

Total productive maintenance (TPM) is a critical element in the transition to lean manufacturing, but manufacturers often find barriers in the way of deployment. Rich Weissman looks at the issues

The next time you bring your car in for service, I want to flush the transmission,” says Dan, my Ford dealer’s service manager. “We’re seeing some data on fluid breakdown and I want to make sure that we keep ahead of it with our customers.” And I added a note to my calendar to make that appointment. Why? I’d rather see Dan on my own terms than with my car at the end of a tow truck’s hook. Over the years I’ve learned the hard way that regular servicing, and a well developed preventive maintenance schedule, is better for the car, and more convenient and cost effective for me. When it comes to car repairs, control is better than chaos.

The same thing can be said for tooling and equipment on the factory floor. Downtime, lost productivity, and unanticipated expenses are often the result of poor maintenance and a reactive culture that responds crisis to crisis rather than in a planned and controlled course of action. In a recent survey conducted by The Manufacturer, 27 percent of the respondents said that total productive maintenance was a current business initiative, yet only six percent claimed to be fully operating it.

While the theory of TPM seems so clear and the benefits so evident, it is perplexing that so many manufacturers do not integrate it into their lean manufacturing initiatives. Barriers include a lack of understanding of the effect of well running equipment on productivity, a short sighted approach to cost savings, resistance to change, and a firefighting mindset that is often accepted, and ingrained, throughout the organization.



Many manufacturers take the “I’ll get to it tomorrow” approach to TPM. When it comes to equipment uptime, however, tomorrow may be too late. Total productive maintenance focuses on a formal process of maintaining the tools and equipment that are used throughout the manufacturing process, but TPM is more than just a preventive maintenance program. It includes an intimate knowledge of production processes, a tracking program for scheduled maintenance, an inventory of spare parts and consumable items required for the equipment, workforce involvement, ongoing training of operators and repair personnel, and an organizational and senior management acceptance of, and commitment to, the TPM process.

Strong relationships with equipment suppliers and third party service providers are also important, as their knowledge and support can help to increase the equipment’s effectiveness, throughput, uptime and yield.

TPM is a continuum. Reactive maintenance, the most common maintenance approach, occurs

when equipment is serviced only when it breaks down. Preventive maintenance means servicing equipment at regularly scheduled intervals to prevent unanticipated downtime. These service intervals are often built into the production schedule, or occur during nights and weekends when equipment may be idle.

Predictive maintenance, the ultimate state, uses data and surveillance to analyze equipment deterioration and monitor equipment conditions, often with an online system. In the TPM continuum, predictive maintenance is the best place to be, but many companies are not even close, thinking that preventive maintenance will be the answer to their problems.

“Many of the of the small and medium sized companies we work with are still focused on reactive maintenance, fixing equipment that breaks down rather than servicing it on a regular basis to prevent the breakdown in the first place,” says Dave Levine, lean team manager for the Cincinnati, OH based TechSolve, a member of the National Institute of Standards (NIST) and Technologies Manufacturing Extension Partnership (MEP). “We are doing our best to make them see the benefits of preventive maintenance and then ultimately predictive maintenance.”

One of TechSolve’s clients, a manufacturer of thermal batteries supplied to a large aerospace company, found that its downtime was increasing while its output was falling. A cross functional team was established to develop and analyze product line performance measurements. The data showed that the cause of the output issues was a press that converted powder into wafers used in the battery assembly. Analysis showed that a portion of the equipment was misaligned, causing the operator to stop the press on a regular, but unanticipated, basis to sharpen and realign the dies. In addition to unscheduled downtime, the misalignment was causing premature die failure resulting in higher tooling costs. Proper equipment alignment allowed the product line to once again meet its productivity goals. Yet, it went deeper than that.

TechSolve had used OEE to help identify the root cause of the production issues. “We also work with our clients on the elements of TPM, including the concept of overall equipment effectiveness (OEE),” says Levine. “OEE measures equipment availability, efficiency, and quality, and manufacturing companies need to look at the data behind their maintenance activities to really manage the process effectively.” During the analysis stage, TechSolve discovered that the OEE for the press was at 39 percent, while world class OEE was considered to be in the 80-85 percent range. “Once we identified the piece of equipment that was impacting production, we dug deeper into the analysis, finding that there was actually a raw material problem that was causing the die to become dull and misalign.”

Some industry segments embrace TPM more than others. “I’ve seen greater acceptance and understanding of total productive maintenance in the process industries rather than in discrete manufacturing industries,” says Bob Dean, managing director of new product development for the Durham, NC based lean manufacturing consultancy TBM Consulting Group. “The process industries have actively embraced TPM for the past 10 to 15 years while many in the discrete manufacturing industries still don’t recognize it as an essential step in the lean manufacturing process.”

“TPM is not an all-or-nothing approach,” says Dean. “Companies, especially small and mid-sized ones, can introduce TPM in newly developed work cells or on specific pieces of equipment on the factory floor. They do need to reduce the shotgun approach to plant maintenance which can be quite ineffective.” Dean advises his clients to methodically analyze their manufacturing process and use TPM where it makes sense, utilizing a limited rollout. “TPM becomes quite important in machining cells where equipment reliability and set-up issues can lead to disruptions. This is a good place to start the process.”

Dean sees predictive maintenance as the key value producing element of TPM. “Predictive maintenance will significantly help in increasing productivity and throughput in all business segments,” says Dean. “But there is an investment that needs to be made in order to reap the benefits.” Dean does see an increasing amount of cost effective TPM applications and analysis

tools geared to small and mid sized businesses. "This may reduce some of the barriers and help to bring in a more of a widespread acceptance of TPM."

Some manufacturing companies outsource their TPM activities in order to increase the scope and effectiveness of their maintenance process, especially as they migrate towards more of a predictive maintenance approach. "Maintenance in many organizations is almost 100 percent reactive," says Mark Hardesty, the regional operations manager for Peoria, IL based Advanced Technology Services, a provider of outsourced factory maintenance. "We've also seen many companies reduce the amount of preventive maintenance activities causing more and more reactive maintenance. When you go to lean you just cannot be in the firefighting mode. "When a company like ATS is brought into a company, senior management knows that they have a maintenance problem that is not being effectively managed at the factory level," says Hardesty. "Many have successfully adopted lean manufacturing and they are finally getting to the TPM part of their implementation. Others are seeing a decrease in lean effectiveness or see quality issues that point to equipment downtime." Hardesty sees that TPM is typically embraced somewhere towards the middle of the lean journey. He'd like to see it happen earlier in the process.

One barrier to deployment, says Hardesty, is that senior management needs to see a return on investment for TPM activities. There also needs to be an availability of skilled resources across the organization. "TPM is more than just tooling and equipment repair," he says. "It also includes functions such as safety, technical training, human resources, factory management systems, facilities management, and even six sigma training." He adds that no TPM process is perfect, and that there is an expectation that there will always be some level of reactive maintenance. "Our goal is reduce downtime by 80 percent. If only 20 percent of the maintenance activities are reactive, we've made significant progress."