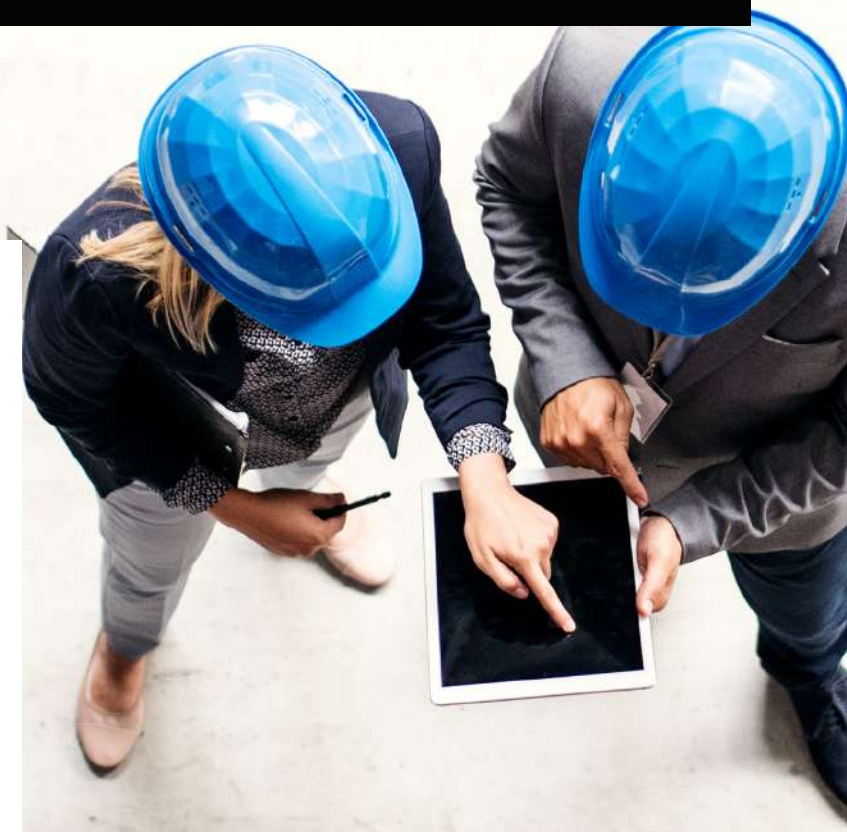
WHITE PAPER

MANUFACTURING AGILITY THROUGH MES EXCELLENCE



AT A GLANCE

This white paper outlines how manufacturing agility is important in today's world of changing customer demand, shorter product cycles, and constant change.

True agility is the ability to change while still controlling costs and quality.

Knowing what's happening on the plant floor is one of the biggest challenges of manufacturing systems and lean manufacturing.

MES communicates directly with the plant floor, providing the right information to the right people at the right time.

Manufacturing agility is increasingly important in today's world of wildly changing customer demand, short product cycles and constant change.

Successful manufacturers don't just grudgingly react to change, they embrace it as an opportunity to get ahead of the competition and gain market share.

Agility is being able to adapt quickly to changing conditions. But it's not just about changing production quickly to meet new requirements – any manufacturer can expedite, change lot sizes, postpone completion of ongoing work or other fire-fighting tactics. But those are expensive and disruptive actions and not a go-forward strategy.

According to the APICS Dictionary, "Agility merges the four distinctive competencies of cost, quality, dependability and flexibility." It's easy to focus on the flexibility alone but true agility is responsive and controlled. And true agility can only be achieved with good internal controls with excellent information management and communications.

TRUE AGILITY IS THE ABILITY TO CHANGE WHILE STILL CONTROLLING COSTS AND QUALITY

Manufacturing, by its very nature, is a collection of complicated processes that bring together people, equipment, and resources (inventory, maintenance, finance, etc.) across the business, along with customers, suppliers, and service providers. Effective management of all of these resources demands accurate real-time data, available across the enterprise, and a clear communications mechanism to relay plans and instructions efficiently and effectively. In manufacturing, those functions are typically addressed by Manufacturing Execution Systems (MES).

Interestingly, many of the same factors that drive manufacturing efficiency and process improvement programs like lean manufacturing (a method of improving production by removing wasted activities) also support agility. Becoming agile, like becoming lean, is accomplished by focusing on what's important (value-adding in lean terms), eliminating waste, and streamlining processes. Lean and agility both benefit from flexibility through reduced change-over time which supports smaller lot sizes and shorter lead times. But those flexible processes must be properly managed and directed.

Before moving on, it may be helpful to note that the boundary between MES on the shop floor and enterprise resource planning (ERP) on the "top floor" that is used for managing the financial and supply chain areas of the business is not clearly defined. An ERP is typically the system of record for the overall business and manages transactions with customers and suppliers as well as accounting for the business. ERP is not designed for the daily details of production but holds so much data needed for production, that it must be effectively connected to the MES. For example, ERP systems typically schedule only to the day (start date, due date) and do not address intra-day scheduling. MES scheduling is more precise, projecting start time/stop time and enabling changes due to priority or escalations within the day or shift.

MES is most widely recognized as the shop-floor system, responsible for:

- Detailed scheduling and dispatching.
- Data collection through direct machine connections, touch screens and barcode scans.
- Quality data collection and quality management including statistical process control (SPC) calculations and displays.
- Messaging and data recording for historical record, regulatory certification, and traceability.

...THE BOUNDARY BETWEEN MES AND ERP IS NOT CLEARLY DEFINED.

No matter which functions you use in which solution, strong links from the plant floor to and from the management systems in ERP are essential for agility. While these are often separate systems, from different developers, integration between the two is of utmost importance. The ideal situation is for a single supplier to develop a single, fully-featured solution from the shop floor to the executive suite working from a common database. The term MES is used in this paper to discuss the shop floor functions and links, but consider that this information must be tightly tied to ERP to complete the closed-loop business planning and management system and deliver the benefits.

Visibility

Visibility is essential to agility. As production jobs are added or changed, the first step to addressing those changes is to understand the impact on current activities. What ongoing work is impacted by this change? When will it be done? Are there enough materials to support new or changed production and if not, can we order them in time? Or can we cannibalize materials from another job that can be delayed? This is a lot of information required to implement a simple change.

Systems function best, and give the best information and recommendations, only when they have timely and accurate underlying data to work with. Data collection on the plant floor, however, may require production workers to perform manual reporting tasks that do not add value to the product and are therefore waste, according to the lean way of looking at things. A lean initiative and value stream mapping would quickly identify reporting as something to be eliminated. Doing so however would effectively blind the ERP system and greatly reduce its ability to direct shop floor activities as well as determining the effect of pending changes on ongoing activity.

The solution, of course, is to make data collection less intrusive on the plant workforce through automation. Direct connection to machine controls and SCADA systems through the plant network is one of the basic functions of MES. The resulting data collected helps in support of quality, scheduling, and documentation such as lot/serial number capture, equipment/worker identification, electronic signatures for regulatory compliance, etc. When MES and ERP are well connected, the same data satisfies the real-time visibility requirement that is essential to increased agility. In addition to direct machine control connections, automated data collection is accomplished through barcode scanning and badge reading as well as entry through shop-floor terminals including touch screens, portable devices (tablets, smartphones and dedicated special-purpose devices), and increasingly through emerging technologies like voice recognition, machine vision, and wearable technology. Admittedly, most of these devices and methods don't completely eliminate operator involvement in data collection, but they do greatly reduce the amount of distraction and the time required to collect and input the data. At least as importantly, the data is more accurate, more detailed, and more complete through real-time computer verification and enforcement. It is also much more timely compared to manual recording and key entry.

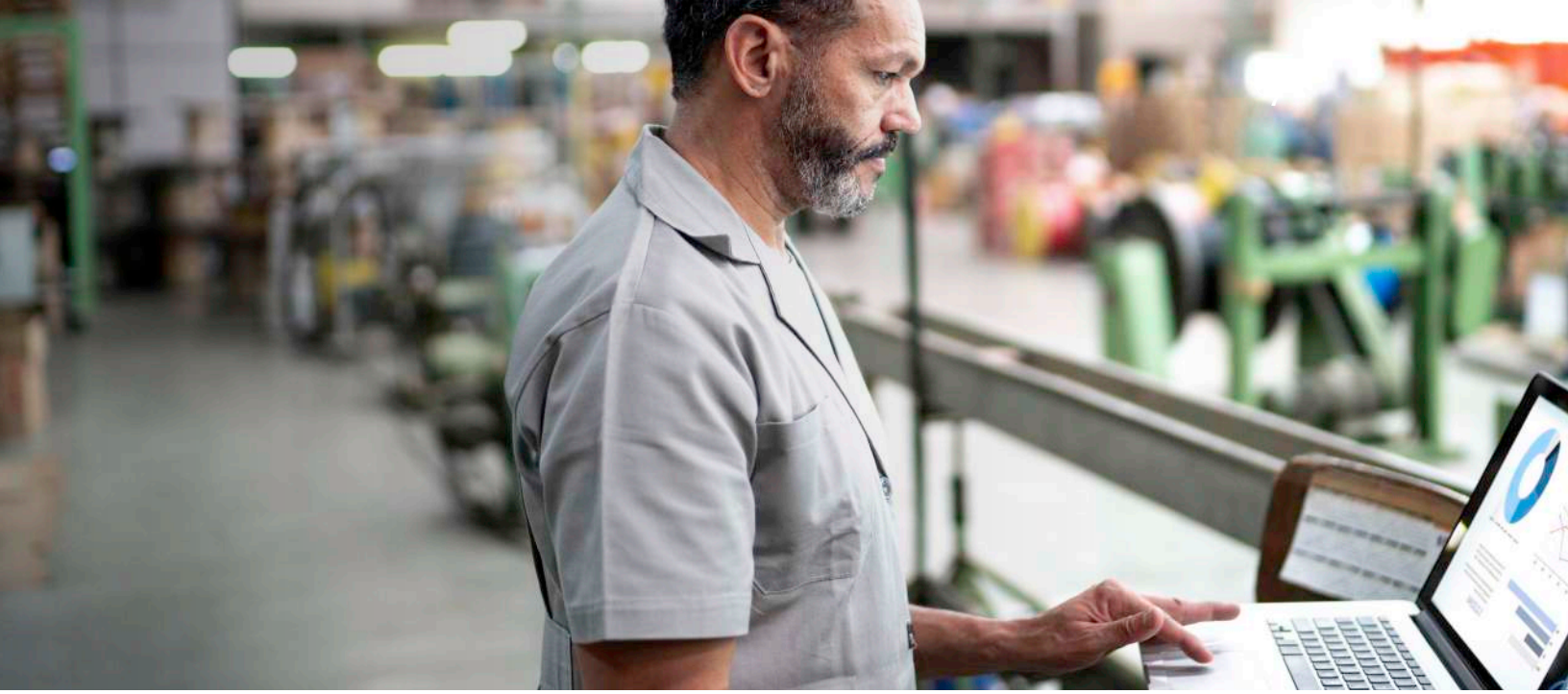
GAINING VISIBILITY ON THE PLANT FLOOR IS ONE OF THE FUNDAMENTAL DILEMMAS OF MANUFACTURING SYSTEMS.

Communications

So far, we've only addressed one side of the equation – data collection for better visibility. Once the system knows of the changed jobs, and has compared that to what's in the warehouse and what's going on in the plant, ERP and MES work together to develop new schedules and the best way to respond to the change, minimizing waste and outlining the speediest and most efficient response.

Then the new instructions must be relayed to every work center, supervisor, manager, procurement specialist, planner, warehouse employee, and perhaps supplier affected by the change. Once again, MES acts as the conduit to the plant floor, providing immediate distribution of the information and directions to where they are needed. Other areas of the business – the warehouse, material handlers, suppliers, etc. may also be affected by the change, so having access to this up-to-the-minute data may be critical for them to do their part of the work. MES typically manages the dispatching function, or communicating which job will be assigned to which machine and communicates directly to the individual work centers. New instructions are immediately updated in that dispatching function and new work instructions, machine programs, priorities, etc. are made available to production workers without delay.

In both cases – visibility (up) and communications (down)--time is of the essence. By removing delays and confusion from both upstream and downstream processes, managers are given the earliest possible notification and the most time to react, while making sure that everything was done properly to make the change without sacrificing quality. An MES helps manufacturers "respond" to change in an organized and timely way versus the disruptive "reaction" typical of companies without an MES in place.



A manufacturer in control

The ability for a manufacturer to increase quality and optimize production is critical in keeping up with ever-changing demand and price pressure from customers. Business systems must provide the capability to collect real-time data on all aspects of manufacturing and the supply chain, and have ready access to data for traceability or quality audits. In addition to insight into the impact of pending changes, increased visibility also opens up the opportunity to identify otherwise hidden opportunities for process improvement and cost reduction. Managers and executives use the insight provided by MES and ERP to develop the best strategy before distributing new instructions to all areas of the company.

Response to changing demand cannot be haphazard or rash. Company leaders need the tools to help them make informed decisions that are timely enough to get ahead of runaway costs, quality issues, or even recalls to deliver great customer service while preserving the organization's quality, productivity, and cost control. MES and ERP working together, or ideally, combined into a single unified solution, provide those tools and allow manufacturers to deliver controlled agility. As listed in the APICS definition, "Agility merges the four distinctive competencies of cost, quality, dependability and flexibility." And all four are required for true success as an agile and responsive manufacturer.

ABOUT PLEX

Plex Systems, Inc.® delivers the first smart manufacturing platform that empowers the world's leading innovators to make awesome products. Plex gives process and discrete manufacturers the ability to connect, automate, track and analyze every aspect of their business – from the shop floor to the top floor – to drive business transformation. Built in the cloud, the Plex Smart Manufacturing Platform includes MES, ERP, supply chain management Industrial IoT, and analytics to connect people, systems, machines, and supply chains, enabling them to lead with precision, efficiency and agility in an ever-changing market.

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