

Manufacturing Execution Systems the cornerstone of **Industry 4.0 success**



Manufacturing Execution Systems

the cornerstone of Industry 4.0 success

Insights in MES as a solution to various practical business challenges.

The Manufacturing Execution Systems (MES) market is booming. In 2020, it was valued at 11.56 billion US dollar. By 2026, it is expected to reach 27.3 billion US dollars, which boils down to an aggregated growth of 15.4% over the period 2021-2026*. There are many factors that contribute to this increasing need for MES: automation of manufacturing processes, integration with business systems, the rise of IoT (Internet of Things) ... All these can be summarized with trendy-sounding terms such as 'industrial digital transformation' or Industry 4.0. In this context, MES is often described as a crucial backbone of the industrial digital transformation.

But what does all this mean for your organization? How does a Manufacturing Execution system solve your practical problems and challenges? How does it meet your manufacturing and overall business needs?

In this e-book, we aim to go beyond the buzzwords and explain how a reliable MES can be a means to dealing with very practical problems and challenges, specific to your environment.

**MES is a
crucial
backbone of
the industrial
digital
transformation**





The visual above clearly summarizes the various stages and departments involved with a typical manufacturing process, from receiving and stocking raw materials up to the shipping and transporting of finished goods. Throughout these stages and across these departments, MES can play a determining role.

More specifically, we will be focusing on why and how to:

- Ensure consistent and accurate weighing and dispensing of all materials while speeding up manual dosing activities
- Orchestrate the planning and dispatching process, considering all constraints
- Enable product tracking and tracing, and product genealogy
- Track product quality and optimize production by integrating with the right quality tools
- Automatically and effortlessly create reports to ensure a complete overview of all manufacturing processes

Your digital transformation journey starts here!



About the author

Sergio Hernandez is an industrial engineer, dog owner, entrepreneur, nature and sports lover and auctioneer.

His tendency to think outside the box has allowed him to fulfill different roles in the industry for seven years. He has worked closely with automation and process engineering within the manufacturing business. He has also been in consulting and executing digital programs with different solutions in the MOM space and has led several digitization projects.

He is currently the director of Execution Systems (MES/MOM) spaces at AG Solution Group, working on projects all over Europe and is the main creator and coordinator of the subject Industry 4.0 Technologies at UPC Terrassa, in Catalonia, Spain.

MES Weigh and Dispense

Key contributor to manufacturing excellence and product quality

Manufacturing Execution Systems is all about managing the production and ensuring product quality. The quality of a product is directly related to its physical composition. Dosing the right quantities of the right products is of critical importance. There are plenty of tools available for this purpose, but without integration into the rest of the MES modules and the organization's entire digital infrastructure, the added value remains limited.



The traditional tools to support and maintain weigh and dispense processes have served their purpose in an analog and non-integrated world. But with the increasing pressure on accuracy and speed of the manufacturing processes, they are found severely lacking.

An organization with several manufacturing plants, often finds itself coping with distributed and heterogeneous business rules for the weigh and dispense (W&D) order management. Moreover, the lack of maintained and documented W&D operations is likely to repeatedly cause mistakes: dispensing incorrect lots, omitting consumption strategies (such as FIFO).

Poorly digitalized and insufficiently integrated W&D units cause a lot of inefficiencies: excessive paperwork, poor management of W&D processes and workflow steps – which leads to mistakes such as product re-processings, product waste, and process variability.

All the above also leads to a poor and inefficient traceability system. And the manual integration of W&D with ERP systems and OT systems (such as weighing devices) is very likely to generate human errors which can seriously disrupt the supply chain and slow down the manufacturing process.

Automation, homogenization, and integration: a cure for the pain

These problems and inefficiencies can be solved with a well-developed and well-integrated MES Weigh & Dispense module, which can also standardize and homogenize the weighing and dispensing activities

A modern, well-connected and integrated MES W&D module should include:

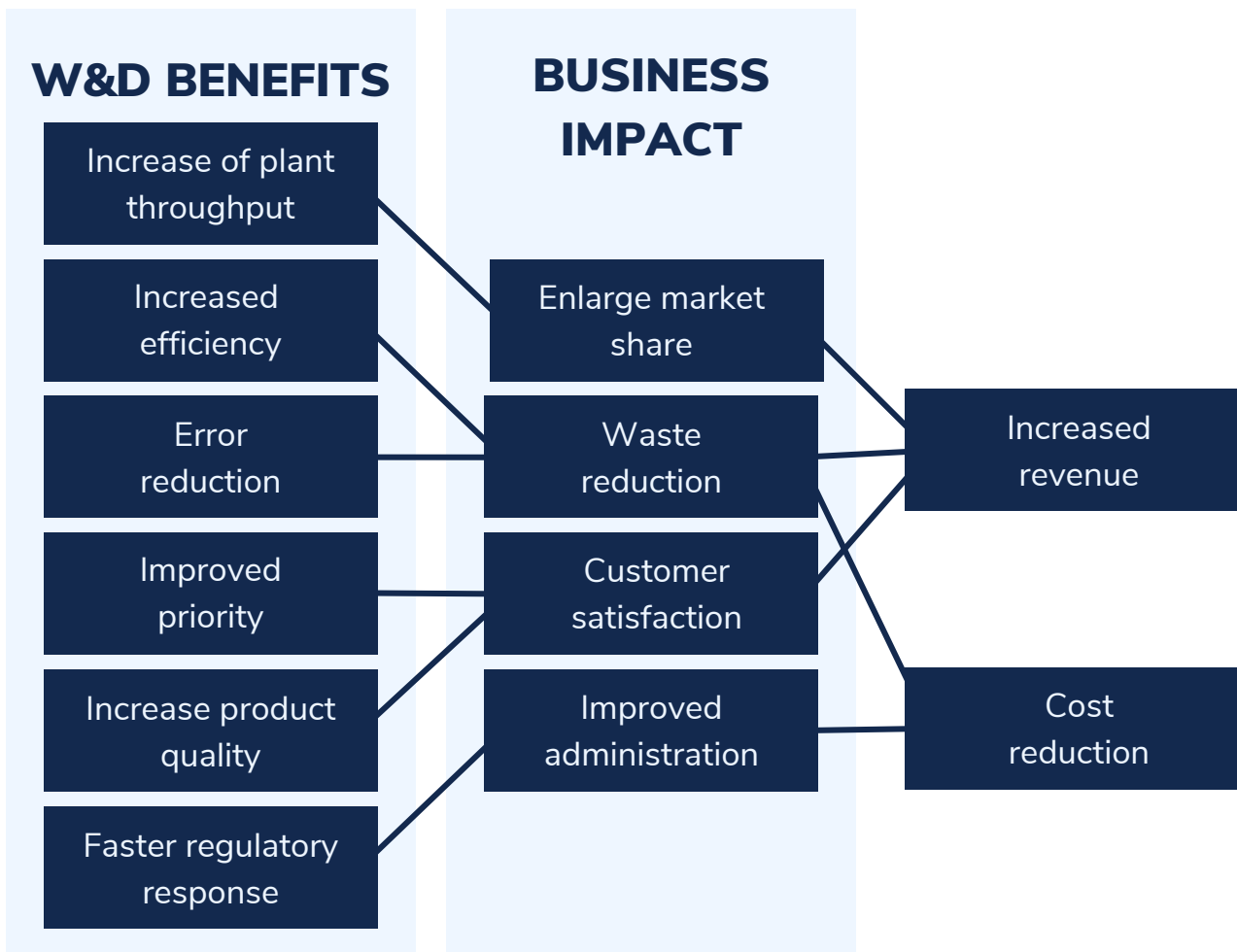
- Management and execution of all weigh and dispense processes.
- Guidance for the W&D operators through well-defined and centrally maintained workflows (manufacturing business rules), including Standard Operating Procedures
- Tracking of all activities involved
- Integration with the shop floor
- Control and visibility of inventory levels
- Reporting capabilities
- Verification of materials by wireless handheld devices
- Centralized and controlled master data about all materials (BOM – bill of materials)
- Automatic label printing

Increase in quality, efficiency, and revenue

A well-developed and well-integrated W&D module will benefit the business on many levels. Planning and scheduling will be improved and can be priority-based. As the W&D business rules will be automated and maintained, there will be no more need for paper validation.

Digitalization ensures more efficient processes and traceability while saving your organization valuable time and reducing the risk of human errors. Last but not least: by introducing a consistent weighing process, you can achieve an optimal level of quality.

Below you can see how various advantages can ultimately be translated into an improvement of the bottom line, by increasing the revenue and reducing the costs:



Benefits across departments

This graph illustrates how the benefits can be experienced in various departments.

The production department enjoys waste reduction, improved lead times, and process optimization. The continuous improvement department will be able to better benchmark processes, and can better detect opportunities for investments. The Quality Assurance department is given the right basis to achieve traceability and end-to-end genealogy, improve the workflow edition and approval process, and – in some industries - react more swiftly and easily to audits from regulatory agencies. Lastly, the supply chain department receives the right data to better benchmark supply chain metrics such as lead times and throughput, and with solid metrics for the preparation of their materials.

In summary, a well-integrated MES W&D module will homogenize, standardize and centralize all data and processes in order to increase efficiency and quality. Additionally, it will provide all parties concerned with relevant data, which leads to yet more business improvement. Thus, the W&D module becomes a significant contributor to the overall business result.



MES Planning and dispatching

How to optimize processes without compromising on quality

MES is all about managing and orchestrating all manufacturing activities, ensuring product quality. But increasingly, organizations expect a detailed and complete insight into the production data, during and after the production. This can only be realized by connecting the MES system with all relevant data sources. A complex but worthwhile endeavor.

In theory, it is not so hard to draw up an ideal plan. But in practice, you find yourself constrained by other business realities such as (un)timely delivery of goods or cost optimization. These factors and others generate a consistent trade-off in planning between efficiency and delivery: you want the production to start as soon as possible, but you also want to optimize the production to minimize the required service activities, such as cleaning and line setup, and to reduce changeover. This requires a comprehensive and up-to-date overview of all the resources needed (human, asset, or material). In addition, you need to be able to easily reallocate and recalculate these resources depending on plant availabilities.



Once all resources are available, you need to dispatch production as soon as possible. But very often, this process is hindered by the slow communication process (over the phone and other non-integrated means of communication) needed to confirm this availability. Meanwhile, you need to ensure that all internal and external conditions are met (cleaning of equipment, security checks, etc.) before launching the production. Failure to do so can create product flaws, rework, or other major issues.

Moreover, a lack of overview and poor management of materials may result in products staying in the warehouse for a very long time or even result in unused raw materials needing to be returned from the dispensing area to the warehouse. This leads to higher inventory costs, which should be avoided at all times.

Accurate, detailed, up-to-date, and integrated information is key

Optimizing the planning and dispatching processes for an ideal business result is a challenging task, that much is obvious by now. An ongoing task, which can, fortunately, be simplified and supported by a reliable and integrated MES solution.

This solution should be able to calculate, among others, the production set-up and processing time. It should be well-integrated with the other MES modules, for instance, to obtain the required information to make recipe-based calculations and predictions regarding the availability of resources. Integration with other systems, such as the ERP software, helps in planning the production based on the expected delivery of materials.

The solution should feature an advanced scheduling function, which will schedule the processes by using real-time data and multiple plant constraints. Last but not least, it should present all data within a user-friendly user interface, thus providing visibility in a complex environment.

Access to the scheduler can also be role-based, depending on the type of user, thus providing the user with the exact information they need at any moment.

On the dispatching side, the software should have an overview of the availability of products and materials, but also of the human resources required and of the production lines, machines, and other assets involved in the production.

The MES system should be aware of the composition of raw materials and of finished goods, and the recipe to produce them. **This enables the system to detect potential shortages and to predict and plan production in terms of the future availability of resources.**

MES planning & dispatching: a powerful optimization tool

With such a MES module at your fingertips, optimizing the planning and dispatching processes becomes a lot more powerful.

Based on accurate schedules for raw material supply and for machine setup, you can make more accurate and reliable plans, and set realistic start and finish dates for each work order. You can better calculate the cost of the plans and assess the probability of meeting the objectives for each and every plan.

Based on the actual timing, you can also improve the reliability of this assessment, by adjusting the processing time and other variables. And you can optimize the available lot based on comprehensive and detailed information on the entire manufacturing process.

In terms of dispatching, you can reduce cycle times by improving the dispatching velocity: a proactive system to alert and advise on the next step replaces the numerous calls and emails of the past, and digitally checks the availability of assets taking coded business rules into account. The accurate overview of all needed materials provides you with a good insight into the availability and real-time status of products. This not only reduces the time-to-market but also increases the number of on-time deliveries.

Meanwhile, the timing of the deliveries improves, because the pro-active system can dynamically calculate delivery times at each step, and warn when theoretical delivery times will not be met according to standardized processing times. This will undoubtedly have a positive impact on your customer relations as well.

All of the above contributes to the bottom line in various ways. Additionally, the tight control and accurate overview, combined with the standardized and centrally maintained standard operating procedures (SOPs), significantly reduce the number of mistakes in the manufacturing process. The use of an integrated MES module for planning and dispatching will pay for itself sooner than you might imagine.



MES Traceability

Connecting the dots for a better insight

MES is all about managing and orchestrating all manufacturing activities, ensuring product quality. But increasingly, organizations expect a detailed and complete insight into the production data, during and after the production. This can only be realized by connecting the MES system with all relevant data sources. A complex but worthwhile endeavor.

Data used to be of secondary importance, a side-effect of the actual production that most manufacturing organizations preferred to ignore. Nowadays, these production data have become very valuable and sometimes even critical for the organization.

Think only of a product flaw generating several complaints. Without an in-depth insight into what caused the problem and which materials/lots/operating machines were involved, it is very difficult to deal with such a problem effectively. But very often, the required data (on operators, alerts, used resources, equipment configuration) are hard to recover or not available at all.



Additionally, this lack of available data can cause lots of inefficiencies: the supply chain department needs to make phone calls to inquire about the status of an order, and the quality department often struggles to find answers.

Moreover, the plant managers or C-level executives don't have aggregated data available to assess the efficiency and effectiveness of the manufacturing sites.

And there are other areas where traceability solutions can contribute significantly. The time to release a product, for instance, can significantly be reduced by using a MES to review by exception (i.e. when a deviation from the expected result occurs) instead of reviewing all process parameters and critical data belonging to a batch.

The latter procedure can be long and painstaking, sometimes up to two days, as was the case for one of our customers. With reviews by exception, most of this time is freed up, allowing the team to focus on value-adding activities.

Wanted: interfaces

The root cause of such data-related problems is the lack of interfacing between the production environment and the rest of the organization. Business applications such as ERPs are consequently not automatically updated in terms of resources, material, and personnel. Which makes it hard to execute any performance analysis or cost calculations.

This lack of interfaces also causes other inconveniences. It will be difficult to trace materials through physical equipment such as vessels, silos, or tanks, compile production data and translate them into business information (including in-work inventory, raw material usage, and energy usage), and deliver calculated data to business applications. Data such as cycle time calculation and resource utilization (both equipment and personnel) can improve the overall decision-making and the predictions of the results of a production run based on a continuous process and operations analysis. If they are available at all.

MES traceability module to the rescue

A well-connected MES traceability module can take care of all that. This means that first and foremost you need to connect your MES system to all relevant equipment and applications that contain relevant data on the one hand, and on the other hand to all business applications that can use this data for analysis, follow-up, scheduling, etc. (see illustration below).

When fully connected, the MES system can start collecting production data from various sources such as sensor readings, equipment states, event data, operator-entered data, transaction data, operator actions, and messages.

BUSINESS

DATA



ERP



Scheduling



Quality



Maintenance



MES



PROCESS

DATA



PLCs



Smart sensors



HMIs



Entry

These data will enable you to:

- Provide reports with production data
- Follow up on the real-time status of production, orders, and batches
- Run a proactive monitoring system to check if manufacturing processes meet regulatory and process obligations
- Maintain information to enable product tracking and tracing, such as tracing products to specific material lots
- Maintain information for the analysis of local processes and for reporting to higher logistics systems
- Provide product quality information for comparison with specifications

A well-integrated MES traceability module will provide valuable information both during and after production, both to operational and executive divisions. It will ultimately benefit the entire organization by enabling smoother processes and better decisions on all levels.



MES Quality

Ensuring product quality and organizational excellence

MES is all about managing and orchestrating all manufacturing activities, ensuring product quality. But increasingly, organizations expect a detailed and complete insight into the production data, during and after the production. This can only be realized by connecting the MES system with all relevant data sources. A complex but worthwhile endeavor.

Quality is a crucial department in any industry, and they are involved in process definition and all quality control procedures. The quality control department ensures that the product meets the agreed specifications (PH, viscosity, etc.) during the production process. The quality assurance department needs to ensure that the finalized product reaches the customer as agreed and follows the customer's quality specifications. This includes collecting documents, reviewing the overall product quality, and signing it off for shipping. In short, the quality department oversees the product quality from the very first customer order up to the final delivery.



To ensure product quality, the manufacturing processes need the right amount of quality controls, and well-functioning procedures when the quality is found to be lacking. But without an integrated system that links the manufacturing with the quality department, it is very hard or even impossible to optimize the processes with built-in quality controls and efficient handling of deviations. There will always be an abundance of phone calls and redundant communication whenever a deviation occurs. And even when it all goes well, the manual and non-integrated quality procedures entail a great deal of non-value-added work.

All this leads to a slow and inefficient product release cycle, which is far more costly than it should be. The quality department lacks real-time visibility of the process and proactive systems to alert about process deviations. Furthermore, when deviations occur, it is very difficult to find root causes for the problem, due to the absence of a system that integrates and connects all types of data.

MES: ensuring the quality of the quality department

A fully-equipped MES interfaces with quality systems and resources and integrates with the production environment to ease the communication between production and quality departments, which results in an optimized production. It allows for better management of sampling, to optimize and improve the quality processes within the production cycle.

The system is naturally capable of interfacing with all different manufacturing IT Systems, and can thus provide an aggregated complete view of all processes. It should provide visibility of these processes in real-time, with the possibility to alert the Quality department proactively whenever there is a process deviation. It also helps avoid mistakes by blocking the shipping of products with deviations.

In terms of features, a well-equipped MES should provide:

- Complete Quality Control Plan management
- Event-based quality actions execution (sampling)
- Periodic generation of Quality Controls
- Quality procedures in production workflows
- Quality traceability and Corrective Action Preventative Action (CAPA)

Benefits: improved product quality, cost-efficiency, and a thriving quality department

When all of the above functionality is introduced, the Quality Department will perform significantly better because of the automation of processes and the proactive quality deviation alerts. It will also contribute to organizational efficiency in various ways.

Processes will be optimized by data retrieval and root-cause analysis whenever a deviation has occurred. The early detection of deviations will lead to a reduction of scrap, rework, and ultimately benefit the release time as well.

Overall, the MES will benefit the product quality as well, because such a system will ensure all procedures have been followed. Additionally, it will collect, combine, and report all manufacturing data, which enables better control and management of all quality-related items.

This centralization, integration, and easy access to data also leads to a dramatic reduction of paper needed for regulated environments, and regulatory audits will be far less complex because all relevant information is at your fingertips.

To summarize, MES Quality leads to improved product quality, a better functioning quality department, and ultimately lifts the entire organization to a higher level by reducing costs while increasing customer satisfaction.



Your digital transformation journey starts now!

By now, you should have recognized some of the technical and business challenges that your manufacturing organization has faced, just once or all too often.

And you will hopefully understand how one or several MES modules can help you tackle these challenges and move your organization forward.

In Industry 4.0, the digitalization and automation of your manufacturing processes and activities is not a passing trend. It's much more than a buzzword. It is about integration, automating, and improving all aspects of your manufacturing organization. And ultimately, it is about improving your bottom line and expanding your possibilities.

**Can't wait to digitalize your organization?
Contact us today and our experts will help you get started.**



www.agsolutiongroup.com



[AG Solution Group](#)



[AG Solution Group](#)



AG Solution Group

AG Solution Group **builds bridges**. We deliver high-end solutions and make your production data work harder for you. Better. More efficient and more accurate. AG Solution Group can make your production process smarter, identify bottlenecks and reach good solutions. Supported, correct, and safe.

AG Solution Group is a **differentiator**. Where OT and IT meet, we make sure they reinforce each other. Automation that delivers a profit, and better and smarter usage of data, is the key to optimization.

To cost efficiency. To certainty. To thorough and good analyses and even better decisions.

Our **6 centers of expertise** allow us to work small and agile as well as large and specialized. Knowledge, methodology, and commitment are our weapons.

The result is a cost-efficient, safe, automated, and streamlined industrial production process. Your production process.

We set high standards for ourselves because you do too. Our software and platform suppliers are market leaders such as Siemens PCS7, Wonderware, Nozomi, and OSIsoft PI.

