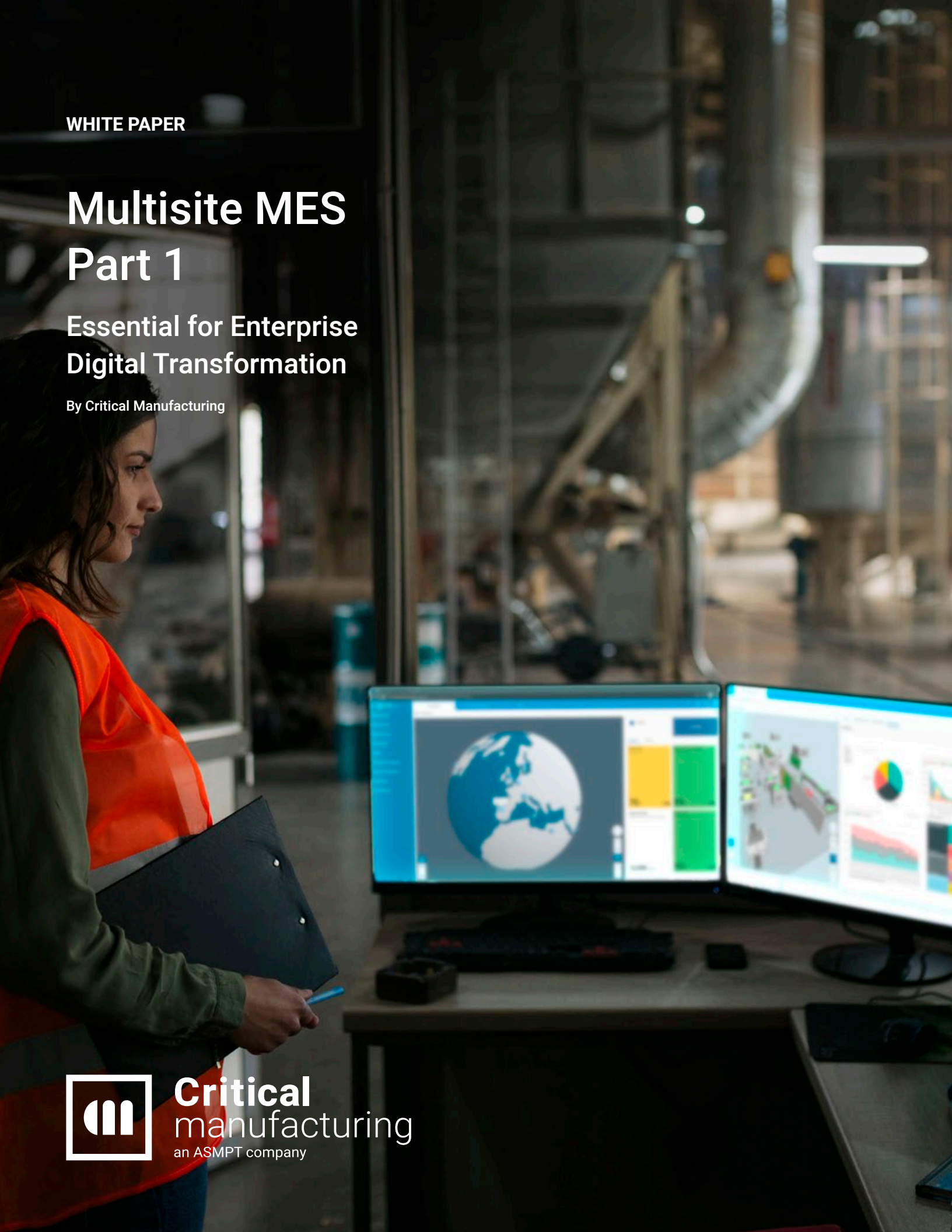
WHITE PAPER

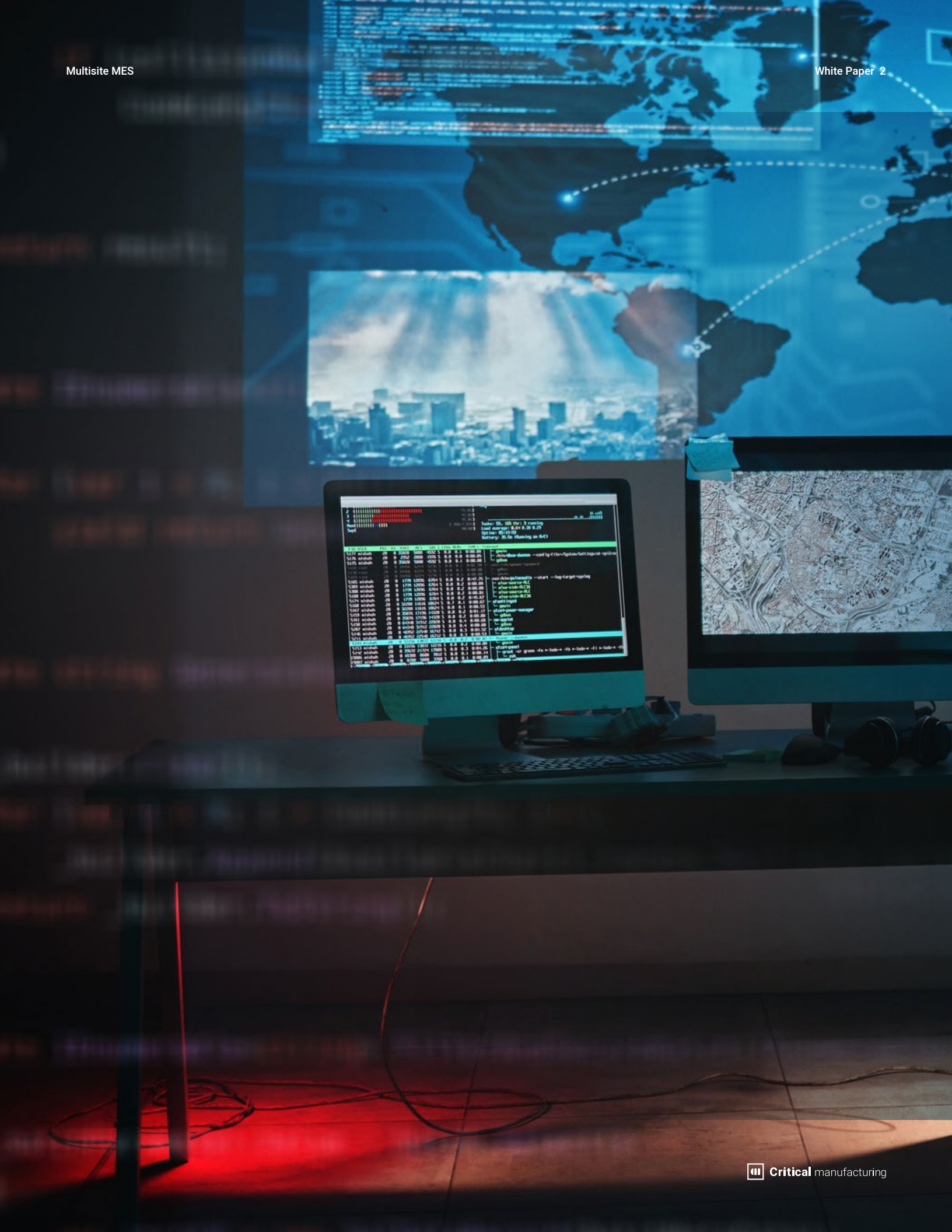
Multisite MES Part 1

Essential for Enterprise Digital Transformation

By Critical Manufacturing



Critical manufacturing
an ASMPT company



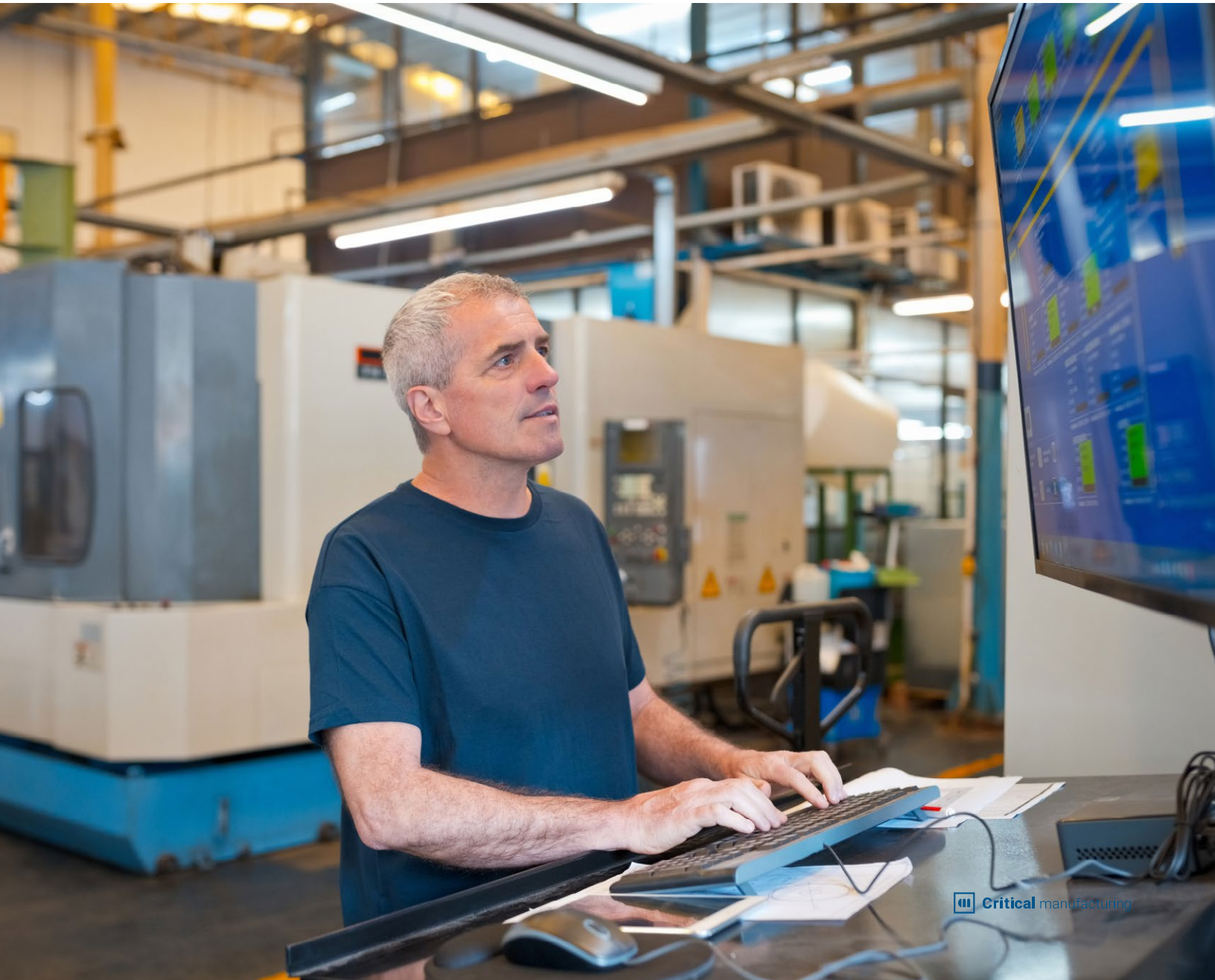
Index

Enterprise MES a Pillar for Digital

Industry 4.0 revolves around easily flowing digital data and information. This means manufacturing data can no longer remain separate or in a silo separate from the digital thread. Production is central to the order-to-cash cycle, product lifecycle, supply chain, and sustainability initiatives.

Manufacturing typically accounts for the largest portion of the total cost of goods sold (COGS). Thus, manufacturing data is crucial to making decisions that help maintain solid profits. Manufacturing realities impact both costs and the ability to capture revenue opportunities. INCIT research shows that manufacturing data is a priority.[1]

Historically, plant managers often made decisions about manufacturing execution systems (MES). As a result, many large multisite manufacturers have a hodgepodge of systems in their manufacturing facilities. Mergers and acquisitions often compound this many-MES scenario. This has played into some local benefits, but often at a high cost to the company in IT needs and inflexibility to move products and people from plant to plant. For these and more reasons we'll explore here, it makes sense to elevate MES to the enterprise level and standardize it.



Benefits of Standardizing MES

MES Benefits

MES Is a proven application set for manufacturers with benefits in costs, revenues, risks, quality, customer service, and qualitative or soft benefits. Some common areas of improvement include:

- innovation and new product introduction (NPI) effectiveness and speed,
- productivity of both direct and indirect labor
- automating manual processes to reduce errors, and shorten training time for scarce plant floor workers
- inventory level optimization and work-in-process (WIP) visibility
- lower cycle times in production and order-to-cash
- improved service levels and line fill rates
- perfect orders as schedule adherence, product quality, and shipping accuracy improve
- support and training for operators, technicians, and supervisors who are challenging to hire

MES also provides the crucial in-plant data foundations for analytics and continuous improvement. Good MES is designed to bring together data from automation or operational technology (OT) and information technology (IT). The nature of an MES project can deliver a more thorough understanding of the process even before implementation. Typically, in the project preparation phases, the team models production processes.

Those are benefits available from any MES. Historically, MES was a plant manager decision, so why move from plant-by-plant to multisite? Answer: to gain even greater benefits across the business. Standardizing MES and implementing it as a multisite project has benefits for both operations and IT.

Operations Benefits by Standardizing

Speed to Benefit: Having an MES template for multiple sites can significantly speed both implementation and time to benefit for each subsequent plant. If the template delivers 80% of what each site needs, that's significant. What each site learns can also speed up successful deployment and use at other sites more easily.

Best Practice Use: Many large companies attempt to share best practices and learning. Beyond occasional meetings, sharing MES also enables and supports consistent, streamlined manufacturing processes, data approaches, and visibility on a day-to-day basis. This can maximize the enterprise benefits from digital transformation.

Optimization: Multisite MES is a solid foundation for simulations, analytics, and performance metrics to identify problems or the "hidden factory" across all sites that use it. Multisite MES supports understanding and control of variances to standard across all sites. It can also help consistently deploy the "golden run" in all facilities. Without this standard measurement platform, comparing sites' operating performance accurately may be suspect or impossible.

Flexible Responsiveness: Multisite MES provides the ability to shift production and people between sites with greater speed and confidence. Supply chain uncertainty puts extra value on being able to see material and order status in production, both for promising orders and efficient manufacturing. MES designed for Industry 4.0 enables this visibility. MES, when applied as an enterprisewide standard, adds the potential to shift production in response to changes in supply and demand quickly as they shift anywhere in the world.

Plant P&L: Choosing a standard MES can radically streamline MES buying processes. Often, enterprise agreements offer the manufacturer the ability to bargain on license cost. This can result in a lower per-site purchase and implementation cost. So, plant managers who may have deferred MES decisions because of the price may have a different business case as one plant of many.

Digital Transformation Value: Not standardizing on MES may leave money on the table. A multisite MES project can encourage process, documentation, and data harmonization and best practice learning and use. It typically also includes standard integration or application programming interfaces (APIs) between MES and ERP or other enterprise systems. This data flow, understanding, and consistency, in turn, can strengthen the digital threads between internal groups and the global supply chain and boost the value of all enterprise digital transformation efforts.

IT Benefits from Standardizing

Many companies' IT teams are rationalizing their application portfolio for higher efficiency and lower cost of IT support. Standardizing on MES for multiple sites creates a single point of development and upgrade.[2]

Cybersecurity and application governance are also easier and much lower cost with a company standard MES for many sites. IT teams struggle with both of those when each site has its own application landscape for manufacturing operations. Knowing that manufacturing is the #1 target for cyberattacks[3], this can greatly reduce risk.

A single multisite MES can benefit the entire application landscape and digital thread. This is because there are consistent APIs to feed manufacturing data to and from ERP, PLM, SCM, CRM, and other systems.

The multisite approach enables faster and less expensive implementation or roll-out to many sites. If every site takes years, a company with dozens of sites will have all team members retire before they can roll out the MES to every site. Typically, companies can implement MES in months if the multisite approach is complete and they are several facilities into the program.

Manufacturers taking the multisite approach get greater leverage from the investment in education, training, implementation, and best practices. They can also build a more significant long-term relationship with the MES and service providers.

All of these factors spur IT efficiency and lower the total cost of ownership (TCO) across the lifecycle of the MES. They can also lower project and support costs for other applications, IoT, and production equipment.

Views on Multisite MES Benefits

"Today, it's hard to find a large company that doesn't have MES systems in place. By pursuing multisite MES from a single provider (or a combination of very few strategic providers, depending on how different the plants are), they obtain license cost reduction from bargaining power, improved ability to share common libraries and best practices across plants, and ease of defining a support structure."

Thiago Martins, Managing Director MES, Accenture

"We're trying to provide the transactions from MES to a process mining tool to understand the process. We are working on how to put MES data into context for improvement scenarios. Some analyses are done in MES, others will be done outside of MES, but we can enable it from MES. Improving performance is an important part of it."

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

"Group Digital & IT are responsible for maintaining and managing the system, and that can only happen with a standard MES backbone. Benefits include reducing operational cost, stability, flexibility, consolidation, and reducing the complexity of the entire landscape. As our organization grows, it is very important to get away from the hairball of several small, custom-built, local MES solutions and reap the benefits of a composable and scalable MES core."

Tarun Chopra, Head of Manufacturing Services, Danfoss Group IT

"Vishay acquired many companies in the past, so having less systems is easier to manage, and we can tear down siloes and network. With harmonized processes, we can talk about the same thing and network to help each other more easily across sites and divisions."

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

Building a Business Case

Most companies require a business justification to allocate the resources to a multisite MES project. As a starting point, seek to understand the company's strategic goals and initiatives for improved customer satisfaction and competitiveness. Explaining what MES can do in that light will be most likely to gain budget approval.

We talked above about some of the benefits. In summary:

- Standardization of best practice processes, data, and reporting, leading to consistent products and greater customer satisfaction in all regions
- Flexibility to move products, production, and people around seamlessly, enabling more assured and greater revenue, reducing risk when regional issues shift
- Cost reduction for IT and operations
- In sum, this can impact top-line, bottom-line, and overall market status.

Many manufacturers also have digital transformation initiatives. Multisite MES can be a foundation for this significant change. Even embarking on the project to assess best practices and processes can provide a structure to challenge the status quo.

A single MES – particularly if it's a broadly functional system – results in fewer data siloes and, thus, a more coherent flow of information through the enterprise and supply chain. Any MES can deliver that in the plant, but the consistency of a template-based multisite system boosts the enterprise's value.

Multisite MES may be an obvious addition to a corporate ERP refresh or advanced analytics initiative. It is typically easier to justify as part of a larger IT initiative than standalone, but either is possible. Yet, many ERP companies' MES is not as capable as that from independent vendors, so the selection should be separate for the two systems.

Multisite MES is a learning and discovery process. You will be learning about what your various sites really do, and what the software and service partners can offer from their broad experience.[4] As a result, there will be things you don't know about costs and benefits early on, but you can typically get a reasonable ballpark to establish a budget.

Views on Building a Business Case

"A key thing we try to find out first is what use cases customers have. A high-value use case is for a fab cluster, with one for development and others for volume manufacturing; the product and tech transfer is much easier with a common MES. Other use cases include consistent reporting across sites and shipping semi-finished goods to another fab or back and forth for seamless material history. The weakest but most common argument is for the IT team to support fewer solutions."

Hartmut Dreische, Head of Business Unit MES Solutions, Systema

"The next major migration became a priority when a customer said they want an MES-like infrastructure on our shop floor. This is the second customer looking at infrastructure and degree of automation in our production as well as the product."

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

"The biggest factor is the mindset that the business needs to jump in. This is a not a purely IT project, it's a transformation journey. It is a business project where both business and IT come together and define key objectives where value can be measured after implementing MES. The ROI is clearly in having our customers' strict traceability met and avoiding legal issues on claims and returns. Productivity gains come by having faster and easier access to production, quality, test, machine data. It makes us realize opportunities where we can have OEE gains, avoid scrap, and gain transparency on shopfloor, etc."

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

"Multisite MES needs to be a strategic investment in how we want to work in the future. Top management must believe it is the right thing to do. There are many soft factors that traditional ROI might not consider."

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

Challenges of Multisite MES Implementations

Despite the many benefits, a multisite MES program also entails some challenges. The one we hear most frequently is setting up the team with proper support. Getting strong enough corporate commitment of human resources is one aspect. The project should have the best people, some dedicated full-time. A follow-on challenge can be investing this team with the authority to make it work.

Sites may not be keen on standardization. If each plant runs to its own profit and loss (P&L), they may not want to invest in a new MES just to meet the company standard. When the sites pay, the rollout may stall. If the MES project team does not have enough authority, the attempt to standardize may fail, which can eliminate many of the enterprise-level benefits.

Often, sites have their own priorities even if they agree to participate in the multisite MES program. Another challenge is ensuring that sites don't move forward before a collaborative discussion. A facility with an urgent need may think they can establish the baseline or template without other sites' input. This is a recipe for template rework.

Standardization can only go so far—but which elements can you successfully roll out the same in each plant? Understanding how to identify and agree on the common 70-80% can take longer than companies initially expect. Yet, this is crucial to scoping the project appropriately from the outset. Just remember in selecting a system, your business needs are the requirements – it is counterproductive to dictate methods by which a system must meet those needs.

We mentioned briefly that uncertainties exist at the start of such a project. The path forward may shift as the manufacturer, software provider, and service provider learn about each other. In short, each side may not know what they don't know early in the process. While this is true for any MES, the challenge is magnified for multisite deployments.

Finally, managing a project across many time zones, cultures, regulations, and languages can be challenging. Regional differences can make expectation setting beyond the project team and pilot plant(s) a significant undertaking.[5]

Views on Challenges

"Plants still try to manage manufacturing IT on their own, and they do not want to take any risks with production. There is a dichotomy of opinion. The central team wants it all standardized as much as possible, whereas the plant and site team has an opinion that they are too unique."

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

"We have a development instance of MES for each of our three regions, and Critical Manufacturing has two also. Over time, with customizations, they are not 100% identical any more. Now, we are now working on a baseline project to merge all five development instances into one, running THE Vishay template."

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

Overcoming Multisite Challenges

Creating a global MES project team or Center of Excellence (CoE)[6] from the outset can establish the credibility and priority of the project and the MES in the company's overall landscape. This team must represent the plants that may eventually use the MES and ideally be physically located in some of them.

The CoE initially includes internal people. This team is responsible for selecting the rest of the players: software vendor and service provider(s). It is vital to free up some of your best operations people who also have the respect of those in the plants. Assigning at least a few full-time people and others who devote some of their time to the multisite MES project usually works best.

One element is selecting the right fit software based on a capable MES with version and upgrade controls. Make sure the vendor and implementation capabilities are also in place. Then, select one of their SI or consulting service provider partners with experienced people available to cover all your plants.

Having a project team that spans the same regions and finding a service partner to deploy in those regions can help. Having strong governance of a template baseline and yet localizing the software is also essential. Software offering DevOps governance, composability, and containers enabled an ability to balance central governance with ensuring local value long-term.

Use a proven approach that the software and services providers offer. They recommend these approaches based on their experience that they work well. Don't stumble on issues other manufacturers have taught the providers to avoid.

Creating a template or base model can significantly reduce each site's challenges. The template represents the 70-80% that is common for every site the MES will serve. This typically includes APIs to other software, automation, and equipment or IoT.

Selecting a pilot site(s) is also crucial. One factor is a pilot site with the need, will, and interest in pioneering and learning. The plant manager and others representing this site must also be open-minded and ready to consider corporate needs as well as local ones.

Spending more time in the envisioning phase can help the solution provider and customer teams learn more about each other before making decisions. Up-front exploration and learning are crucial to avoid problems further into the deployment and rollout of the multisite MES.

Views on Overcoming the Challenges

"In the beginning, it is hard for sites to understand how to use the MES and start the journey. It's a struggle to show and quantify the benefits until a few sites are using it."

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

"You must have a long-term relationship with the software company. We come together daily and are a single team in spirit. In my new role, internal people see only Critical Manufacturing. Their people are B Braun people; we all have to stand in front of our managers and represent what we need."

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

Multisite MES Project Stages

Preparation
The first phase may include defining objectives plus a process for starting the program. Creating a core project team and CoE for short- and long-term governance is another part of the preparation. This team can then report from many plants to create an as-is baseline to identify priorities and measure results and ROI.[7]

Partner Selection
Selecting the vendor and service partner(s) is a crucial project team function. It's important to remember that the requirements in a request for information (RFI) are about your company and its processes and improvement needs, not about how the software should work or look. This is a mistake companies frequently make.

Envisioning
Creating a vision of how things could be once the MES is rolled out to multiple sites is vital to staying on track and focused. At this stage, the boundaries of what's in and what's not, what to do first, and what to do later may appear. Perhaps the most crucial aspect is getting to know the software and service providers and educating them about your operations.

Pilot Approach
Selecting pilot sites is not trivial. Some companies start with a simpler site for a lower cost; others with the most complex to cover more needs. Some manufacturers start with a site with an urgent need and a clear value proposition. The MES pilot site may have similarities to many other plants for a more robust first test of the template. Some choose two pilot sites.

MES Template Development
The CoE typically defines and creates what will be shared across all sites or a template. The template can normally only cover 70-80 % since every site will have specific needs. (Products, equipment, existing software, culture, and more may play a role.) Some companies have more than one template or sub-templates, just as they have more than one type of product or process.

Pilot & Deployment
Most manufacturing plants can afford little to no disruption to their operations for MES deployment. This means careful testing and deployment planning and a process for handling products, templates, customization layers, and master data. Ideally, the team will learn from the pilot deployment and use best practices for subsequent sites. MES architecture, such as containerization and composability, play a role here and are covered in more detail later.

System Handover
Long-term support will likely move away from the project team, at least partially, to other people over time. For example, the software vendor personnel may not be part of the core team after deployment of the first site(s). Service partners and local site personnel typically handle ongoing system maintenance with support from the CoE.

Views on Project Stages

"Identifying which plant should come first is not necessarily based on cost or value, but also who has the appetite for change."

Thiago Martins, Managing Director MES, Accenture

"We allow the business to choose when they want to go live with the system. Until they are ready, we prepare and train them, and they can go live when they are ready. Our deployments are not sequential, not fully parallel, but overlapping."

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

Crucial Early Decision	One End of Range	Other End of Range	Other Options
Pilot Site	Easiest, simplest	Most complex, difficult	Ready, Need, Value
What to Rollout	Base set of functions	All functions from start	High need functions
Tracking Value	Once budgeted, no view	Detailed tracking before & after to show value	Use ROI #s at a high level for progress
Template Weight	Sites have most weight	Template has most weight	Template whenever possible, 70-80%

Table 1 Examples of early decisions that are crucial to the rollout and long-term perceived success of multisite MES

Conclusion

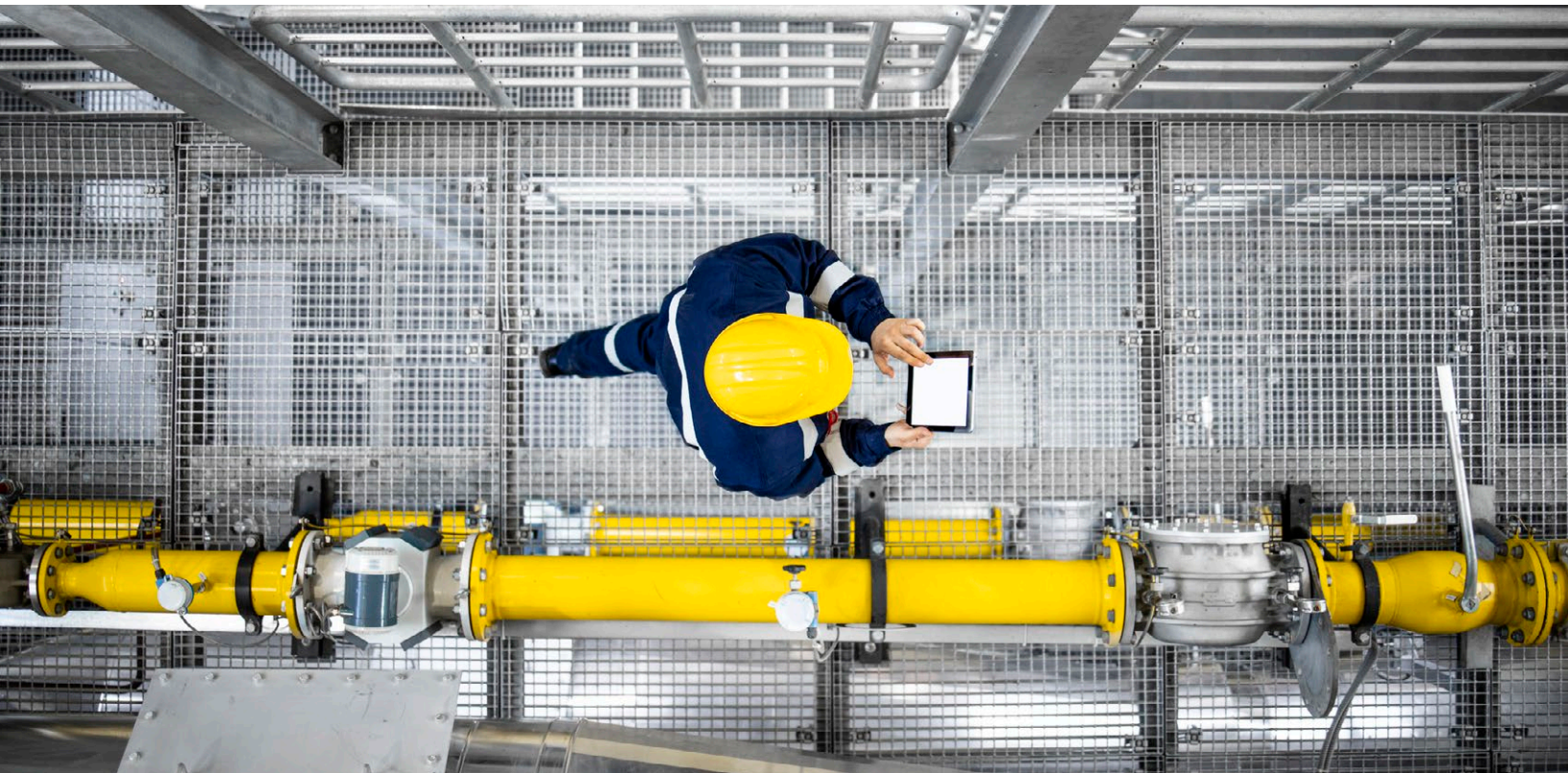
In summary, multisite MES can provide outstanding benefits to manufacturers. Greater standardization results in improvements for both operations and IT. Note that in the best case, the entire company and disciplines well beyond the production operations will also gain benefits.

Multisite MES also presents specific challenges. We've explored known paths to overcome the challenges that companies are already taking. A multisite MES also program has multiple stages, and each one brings decisions to make. Starting with this awareness and educating the team to the path ahead is crucial to success.

Part 2 of this Multisite MES White Paper will address issues of governance, including building out an MES Center of Excellence, templates, and policies. The next part also includes examples of various approaches companies are taking. It also explains why the MES architecture and service partners are crucial elements to consider in evaluating MES offerings for multisite deployment.

References

1. The Global Smart Industry Readiness Index Initiative: Manufacturing Transformation Insights Report 2022
   https://www3.weforum.org/docs/WEF_The_Global_Smart_Industry_Readiness_Index_Initiative_2022.pdf
2. The Business Case and Benefits of Multi-site MES Program, Critical Manufacturing blog
   https://www.criticalmanufacturing.com/blog/the-business-case-and-benefits-of-a-multi-site-mes-program/
3. IBM X-Force Threat Intelligence Index 2024 © 2024 IBM Corporation
   https://www.ibm.com/reports/threat-intelligence
4. MES Buyer's Guide: Why, How, and What, Julie Fraser ©2024 Tech-Clarity, Inc.
   https://www.criticalmanufacturing.com/insights/ebooks/buyers-guide/
5. Challenges of Multi-site MES and How to Overcome them, Critical Manufacturing blog
   https://www.criticalmanufacturing.com/blog/challenges-of-multi-site-implementation-projects-and-how-to-overcome-them/
6. Multisite Center of Excellence, Augusto Vilarinho, Critical Manufacturing blog
   https://www.criticalmanufacturing.com/blog/multisite-mes-center-of-excellence/
7. Stages of the Multisite MES Deployment Project, Critical Manufacturing blog
   https://www.criticalmanufacturing.com/blog/stages-of-the-multisite-mes-deployment-project/



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