Infor ERP

The importance of execution

Five reasons why you need Lean MES now

be enterprising

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Executive overview

Manufacturing Execution Systems (MES) have been around for a number of years, but many companies have yet to recognize the critical role they play in lean manufacturing operations, control, and performance. In this paper, we discuss five areas where MES can play a critical and expanded role in your company's pursuit of excellence.

- **Agility:** Tight ties between plans, customer demand, and manufacturing contribute to your company's ability to react to external changes and internal situations. This is increasingly necessary in an environment characterized by uncertainty and rapidly changing market conditions on both the supply and demand sides
- **Product Release/Design changes:** With ever shorter product cycles and tighter competition, companies cannot afford delays or errors in communicating engineering changes and design activities to the plant floor
- **Quality:** Quality management is a prime component of MES. Maintaining consistent quality and eliminating scrap, rework, and other waste while improving customer satisfaction issues is critically important
- **Compliance:** Both regulatory compliance (Sarbanes-Oxley, FDA, etc.) and meeting customer expectations require thorough documentation and traceability that can only be provided efficiently through MES
- **Manufacturing performance:** The plant is where "the rubber meets the road." Real time measurements and controls provide the tools to get the most out of the company's most important resources, including green initiatives.

Lean MES systems bridge the gap between management systems (ERP) and machine controls (SCADA) and provide a conduit for plant floor data to feed monitoring, measurement, and management systems above, while passing programs, drawings, and instructions down to workers and machines. MES also plays a critical role in capturing data, logging activities, and documenting processes for quality, compliance, and analysis.

Planning is wasted without execution

Manufacturing Execution Systems (MES) have been around for a number of years but many companies have yet to recognize the critical role they play in manufacturing operations, control, and performance.

An earlier generation of manufacturers, those companies searching for the key to a competitive edge in the 1980s and 1990s, focused on planning—factory planning and scheduling, enterprise planning, supply chain planning, and various so-called advanced planning functions. While many succeeded in improving agility and on-time delivery, reducing costs, and becoming demand-driven, others struggled and did not achieve the desired results.

More recently, attention has shifted to Lean—a variety of techniques that are focused on reducing "waste"—defined as anything that does not add value and includes inventory, excess lead-time, unnecessary handling, and the like. Lean initiatives often focus on physical techniques such as Kanban[1] cards and Kaizen Events, rather than computer applications, although even Lean purists will admit that planning is at least as important, and perhaps even more so, in Lean environments. While some Lean zealots will argue that Lean techniques replace planning and/or execution applications, in reality, planning is even more critical in Lean environments where traditional buffers like safety stock have been drastically reduced if not completely removed. Lean execution techniques like Kanban work best in carefully controlled and monitored environments—relatively steady usage, inexpensive parts, parts and materials with short lead-times. Nevertheless, even in traditional Lean environments with physical signals and controls, Lean MES can still play a critical role in the areas on which this paper is focused—agility, quality, compliance, performance, and the interaction between engineering and the plant floor.

Throughout this evolutionary journey, manufacturing execution has been recognized as a necessary part of the process, but execution has repeatedly been relegated to a lower priority. It always seemed like planning or quality or demand-driven initiatives were more important, and limited resources often did not allow companies to ever get around to execution.

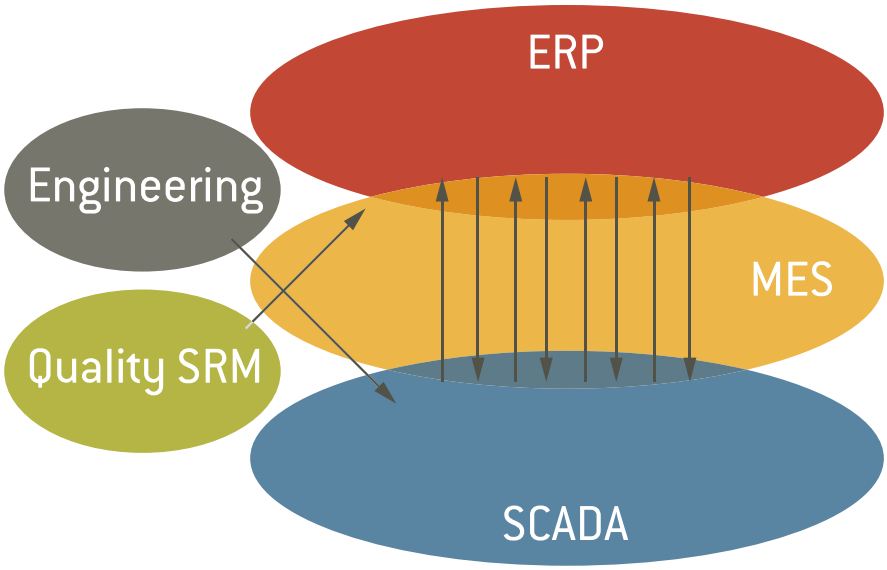
[1] Kanban, a Japanese word meaning 'card', refers to a physical replenishment signal —a card, tag, empty bin, or, in some cases, an electronic signal that triggers replenishment after an item or quantity of an item has been used in production or sold. Kaizen refers to suggestion-based continuous improvement efforts.

Lean MES defined

There has also been a rather remarkable lack of understanding about just what an MES system is and how it fits in with enterprise systems such as ERP and machine control (SCADA[2]) systems. The short answer is that it fits in between and, in fact, overlaps both areas. Manufacturing Execution Systems include applications to manage plant schedules, often to a more detailed level than ERP—ERP usually schedules to the day, whereas MES might schedule to the minute or at the very least manage the sequence of activities within the day and coordinate the delivery of machine instructions, quality plans, and specifications (drawings) to plant resources at the proper time.

MES includes quality tracking and control, equipment maintenance (scheduling and tracking), and data collection—all functions that may be included in ERP, but that are usually handled at a more detailed level within MES.

MES systems often connect directly to machine controls and collect information—status, rates, piece counts, parametric data—as well as managing instructions and programs from engineering in coordination with the schedules developed by ERP and supervised within MES.



[2] Supervisory Control And Data Acquisition

At the most basic level, you can say that MES lives in a world of minutes and seconds, while ERP is day-week-month oriented. SCADA's time orientation is in milliseconds, seconds, and minutes. Hardware, networking, communications, and the basic structure of applications have to be different to operate effectively in these three unique environments. That's why one universal system or architecture has not evolved to satisfy all of the needs of the plant from the machine program to the executive suite. Separately, management systems (ERP) evolved at the same time plant level technologies have become more capable and comprehensive. The role of MES is to bridge the gap, bringing these two very different environments together and filling in the intermediate needs of translating management functions into executable instructions and converting bits-and-bytes data into informative and actionable information back up the line.

More important than hardware and software, MES is "a system of processes, orchestrated through or enabled by technology, to achieve a specific goal, which is the management of manufacturing execution," according to AMR Research. In a recent Managing Automation webinar, AMR defined MES functions to include "the creation and management of electronic work instructions, the ability to track work-in-process inventory, the ability to track the genealogy of the products that you're making in terms of which suppliers gave you which product … track and trace … asset management … laboratory management … metrics … allowing us to leverage a lot of the applications that we already have in place," among other functions.

Bridging the gap and acting as the interpreter and agent between the front line and the top floor enables significant improvements and capabilities that pay significant dividends in many areas of business operations and performance. The remainder of this paper will address five areas of manufacturing operational concern where Lean MES can play a significant role.

Agility

In a world characterized by rapid change—short product cycles, proliferation of variations and choice, sudden changes in demand, technological breakthroughs—agility is critically important. Manufacturers must be able to "turn on a dime," that is, react rapidly to those changing demands, aggressive competitive actions, disruptive innovation and product releases, and ever-shortening product cycles.

The key to agility lies in the manufacturer's ability to quickly change production schedules, product mix, product design, and specifications, whether that change is required by an outside event or influence, or in response to an internally-generated need (new product introduction or engineering change).

MES serves this need in two basic ways. Because MES is closely tied with plant floor activities, immediate and accurate status information is available to help in assessing the current situation and determining the impact of the disruption, as well as the best way to "cut in" the changes necessary to minimize waste and ensure the best product flow to support the changed situation.

Secondly, MES is the conduit through which new instructions, schedule changes, and design changes are most immediately and effectively transmitted to individual shop personnel and resources. As a result, the reaction to the change is quick, intelligent, and effectively implemented, delivering the best possible customer service at the lowest possible cost.

New products/engineering changes

AMR Research recently said "Based on some research we did last year (2007), one of the top business priorities for manufacturing next year is reducing the impact of new product supplier or engineering specification change in the manufacturing process." Engineering activity—whether to support new product development and release or for changes to existing products or production—must be closely coordinated with the plant floor to ensure a smooth handoff with minimal disruption and waste.

MES is the link between engineering and production, providing the visibility needed to determine the impact of the release on on-going production. Working in conjunction with engineering release control applications—often part of Product Lifecycle Management (PLM) systems, MES assists the engineer in determining the impact of proposed changes on ongoing production, in-process inventory, production schedules, and required rework and scrap.

When the optimum "cut-in" strategy is determined, MES is the conduit for passing specifications, machine control programs, and drawings to production, and the mechanism for enforcement to be sure the changes are properly applied. MES provides the controls that reduce scrap and rework, helping to shorten the learning curve and ramp up to full production rates more quickly.

Quality

While Quality Management may be a part of some ERP product offerings, these applications tend to focus on developing sampling plans and maintaining records—good things, to be sure, but, the quality management part of MES works more closely with the plant floor to implement (enforce) quality plans, collect and process parametric data, and work with controls systems to maintain quality processes. Higher process quality improves yield and reduces costs, eliminates scrap and rework, reduces errors, and supports compliance with customer and regulatory requirements.

Quality requirements in many industries dictate that processes be fully documented, and measured parameters captured and archived. MES quality applications fulfill these requirements in conjunction with the enforcement of quality processes and procedures.

Of course, better quality production (build it right the first time) results in lower costs (reduced scrap and rework), shorter lead-time (eliminates repeated checks and inspections), and higher levels of customer satisfaction. The real benefit of good quality management is to increase profitability by reducing the overall costs of goods sold.

Compliance

Many industries are faced with stringent regulatory and industry requirements for quality and for process documentation. Many more are struggling to comply with Sarbanes-Oxley, which requires excellent visibility into all company activities and operations. MES plays a key role in meeting these needs.

MES can provide extraordinary visibility into what is happening throughout the plant—every line, machine, and activity. Each activity and "event" is logged and assessed by the system for significance. The MES can report significant events to monitors, supervisors and/or executives for appropriate corrective action and documentation to comply with regulations and Sarbanes-Oxley requirements. Full traceability and process documentation is maintained through the MES.

Additionally, the MES can enforce compliance by making work instructions, drawings, and formulas available at the workstation, delivering appropriate cues, and logging activities, including electronic sign-off for regulatory compliance. It can also enable full product genealogy—all batch/lot/serial number identification can be maintained and archived through MES.

Performance

The plant is where "the rubber meets the road"—where plans and preparation are put into action to actually build the products that the customers will buy. Real time measurements and controls provide the tools to get the most out of the company's most important resource.

The high level of visibility provided by MES is invaluable for process enforcement and maintaining high quality, both of which lead to reduced scrap and rework (improved yield) and therefore lower costs, shorter lead-times, and more efficient operations.

Visibility and documentation is also important in order to analyze and execute performance improvement and waste reduction programs.

Data collected by and through MES feeds management systems that control schedules and report activities and performance to executive information systems. These measurement systems are a critical tool for executives making decisions and directing activities to improve performance.

Summary

Management systems (ERP) develop plans that extend from days, to weeks, and months into the future. Plant-level (SCADA) controls manage and monitor finite activities in the realm of milliseconds, seconds, and minutes. MES bridges this difference in time scale. It translates daily ERP schedules into hour-by-hour and minute-by-minute plans that can be executed and managed on the plant floor. MES also gathers SCADA data, along with quality parametric data, piece counts, rates, and human input, then consolidates and translates that data into a form that is useful for management systems and performance monitors

MES acts as an intermediary between the management system (ERP) and machine controls (SCADA), and other key areas such as quality, product lifecycle management, and reporting. As such, it is the conduit through which plant floor activity is monitored and relevant information passed up to the ERP system's inventory, production control, planning, quality, and other applications. Simultaneously, MES can handle and deliver machine instruction programs, drawings, work instructions, quality management requirements, and the like from the ERP system or from engineering databases in coordination with ERP-generated schedules and instructions. Data c ollected and massaged by MES is critical input for regulatory documentation, quality records, and executive information system use, including those monitors used for industry, regulatory, and Sarbanes-Oxley compliance.

MES provides visibility into activities and events on the plant floor. MES functions also refine and administer plant schedules, collect and manage quality data, help enforce processes and procedures, and provide supervisory functions in conjunction with machine controls. The visibility and functionality provided by MES contribute greatly to a manufacturer's agility, quality, efficiency, performance, and regulatory compliance.

In a fast-changing world, agility is of utmost importance. A manufacturer must be able to identify developing problems and make the appropriate corrections as quickly as possible to avoid waste and be able to meet market demands. With the visibility provided by MES, designers and engineers, marketers, and executives can quickly determine the impact of any proposed changes to product designs or production schedules, and quickly implement the appropriate adjustments.

MES also plays a key role in quality management, supporting compliance efforts, maintaining required documentation and genealogy, and reducing waste and scrap.

It's hard to imagine how a manufacturer can maintain the high level of performance required in today's highly demanding and competitive environment without the capabilities provided by MES.

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