WHITE PAPER

Center of Excellence in Multisite MES Implementations

Benefits of Standardizing Manufacturing Processes and Systems

By João Cortez
Co-Founder and Product Manager at Critical Manufacturing

Critical manufacturing
an ASMPT company

Index

Center of Excellence in Multisite MES Implementations

Manufacturing companies with multiple sites can realize significant benefits by standardizing and reusing manufacturing processes, operations, and systems – while at the same time remaining responsive and agile to ever changing requirements and business conditions – all within a reasonable cost.

Why an MES Center of Excellence?

The deployment of an MES in any manufacturing company provides many benefits, but it is a significant undertaking that involves a lot of people, departments and organizations, and it represents a major investment. For an enterprise with multiple locations, it would be prohibitively expensive to carry-out MES implementation projects in isolation for each site. Since the introduction of an MES provides an opportunity to rethink and optimize several processes and workflows, the introduction of a corporate MES baseline provides an excellent opportunity to standardize and harmonize manufacturing operations and best practices across the different sites, while taking advantages of economies of scale to leverage the benefits of a common enterprise investment. Table 1 provides a summary of the Center of Excellence (CoE) benefits.

What is an MES CoE?

An MES CoE consists of a central organization that provides governance and that manages an enterprise level MES baseline. The typical responsibilities are described in Table 2.

CoE benefits	
Cost reduction and improved ROI via economies of scale	• The enterprise is better positioned to negotiate better license, maintenance and service terms from the MES and other vendors. • The MES baseline is only developed once, and then it's rolled-out to every site so that benefits can be leveraged by the whole enterprise. Furthermore, a standard MES baseline enables that multiple sites run their MES from the same instance.
Improved standardization and harmonization	• The MES baseline enforces certain standards, workflows, and business processes across the different sites where it's deployed.
Easier knowledge sharing and exchange	• People from different sites can communicate in a common language, can easily interact with the MES from other sites, can easily exchange data, and can quickly understand and analyze KPI values.
Continuous improvement and innovation	• Improvements, innovations, and best practices are quickly disseminated throughout the whole organization.

Table 1

CoE responsibilities	
Define enterprise and site boundaries	The CoE must define what is managed by the CoE as a central organization and what must be handled by each site.
Manage enterprise level requirements	The CoE must collect, consolidate, and prioritize the enterprise level requirements for the different MES functional areas as well as the MES non-functional requirements. The CoE must manage the authoritative set of enterprise requirements, also considering innovation and strategics aspects of the corporation.
Manage MES baseline principles	The CoE must govern the set of MES baseline principles, such as naming conventions, modeling principles, object attributes and KPI calculations.
Disseminate MES baseline best practices	The CoE must compile, promote and disseminate MES baseline best practices across the different sites to ensure that every site benefits from the best solution to common problems.
Manage the MES baseline roadmap and development	The CoE must take into consideration all the constraints and milestones from the different sites, the priority of the different requirements and the roadmap of the MES vendor to create a MES baseline roadmap. Once the MES baseline roadmap is defined, the development of each release must be planned and executed. It is the responsibility of the CoE to ensure that release meets the necessary quality and documentation standards.
Manage the site deployment roadmap	The CoE must coordinate the deployment plan of the different releases with each site. It is recommended that the deployment or upgrade project is driven by each site with articulation and support from the CoE.
Provide MES baseline training & support	The CoE must provide training materials for each MES baseline release. Furthermore, the CoE is responsible for providing support for the MES baseline, involving MES and technology vendors when appropriate.

Table 2

The typical MES CoE organization

The CoE comprises of a central organization that must guarantee representation and communication with the different sites for the different aspects of the MES baseline. Note that the organization is considered central because it manages the enterprise MES baseline but the people that make up that organization can (and often are) distributed across the different sites. Having the organization distributed across the sites improves communication and buy-in of the different sites, but it comes with an increase in the effort and difficulty to coordinate this central organization.

A typical CoE organization consists of the core sub-organizations that are responsible for defining the content of the MES baseline described in Table 3 and supporting sub-organizations that are responsible for the realization and deployment of the MES baseline described in Table 4.

CoE core sub-organization	Description of responsibilities
Manufacturing	Represents the Manufacturing department across all sites for the purposes of requirements management, functional design and release acceptance. It is concerned primarily with the manufacturing operations of the operator, line controller, production supervisor and shift leader.
Engineering/R&D	Represents the Engineering/R&D department across all sites for the purposes of requirements management, functional design and release acceptance. It is concerned primarily with the process, product, equipment and materials engineers.
Quality	Represents the Quality department across all sites for the purposes of requirements management, functional design and release acceptance. It is concerned primarily with quality processes as well as the quality engineer, and quality assurance personnel.
Planning & logistics	Represents the Planning & logistics department across all sites for the purposes of requirements management, functional design, and release acceptance. It is concerned primarily with materials, resources and production planning as well as materials logistics and enterprise resource planning (ERP) integration.
Maintenance	Represents the Maintenance department across all sites for the purposes of requirements management, functional design, and release acceptance. It is concerned primarily with the maintenance processes of the maintenance engineers and maintenance technicians.
Equipment integration & automation	Represents the Represents the Equipment Integration & Automation department across all sites for the purposes of requirements management, functional design, and release acceptance. It is concerned primarily with aspects related to equipment integration as well as with factory automation.
Technology & architecture	Represents the IT department across all sites for the purposes of technology and architecture. It is concerned primarily with aspects related to software, hardware as well as non-functional requirements such as performance, high-availability, scalability, security, and data protection.

Table 3

CoE supporting sub-organization	Description of responsibilities
CoE management	• Executing the strategy and direction as set forth by the steering committee, and thus it has overall responsibility for the CoE organization and coordination.
Deployment management	• Articulating and coordinating with the different sites for the deployment of the different MES baseline releases. • Providing dedicated resources to facilitate and expedite the site deployments.
Release management	• Integrating all the demands and requirements from all other sub-organizations into a release plan, and then to manage the implementation of the releases according to the plan and to the specified quality and documentation standards. • Making sure that the necessary user documentation and training materials are completed and up to date. In some cases, this organization is also responsible for training the sites in a train the trainer model.
Vendor management	• Negotiating contracts and terms of the MES vendor and other suppliers, and to monitor their performance.
Support	• Providing MES baseline support and involve the MES and other vendors when appropriate.

Table 4

For accountability and execution purposes, it is strongly recommended that the CoE organization overall and each CoE sub-organization have a single named leader.
Each sub-organization, with the notable exceptions of release management, vendor management, and support must have a representative at each site to ensure that it is represented in the respective CoE sub-organization. Depending on the number of sites, it can be further organized into by region or by business unit. Each site must also have a named local MES leader that can both plan the deployments at the site and coordinate site specific developments according to the boundaries and guidelines set forth by the CoE.

A CoE must be supported by a steering committee that consists of the enterprise executive sponsors of the CoE, the CoE leader and MES leaders of the different sites. The steering committee must meet at least once per year and whenever is needed. CoE steering committee responsibilities are described in Table 5.

CoE steering committee responsibilities	
Set strategic direction	Sets the mission, purpose, objectives, boundaries and constraints and overall strategic direction for the CoE.
Provide guidance	Provides guidance and advice and makes recommendations to the CoE.
Allocate resources	Provides the necessary resources (including personnel and budget) to support the CoE activities.
Monitor progress	Monitors the progress and performance of the CoE.
Resolve conflicts	Whenever required, it resolves problems or conflicts, including defining priorities and making binding decisions.

Table 5

Figure 1 Standard CoE organization

CoE MES baseline models

An MES baseline will always represent a trade-off between more centralized standardization and more site autonomy and flexibility. Also, an enterprise may have different business units that have little commonality among them. The first and most critical decision that must be made when creating a CoE is to define the MES baseline model that will be implemented in the organization. Figure 2 illustrates some possible baseline models that are described in more detail in Table 6.

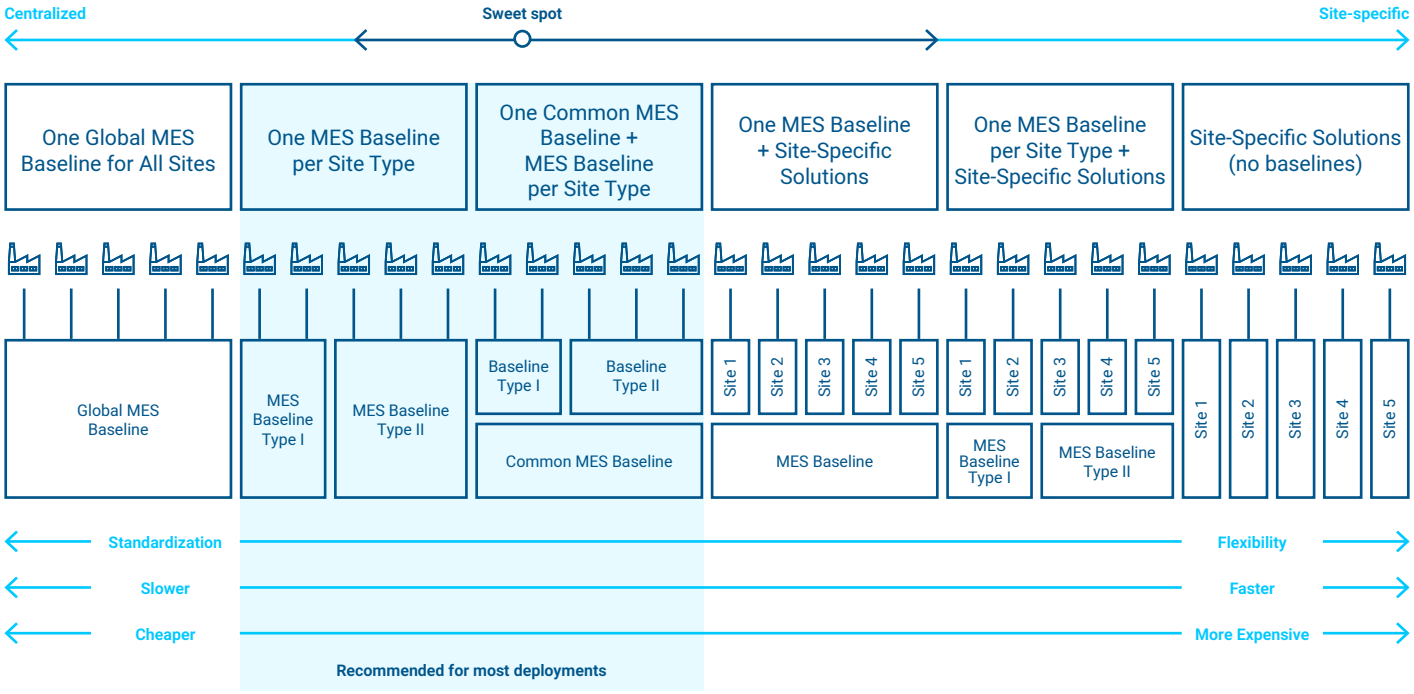

Figure 2 MES baseline models

Baseline models	
One global MES baseline for all sites	• There is a common global MES baseline that is the same for all sites. While this would be the ideal model, it is often difficult to implement due to the variety between business units and sites, slow speed of development and lack of flexibility to accommodate site specific requirements.
One MES baseline per site type	• The sites are grouped by type according to their commonality in terms of manufacturing processes • In this model there's one MES Baseline per site type with each MES Baseline being maintained independently.
One common MES baseline + MES baseline per site type	• In this model there's one common MES Baseline for every site, plus an additional baseline that is maintained per site type and that is created on top of the common MES Baseline.
One MES baseline + site-specific solutions	• In this model there's a common MES Baseline, plus a site-specific solution that is managed by each site and that runs on top of the common MES Baseline.

Baseline models	
One MES baseline per site type + site specific solution	• In this model there's a common MES Baseline per site type, plus a site-specific solution maintained by the different sites and that runs on top of the site type MES Baseline.
Site-specific solutions (no baselines)	• In this model there's no common baseline, only site-specific solutions. In this model, there's no need for a CoE since there's no need for standardization or harmonization.

Table 6

MES standardization levels

When discussing CoE MES baseline models, it is also possible to consider different MES standardization levels. These MES standardization levels are listed in Table 7. It is worth mentioning that moving towards an increased level of standardization makes the turnaround time longer for new site requirements.

MES baseline development and deployment

The MES baseline development follows a normal software development process. Currently, it is common and recommended to use an agile development method for quick feedback and flexible scope adjustments.

Release planning

Each MES baseline release needs to be planned. The different CoE core sub-organizations are responsible for managing their respective backlog by getting input from the different sites and also by understanding the MES vendor roadmap (which they should try to influence). It is the responsibility of the CoE release manager to consider the backlogs of the different sub-organizations and any site constraints and milestones together with the MES vendor release roadmap to come up with a MES baseline release plan. This release plan must define the scope and date for the next release(s). This process is illustrated in Figure 3.

MES standardization levels	
0	No common MES solution. Different sites use different commercial solutions and/or home-grown solutions.
1	Sites use the same commercial solution, but each site implements it on its own.
2	Sites use the same commercial solution and try to reuse parts of the solution on a best effort basis without a formal CoE organization in place and without a MES baseline.
3	Sites use the same commercial solution, there is in place a CoE organization and sites use a defined kind of baseline.
4	All sites use the same MES baseline. Site flexibility is provided by configuration level only and under the guidelines defined by the CoE.

Table 7

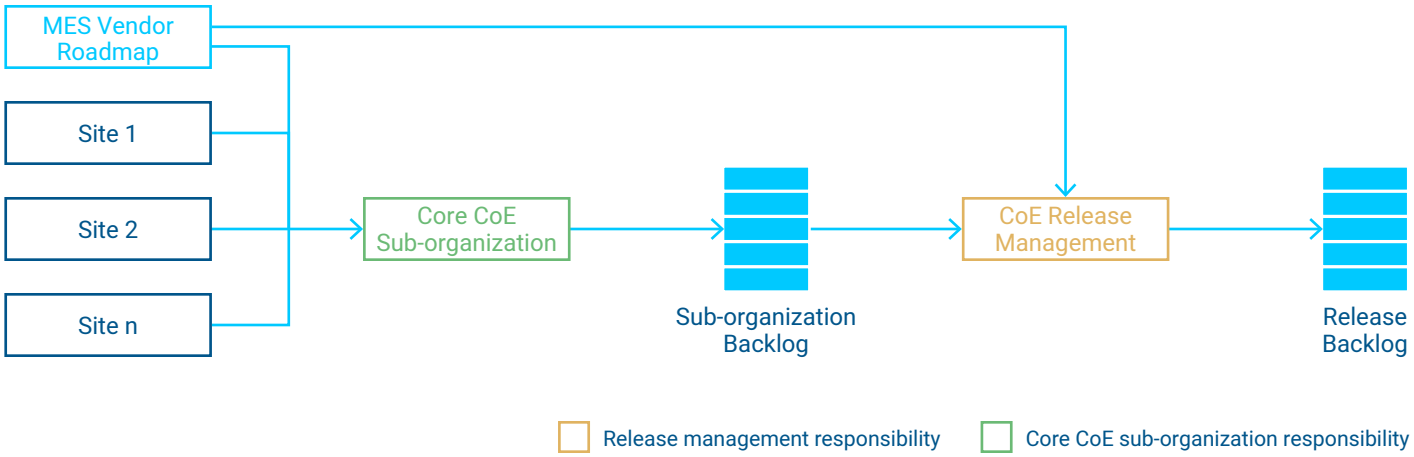

Figure 3 MES baseline release planning

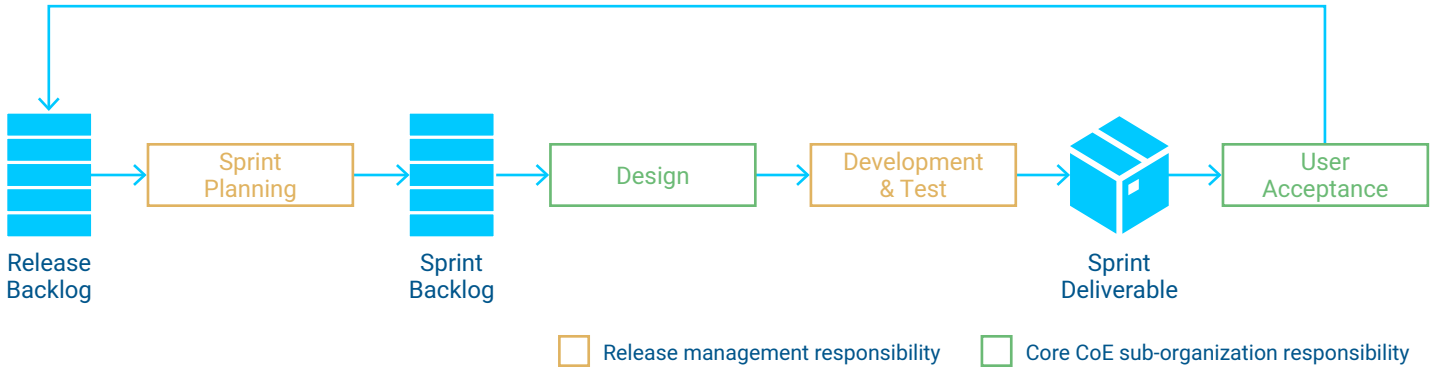

Figure 4 MES baseline release development

Release development

After a scope and timeline has been defined for a release, the development can start. The release management sub-organization is responsible for the delivery of the MES baseline release on time, on scope and on budget. The CoE for the different core sub-organizations must be involved in the design and acceptance of the deliverables for the features under their responsibility. An agile methodology provides early feedback and thus the opportunity to detect and correct any issue long before the release is complete. This release development process following an agile methodology is illustrated in Figure 4.

Release deployment

The CoE deployment management sub-organization is responsible for planning the roll-out of the different MES baseline releases to the various sites. This sub-organization must take into account the different site constraints and milestones and must involve the sites in the planning of the deployment or upgrade activities. The CoE may assign resources to assist in the deployment, but for better buy-in, it is recommended that the deployments are owned by the site and supported by the CoE. Depending on the number of sites, the complexity of the deployment and the availability of resources, deployments may be carried out sequentially or in parallel. Figure 5 provides an example for a MES baseline deployment plan.

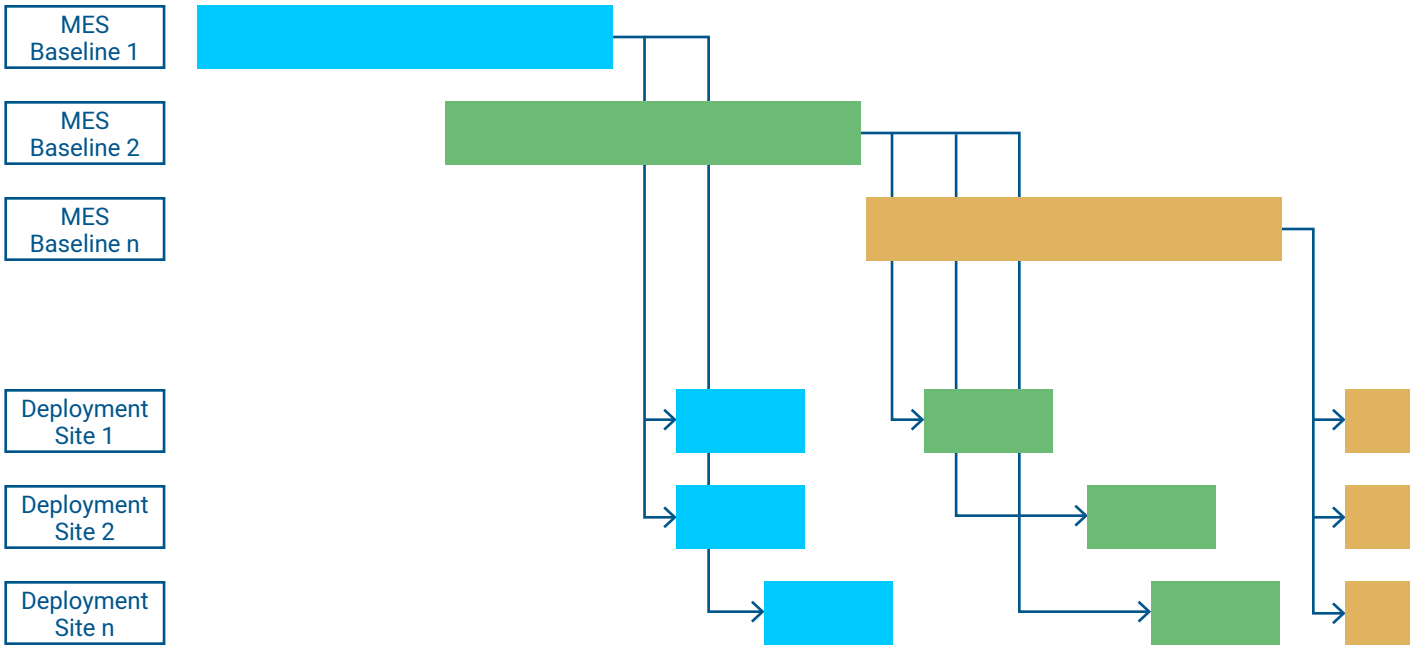

Figure 5 MES baseline deployment plan example

Lessons learned

When embarking on a CoE journey, there are some lessons learned from some CoE experiences that are important to keep in mind, such as:

1. A CoE must be initiated and supported by a team of corporate executive sponsors that must communicate the CoE strategy clearly and get buy-in from the different sites.
2. Good communication, coordination and articulation between the CoE and the different sites is key.
3. Sites must be involved and actively participate in CoE activities. Furthermore, it helps in gaining buy-in if the sites are represented directly in the CoE organization and if the sites get ownership of the deployment projects.
4. The center of competence and baseline approach must be sufficiently agile to address the plant requirements in a timely manner.
5. The baseline must contain sufficient flexibility that the sites will still retain some autonomy in the configuration and utilization of the system.
6. A good application lifecycle management (ALM) system is required to support the requirements management, release planning, design, development, testing, deployment and support processes.

Conclusion

A Center of Excellence (CoE) represents a significant investment, but it can provide major benefits in terms of standardization, harmonization, and cost. The CoE approach is not something to be taken lightly. Before setting up a CoE, the strategy, goals, organization, processes, working mode, communication channels must be carefully planned and then be well documented and communicated. Furthermore, this setup must be re-evaluated periodically to resolve any issues that are not working well and to check for improvement opportunities. When implemented and executed well, the company can enjoy fruitful rewards and gain a competitive edge.

ABOUT THE AUTHOR

João Cortez holds a Computer Science Engineering Degree from University of Minho. He began working with MES in the semiconductor industry in 1997 and he has held different positions related with manufacturing software and software architecture. Cortez is one of the founders of Critical Manufacturing having held the role of Product Manager since joining the company in 2009. As a Product Manager, Cortez leads the Critical Manufacturing MES product design and roadmap.

ABOUT CRITICAL MANUFACTURING

Critical Manufacturing provides the most modern, flexible and configurable manufacturing execution system (MES) available. Critical Manufacturing MES helps manufacturers stay ahead of stringent product traceability and compliance requirements; reduce risk with inherent closed-loop quality; integrate seamlessly with enterprise systems and factory automation and provide deep intelligence and visibility of global production operations. As a result, customers are Industry 4.0-ready. They can compete effectively and profitably by easily adapting their operations to changes in demand, opportunity or requirements, anywhere, at any time.

To learn more visit: www.criticalmanufacturing.com