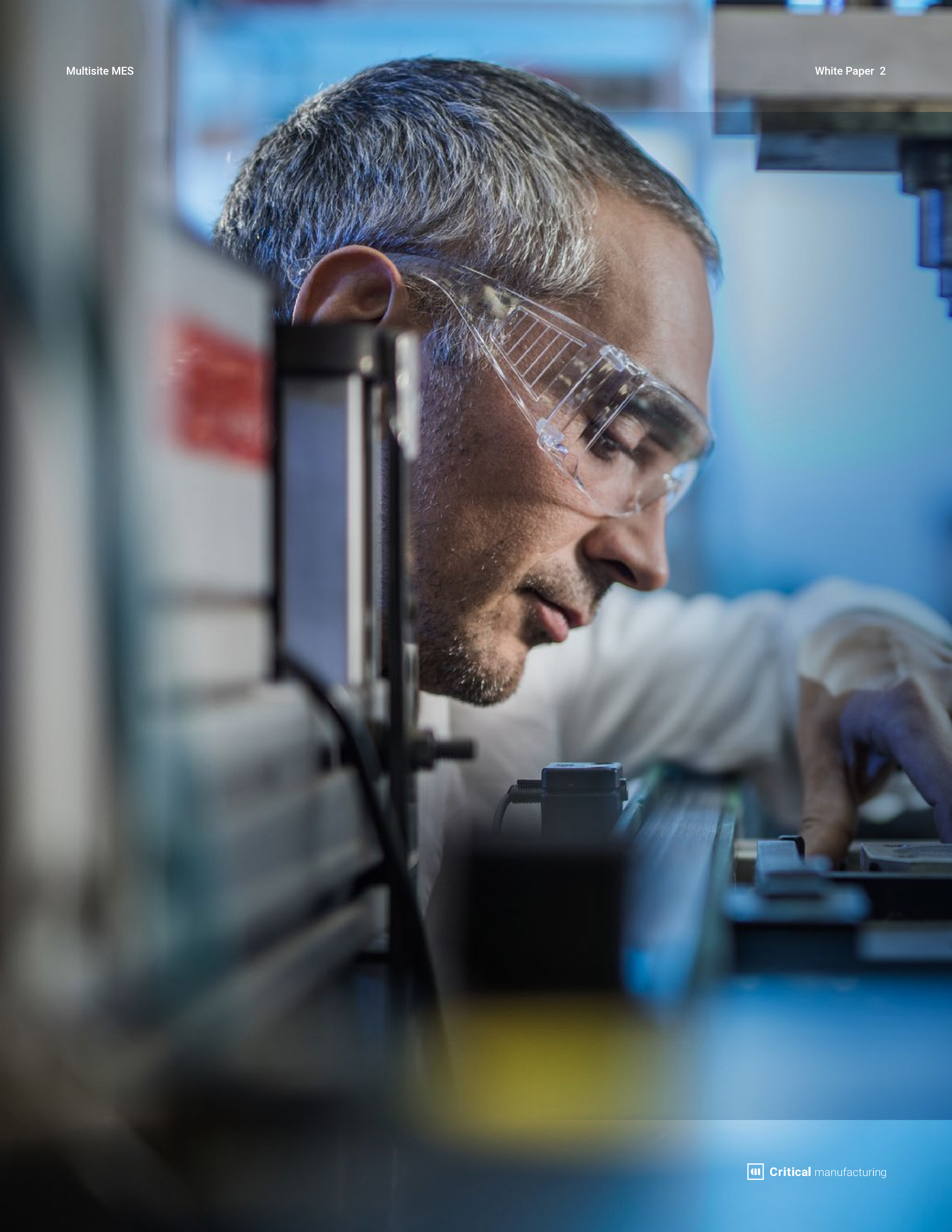
WHITE PAPER

Multisite MES Part 2

5 Steps to Successful Implementation

By Critical Manufacturing

Critical manufacturing
an ASMPT company



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Crafting a Winning Approach

Deciding to standardize MES across multiple production facilities is just the start of a journey. Part 1 discussed why multisite MES is essential for enterprise digital transformation. That paper has an overview of the challenges and how to overcome them. It also outlines the stages of a multisite MES project.

This paper delivers some recommendations, best practices, and examples. The goal is to ensure the company consider the elements that will help a multisite MES program succeed. Again, experienced practitioner's views inform this paper and are included as quotes throughout.

The first element is an organizational structure to lead and manage the program. The paper next considers one of the main differences between standardizing with multisite MES and traditional plant-at-a-time MES, the template. These lead to a discussion of policy for governance and choices about standardization. Then, the paper covers technology and IT architecture considerations. Beyond the software provider, another key to success is selecting the right services partner(s) with appropriate roles. The paper concludes with manufacturers' lessons learned and a short wrap-up.

Manufacturers who consider all of these aspects have a better chance of full success and meeting the ROI desired from a multisite MES project. This paper's aim is to support companies in considering and building out all of the angles for this digital transformation foundation.

Step 1: Center of Excellence and Governance

A company's MES Center of Excellence (CoE) provides project definition for the multi-plant MES project, develops and controls the template, and manages ongoing governance. The CoE team requires good business understanding, communication, and technical skills.[1]

Disciplines involved in the CoE are typically production, maintenance, quality, planning, materials management, IT (including ERP integration), process engineering and equipment integration, and analytics leaders. Ideally, the IT team comes from both the corporate group and plants. Many companies also consider some personnel from the software provider and services partner as part of their CoE.

The CoE has many responsibilities. These typically change from pilot to baseline evolution to rollout and sustainment. What is consistent is that the CoE must embrace and set policies that reflect not only the similarities between plants but also their differences. We also offer a paper with more specifics about the CoE, its organization, and its responsibilities.[2]

Setting up and succeeding with multi-plant MES often revolves around the strength of the CoE. With so many aspects to consider, setting up the CoE can be a challenge. The CoE is so essential to MES success that ISA published a book on MES CoE.[3]

Figure 1 Standard CoE organization

Views on CoE and Governance

"We recommend that people in the local fabs pull into a global organization—they sit in the local site but are part of the corporate CoE organization. That works out best. There's a single corporate strategy, but the CoE has 'boots on the ground' in the local fabs to understand their problems, use cases, and environments."

Hartmut Dreische, Systema

"Our organization is spread out globally. This way, we have people in the functional CoE who meet daily with colleagues in the coffee corner of the factory and speak their language. Also, when we spread our people around the world, we can give 24-hour second-level support to our global factories in a 3-shift system without working three shifts."

Simon Haemmerle, Head of Discrete Manufacturing Platform 1, B. Braun Gruppe

"We are a service organization, not mandating, but guiding people at the sites into a standardized direction. Convincing people takes time. But once they are convinced, they are more open-minded than if you force them."

Thomas Amrein, Vice President of Manufacturing Automation, Vishay Intertechnology, Inc.

"We work hand-in-hand with an internal CoE at every customer. People at the plant will be reluctant – they can't risk daily production rates. So, you need a good, empowered, and strong CoE. The CoE must be able to drive change at a plant."

Shantanu Rai, VP, Digital Manufacturing & Industry 4.0, HCLTech

Roadmap definition	• Defines global MES roadmap
Change management	• Owner of MES baselines • Evaluate if requirements should be implemented in baseline or individual sites • Approve changes to global baselines
Global tech team coordination	• Coordinates work of global technical implementation team • Manages priorities between sites • Defines roll-out plans
Configuration management	• Responsible for deployments • Manages site versions and dependencies

Table 1 CoE Roles and Responsibilities

Step 2: MES Template

A template is the key to gaining many benefits of a multisite MES. Developing a good template enables greater standardization between plants, accelerated time to value, and lower cost per plant.

Template Definition

An MES template standardizes and models common processes and data flows shared among facilities. It's important to realize that the template is not just a shared set of features but also configurations, processes, and how you use the MES.3 Yet the template must leave flexibility for custom portions to meet unique needs at each site.

The CoE defines the template for the enterprise's sites to facilitate smooth rollout and gain the advantages of multisite MES. Some companies have more than one template, and others have subsets of a single template based on different process types and needs. Some have a common baseline plus one or more template(s).

Template Advantages

Having the template as a standard baseline reduces implementation effort and costs on follow-up sites. Starting with a template reduces each site's rollout timeline since much of the information is pre-defined and tested within the template.

In addition to speeding and easing implementation, validated industries can streamline validation. The template enables a single installation qualification (IQ) for multiple sites. Completing the IQ via the template enables operational qualification (OQ) and performance qualification (PQ) to proceed sooner.

Developing a template also fosters process standardization. As a result, all sites using the template gain harmonization and flexibility to move products and people among them. This can boost agility and responsiveness to customer, market, and supply chain shifts.

Views on MES Template

"There is no way to do a global implementation without a template – it's not financially viable. Using a template, you can taper from, for example, 1000 hours for the first site to 600 hours for the second site to 300 hours for the third site. You can see it's progressive for each site. Otherwise, it would be 1000 hours per site."

Thiago Martins, Managing Director MES, Accenture

"We want to create the first template with maximum functionalities and capabilities. There will always be plant-specific customizations that might not be usable for other plants. We will keep those separate."

Tarun Chopra, Head of Manufacturing Services, Danfoss Group Digital & IT

"The template approach is to avoid investing millions at each site. Based on what we have right now, we want to implement each site in a few months. It should be shorter with every implementation – we aim to have very fast rollouts in days, not months. Key for us as a medical device company is also the qualification, to have as much as possible in the template."

Michael Kaiser, Lead Smart Manufacturing at CoE Infusion & Pain Therapy, B Braun Group

"We have much deeper ERP integration with this new backbone than in the past. Now, we mirror 100% of material and people transactions from MES into ERP. Thus, ERP has the necessary data for controllers to calculate product costing, supply chain to understand when to re-order material, HR to understand workforce management, and all to see opportunities to improve."

Thomas Amrein, Vice President of Manufacturing Automation, Vishay Intertechnology, Inc.

Step 3: Policy: Standardizing and Customizing

Governance

To get a robust MES template that works as planned and stays valuable, you must govern it. That means the CoE must be empowered to craft and implement the template(s) across multiple sites. This includes the traditional skills of software governance. Beyond that, this is a blend of setting and enforcing policy to enforce the selected blend of standardization and customization for the company, its divisions, and each facility.

Levels of Standardization

We have developed a 5-level MES standardization description[4]

- 0 = no common MES solution
- 1 = same commercial MES, but each site implements it independently
- 2 = Sites use the same commercial solution and try to reuse parts without a baseline template or CoE
- 3 = Sites use the same commercial solution, CoE in place, to create an MES baseline template with variations and flexibility at the sites beyond configurations.
- 4 = All sites use the same MES baseline, with site flexibility by configuration only and guidelines defined by the CoE

There is also variety in MES baseline models – from one baseline for all sites to one per site type, a blend of the two, or a baseline template plus site-specific solutions. These models, plus MES baseline template planning, development, deployment, and governance, are covered in more detail in the companion paper on CoE.[5]

Views on Customization

"For us, it's important how much configuration and customization a system requires. We did not want to enforce the same thing in all businesses. The need for traceability is the same (some might need batch level, some unit level), but how you want to enable them may vary. Critical Manufacturing's modular approach allows us to choose certain capabilities and keep the system scalable and maintainable."

Tarun Chopra, Head of Manufacturing Services, Danfoss Group IT

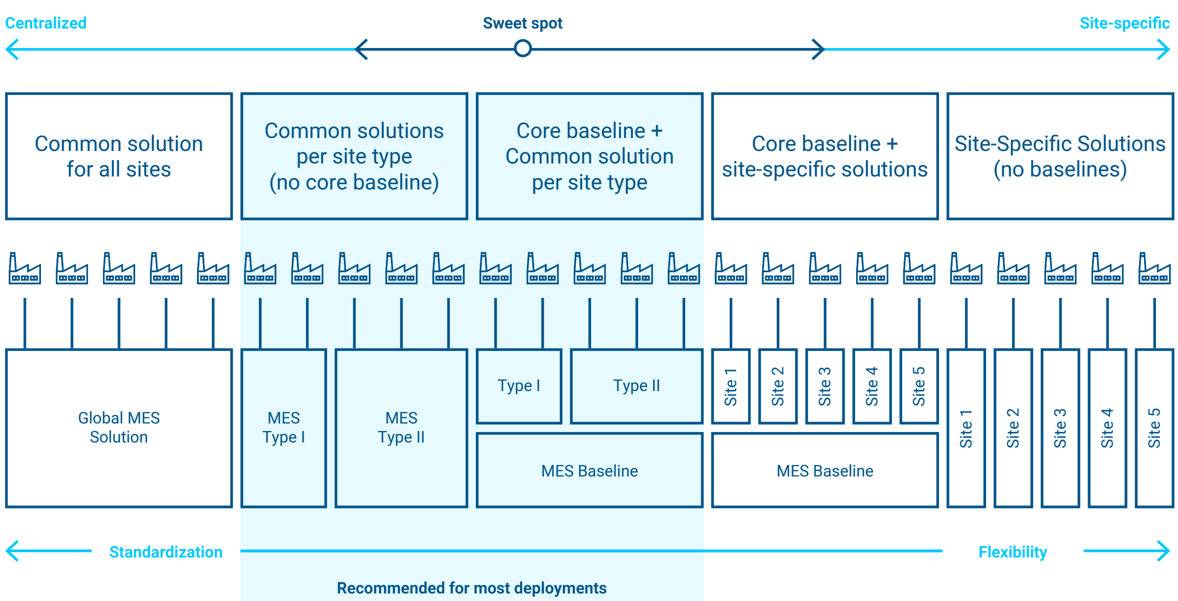


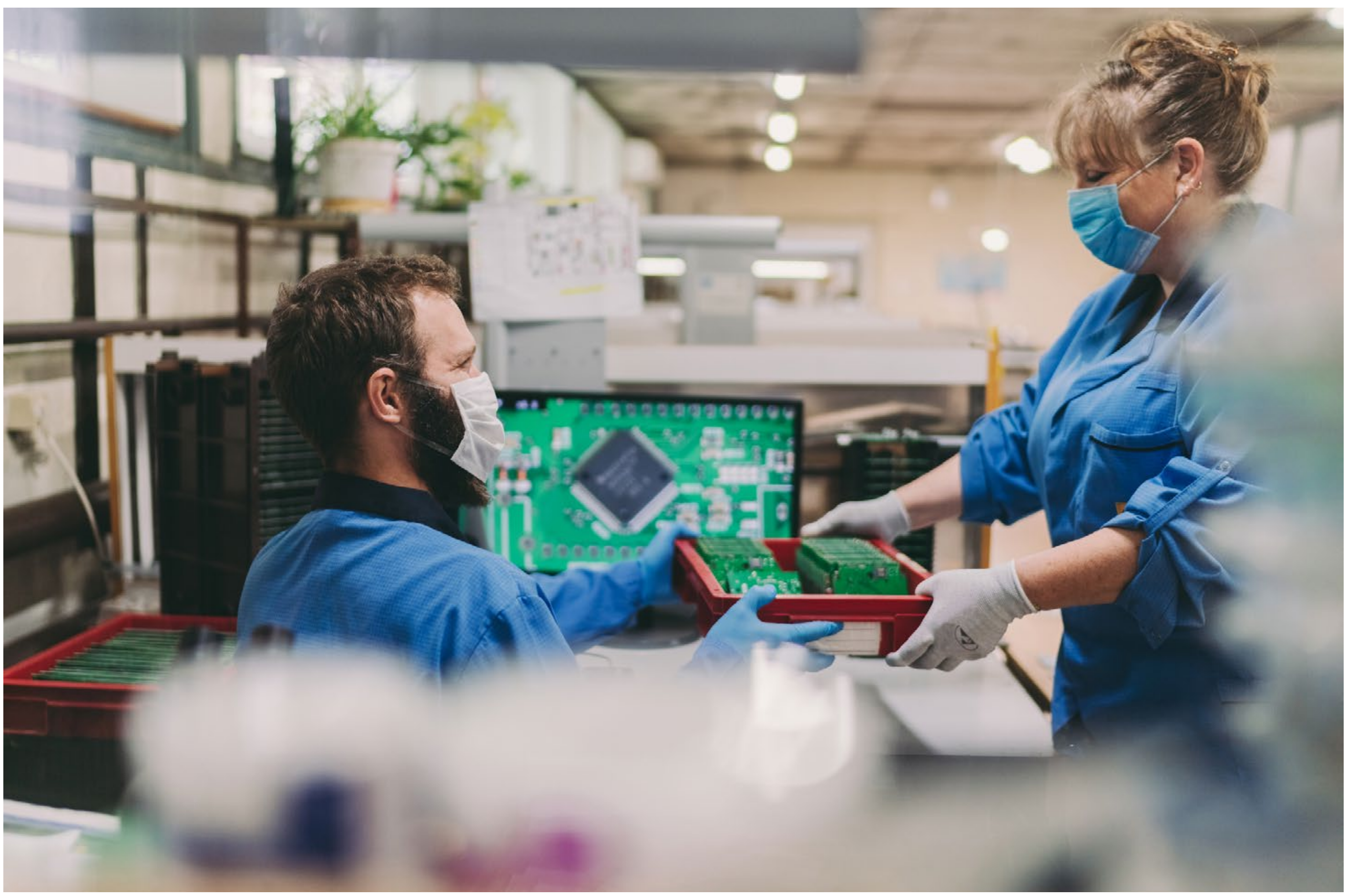
Figure 2 Different approaches can be selected depending on desired process similarity, standardization and IT landscape.

Template Maintenance

Keeping a functional template and baseline intact requires a good maintenance process for the many changes coming from all production sites. In a modern, digital production environment, changes can come fast. It may require creating a strict release management approach, which is common for software companies but not manufacturing IT groups. You'll want a way for internal and external team members to develop on the same baseline or template simultaneously without disrupting each other.

Various Examples

- One customer started with isolated MES projects and then signed a multisite global contract to follow a template approach. However, one project was scheduled to begin before the template was in the concept stage. So, two sites got started, and then they created a separate project for the template to identify common areas in the running projects. The first projects did not try to challenge processes. The CoE is understaffed, and while they are recruiting, the go-lives of the first two sites are their priority. Some of the advantages of a template and CoE are lost in this case.
- Another company initially had a project with two sites and no common source code. A third site started with the MES when they moved production from one plant to another. They then merged the capabilities from all of these into a single "template." This was not a well-structured template, as all sites' needs were not discussed concurrently. They have since engaged with a partner, are starting to build a catalog of capabilities, and are evolving a template. Critical Manufacturing will be the software build factory, and the partner will work with the sites, but it's a team of nearly 150 people from the services partner and software provider for just the subsequent four sites, which are planned to deploy in 4-5 months.
- One customer had ten independent businesses that migrated to the same MES and created a project. A strong project leader and team moved the conversation away from how to avoid sharing information to doing so in a streamlined way via a multisite MES rollout. This was a transformation designed to generate greater collaboration, coherence, and efficiency, with the software as an enabler.[6]
- One customer is moving rapidly by following the CoE and template approach for dozens of sites. This company has gotten so comfortable with their service partners that they are implementing sites without the software provider. They have one service provider to evolve the template, and another is responsible for rollouts and customizations at each plant.



Step 4: MES Architecture for Multisite Deployment Ease

Modular and Composable: MES with a library of functions that can turn on or off can make a multisite rollout much more feasible. Each site can use the functionality they need both at the outset and over time. Choosing which functions to use has no penalty.

Reusable and Flexible: Containerization with orchestration can streamline standardized deployment and reuse of application elements. This also provides options about hosting on-prem, at the edge, in the cloud, or a hybrid[7] not only at the outset but at any time.

Delta Identification: MES with master data comparisons can detect modifications and differences. This makes governance and enforcement of enterprise template policies much more straightforward.

DevOps: Structured MES DevOps driven from backlogs and user stories can speed the delivery of centrally-developed configurations to local deployment teams. If site teams run independently, this still delivers visibility and consistency to the CoE or central team.

Specialized Instances: Multiple MES instances for development, staging, training, and live production support rapid progress and stability of the template and overall environment. This is a recommended practice for all MES but essential to success for multisite, template-based implementations.

For more information about MES Architecture from a technical perspective, see

- Accenture's Next Generation Manufacturing Systems Architecture[8]
- Critical Manufacturing's Master Manufacturing Software under Extreme Uncertainty Technical Guide.[9]

Step 5: Service Partners

Service not just Software Partner

The software company must be committed but, ideally, is not the long-term support partner for multisite MES. Why? Because the MES provider's role is to continually innovate and improve the base commercial software. Caring for each customer's instances of it can be a distraction that slows overall software product development.

It is wise for manufacturers pursuing a multisite strategy to engage a service partner to support the program. Look for a network of trained and certified service partners on your favored MES company's website. If you already have trusted service partners who know this product, they may be perfect since they know your company and IT approach. Even if they don't know the product, your relationship may encourage them to get trained and certified.

Benefits of Service Partners

Global Reach: Service providers' MES teams are designed to work in multiple sites across the globe simultaneously—to have experienced people at every location. Many software companies struggle to do that.

Deep Capabilities: Service companies extend and deepen both your corporate CoE and the sites' manufacturing IT capabilities. They also complement the software company with their deployment track record.

Broad Wisdom: These service providers' team members often know many products and are thus credible when they reassure naysayers that you made a good choice and how to make the most of it – even when you hit obstacles or challenges.

Change Champions: Some service partners are IT and management consultants who can support the mindset and change management challenges. Having skilled change management consultants can boost the success of multisite MES initiatives.

Views on Service Partners

"Our partner is one who has over 20 years' experience in MES and manufacturing automation. They have lots of competence and knowledge about equipment integration, particularly in the semiconductor industry. We can't cover that with our own resources. The partner also gives us additional resources for only the period of time we need them. We want to become independent but use partners for more difficult and new things."

Thomas Amrein, Vice President of Manufacturing Automation, Vishay Intertechnology, Inc.

"Organizational change is important. Multisite MES is not just a technical question or one of MES functionality. That's just a tiny part of the equation."

Hartmut Dreische, Systema

"Critical Manufacturing is a product company, they create scalable, composable architecture and systems. We cannot rely on them for deployment and continuous improvements– they'll always be short on resources as their core competence lies with product. We must be independent with the maturity and freedom to have the right talent pool. So, we have two partners, each with a well-defined role with whom we co-create and they support us in this journey."

Tarun Chopra, Head of Manufacturing Services, Danfoss Group IT

"The value of having hands and feet on the ground in any situation cannot be overemphasized, regardless of where you are deploying in the world."

Shantanu Rai, VP, Digital Manufacturing & Industry 4.0, HCLTech

Partners are High Value: "I would have brought in the external partners from day one. They bring a new perspective. They have experience in different areas of Critical Manufacturing. We challenge them, and they challenge us."

Tarun Chopra, Head of Manufacturing Services, Danfoss Group Digital & IT

Service Partner Roles

It is critical to scope what the service partner will do. As you get to know each other and the program progresses, the scope and details may change. Some of the roles your service partner may be able to play include:

- Building a business case for multisite MES (and tracking as-is status for measuring benefits over time)
- Challenging current ways of working that might present obstacles to standardizing or best use of the chosen software and offering best practice substitutes
- Acting as an integral part of the CoE (ideally from the outset, but at any point) perhaps contracting to or as a contractor to the MES software provider
- Providing local support in the local language and time zone for each site
- Contributing additional frameworks and methodologies to support multisite MES success
- Working with the corporate CoE to develop and govern the template
- Taking your needs to the software provider as requests for commercial product updates or to check for new approaches
- Acting as liaisons with both MES product experts and some personnel deep in your company's approach to act as a bridge for understanding and forward motion.
- Service partners can dramatically speed up a multisite MES rollout by deploying their best people as part of your team in every region to support your sites.

Learnings and Recommendations from Critical Manufacturing Customers

Customers on the multisite path are varied by industry and number of sites. However, they all agree that they want to establish a CoE or Center of Excellence and use a template for standardizing across sites. All are also planning to include a service partner to support their multisite endeavor. This suggests strong best practice recommendations.

	Customer A	Customer B	Customer C	Customer D
Center of Excellence	Yes	Yes	Yes	Yes
MES Template	Yes	Yes	Yes	Yes
Template adoption Level*	3	3	3	4
Number of Sites to implement MES	Target 90	Target 24	6	12
Team size	5	6	20	15
Partner Yes /No	Yes - one for development, one for implementation	Yes - selection process ongoing	Yes - selection process ongoing	Yes

Table How companies approach Multisite MES implementation. Companies from various segments: Industrial Equipment Manufacturing, Electronics and Medical Device Manufacturing.

*What is the adoption of the template?

- 0 = no common MES solution
- 1 = same commercial MES, but each site implements it independently
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- 3 = Sites use the same commercial solution, CoE in place, to create an MES baseline template with variations and flexibility at the sites beyond configurations.
- 4 = All sites use the same MES baseline, with site flexibility by configuration only and guidelines defined by the CoE

Customers’ Lessons Learned

Scope and Rescope
“It’s super important to scope your project really, really well. It does not hurt to pause and rescope. The amount of effort to implement an MES can be exhausting for IT and the business. First initial phases – everyone goes with a huge ambition – scoping is super important. If you boil the ocean, you’ll need too much money and too many resources.”

Tarun Chopra, Head of Manufacturing Services, Danfoss Group Digital & IT

Understanding How You Really Work
“One takeaway from the first years of introducing MES is that many processes and procedures on the shop floor are still very manual, and that existing ERP routes can be quite different from how the work is being executed. Operations can be obsolete or in the wrong sequence, they can use alternative resources or BOMs, rework flows are not reflected, etc. Investigating how the work is really done and reported on the shop floor, what information can be found in different systems, in paper etc., is very time- consuming..”

Måns Forsberg, Team Manager, Automation & Digitalization within Operations Development Technology Office, Alfa Laval

Process Harmonization Enables MES Standardization
“What we have seen is that in parallel to template development, you need a separate activity on process harmonization. This includes organizational roles and responsibilities as well as harmonizing ERP master data, inspection plans, etc. If you don’t do that, the technical template cannot roll out as efficiently as we want because there are too many differences between deployment sites.”

Michael Kaiser, Lead Smart Manufacturing at CoE Infusion & Pain Therapy, B Braun Group

Template Must Reflect Plant Workings
“It works well to have technical roles work in deployment and template development projects. Benefit out of these is, that they can reflect what really happens in the factory each time to adjust the template if necessary.”

Simon Haemmerle, Head of Discrete Manufacturing Platform 1, B. Braun Gruppe

Preparation Matters
“One lesson we learned is to bring people up to a certain understanding before we start a project. We created a relatively intense briefing phase before we start detailed planning. This mutual learning includes us understanding what they produce, how, and with what equipment, plus specific day-to-day problems and needs. We explain what MES can do for them and the benefits. We also explore the readiness of the ERP setup (worcenters, routings, BOMs, etc.) for the standard MES interface. This preparatory or readiness stage avoids surprises that can break or delay the project later. It also aligns expectations.”

Thomas Amrein, Vice President of Manufacturing Automation, Vishay Intertechnology, Inc.

Conclusion

Increasingly, manufacturers are turning to a multisite MES approach to gain IT and operational advantages. These advantages can be quantified to build a business case.

Experienced MES software and service companies can help a manufacturer overcome the challenges of multisite MES deployment. Including both software and service partners can help ensure the project is well-staffed with maximum expertise.

Multisite MES requires substantial planning and governance, with resources and authority to impose standardization on sites if desired. Set up a mixed team, ideally owned by the manufacturer through a CoE, including the software provider and service partner.

A template, or small set of templates, will be a foundation for faster, less expensive, and more reliable rollout to multiple sites and long-term sustaining and support of the MES. Note that the baseline in the template may be a more or less important factor.

MES with a modern composable, containerized architecture and DevOps can also support multisite MES success. The CoE will appreciate these tools for long-term governance, managed development, and flexibility in choosing what to deploy and how.[10]

Partners are essential to generating solid returns on the MES investment and consistency across global sites. They add value in many dimensions and are ideally suited to support ongoing multisite projects. Their people can help represent your needs to the software provider and your overall multisite program needs to the sites – as well as site needs to the CoE.

Multisite MES is a major undertaking but is a foundation for large companies' Industry 4.0 progress. Step into a future where you serve markets more consistently and your data flows more easily. Develop, staff, fund, and support a multisite MES program well to gain a competitive advantage now and for the long term.

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