CIMx SOFTWARE
The Leader in Paperless Manufacturing

Selecting a Manufacturing Execution System (MES)

Executive Summary

This white paper offers a basic introduction to the MES selection process. Insights offered in this paper are developed from customer interviews, market research, and real-world project experience. After reading, stakeholders will understand the selection process and be equipped with criteria for choosing an MES solution provider. These criteria greatly reduce risk and position a project to be completed on time and within budget while achieving the expected Return On Investment (ROI).

Contents

1. Establish need (Do we need an MES solution?)
2. Determine Functionality (What do we want the system to do?)
3. Forecast future needs (Can we continue to meet the needs of a changing industry?)
4. Begin selection process (What is the best solution?)
5. Calculate total investment (What will this cost us?)
6. Create implementation plan (How are we going to do this?)

A Manufacturing Execution System, or MES, is a software solution used to manage, control and document manufacturing operations. A successful MES project improves productivity by managing all of the information needed during the manufacturing process, collecting and documenting all production data, and ensuring real-time access to the production information.

Selecting an MES is a critical task for manufacturers. A successful MES implementation should improve production and quickly add value, while failure could leave a manufacturer with a number of shop floor challenges hindering efficiency. The guidelines outlined in this paper will reduce risk in the MES selection process.

1. Establish Need

Do we need an MES solution?

Understanding and carefully assessing why you need an MES solution will help guide the selection process. There are numerous potential reasons why manufacturers look for MES solutions, including:

- **Enabling more control over or improving production**; an MES solution ensures accurate information, collects quality and production data, and manages an accurate archive of as-built information, enabling better control of production operations and faster response to problems when they occur.

- **Integrating production with company operations**; an integrated MES system ensures the company has timely and accurate product information to make effective decisions.

- **Standardizing information across company operations**; a cost-effective software solution which standardizes operations and is optimized to meet the unique process needs of each location will lower the cost of support and training.

- **Meeting customer requirements for record keeping**; many industries require archived production documentation for the lifetime of the product. New FDA regulations also require companies to more accurately document production. MES can automatically record and archive production data.

- **Implementing sustainable quality improvements**; lean initiatives, lean manufacturing, and Six Sigma initiatives improve shop floor efficiency, but can be difficult to sustain. An MES can ensure procedural enforcement to sustain process improvements.

You may have a reason not mentioned here to study MES solutions. No matter your reason, the initial assessment should guide the selection process. The solutions you research should have the functionality that matches your companies current business needs.

Guideline: MES projects can improve control, provide complete product documentation, increase profit, and simplify the production process. Before you begin researching MES providers, understand your core motives for an MES solution and the challenges you will solve with the system. This should guide your selection process.

2. Determine Functionality

What do we want the system to do?

Once you have identified the shop floor challenges you will solve, you will define the necessary functionality of the system. To avoid a project bigger, more complex and expensive than necessary, control the scope by defining the contributions to your business process in the MES, and determine the ROI of each. Prioritize items which quickly add to the ROI and make positive contributions to the business.

The core functions of an MES solution could include:

1. real-time, accurate information needed during manufacturing process;
2. complete shop floor data in one database;
3. rapid, accurate communication between stakeholders;
4. archival of production information and creation of an accurate, complete as-built record;
5. real-time analysis of current production.

When writing an RFP or RFQ, the following items will influence the final cost of your software solution:

- Ease and cost of training;
- Ease and cost of enhancements as shop processes change;
- Ease and cost of integration within the existing infrastructure;
- A fixed fee pilot or initial installation.

Include these items in the RFP or RFQ to best evaluate the MES systems.

An MES will include other functions, but these should be the core functionality. Once you have identified the core functions, analyze other features using the ROI contribution test to determine what functionality to include in the list of requirements to ensure the ROI and maximize usability of the system.

Guideline: Once you have identified the core functionality for an MES system, create a list of additional functionality and determine the ROI of these items before adding it to the solution.

3. Forecast Future Needs

Can we continue to meet the needs of a changing industry?

As technology grows, the marketplace adapts, and manufacturing processes are refined, the environment and need for an MES will change.

For example, the need for a mobile manufacturing solution is growing. Ten years ago, few would imagine shop floor workers using a tablet or cell phone to make quality checks or to consult work instructions, but now it is easy to imagine. When considering an MES solution, it is important to look at how change and updates are handled in the system. Without the ability to update the MES solution, or make changes as new technology and processes are implemented, you risk the solution becoming legacy software.

There are three types of MES solutions - *Out of the box* (OOTB), *Tool Sets* linked to a solution using custom code, and *Custom Code* solutions. An OOTB solution is a ready to install and configure application to meet your process needs, while *Tool Sets* and *Custom Code* are applications written to meet your specific process needs.

As a general rule, solutions built with custom code are more difficult and more costly to upgrade or change. Many times, changes will require significant IT investment or the original programmer to make significant revisions to the system, which will incur service charges. Solutions with custom code are best suited to capture the needs of a manufacturer at a specific moment in time, and are not designed to be easily upgraded or modified.

OOTB solutions will most times be supported by the company developing and marketing the solution. Development costs for an upgrade or update are shared by all the companies using the solution. Many times there will be a licensing cost or service charge for an upgrade, but the upgrade itself is as simple as a download.

As you consider possible MES solutions, look at how upgrades and modifications will be handled, and how important it is for your business to have access to modifications.

Guideline: To reduce risk of schedule slippage, cost over-runs, and increased Total Cost of Ownership (TCO) an MES system should be agile and adaptable enough to manage change. Address system change management and updates in your list of features. Your goal should be a fully-functional MES that will add value as business needs change. Solutions that quickly become obsolete or can't adapt to meet market or business needs will disastrously impact the ROI.

4. Begin Selection Process

What is the best solution?

Once you have defined the shape of the solution, you'll find yourself confronted with an array of options. One option is using your current ERP (Enterprise Resource Planning) or PLM/CAD (Product Lifecycle Management/Computer Aided Design) system to provide MES functions. Unfortunately, in most cases the transaction-based software of an ERP cannot efficiently meet the design and work flow-based needs of manufacturing. Because it was not designed to manage the work process flow of manufacturing, an ERP system will constrain efficiency and add risk and complexity to the manufacturing process. A fully-functional MES was designed to meet these specialized needs.

Watch out for "least common denominator" solutions which potentially reduce, rather than increase, the efficiency in some locations. Your MES should quickly and easily allow local optimization at each location or production line without the need for custom code.

Another option you will face is whether to use Custom Code or an Out-of-the-Box (OOTB) MES solution. Advantages of custom code include:

- a system with exactly the features and functionality you want;
- no extra features, with a focus on your current processes;
- and a system in use by no other manufacturer.

However, there are disadvantages to custom code. Changing custom code and adding functionality once the solution is developed is time-consuming, expensive, and adds complexity. Support for custom code is usually outsourced, and the cost of services to enhance or upgrade the system is high, especially if different code must be written and tested for multiple sites.

An OOTB solution offers benefits that include:

- quick installation;
- shortened learning curve for end users;
- ability to "see and touch" features before purchasing;
- and is less expensive.

A point to consider – an OOTB solution may not have 100% of the functionality you need, requiring additional coding to address this issue. The solution may also use proprietary code that requires service from the provider. When considering an OOTB solution, investigate the service charges that may be required of the solution, and how much capability will internal IT resources have to optimize the solution.

> As a general rule of thumb, OOTB solutions should meet at least 80% of all process needs before additional functionality and code is necessary. If a solution does not meet this standard, look for more robust software on the market.

Another point to consider is cloud-based solutions. Many companies are moving slowly toward cloud-based with SaaS (Software as a Service) pricing model. There are advantages to a cloud-based MES, including less need for internal IT services and security of data and system back-ups. There are risks and challenges as well. Many times, cloud-based solutions mean company data is held offsite by a 3rd party vendor. There are challenges to integrating a cloud-based solution with enterprise systems that aren't cloud-based.

As you evaluate possible MES solutions, study more than the functionality. Look at other benefits and potential challenges of each before making a final selection.

Guideline: Watch out for solutions that partially improve productivity, quality or efficiency without fully achieving the expected ROI, or systems that offer more challenges than solutions. They will add risk and complexity and will constrain future optimization.

5. Calculate Total Investment

What will this cost us?

The initial implementation investment cost includes the purchase of the software, purchase of services from the provider, purchase of hardware for your shop, and the cost of internal staff in planning, training, and implementing the solution. Other costs, such as software maintenance, service fees, and staff support costs, will add to the investment. In addition, upgrades may be needed as your processes change. The grand total of your investment up to the time you replace the software with another solution is the Total Cost of Ownership (TCO), a more accurate way of studying potential costs of an MES solution. Once the TCO is calculated, compare this to the ROI you developed to generate a net benefit of the MES, which will be used in finding funding for the project among Executive Leadership.

There are a few points to consider as you look at TCO. If the MES solution has a low initial investment, but will need expensive upgrades or becomes obsolete quickly, the TCO will be very high. Study potential service charges that may be incurred for maintenance of the solution. Many times, companies will offer a lower cost for the initial investment, but require costly service charges. Look for solutions that offer a low cost initial investment that delivers an adaptable -solution that is easily upgraded and requires little service provider support – keys to a low TCO.

Beware of service providers that offer a software license fee with an open-ended time and material proposal. These are often used to provide functionality and compatibility, but could potentially lead to a high-risk project that misses schedule and budget goals. Look for fixed-fee service contracts that meet your process requirements.

> One frequent result of an MES implementation is the discovery of additional benefits to quality and efficiency in the MES solution. In order to capitalize on the efficiencies, the priority and order of subsequent phases of the project will need to be reassessed. In other words, the actual project requirements become a moving target with changes as the project progresses.

Guideline: When considering the cost of your MES solution, study the Total Cost of Ownership (TCO) to more accurately forecast investment costs. The TCO considers costs over the lifetime of your solution.

6. Create a Schedule and Implementation Plan

How are we going to do this?

A well-crafted implementation plan is an important part of a successful MES project. Here are a few guidelines to follow as you craft an implementation plan:

- Establish an implementation team including key stakeholders involved in the project (operations, IT, and shop users);
- Ask an executive with decision-making authority to mentor the implementation team;
- Create a plan focusing on major ROI contributors and save other requirements for later phases;
- Implement phases with short-term deliverables so progress can be seen;
- Evaluate deliverables for benefit and impact on later phases.

> You will need a champion for the MES project on the executive team who can ensure buy-in and funding for the new system. Win support using targeted demonstrations and project trials. Once recruited, this champion can also act as a mentor for the implementation team.

When planning a project, it is extremely important to show progress. A successful project schedule is built around small phases with measurable results to show “real ROI.”

Many projects with a long schedule run into difficulty as requirements or business needs may change during the implementation period, leading to change orders that add to the time and cost of the solution. As the schedule and cost increase, the original energy and internal buy-in for a project decrease, and it becomes increasingly difficult to deliver a successful project.

This is also a danger for the manufacturer. If a project takes a significant amount of time from internal resources, or there is a long training period or a lengthy conversion process from current work instructions to a new format, then there will be less internal buy-in for the project there will be increased risk of workers not using the new system.

Guideline: A short schedule or a project with short, focused phases where stakeholders can quickly see and touch the solution is usually the lowest risk, lowest cost solution with the fastest buy-in from users. In many cases, implementation success or difficulty will determine the ultimate success of the MES system.

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An MES solution can quickly deliver a positive ROI for a manufacturer, improving quality, efficiency and productivity, but there are risks associated with the selection process. Using the guidelines discussed in this introduction to MES selection will help alleviate the risk and ensure a positive ROI.