The New MES: Backbone of Industry 4.0

White Paper
EXECUTIVE SUMMARY

Industry 4.0 is the vision of future manufacturing that allows not only lower cost, higher quality, and faster processing – but all of that with personalized products. It’s a marketplace where smart products and smart equipment interact autonomously for dynamic optimization on the fly. For most companies, it’s a concept and the way to implement it is not clear. While testing out new technologies and creating a new approach to production and supply chain operations, there is one critical foundation piece companies must lay, and that is a new manufacturing execution system (MES) that is Industry 4.0 ready.

Customers demanding less expensive, yet customized, products are driving manufacturers to make Industry 4.0 a reality. Fortunately, technology exists today that allows not only lower cost, but higher quality, faster processing, and shorter time to market for personalized products. The obvious technologies include the Internet of Things (IoT), mobile computing, cloud storage, software and service availability, big data, advanced analytics, machine learning, robotics and virtual and augmented reality (VR and AR). However, much like the nerves, limbs, and head of a person, these new technologies need a backbone connecting and coordinating them. The only way to guarantee quality, ensure productivity, manage cost, and have reliable delivery dates is with a manufacturing execution system (MES). The success of Industry 4.0 rests on a new generation of MES that is Industry 4.0 ready.

The New MES has some key characteristics that very few current MES products can claim. To be Industry 4.0 ready, MES must be service-oriented and modular. That means it’s ready to process IoT data including event and locations, as well as integrate with augmented reality. It is equipped to provide complete plantwide context for operations data, so it’s ready for use in big data and advanced analytics. It can run on mobile and in the cloud, and on any version of both mobile and cloud. Its capabilities include brokering connections between autonomous products and equipment in the shop floor marketplace. This is essential to ensure that a mix of smart and traditional products can flow through the autonomous marketplace effectively, driving plantwide and supply chain-wide optimization for speed, cost, and performance.

The New MES with its role as orchestrator, dynamic engine, broker agent for the marketplace players, and documenter is essential to making Industry 4.0 a reality and gaining the benefits. This is particularly true for innovation-driven companies in industries such as semiconductor, electronics, avionics, automotive, and medical device technology.

Although the MES software category is now decades old, it’s perhaps even more relevant as many new manufacturing technologies emerge. In fact, the New MES is the backbone of Industry 4.0.
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Do manufacturers with highly automated plants need to concern themselves with Industry 4.0? Yes, as this is the next production paradigm that can help these companies meet urgent priorities.

Companies must improve speed and lower cost to innovate. Mass customization and personalization are becoming the norm. There will be fewer high volume products and more low volume products, resulting in a need for quick changeovers. Quality must improve to approach zero defects. Customer requirements – and thus products – are often complex. At the same time, there is intense price and margin pressure, even while customers’ requirements are more complex and diverse.

Current manufacturing systems and automation approaches cannot deliver those results in the face of constant and rapid change. Margins, cycle times, and quality all suffer in the face of greater mix and complexity. Significant quality ramp challenges mean that by the time a manufacturing process is under control, the market window for leadership and profit has closed. As a result, this opportunity to serve customers in a high value way is instead a severe constraint. The top objective of Industry 4.0 is to lower the cost and improve the reliability of more customized and smaller-run production.

How does Industry 4.0 enable companies to outperform competitors? By delivering vastly more data and intelligence.

**Data:** IoT devices collect data at unprecedented frequency from many more touch points, creating valuable, timely, and granular information for decision making. This supports online correction of the current process and product. With machine learning, it also automatically improves management of future runs of the same type of product. Machine learning algorithms, trained on historical data and continuously tuned, enable very fast decision making based on predictive analytics.

**Intelligence:** Products, equipment, and the shop floor as a whole, are self-configuring and self-optimizing. Using artificial intelligence, they complete complex tasks in the shortest possible time, with the least possible cost, and deliver outstanding quality. Industry 4.0 creates a dynamic marketplace that is efficient and effective at making exactly what’s needed - even unique products in lot sizes of one - in the fastest and cheapest way possible.

What’s so Different in Industry 4.0?
At the point where IoT-enabled products and equipment interact, Figure 1 shows that Industry 4.0 is quite different from today’s production approach. In this Industrial Internet of things (IIoT), some intelligence is distributed throughout the system. Here, processing and sensors reside in products, materials or carriers, pieces of equipment, and production lines across facilities and partners in the supply chain. This distributed intelligence does not eliminate the need for plantwide monitoring, control, and guidance – but it changes it significantly.

Once the industrial internet of things (IIoT) and Industry 4.0-ready intelligence structures are in place, companies can fully leverage new technologies such as 3D printing, augmented reality, cloud computing, machine learning, digital twin, predictive and prescriptive big data analytics, and more.

Figure 1: Current customization typically involves holding after a generic build, and always has a pre-defined routing. In Industry 4.0, intelligent products and equipment allow custom products to dynamically go through the process in an optimal way without pre-staging generic sub-products.
The New MES for Industry 4.0

As with previous generations of high-tech manufacturing, a manufacturing execution system (MES) is still central. In some ways, its role is even more critical than in the past. Unfortunately, not every MES in use today is capable of supporting Industry 4.0. Figure 2 compares traditional MES with the New MES. The Industry 4.0 vision calls out specific capabilities that will enable all of this. The five main areas are:

- **Connectivity/sensing/mobile** – handling sensor, location, and device IIoT data no matter where, while providing additional MES context
- **Cloud/advanced analysis** – making sense of the masses of data whether in the plant, connected to enterprise, mobile and IIoT, or out to big data
- **Decentralization** – managing and controlling the state of smart products and tools through their IIoT
- **Vertical integration** – ensuring integration from the manufacturing-wide MES down into controls and automated equipment, as well as up into enterprise systems, such as ERP
- **Horizontal integration** – ensuring the plant is a transparent, integrated, and predictable part of the supply chain, and eventually able to interact as a smart factory in a global marketplace

Together, these characteristics point to a new generation of MES. One designed not only for complexity, but for constant change that it monitors and oversees in collaboration with a marketplace of autonomous smart products, equipment, and supply chain partners cyber-physical systems (CPS) and smart equipment or (CPPS).

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**Figure 2:** Industry 4.0 requires characteristics that many current MES do not have, so manufacturing IT must evaluate carefully.
Connectivity & Mobile

The implications of IIoT for what constitutes connectivity and mobile for MES are significant. It expands the focus well beyond the MES itself being internet-connected and visible on mobile devices. It changes the capabilities required dramatically so MES becomes an orchestration layer central to this dynamic marketplace.

The core function of MES has always been to guide, monitor, and record actual production activities. Figure 3 shows that in the Industry 4.0 shop floor marketplace, much of the logic driving which materials go to which piece of equipment for processing is derived from the intelligence in the product (or CPS) and the piece of equipment (or CPPS).

Figure 3 is a simplified view based on only one step. In reality, the New MES must look across all subsequent operations to determine the actual “lowest cost” route through the entire process. Each piece of equipment can bid from its scope, but the MES will be adding plantwide context for subsequent and dependent steps to optimize the overall routing and operation. (See Figure 4 on page 10)

In this environment, rather than just connecting to push out directives about what should happen next, the MES must parse what’s actually happening in the shop floor marketplace. This requires IoT event processing. An IoT management portion of the MES must both push out information to CPS and CPPS, and be ready to accept and post data based on events.

Beyond that, the MES provides orchestration for the IIoT. For example, when an IoT device capable of making a certain set of measurements is connected, several things need to happen for it to function as envisioned. First, the IoT device needs to inform a high-level IoT platform that it is available and ready. Then the platform needs to register it and associate it with a given entity (e.g., a production machine). At any time, the platform must be able to monitor the device for status and communicate bi-directionally to make it part of a set of high-level orchestration workflows at the New MES level.

Shop-floor Marketplace

Figure 3: The shop floor marketplace of Industry 4.0 leverages intelligence in products and carriers requesting services and in production equipment, lines and plants bidding to provide services. This shows one product and one step, but of course many products at many steps will be negotiating.
These few examples above illustrate that the IoT needs to be integrated with a high-level platform to control it and make it part of the MES workflows.

Ideally, the MES IoT component is lightweight and self-discoverable, creating a layer on the IoT-enabled device that’s above its communication and security. What makes this connectivity tricky is that different devices will have different capabilities – and for a while, some may not even be smart. So, it’s important that the MES be able to provide different configurations and types of instructions to each device to match those abilities.

Typically, MES will need to handle a combination of smart and traditional lines, or even a mix of smart and non-IIoT-connected products on a single line.

Mobility for MES now means more than being able to access the system from a tablet, smartphone, or industrial mobile device. The new level of connectivity begs for new user interfaces that are also more agile and intuitive.

Specifically the user interfaces must also be fine tuned, not just to allow operators doing repetitive tasks to be efficient, but to deliver intelligence. In Industry 4.0, the employees are doing high value-added work and making critical decisions. That in turn means that the interfaces must be specific, not only to the workstation, but to the combination of step, equipment, and product being made.

The result? MES of the future must allow manufacturing personnel to quickly build specific MES user interfaces to be used in different contexts. The system must detect the operator’s location, the equipment in use, and the product being processed to automatically adapt the user interface! Because this is so dynamic, it would create a huge IT backlog if IT were the only group capable of configuring these GUIs.

Since MES also provides the overall plant context for process and product data, in the IIoT world, this means it must handle location data from the materials and products. Location sensing also enables MES to distinguish one CPPS from another based on its location.

This capability may also feed a live factory representation of status of all equipment, or the location and status of every lot or unit as it is being produced. Ideally, a 3D representation of the factory as designed will be compatible with the MES factory model. Beyond visual status, location sensing can support 3D navigation and direct someone to perform a maintenance task effectively using augmented reality. Maintenance is the first application because equipment context is often enough. As more MES data can be viewed in AR, quality and production tasks will also be available. Tasks might include validating materials and product IDs, checking equipment schedules, maintenance plans, and modifying them base on yield.
All of that may be compelling, particularly for the manufacturing IT team. However, there is a clear business case for the connectivity and mobile aspects of the New MES as well.

In high-tech manufacturing, from semiconductors to everything that uses them as components, customers are expecting edge computing to support their advanced applications. Full leverage of this on the production floor means these products can be made faster, more reliably, at higher quality, and with fewer human resources. People in the operation will have faster, deeper understanding of status for “decision-making” while needing to do less to control it.

It also allows production tracking wherever it takes place, in partner or remote sites. Guidance of maintenance technicians through augmented reality is also starting to show benefits in lower error rates, and thus higher equipment uptime.
The benefits of having applications reside in the cloud are now abundantly clear. As more intelligence is coming from IIoT, rather than hardwired in-plant networks, one key argument against cloud-based MES and automation connections vanishes. The network latency, reliability, and security issues are not yet addressed, but progress is rapid. So, MES is moving to the cloud. Hybrid cloud allows the most critical information to reside on premises, at the edge. In these scenarios, the data may go up to the cloud to set up machine learning algorithms. After that, the algorithms are executed by simple software in the IoT sensors.

There are many approaches to cloud, including software as a service (SaaS) hosted on infrastructure as a service (IaaS). In this scenario, users connect through a browser to software that runs on cloud infrastructure, but uses traditional technologies for the database and application. Eventually things might move to platform as a service (PaaS) where the entire set of applications, database, and infrastructure are all hosted in the cloud.

Of course, different companies may opt to have their cloud implementation public, private, or hybrid. It’s important that the MES not dictate that environment, and that it be set up to protect the company’s sensitive production data and deliver fail-safe service in any of those cases.

One of the clear benefits of the cloud is the ability to temporarily use massive amounts of computing power to process advanced analytics. Clearly, MES needs to have an operational data store from which reports are run and to send data to a data warehouse at the enterprise level. That’s not new. What will be new in the cloud is the ability to export selected views from the MES or enterprise analytics out to big data structures.

Big data structures split up data sets for enterprise-scale big data analytics to occur efficiently in the cloud. Specific to the New MES is the ability to create a time-based data export to a big data structure that allows the production context to be captured fully. Without that full context, production data will be of minimal value to the enterprise.

So, having this in-context production data will enable the rest of the enterprise to make good decisions, even as conditions change. These decisions are also the foundation of what happens in the plant for the order or product lifecycle, as dictated by the ERP and PLM systems.

In the production arena itself, adding analytics to connected and mobile capabilities will enable predictive and prescriptive maintenance as well as quality, performance, and manufacturing to emerge. For example, when analytics show the output of one run, the system can automatically optimize the next run.
Cloud allows for smooth and constant software upgrades. This is an important consideration for manufacturing software such as MES, which in many high-technology facilities is so difficult and risky to replace. As a result, companies now have completely antiquated “spaghetti code” systems that are unsupported by vendors.

The reduction in hardware can free up the IT team to focus on strategic advantage. Again, with many of the older MES in place currently, hardware failures present another major risk. Often the computers are long out of support and parts are no longer widely available.

We already mentioned the larger capacity for data analytics at reasonable cost and response time. Broader and more strategic use of advanced analytics will allow predictive measures for success in the face of shifting business realities. Machine learning will enable systems to better keep pace with the constant changes in products and processes. Moving into predictive and prescriptive analytics will continuously update the MES models to enhance throughput, yield, and uptime.

Ensuring that business decisions are based on the current state of production will improve supply chain, product lifecycle, and financial decisions. When production is always based on up to date company strategy and decisions, plant personnel can make decisions that result in better customer service and margins.
Decentralization to Oversee the Marketplace

We talked about the shop floor marketplace of CPS and CPPS, seeking and offering production services. This is a central concept to Industry 4.0, providing autonomous decision making about processing routes to match the actual situation at any given moment. Making this shift is essential to allow higher mix, or even one-off processing, to be speedy and cost effective.

MES can act as the broker agent to allocate or bind a piece of equipment to manufacture a product in two ways: scheduling and dispatching. In scheduling, the system pre-determines which products go with what equipment at which time to meet plantwide and business optimization criteria, such as equipment utilization or customer-requested delivery times. Dispatching is done based on local context to maximize bottleneck equipment usage, using rules that may be as simple as first in first out (FIFO), but often focus on MES data about status and availability of materials, equipment, lines, and other resources.

Optimizing a shop floor for one-off production would be nearly impossible without special marketplace dispatching. This move from simple dispatching rules to services for this complex marketplace is not trivial for the MES software architecture. The best way to address this is for dispatching rules to be performed as a callable ‘external’ service that can run inside MES or truly in an external system. Also, rather than pushing one way from the MES to the production workstations, this is a two-way, dynamic flow of information.

In the shop floor marketplace, at the point where a CPS product or material requests a resource for its next processing step, as shown in Figures 3 and 4, the MES must provide context resolution. To avoid an exponentially growing number of bill of material (BOM) configurations for one-off products, the New MES can use context resolution with precedence keys. The system users create a mainstream configuration with flows and recipes and creates an exception based on step, product, flow, and material keys. The system reviews these combinations of keys in a certain precedence order. Most important, this context-driven approach allows each object or specific product unit to be modeled in the MES as a unique entity. This avoids the need for every new product to require a new lot, and creates a way to understand the specific configuration of the individual unit making the request.

When the request is then approved and sent from the CPS to a set of CPPS candidates, the MES stands aside until a particular CPPS wins the bidding process. At that point, it provides a logical binding between the material requesting service and the machine. The MES binds the equipment and material. This supports the blend of traditional dispatching and dynamic CPS.

Once that binding is recorded, the material knows its recipe, and can send it to the CPPS for that unit to run on that piece of equipment. Until the binding is complete and recorded, the MES may hold the recipe. The resulting record shows “this material is running on this piece of equipment for this step using this recipe.” So it automatically creates a full genealogy, or track and trace record, as well as enables current status views.
The marketplace is one of the keys that makes Industry 4.0 so compelling for a business. With the real-time granular decision making happening “in the fog” of the CPS and CPPS, production can happen in an optimized way. The marketplace bidding results in work going through a production path that is as fast, low cost, and efficient as possible for every product configuration or equipment setup. That best path through the plant will help with utilization and throughput time. This individualized path through production can cut cycle time, cost, and defects compared to end-of-process personalization, as shown in Figure 1 on page 5. Because each piece of equipment or factory in a network is bidding to work on products based on their current status, in real time, products negotiate the fastest, lowest cost, and most reliable option for routing themselves.

Of course, the IoT-enabled autonomy also reduces lag-times and effort from human beings, including some of the specifics of rigid detailed scheduling. People will be critical in setting up the rules for the operation of the marketplace, troubleshooting it, and ensuring continuous improvement. They will not be as busy with expediting, running equipment, and other such tasks.

As noted before, the binding process also creates a complete genealogy record including equipment and recipe used at each step. This is not new for MES, but in a future scenario where operations are also physically decentralized, the genealogy could be written directly in the IoT device and readable from the product itself at any time, during or after manufacturing. Being able to see this in the field could be a boon for medical devices as well as avionics, automotive, and other electronics.
Vertical Integration

For next-generation business processes both within the plant and throughout an enterprise, Industry 4.0 envisions vertical integration. MES has always been the layer intermediating between ERP and other enterprise systems and the automation and equipment in the plant. What’s new is that with IoT everywhere – both within the shop floor marketplace and to the supply chain and products in the field – there are many new data flows to integrate.

The MES must provide integration of the dynamic shop floor marketplace with company-wide processes. These complex processes may include sales, supply chain planning and logistics, quality assurance, maintenance, and both product and process engineering. Each of these represents a lifecycle with the shop floor marketplace at the center.

As mentioned above, the New MES must be able to ensure the CPS-related communications involve all manufacturing-wide processes, not only the immediate next step. As decentralized activities take place, MES must ensure it updates the full context for analysis and transactions in all systems.

To handle this, Industry 4.0-ready MES needs to have a dynamic workflow system capable of orchestrating processes through calls to the capabilities of any functional module. Workflow rules can be stored in a database, ready to serve the MES services as they orchestrate from equipment to enterprise and supply chain, as seen in Figure 5 below.

**Figure 5:** Vertical integration requires a dynamic workflow engine with rules that govern the MES services for processing actions and transactions.
Having vertical integration to ensure business processes run smoothly “top floor to shop floor” is not a new concept for MES. However, it’s far more complex with the ever-changing shop floor marketplace in the center.

One example of an area where benefits are likely is in sampling plans for quality. These plans define a specific measurement or procedure that must happen as every X lots become products on a given piece of equipment. These plans lie above the CPS/CPPS level. Another would be aggregating multiple measurement points for statistical process control (SPC), knowing to look, for example, for seven consecutive points going either up or down. Predictive asset maintenance will also involve higher level plans intersecting with the CPS/CPPS actions and status.

The key here will be the ability to turn on new MES capabilities on the fly, without complex integration, installation or implementation. If core MES can expand to accommodate maintenance, scheduling, quality, and other functions, and to support the constant stream of new and uniquely configured products, the speed and cost visions of Industry 4.0 can become reality.
Horizontal Integration

This facet of Industry 4.0 is broader than the plant – or the enterprise. This is where the end-to-end supply chain or value network of a company can be better synchronized. The shop floor marketplace can be replicated at the supply chain levels, with plants and lines bidding on work as well.

To do that, the MES in each plant must have complete information readily available about current and upcoming status. MES has always provided information on material status and position, as well as manufacturing capacity. However, the shop floor marketplace means this is a far more dynamic picture than it was previously. The decentralized logic of the New MES must feed into the updates, not only across the enterprise, but out to suppliers, contract manufacturers, and distribution partners as seen in Figure 6 below. This matches the Industry 4.0 vision of smart supply chains.

This requires the New MES to have a service-oriented architecture (SOA) and modular functionality. Exposing services that serve up current information on the dynamic state of production in a secure and in-context format that other systems can accept is crucial for the emergence of the “smart supply chain” that high-tech industries are already working toward at a fast pace. Ideally, the MES also provides visibility into a complete 3D representation of all objects or CPS and CPPS in the facility at any given time, with status. This can be thought of as a digital twin of the dynamic production process.

Smart Supply Chain

Figure 6: The Smart Supply Chain requires not only a supply chain control tower, but also a New MES in each facility to ensure optimized service and cost.
The faster information travels in the supply chain, the more effectively the partners can work together. Today, the plant operations information is often somewhat dated or guarded. Coming from the IIoT-enabled shop floor marketplace, companies will still be able to filter information for each trading partner, but will be able to show the current state in closer to real-time and with down-to-the-item granularity, if they wish.

As products in the field report back any issues they experience, it may also help troubleshoot production processes and material issues across partners more quickly. This may, in turn, also permit better customer service to those who have received products that might be affected by a problem.

A dynamic representation of the plant and its status (a plant digital twin) enables people to get a visual of what’s actually happening in the dynamic shop floor marketplace, even if they are not physically located there but in an office or a partner’s site. Beyond that, this full-plant digital twin will allow planners to conduct simulations more easily and visualize the results more effectively than ever before.

Supply chain analytics will be able to reach a new level in this Industry 4.0 scenario. This is particularly true with the emergence of Manufacturing as a Service (MaaS), where factories may bid on complete production or on particular processing steps. Specialization in steps that the facility performs particularly well may eventually lead to more bidding on those specific process steps.
Ready to Implement Industry 4.0?

As companies embark on their Industry 4.0 initiatives, many are trying out new technologies and approaches. What becomes clear is that they will not bring it to full scale and benefits without a New MES.

As described above, that means New MES must have all of the functionality that traditional MES has, plus some advanced capabilities:

**CONNECTIVITY**

The New MES can connect to IoT-enabled products and equipment. It can also manage and control unconnected devices. In this environment, it must also secure assets, both physical and digital.

**MOBILE**

Beyond the MES GUI on mobile, the New MES can use location data effectively and can present current asset and product state in augmented reality to improve maintenance and operations.

**CLOUD**

As network latency, security, and reliability issues are rapidly evolving, cloud hosting for the New MES becomes more and more attractive.

**ADVANCED ANALYSIS**

Real-time visibility and improvement of plant performance metrics is central to the New MES. It will also leverage predictive and prescriptive analytics in the plant, and feed enterprise big data initiatives.

**DECENTRALIZATION**

The New MES will be implemented centrally, but be able to handle the decentralized execution of the shop floor marketplace. It models objects, provides services, and has context resolution to create a complete genealogy through a routing it does not specify, but rather monitors.

**VERTICAL INTEGRATION**

The New MES will continue to integrate seamlessly with equipment and automation, as well as enterprise systems through a dynamic workflow engine with rules.

**HORIZONTAL INTEGRATION**

In addition to working across plants in one enterprise, the New MES delivers critical capabilities in coordinating the smart supply chain. As relationships become more dynamic, this integration must be as well.
The New MES Fosters Industry 4.0 Benefits

Industry 4.0 is a brave new world, and new technologies will be important. Even though MES has been around a long time, the New MES is really different from most of the systems in use today, and is itself laden with new technologies and concepts. Figure 2 on page 6 summarizes the differences.

This new form of MES is needed for Industry 4.0 and related initiatives to succeed in innovation-driven industries with complex processes. This is a recap of the benefits by objective for an Industry 4.0 initiative. Typically, all of these are in scope and work together.

### PERSONALIZED PRODUCTS
Perhaps the number one driver for Industry 4.0 is a move to mass personalization. While not every product will be made in lot size of one, the capability to do this makes plant and supply chain operations exponentially more complex. The New MES is the orchestrator for the shop floor and supply chain marketplaces.

In this environment, many traditional MES and enterprise approaches are not suitable. The binding of CPS and CPPS with recipes and instructions enables control, visibility, and documentation of the activities in the plant marketplace and out into the supply chain. This is critical for ensuring that each individual product gets to the right next step reliably to result in a fully personalized or customized product. This is a problem that’s intractable with traditional methods for guiding operations.

### LOW COSTS
The goal of Industry 4.0 is to continue the trend to lower production costs even in the high-mix, personalized product environment. Lean concepts combined with increasing automation have created lower costs for manufacturers for years. Industry 4.0 technologies such as robots, IIoT, AR, VR, mobile, and cloud all help reduce the need for people to do repetitive work. However, the data all of this creates is not ready for enterprise consumption. MES is essential to efficient and streamlined production as the orchestrator. In that process, it also generates the context needed to use all of that production data anywhere in the enterprise or supply chain – including advanced analytics.
SPEEDY DEMAND RESPONSE

One of the advantages of producing in small lots is the ability to respond to demand rapidly and accurately, with minimal inventory carrying cost. Producing to demand is also a foundation of lean manufacturing. The shop floor marketplace is designed to enable this, and the MES, as we’ve highlighted previously, is critical to marketplace functioning. It provides the connection between CPS and CPPS, both for current process and historical visibility. Beyond the shop floor marketplace, the MES also connects out to supply chain partners.

PERFECT QUALITY

MES has always supported quality both functionally and through a workflow engine with rules. In Industry 4.0, ensuring quality is no longer as simple. Each personalized or configured product may have a unique set of specifications and processes. The New MES’ binding service and dynamic workflow engine and its rules together allow quality assurance, even when every product is a bit different. It also coordinates with supply chain partners, feeding information on quality where it’s needed.

RAPID NEW PRODUCT INTRODUCTION

Innovation-driven companies must be able to successfully bring new designs through the entire lifecycle through production and distribution smoothly. The New MES enables this by delivering production context to the dramatically increased amount of data available with smart products.

Complete context from the plant out into the supply chain can also be critical to boosting supplier and contract partner quality as they can more fully understand why problems happen. R&D in every supply chain partner has more clarity from past and current products as they work on new product designs.

BETTER DECISIONS

Industry 4.0 offers many advantages, and among them is the ability to use advanced analytics to make better decisions. Predictive and prescriptive analytics are the future, and they would be crippled without the context provided by MES. Getting a temperature reading directly from a CPPS sensor means nothing without the information on what is being produced, what recipe is being used, and the specifications of that CPS.

The decisions enabled by the New MES and its context-rich information and 3D digital twin are not just for plant operations, but for product development, process and plant engineering, quality, maintenance, and supply chain areas. They can also flow in to impact finance and strategy with a clearer understanding of what’s possible and profitable.

Of course, all of the operations personnel need context for their real-time decisions as well. MES has always served this role, but as more is automated and autonomous, people need clear and quick visuals. The plantwide and task-specific visualizations through VR and AR will enable all of the cost, quality, and speed initiatives.

Suffice it to say, companies are moving to Industry 4.0 to alleviate some of the pressures their operations feel today. The New MES is designed to support, orchestrate, and provide context and optimization to all of those new approaches and technologies. It’s truly the backbone of Industry 4.0.
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