and workers’ compensation claims will ensure that the process will continue to be a management priority.

Workers’ compensation costs should be developed to their conclusion to capture the total cost of the claims related to the

work area involved in the lean initiative. Loss development factors are used to multiply the current costs of injuries to project the total claim cost to closure. Claims data can be obtained from the workers' compensation carrier or third-party claim administrator, the insurance broker and the internal risk management department. Loss development factors also may be obtained from these sources.

A spreadsheet template should be developed to simplify and standardize the methods used to measure or project the financial impact from lean initiatives. Productivity gains can be translated into cost reductions by multiplying the cost of labor by the calculated reduction in man-hours. Quality savings can be estimated based on the current cost of returns, rework and warranties. Workers' compensation cost reductions can be based on current claim costs and the reduction in the MSD risk factor scores. Consistently providing management with conservative estimates of cost savings will ensure that resources will continue to be provided to the lean process.

Case study: Filling pies with lean ergonomics

To show how integrating ergonomics into your lean implementation can work, let's examine the case of a commercial bakery supplier that performed a lean event for its pie filling line.

Two pie filling stations were located in parallel, where the operators fed pie filling into plastic pails and sealed the pails. Material handlers were assigned to each line to invert the pails onto their lids and place them on pallets on the floor. Once full, the pallets were moved with a lift truck, and the material handlers dragged empty pallets to the work area.

The lean team found that, given the amount of material handling, the existing design of the palletizing process was inefficient. An ergonomics risk assessment

NOT SO PHABULOUS

The newest smartphone craze is being dubbed the "phablet," as in fabulous tablet that replaces your oversized tablet and your too-small smartphone.

Several such smartphone-tablet hybrids had their coming-out party at January's Consumer Electronics Show in Las Vegas, joining the class created in 2011 by the 5.3-inch screen Galaxy Note. Phablets have screens larger than five inches that are great for watching videos and viewing websites and documents, but ergonomics issues might prevent them from being the next big thing, wrote Bonnie Cha of AllThingsD.com.

"It comes at the price of comfort and ergonomics," Cha wrote, going on to say that the size makes phablets difficult to hold (unless you're a basketball player), and they look ridiculous next to your ear or jammed into your pants pocket.

Peter Griffin of the *New Zealand Listener* agreed. He said it doesn't make sense ergonomically to hold a 6-inch "slab of glass and silicon to your ear to take a call," although he will give the new class of devices a test run.

Ross Rubin, principal analyst at Reticle Research, told Cha that at some point consumers will see a diminishing ergonomics return in terms of device size versus the benefits of larger screens.

"That's not to say we won't see more phones in the upper 5- or 6-inch range, but clearly at some point you're no longer designing for one-handed operation," he said.

That's OK for some. The growing screens and computing power available in smaller, but not too small, devices led Benjamin Robbins to the decision to go entirely mobile for one year. The co-founder of Palador Inc., a Seattle-based enterprise mobile design and consulting shop, is spending an entire year using only his Samsung Galaxy Note II phablet – no tablet, Ultrabook or PC.

But even this mobile pioneer couldn't work his way around certain ergonomic limitations, Robbins told Bob Egans at Forbes.com.

"Screen real estate is still important," Robbins said. "A keyboard is still the fastest way to enter information. When I'm in the office, I have a Bluetooth keyboard, mouse and a monitor that I sync with my Galaxy Note II."



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determined that this was a “high risk” job, since it required frequent lifting to floor level, stressful shoulder and back motions to invert the pails, and forceful pulling while moving the empty pallets into place. Two back injuries typically occurred on this line each year, costing an average of \$18,000 per claim.

The lean team determined that it could redesign the pail palletizing process to allow the palletizing to be done by one employee rather than two. Powered roller conveyors were installed at the end of each line, and the two conveyors converge at a palletizing station. As the pails travel down the conveyor, flipping stations on each line invert the pails onto their covers as required.

Pallets are placed onto a self-leveling lift table in the new palletizing area using a lift truck. A vacuum hoist is used to lift the pails onto the pallets, eliminating the manual lifting required by the material handler.

The changes are diagrammed in Figure 1.

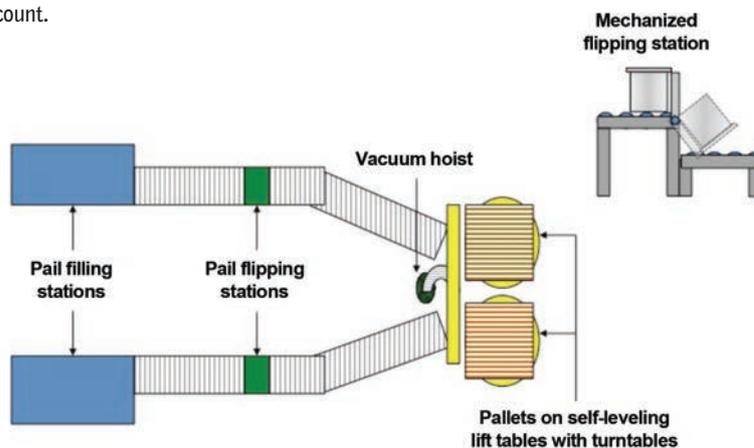
The financial impact for this lean redesign is calculated in Figure 2. The total cost of the equipment, installation and training was \$10,150 with a total annual savings in workers’ comp and labor costs of \$66,000. The return on investment was calculated at 5.5 with a payback period of 36 days. The ergonomics risk assessment rating was reduced from 18, which is in the high-risk range, to seven, which falls in the lower risk range. This project was highly successful in improving productivity while significantly reducing the risk of back injuries.

Winning on multiple levels

Lean manufacturing allows employers to improve operating efficiencies and compete in the global marketplace. When implemented effectively, the lean process creates a culture of employee involvement and empowerment and establishes a positive working environment in which

IN WITH THE NEW

Figure 1. The lean redesign of the pie filling and palletizing station took ergonomics into account.



LEAN ERGONOMICS PAYS OFF

Figure 2. A lean redesign with ergonomics in mind reduced costs by more than \$55,000 a year.

	Before	After	Impact
Labor costs – remove one material handler	\$60,000	\$30,000	-\$30,000
Workers’ comp costs (two back injuries per year)	\$36,000	\$0	-\$36,000
Installation of conveyors	\$0	\$600	\$600
Purchase/installation of vacuum hoist	\$0	\$9,500	\$9,500
Employee training on the new equipment	\$0	\$50	\$50
First year totals	\$96,000	\$40,150	-\$55,850

workplace changes are expected and accepted.

Sharing the mission and goals of the lean process and recognizing employees who make meaningful contributions to achieving cost savings will make the process successful and effective.

Ergonomics provides additional tools for lean teams to reduce waste and create value within your organization. Ergonomics is not another step; it is part of the process.

Without ergonomics, lean processes can lead to costly workers’ compensation claims in the months and years after implementation. With ergonomics, lean processes can reduce costs and the payouts from workers’ compensation claims. Can your company afford to ignore ergonomics as you create a lean organization? ~

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