



MES Solutions by Grantek: From Requirements to Results

Background

The purpose of Digital Transformation is to fundamentally change how companies operate and deliver value to customers through integrating digital technologies into all aspects of a business. Grantek has been partnering with manufactures for 40 years to help them meet their business goals, Digital Transformation provides a modern challenge that Grantek understands and can help solve. This transformation requires employers, hardware manufacturers, and service providers to see and understand the bigger picture of how their manufacturing operations fits into their overall business.

The modern manufacturing landscape demands optimization, creativity, and leveraging the best-in-class technology to support Digital Transformation. The need to reduce costs, increase throughput, and improve value is imposed on manufacturing in order to enhance the entire supply chain. When faced with such pressures, we often look to advances in technology and how it can be leveraged to give our business the edge.

Manufacturing Execution Systems (MES) are one of the foundational building blocks necessary to optimize a Digital Transformation that provides real-time and actionable insights. MES connects the manufacturing space to the other functions of your business: supplying larger context and visibility to the shop-floor and providing real-time information to the wider supply chain. MES implementations can provide immediate value through streamlining manual processes and providing actionable information to stakeholders, but it also provides a platform to facilitate other Digital Factory technologies like Advanced Analytics and Machine Learning, Cloud Computing, and Mobile Manufacturing.

This whitepaper will review:

- What is MES and how does it fit into our business architecture?
- What immediate and future value does MES provide?
- What are common pitfalls and obstacles to implementing MES?
- How does Grantek approach new MES opportunities to maximize value and reduce risk?

What is MES?

The ISA-95 Functional Hierarchy (ANSI/ISA, 2000) model (shown in Figure 1) was created by The International Society of Automation (ISA) to describe how Manufacturing Execution Systems fit into your greater operational systems architecture. This model can help us to characterize the systems and data flows within our manufacturing business:

- Level 0 represents the physical production process, where data moves in real-time.
- Levels 1 and 2 are the process control and automation layer. At these levels data-rates can span milliseconds to hours; representing real-time physical processes in timeframes that are easier for human operators to work with.
- Level 3 is the MES/MOM (Manufacturing Operations Management) layer, which is responsible for managing Level 1-2 manufacturing systems and communications between plant-floor and Level 4 business systems. Data timeframes range from seconds to days in order to convey data from business systems to manufacturing systems and vice-versa.

- Level 4 contains Business Planning and Logistics systems, like our Enterprise Resource Planning (ERP) and Supply Chain systems. These systems are used to connect production data to financial data for long-term planning, and work on a much larger timescale.

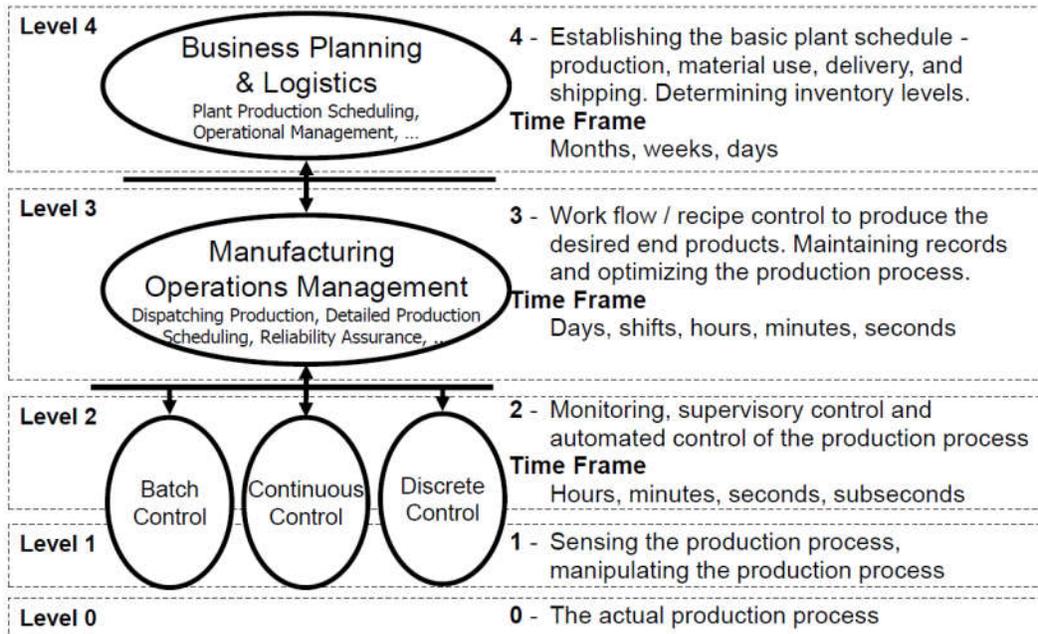


Figure 1 - ANSI/ISA 95.00.01 Enterprise-Control System Integration: Part 1 Models and Terminology

In this structure, MES/MOM systems are responsible for the management and control of processes that link the demands of the overall business to those of manufacturing. The ISA-95 standard models address MOM activities of Production, Quality, Inventory, and Maintenance management and how these activity areas interact with Business Systems, Automation Systems, and amongst themselves. Examples include:

For manufacturers without an software-based MES solution many of these operations are done manually through emails, meetings, and knowledge-from-experience, but those procedures are labor intensive and prone to error. MES software can be implemented to provide more tools and information to the people who need to make these decisions, or even completely automate business-to-manufacturing management tasks.

The Value of MES

According to recent surveys published by MESA International (Rick Franzosa, 2019), 87% of MES installations have achieved their expected long-term benefits. However, that same survey also reveals that 98% of companies that have installed MES feel there is unrealized value to be captured from their installation.

What benefits are associated with MES projects and where can we expect to derive value? Business Criteria used to justify MES projects often include:

- Improving access to actionable data to promote better decision making

- Improving product quality
- Enforcing standards and best practices
- Reducing cycle times and increasing line efficiency
- Complying with regulatory requirements, including traceability and serialization

Business value of MES solutions is often categorized into hard benefits (such as direct revenue increases or cost reductions), soft benefits (like making people more available for high-value work, or risk reduction), and qualitative benefits (benefits that may not have a direct, measurable monetary value (Dyck & et al, 2014)). Examples of each are shown in Figure 2 - Benefits of MES.

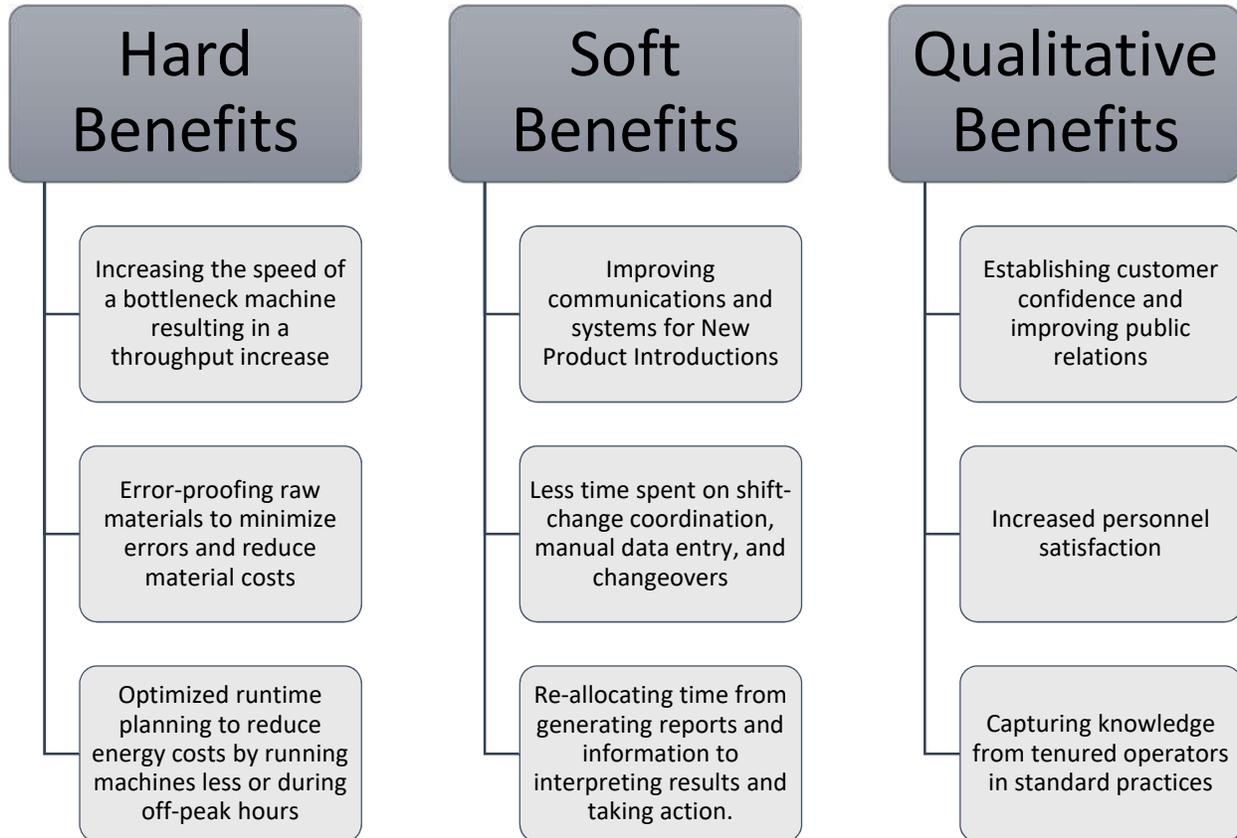


Figure 2 - Benefits of MES

Common Pitfalls and How to Address through Requirements

While implementing MES can provide significant value into your manufacturing business, implementing such systems can be challenging. By their very nature Level 3 systems require cross-functional teams, communications and coordination between various disparate systems, and an understanding of the business and manufacturing contexts in which they operate. In fact, recent MESA International surveys showed 78% of those who recently implemented MES reported that integration with other systems was more difficult than expected (Rick Franzosa, 2019).

Based on industry research and Grantek’s experience, common challenges that impede successful MES installations include:

- Limited understanding in how to properly establish and communicate MES goals
- Misalignment of MES solutions to their associated functional requirements
- Difficulty establishing a common understanding of manufacturing and business processes across different departments
- Limited endorsement and support from critical stakeholders (cultural buy-in)

The foundation of a successful MES implementation relies on a solid understanding and articulation of your Business Goals and System Requirements. What does your business value, what are your short and long term goals, and how might we be able to leverage new technologies in the MES space and beyond to realize those goals? Once our overall business requirements are better understood, what does our MES need to accomplish to support those goals? This clear link between value, requirements, and verifiable results is key to a successful MES implementation.

Table 1 - MES Initiative Challenges

Approach	Leads to
Driving MES projects by technology instead of business goals	<ul style="list-style-type: none"> • High cost of ownership • White elephants • Unsatisfied end users • Unrealized business value
Selecting a MES platform without clearly defining user requirements	<ul style="list-style-type: none"> • Hit-and-miss success • Higher system complexity • Unmet requirements • Buyer's remorse
Ignoring 25 years of industry best practices embodied in standards	<ul style="list-style-type: none"> • Trial-and-error implementation • Poor integration between business systems and plant floor • Duplicated and/or inconsistent data.
Failing to engage end users in requirements and acceptance criteria	<ul style="list-style-type: none"> • Users ignore or turn off system • Productivity suffers • Business value not realized
Focusing on a single pain-point instead of the big picture	<ul style="list-style-type: none"> • Complex systems • Missed opportunities • Duplicated capabilities and data • High cost of ownership and support

Grantek's Implementation Methods

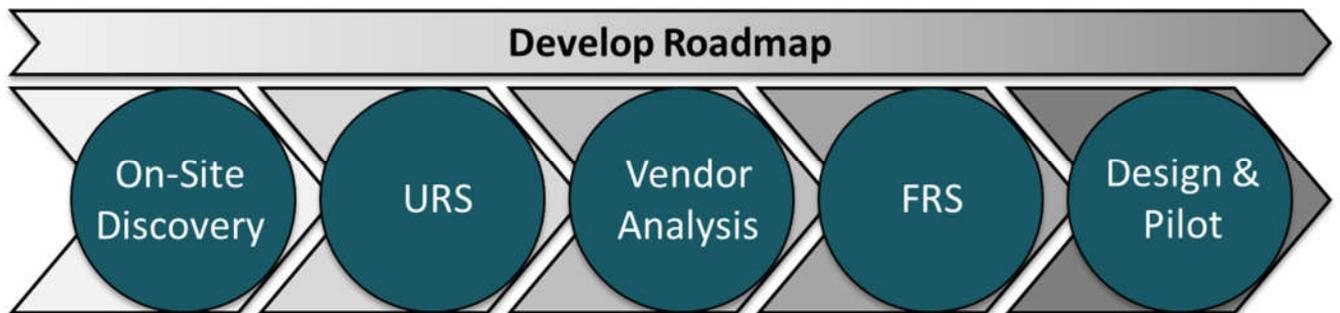
Grantek's MES Roadmap to Success process is specifically designed to ensure successful implementation by avoiding common pitfalls and mistakes. We utilize best-practices, manufacturing models, and requirements gathering techniques from industry organizations to leverage the best information and methods available. Namely the ISA-95 standard for Enterprise-Control System Integration, the GAMP-V model for requirements and validation, and material from MESA International are major influences for our process. Grantek has a number of MESA Recognized Practitioners on staff who have been

specifically trained in how to gather requirements and set the foundation for a successful MES implementation.

We start with capturing Business Goals, understanding your business and processes, and involving stakeholders from across the organization in the early design phases. Requirements are discovered, documented, and progressively iterated towards actionable, testable work-blocks for our implementation teams.

Grantek's MES Roadmap to Success Process includes:

- On-Site Discovery to provide education around MES and best practices, understand your organization and its processes, and get hands-on experience with how your organization operates.
- User Requirements Specification (URS) documentation to formalize your business goals and high-level requirements for an MES.
- Vendor Analysis to compare multiple MES software packages against your requirements or assess the software you've already selected to understand how it fits. This includes an assessment of up-front licensing and long-term support costs.
- Functional Requirements Specification documentation, which takes the User Requirements the system is intended to address and describes the functional steps that will be required to accomplish those requirements given the selected software and related existing systems.
- Design and Pilot to finalize detailed design specification documentation, implement a pilot, and validate that the system meets the original Business Goals.



Advantages of Working with Grantek

Standards-Based Solutions

Grantek emphasizes the value of leveraging industry standards and best practices in the design and implementation of MES solutions. Grantek is well-versed in pharmaceutical and life sciences manufacturing as well as food, beverage, consumer packaged goods (CPG) and commodity manufacturing and are therefore familiar with the relevant regulations and applicable standards. The roadmapping process followed by Grantek is derived from the GAMP-V model applicable to the life sciences. Good manufacturing processes, regulatory requirements, and qualification testing concept applicable to Health Canada and FDA-regulated manufacturing are also beneficial to the other industries that have less stringent regulatory requirements.

From Consulting to Delivery

Grantek is not solely a MES consulting house—we are a full-service consulting and integration company providing MES consulting services along with our integration services, enabling us to develop and implement the MES solutions we recommend. Our deep engineering capabilities gives us a very realistic view of how to design and build the project from end to end. We fully understand the details of each process involved with actual installation and optimization of the MES solutions we recommend. Our analysis and MES roadmap are built on practical experience gained through our many years of experience as a systems integrator.

Next Steps

If your Operations, IT, Engineering or C-suite staff would like more information about Grantek's MES/MOM consulting and implementation services, please email info@grantek.com. Our Strategic Initiative consultants and Subject Matter Experts can also provide insights into potential improvements to your network infrastructure and cyber security, and our Automation and Systems Design teams are ready and able to assist with implementation and integration.

About the Author



Sam Russem [Director, Smart Manufacturing Practice] has over 10 years of experience in manufacturing execution and automation system design. As the Director of Grantek's Smart Manufacturing Practice he is responsible for guiding our customers and Grantek through the world of Smart Manufacturing: assessing industry trends, curating cutting-edge technology, and constructing roadmaps for achieving operational excellence.

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