CAI

EBOOK

# MES

## THE COST & THE BENEFIT

# Considering a Manufacturing Execution System?

For the last two decades, Manufacturing Execution System (MES) has been a hot topic at nearly every automation conference and for good reason. MES is a powerful tool that can deliver process efficiencies, yield improvements, cost avoidances, right first time, and much more. For a number of organizations, the process for choosing an MES begins with contacting their current automation supplier. Alternately, the process may begin with attendance at a trade show or conference that presents case studies promoting a particular product or solution. When supplier or product familiarity become the driving force behind product selection, very little analysis goes into the requirements or the business case prior to making the procurement decision. Generally speaking, the organization has "hot buttons" and makes these the focus of their search. Such an approach can be a costly mistake. The supplier vehemently asserts that their product directly addresses the client's concerns. Let's be honest, in most cases, the supplier doesn't identify which features are fully supported, those which will require extensive configuration, or those that will require customization. And when customization is necessary, the supplier's estimate is sure to be optimistic. Furthermore, if the system will be used in a regulated industry, the effort required to validate the customizations is sure to be underestimated as well. There is likely little discussion of how the customization may complicate lifecycle support and product upgrade. Above and beyond the failure to identify the system's requirements prior to MES selection, a genuine cost/benefit analysis is rarely conducted.

These selection considerations notwithstanding, let's look at the business drivers behind selection. Generally speaking, once the MES conversation takes hold in an organization, it is assumed that the business is going to purchase a new product and integrate it with current process control and information systems. However, the first question a business should ask is, "Do we need a comprehensive MES product, or will we benefit most from a few select MES features?" Before the conversation goes too far, the business should evaluate the full MES feature set to quantify each feature's value in terms of return. This evaluation of MES features is particularly important if the MES supplier provides a modular product that has a licensing model based upon its modularity; the user can eliminate license costs for features that won't provide a benefit, offsetting the license cost and thus reduce the Total Cost of Ownership (TCO). Out of the myriad of MES features, it has been our experience that the most commonly implemented and beneficial MES features are Automated Process Orders, Electronic Production Records, Weigh and Dispense, Track and Trace, and Electronic Logging. Of the remaining MES features, many businesses will have implemented these features in their Enterprise Resource Planning (ERP) system or other information management systems. Such features commonly implemented in the ERP include Manufacturing Scheduling, Product Definition, Master Recipe Management, and Resource Management to name a few.

Although these features are considered to reside in the MES feature domain, they are typically already accounted for in the business's process model and have been implemented in other information management systems. If there are a small number of MES features that will deliver a significant value, like the features mentioned above, a full business case should be developed to determine the best course for implementation.

Before laying out the complete business case, let's look at an approach that may not have been given sufficient consideration. If a few MES features will deliver the majority of the value of the MES, do you already have a platform in place that could deliver these features and their subsequent value? Do you actually need to purchase a new product? For many organizations, the answer to the former question is yes, you already have a platform that can deliver the key functions. Most of the customers we work with have process data historians. In fact, in regulated industries, most of our customers have one of two products. These two industry-leading products have the necessary components to deliver a number of MES functions. These two primary solutions provide continuous data historians, contextualized data historians, manual data entry tools, reporting and visualization tools, and software development kits. These solutions can be configured to support a number of MES features, usually at a significantly lower cost than a traditional MES solution. This is particularly true when it comes to electronic batch reporting. With little effort, both of these data historian products can be configured to use the process context captured from the process control system (PCS) to aggregate instrument values. These aggregated values can then be stored as batch parameters in the contextualized data historian.

Let's take a look at a simple example. Let's say we have a Steam In Place (SIP) phase in our unit procedure. During the SIP phase, the PCS monitors a number of temperature instruments to ensure that a minimum temperature is held for a designated period of time to obtain a required lethality. In this case, the SIP phase start and end times, the context for the phase, are being acquired and stored in the continuous data historian. Likewise, the instrument values are being acquired and stored in the continuous data historian. Tools associated with the contextualized data historian can be configured to aggregate the instrument values over the context of the phase to calculate the minimum temperature value held during the SIP phase. This aggregated value can be stored in the data historian where additional context information such as batch ID, unit, operator, etc. can be applied. The data historian can be configured to store all the critical process parameters for a batch in a product, process, batch hierarchy. These stored critical process parameters provide the basis for an electronic batch record.

Once the critical process parameters are stored in context, we have the ability to perform analysis across batches and to provide the real basis for Manufacturing Intelligence—the transformation of process data into process information and process information into process knowledge.

Furthermore, when all the process parameters are stored in a batch context, additional information can be readily integrated into the hierarchy. For example, assay values from a Laboratory Information Management System (LIMS) can be integrated into the batch hierarchy to provide yield calculations for the batch. Calibration and maintenance information can be integrated into the hierarchy to determine the impact of calibration and maintenance on yield and quality. As another example, process context from the PCS can be integrated with Building Management System (BMS) data to indicate when a cleanroom is in use. BMS data for differential pressure and flow rates can be integrated into the hierarchy to demonstrate that the room was within specifications during cleanroom activities. If automated environmental monitoring (EM) equipment is available, likewise, this data can be integrated into the cleanroom hierarchy as well to demonstrate that the room was in specification. No longer is it necessary to sift through BMS or EM data to conduct out-of-specification investigations. A third example achievable with modest effort is automated process orders, referring to the consumption of raw materials and posting of yields from/to a materials management system. To determine product consumptions, product addition context from the PCS can be used to calculate deltas of weigh cells or level indicators. These product additions can be stored in the process hierarchy and at the end of the unit operation, phase, or batch, can be applied to the materials management system transactionally. Such a solution can eliminate the need to perform shop-floor keying of consumptions and yields by operators in an ERP system thus reducing the number of defects produced by keying errors and improving the process efficiency by eliminating process steps. As stated above, many clients already have the tools in place to deliver these types of solutions at a fraction of the cost of a full MES implementation.

Finally, here are some things to think about when developing the MES business case. If a large MES project costs in the neighborhood of $5M - $10M (excluding the costs of the PCS and data collection infrastructure), in terms of process efficiencies, cost avoidances and yield improvements, what is the payback period on that $5M - $10M investment? My guess is that most of the implementation team will be retired long before that period is reached. Consider also the "do nothing" case. What will be the total loss and risk if the business continues to operate as-is over the same period? When considering the case of a comprehensive MES solution, evaluate the MES features that will yield the greatest return on investment. These features are likely the ones that will significantly reduce cycle time or eliminate errors and reprocessing. Returning to the theme of this paper, consider also the case of implementing these high-return features utilizing a contextualized data historian and its associated tools. This last case may require some thinking outside of the box, but there are huge savings and rewards available to those who are willing to consider it.