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Siemens Digital Industries Software

Digital solutions for CPG manufacturing

How integrated manufacturing operations enables smarter manufacturing

Executive summary

Digitalization is changing business models and manufacturing approaches across the consumer packaged goods (CPG) industry. The pace of innovation in digital technologies along with the ability of these technologies to disrupt traditional processes is becoming a key factor in global competition. These changes may increase pressure on CPG manufacturing professionals, but at the same time they open up new business opportunities. How can your CPG company seize upon these opportunities? In this white paper we will characterize and frame the challenges you face – challenges that take on a distinctive quality given the particulars of CPG manufacturing – and then discuss the digital tools that will help you tackle these challenges today and into the future.

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Abstract

From the very beginning – long before digital technology came on the scene – the CPG industry has taken deliberate steps to resist a divided business ecosystem. After all, one of the most consequential features of CPG manufacturing is its dual value chain. The primary value chain is batch production (process manufacturing of the semifinished product: food and beverages, cosmetics, cleaning products and other goods that customers consume and replace regularly. The secondary value chain creates the finished product using discrete manufacturing operations of packaging and palletizing. This dual value chain thus entails two distinct and often detached operations, using different production lines, equipment and floor personnel.

Historically, CPG manufacturers have counteracted this natural compartmentalization with non-technological efforts, like the simple promotion of a culture of cooperation among employees. These efforts yielded real benefits that are still valuable. More recently, however, the need to unify numerous operational aspects is growing and intensifying. Quantifiable benefits and efficiencies are achieved once companies better coordinate crossover tasks such as formulation and labeling, or correlative scheduling of the dual production operations. Digital technology is often applied to these crossover tasks, but today, market forces and technological advancements are propelling CPG manufacturers toward more widespread and integrated digital solutions.

Joining virtual and real production

Central to these digital tools is an integrated manufacturing operations management (MOM) solution, which addresses the critical domain where virtual and real production converge. MOM links enterprise resource planning (ERP) and product lifecycle management (PLM) solutions, which integrate data, processes and business systems, to the manufacturing floor's production machinery and automation. A MOM solution consists of several key systems, including advanced planning and scheduling (APS), the manufacturing execution system (MES), the quality management system (QMS) and manufacturing intelligence (MI). Importantly, it is neither necessary nor desirable for a manufacturer to invest in a full-orbed MOM and implement these components all at once. Instead, we recommend a stepwise approach in which the manufacturer makes incremental investments that generate immediate returns that can then be invested in the next MOM asset.

MES is arguably the centerpiece of MOM technology. For many CPG manufacturers, it is the most critical next step they take on their digital journey. This white paper uses MES to illustrate the value of digitalization, though some CPG manufacturers may have reason to choose a different starting point in the MOM implementation. We will address these other starting points along the way.

We contend you will achieve and sustain a competitive advantage in your digital journey using a strategic, stepwise implementation of a MOM solution.

Bridging the digital gap

When it comes to manufacturing automation, CPG companies span a large range, from low level and programmable logic controllers (PLCs) to fully automated lines. The industry as a whole is currently characterized by a fragmented digital landscape in which there is often little visibility into the performance or failings of each process step – no matter how automated it is. For most CPG companies, achieving this visibility is the most valuable next step in digitalization, whether they are a larger CPG corporation that has significantly digitalized multiple MOM functions, or a small or medium CPG company that employs paper-based systems and/or standalone third-party or homegrown digital solutions.

All CPG manufacturers must also communicate a wealth of information from their front-end enterprise systems to their manufacturing floors and back again: order information, product formulations and recipes, manufacturing schedules and production line assignments, human and material asset allocation, quality procedures and processes, manufacturing results and much more. No matter the current level of digitalization, nearly all CPG manufacturers are seeking ongoing operational improvements through more digital systems, more capabilities or a more integrated approach to digitalization.

Two factors have conspired to create the current demand for MES and MOM digitalization across the spectrum of CPG manufacturing operations: (1) the nature of CPG manufacturing and (2) evolving market

conditions. Let's take a closer look at these two factors and see how they suggest some fundamental challenges the industry faces. Then we will discuss an approach to continued digitalization that successfully addresses these challenges.

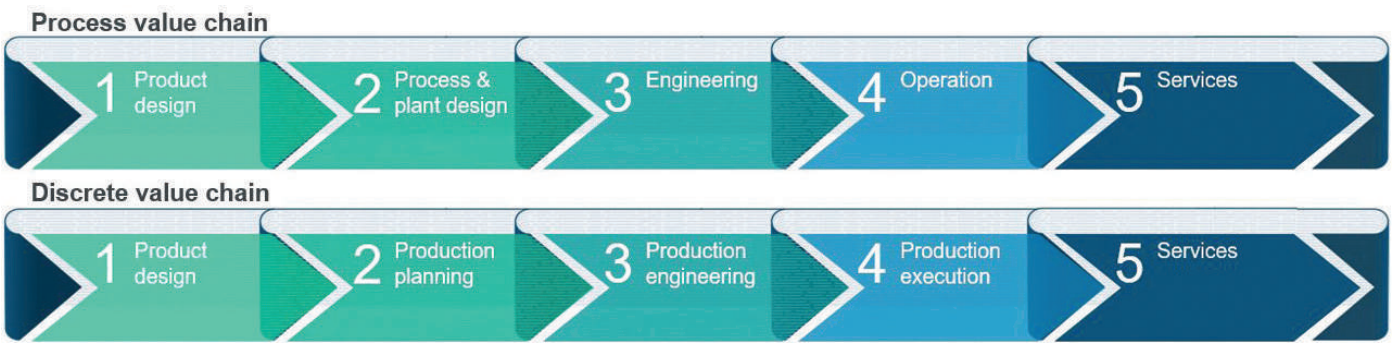
Digital solutions must be suited to the needs of CPG manufacturers

Whether they are making soda or specialty household cleaners, cereal or lip balm, CPG manufacturers are highly dependent on the quality of raw materials and the reliable functionality of equipment and instruments. CPG producers must also address globalized, evolving markets as well as the complete supply chain and production lifecycle. Because of CPG's dual value chain, these critical factors often are monitored and maintained using two different digital systems, one for managing batch processes and the other for discrete manufacturing.

Managing the process and packaging steps separately is becoming exceedingly time- and labor-intensive – and prone to errors – for many CPG companies as the portfolio of finished products they manage grows larger. A significant increase in finished products, of course, is accompanied by a correspondingly high number of new product development (NPD) projects and new product introduction (NPI) efforts. Because of this growth, one highly valuable digitalization step for these manufacturers is to combine the two value chains by supporting them with a common, holistic digital solution. More on this later.

CPG manufacturing operations have many different facets, each with its own challenges to optimize and improve the overall process. Every single item – each formula, recipe, raw material, manual or automated task, equipment or quality inspection – is like a cog that must work in concert with all other cogs in a large machine. The demands on MOM functions come into sharp focus when one considers that CPG manufacturers must multiply each of these operational cogs by their growing number of finished products. CPG manufacturers must switch production lines from one product to another with increasing frequency and to accommodate a growing number of NPIs. Data generation, aggregation, contextualization and management is critical in these conditions.

As a competitive CPG company, you would like the machine, with its many cogs, to run as fast and efficiently as possible. All the products, NPIs, integration with research and development (R&D) and recipes must be managed efficiently. Visibility is needed into batch execution, order tracking, batch recording, material tracking and production key performance indicators



(KPIs). Keeping everything aligned and synchronized is of paramount importance. For example, changing one parameter in a formulation can have a cascade effect on many other facets of the production chain: raw material availability, quality specifications, shop floor resources, regulatory compliance requirements, specific manufacturing recipes for each production line and more.

For CPG manufacturers that operate multiple plants in diverse locations, the picture for operations management is much more complex. Even if each individual product formula is relatively simple, the level of complexity quickly grows when one considers the multiple recipes each formula may require to account for different raw material profiles, equipment operational profiles, even ambient climate conditions at varying plant locations.

These factors are characteristic of CPG production. They alone provide more than sufficient justification to consider new investments in digital solutions. Today's market forces intensify the need and also the shape of specific challenges that digital solutions must address.

Digital solutions must address market trends

Accelerating changes in CPG market conditions and consumer demands are forcing manufacturers to rethink the way they develop, produce and distribute their products. Evolving market conditions increase the urgency with which these manufacturers are considering investments in digital solutions. Four market trends in particular are having the greatest impact:

1. Growing visibility and demand for high quality

Although quality has always been a critical factor in consumer packaged goods, today's social media and connected world have raised the stakes significantly. It doesn't take much to spread comments asserting poor quality or safety issues. Conversely, more consumers are rewarding high quality by recommending a product on the internet. Instant and sometimes viral communication heightens not only the impact of product quality on a brand's success, but also the product's reputation for quality. Significantly, this puts CPG companies in a position of now selling trust as well as products. Transparency has become critical.

Compounding the challenge of high quality, many CPG sectors have experienced large price increases in their raw materials and commodities coupled with a decreasing willingness among consumers to pay a premium price for premium goods. Premium quality is now the norm. As a result, control over all the factors that affect product quality must now be achieved in a highly efficient manner – one made possible by digitalizing quality efforts.

2. Mass customization

A circular cause-and-effect pattern feeds the trend of mass customization in CPG products: some customers seek individualized products at the price they would pay for mass-produced goods. Some CPG manufacturers use digital tools to fulfill this desire. For example, Mondelez interacts with consumers to design their own preferred or personal packaging for Oreo cookies; and personalized labels on Coca-Cola bottles may include the consumer's name. As word spreads, consumers look for individualized products so more CPG companies are adopting digitalization, which enables direct interaction with the consumer.

Mass customization has several significant effects on the ways in which consumer packaged goods are produced:

- **Customer interaction.** Product innovation and customer interaction are merging to affect the way formulations are managed. For example, they may be managed by means of Internet of Things (IoT) enabled batch-of-one processing and a smartphone app. These enable the consumer to create, store and communicate personal preferences and have the product delivered wherever that person goes in the world, all with the simple touch of the mobile device screen. This technology will likely extend to many CPG products, whether they are produced at point of sale or made in the factory, packaged and delivered
- **Product differentiation.** Tremendous product differentiation and customization opportunities are being created as 3D printing technology takes hold. For example, Barilla is offering a platform to design and 3D print personalized pasta
- **Customer needs.** Heightened interest in health and the environment are creating consumer demand for changes in packaging, in-season-only availability of products, specific nutritional value (low fat, low sugar, etc.), elimination of certain ingredients like gluten free and more

These diverse consumer interests and needs result in huge growth in product and packaging variety, making digital management of production essential

3. The rise of digital shelf space

The growth of product ordering over smart devices and speakers via digital space purveyors (for instance, Amazon, Facebook). One indicator of this growth is the increased ownership and use of smart speakers: The United States experienced a 127 percent increase in smart speaker ownership in 2017. More than half of smart speaker owners use their device with greater frequency after the first month of ownership. They are ordering household supplies (58 percent), health and beauty products (48 percent), pet food (45 percent) and groceries (42 percent).

Using algorithm-based personal buying profiles, digital shelf space purveyors apply filters to their apps for shopping purposes – with the effect that CPG companies face acute competition for shelf space. Instead of being one of the 20 brand choices on a shelf in the supermarket, for example, a CPG company's product will have to be in the top three of most value-added products in order to be on the "digital shelf" of Amazon Echo. Thus, value-added innovation will be key for gaining digital shelf space and this can only be achieved using time-efficient and cost-efficient innovation. Digitalizing the R&D/innovation process is essential to this effort.

4. Increasing regulatory and cultural demands

CPG manufacturers must transparently manage the increasing production complexity they are experiencing as a result of increasing regulations, both added rules in existing markets and new sets of rules in new evolving markets (for instance, Pakistan and other regions of Asia).The increasing introduction of different cultures and habits also adds to complexity, especially for CPG companies that are addressing demands for localization by distributing their production facilities in new places. Manufacturers must learn about local product demand, the market, new technology providers and more. Transparency is also needed regarding energy consumption, environmental pollution and other factors related to environmental regulation. CPG manufacturers must not only achieve an acceptable level of quality control, they must also demonstrate it to regulatory authorities.

Of course, regulatory and cultural demands also continue to evolve as new generations of consumers must be served. It is estimated that 3 billion new consumers are generating $8 trillion in new revenue in 2020. Most of these new consumers are from the Asia-Pacific region. A portion of them will be some of the most affluent consumers in the world and some will be the poorest. Meeting the needs of consumers with a growing diversity of tastes, nutritional needs, cosmetic needs, health conditions, economic circumstances and more will require different products.

Generationally, the most influential consumer group is millennials. They use social media to influence purchase decisions of their peers, but also to reach a wider audience. They are the first generation to significantly influence the purchase behavior of their parents. They are fast adopters and are driving the demand for technology in everything. They are a connected generation and expect producers to be as well. Getting close to consumers helps CPG companies develop products that meet these consumers' needs. Companies will have to get close to these diverse new consumer groups

Vast new sets of information that affect CPG operational choices and management are arising from regulatory, cultural and consumer changes. Digitalization makes effective use of this information technologically and economically feasible.

Combined with the inherent characteristics of CPG manufacturing, these four market trends create a set of industry challenges – challenges that can best be met by MES and other integrated MOM-based digital solutions.

Fundamental challenges and requirements for CPG manufacturers

In our introduction, we mentioned that digitalization may create new pressures on CPG companies, but at the same time, it is creating opportunities to meet the fundamental challenges the industry faces. What are those fundamental challenges?

Shifting from playing defense to offense

CPG firms are structured to play defense – with large balance sheets, extensive distribution networks, extended supply chains and hierarchical decision-making structures. Fueling much of the resource allocation and decision-making are innovation incentives that encourage quick, incremental efforts in support of large, existing brands and fixed assets. Even the signature job function, brand manager, suggests stewardship and operational focus, rather than growth and innovation.

This can no longer be the case, as innovation and growth are more closely linked than before in CPG markets. As Nielsen pointed out in its 2016 Breakthrough Innovation report, "There will be more change in CPG in the next five years than there was in the last 50." Statistics bear out large CPG companies were still playing defense in 2015: Nielsen found the 25 largest CPG and process companies generated 45 percent of category sales in the U.S. yet drove only 3 percent of total category growth – and grew at a compound annual growth rate of 0.1 percent. Innovative approaches are needed to break this stagnation; and innovation of this kind is best supported by digital solutions. This implies that small innovative companies are creating the growth in the CPG industry.

The need for flexibility

Consumers want individualized products – but at the prices they would pay for mass-produced goods. As a consequence, production has to be more flexible than ever before. Individualized mass production is accomplished more efficiently by taking a modular approach to production that creates the needed flexibility, allowing for fast changeover times.

Flexibility is also needed for a manufacturer to accommodate plants in different areas of the world. For example, each plant is tasked with producing the same finished goods as every other plant in the company but must do so despite the variations in raw materials or fuel that result from having different suppliers. The need for flexibility is driving digitalization of the entire supply chain, and the digital technology chosen must provide that flexibility.

Time-to-market

Escalating and accelerating changes in customer demands also drive the need to bring new products to market promptly. Innovation cycles are getting shorter and product variety is increasing. To introduce new products to the market as quickly as possible, manufacturing processes – in concert with business processes – require the capacity for rapid adaptation. As manufacturers speed up their product development processes and their introduction to production facilities, an integrated digital approach to product and process development and implementation is becoming essential.

Increasing quality and efficiency

As the increasing cost of raw materials places great pressure on margins, efficiency becomes the watchword for CPG producers seeking to optimize manufacturing output. Efficiency is addressed by monitoring and increasing the availability, performance and quality of assets. Manufacturers must not only monitor overall equipment effectiveness (OEE) but also monitor and manage OEE changes that occur based on the products each manufacturing line is producing. A myriad of possible scheduling combinations of production tasks must be considered to optimize resource assignment and utilization. Detailed production scheduling is fundamental to delivering output as fast as possible.

Inherent in the concept of efficiency is quality: the goal is not simply to make products quickly, but also to make them correctly. Ensuring high quality can be accomplished efficiently by closed-loop quality processes that provide full product traceability. Synchronizing tasks between departments is also critical to ensure production is performed efficiently with the proper material flow at the right time. In the dual value chain of CPG production, synchronization includes coordinating production so a batch completes processing just in time for delivery to the filler at the beginning of the packaging line.

Standardizing and optimizing processes and organizations are key levers in using digitalization to reduce costs. A solution that supports standardized systems and processes will help manufacturers optimize the cost of rollouts and manufacture products in a consistent way across many plants, especially when those plants are subject to diverse environmental and geopolitical conditions around the globe.

Cybersecurity

Digital tools are key to meeting the above challenges, but they also introduce an industry challenge of their own. Digitalization leads to increasing vulnerability of production plants to cyberattacks, thus increasing the need for appropriate security measures. A proper information technology (IT) security concept must provide the basis for a sustainable digitalization strategy. Companies must consider in-depth IT security measures using multiple layers. These should be implemented right from the start to protect a company's know-how, the quality of its products and the availability of its production facilities.

Meeting these challenges in a way that not only addresses immediate needs but also equips your company for the future requires some deliberate, strategic decision-making – the kind that considers how your manufacturing enterprise will navigate its continuing digital transformation.

Digital transformation and the Siemens approach

When engaging with our CPG manufacturing customers, we often see a system landscape composed of multiple individual legacy and custom systems. Although many of these systems have helped companies to keep up with the growth and pace of business, they are finally reaching the limits of their adaptability to today's circumstances. For one thing, these systems are often siloed, meaning they are not integrated and communicating transparently with other systems, and therefore are unable to collaborate horizontally. Legacy systems may not be integration-ready, and also may not be able to scale to growing demands or add newly required functionality. With new demands placed on custom systems by evolving market trends, it is nearly impossible to continue adapting them quickly enough to keep up with NPIs or the accelerating changeovers required by the smaller and more numerous batches that fulfill growing product individualization.

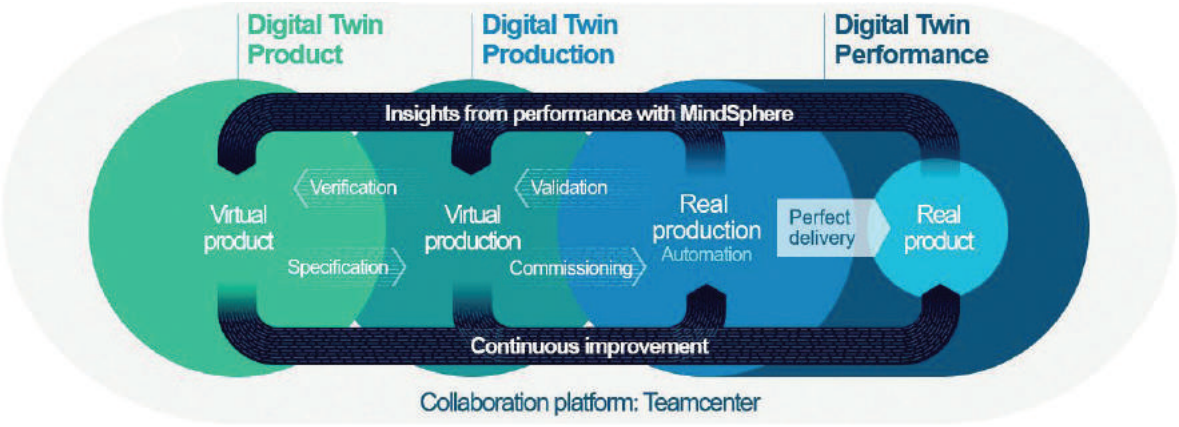
To address today's fundamental industry challenges, a digital solution must offer speed, flexibility, quality and efficiency. Thankfully, current digital technology has achieved these characteristics. In particular, digital technologies that provide effective, efficient, standardized solutions for manufacturing execution and manufacturing operations management are poised to address the challenges CPG manufacturers face.

As we consider an effective approach to manufacturing digitalization for CPG manufacturers, let's look first at the broader picture of digital transformation and then focus on MES and integrated MOM technology.

Holistic digitalization and the digital twin

With the Xcelerator™ portfolio, the comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software, we offer a holistic approach that transforms a traditional dual value chain into a unified, integrated product and production lifecycle – from product design to production planning, engineering, execution and service (from idea to shelf). Only a fully digitalized business model with a consistent digital thread has the power and flexibility to speed up processes and optimize production operations. This also requires a joint data storage and data management system – a unified data backbone that delivers a collaboration platform throughout the value chain.

There is an advantage in combining CPG's two value chains in a common, holistic one. To illustrate, all information available in the formulation of beer can seamlessly be consumed in the artwork design of the label. A holistic system supports manufacturers in selecting what information must be printed on the label for which country. For example, English and French are



mandatory in the Canadian market, while a warning for pregnant women is mandatory in the French market. During the production execution, the scheduling of beer batches and filling orders is crucial to meet the customer demand in time, quality and cost.

The Siemens approach is built on a comprehensive digital twin, virtual representations of physical products and associated processes. A common platform enables integration of the digital twin of product, production and performance, creating support for the entire value chain. By employing a digital twin, manufacturers gain foresight by simulating product, people, processes and resources in the virtual realm before implementing production on the manufacturing floor. They gain additional insights by matching real-world to predicted performance, and they can use those insights to drive continuous improvements.

Beyond individual plant operations, a unified, integrated approach means that processes can be standardized via the digital twin and easily rolled out to different plants. They can quickly be up and running in a standardized, transparent way at full speed.

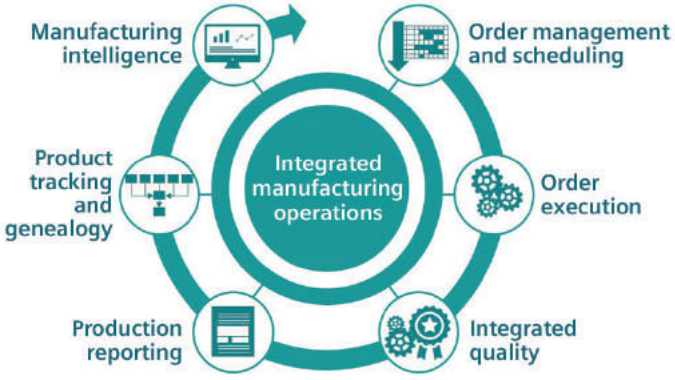
Ultimately, a holistic value chain is supported by a cloud-based, open IoT ecosystem, which enables companies of every type and size to unlock their data assets and put them to profitable use to increase availability, quality and efficiency across the value chain.

With this all-encompassing future vision, many manufacturing companies ask whether they must implement a complete digital transformation all at once. Not at all! The Siemens approach is indeed holistic, but it also enables a modular, stepwise implementation with an ongoing return-on-investment (ROI) that supports the next module or step.

From their current level of digitalization, manufacturers are able to incrementally integrate legacy and custom functionality systems. Eventually, a manufacturer will transition from each legacy system to a next-generation software solution. This approach protects earlier investments while it starts building toward a flexible and efficient unified digital enterprise.

Integrating MOM is a key solution in digital transformation

In today's business climate, it is essential for CPG manufacturers to make rapid, informed decisions in fast-changing operating environments. Using MOM software enables this kind of decision-making and ensures quality and efficiency are built into the manufacturing process and are proactively and systematically enforced. An integrated MOM solution connects multiple departments and stakeholders in one facility. In multisite enterprises, it also connects multiple plants, sites and vendors' live production information. MOM can be easily integrated with equipment, controllers and enterprise business applications. The result is complete visibility, control and manufacturing optimization of production and processes across the enterprise.



MOM enables you to track product and order details on the plant floor, collect transactions for reporting to financial and planning systems and electronically dispatch orders and manufacturing instructions to shop floor personnel. It also helps eliminate human error in manufacturing by providing real-time quality data checks, yield monitoring, automatic enforcement of specifications and business rules, and as-manufactured lot, batch or finished product traceability – all resulting in improved product and process quality and productivity. Paperless manufacturing enabled by MOM helps to reduce scrap and eliminate paperwork errors and redundant checks.

For larger CPG manufacturing companies, a MOM solution is used to monitor and synchronize manufacturing activities across globally distributed plants and link them in real-time to the enterprise for optimal performance.

An integrated MOM also enables manufacturers to aggregate, analyze and transform data into actionable information that can be reported back to both product development and production planning, creating a closed-loop decision environment for continuous improvement.

As manufacturers implement integrated MOM, a standardized solution enables them to lower total cost of ownership using delocalized installation. MOM functions can be implemented in steps so that legacies are replaced in a nondisruptive way. The holistic platform that supports an integrated MOM also allows for a personalized user experience and enables manufacturers to rethink work center ergonomics, data consumption and other factors that affect manufacturing efficiency.

To advance MOM functionality and future-proof each MOM investment, each MOM system needs to be:

Scalable – Able to add greater capacity, such as more users, facilities or transactions

Extensible – Able to add functionality, such as modules related to supplier management

Integration-ready – Able not only to stand on its own and offer a full breadth of capabilities, but also to interface with other systems and communicate seamlessly via an interoperable platform

For many CPG manufacturers, the most beneficial first step of MOM implementation is an MES. But other options discussed below are also valid starting points for particular manufacturers, depending on their current systems and near-term needs. A manufacturing operations management solution is centered around the MES pillar: managing the execution of manufacturing processes is the core of MOM. Nevertheless, we talk about a MOM solution because within such a solution, the MES domain is tightly integrated with other domains:

- Planning and scheduling
- Quality
- Manufacturing intelligence

MES

MES provides automated **track and trace of manufacturing history records** and ensures complete visibility into all operations on the shop floor. It grants manufacturers insight into the raw materials, equipment and personnel producing each batch, as well as process and product characteristics for each individual production run.

MES provides **vertical integration** that bridges the gap between ERP and manufacturing automation as well as PLM.

MES enables **standardization of production processes**, making sure that manufacturing workflows are rolled out easily and consistently. Best practices can be clearly identified and adopted to help increase production efficiency and quality.

MES provides real-time **orchestration** of manufacturing orders and tasks, stitching all the separate production steps and resources together into a unique and efficient manufacturing flow.

MES grants **end-to-end enforcement** of all manufacturing resources:

- **Material** – Ensuring the right material is available, unexpired and used per the latest revision of the bill-of-materials (BOM)
- **Operator** – Ensuring correct operator actions with electronic work instructions (EWI) and certifying that each operator is properly trained and allowed to perform each task
- **Equipment** – Ensuring the right equipment is available, well maintained and certified for use

Other MOM pillars

Integration of **advanced planning and scheduling (APS)** enables efficient management of orders and sequencing with product lines, formulas and recipes

and production assets. It gives manufacturers the opportunity to plan and schedule orders based on different optimization criteria; for example, minimizing the equipment setup or cleanup time.

Integrated quality management improves visibility and coordination of all quality operations, from formulation to at-line and off-line laboratory quality test execution and monitoring, helping to ensure and demonstrate full compliance with regulations.

Enterprise manufacturing intelligence (EMI) provides full visibility into process and production performance by aggregating raw data collected from the production environment and transforming it into key performance indicators (KPIs), which is shown with simple and intuitive graphical dashboards and graphs. EMI data analysis, contextualization and visualization capabilities enable manufacturers to close the manufacturing loop and to implement continuous product and process improvements to maintain a competitive advantage.

A specific function within the manufacturing intelligence pillar is managing manufacturing performance focused on **OEE:** asset monitoring, analysis equipment performance and downtime and detailed failure explanations help manufacturers to measure and track how well the operation resources are being used, and to identify opportunities for greater utilization and efficiency.

How integrated MOM supports CPG manufacturers

An integrated MOM generates many of the benefits needed by CPG manufacturers to address today's fundamental manufacturing challenges. These benefits provide much-needed visibility into manufacturing operations, enhance product and process efficiency and quality and feed a closed loop of continuous improvement.

Visibility across the dual value chain

MOM provides visibility into any kind of manufacturing in terms of gaining actionable insights, viewing performance, root-cause analysis and continuous improvement. There are also significant advantages to combining the two value chains of CPG manufacturing into a common, holistic one supported by integrated MOM. For instance, all information in the formulation of product is available to the quality management system, streamlining the development process inspection and product testing procedures. An integrated MOM also supports the development of product quality reports for each country or regulatory jurisdiction.

The integrated MOM also aggregates manufacturing data, which can then be contextualized with an integrated enterprise manufacturing intelligence solution. Smart and easily understood dashboards and KPIs make this intelligence accessible to all stakeholders in a way that encourages operational excellence.

Efficient NPDs and NPIs

As new products are developed, an integrated MOM supports formula and recipe management that makes it possible to re-use approved materials and ingredients when designing a new formulation. This saves time and ensures high quality. In addition, what-if scenarios for new formulas, raw materials, packaging materials and ingredients can be simulated and their performance compared in terms of quality, nutritional profile, allergens and cost constraints. When the formulation is finally validated, MOM transforms the formulation into executable recipes and generates BOMs and specifications.

Manufacturing efficiency

During production execution, the scheduling of product batches and filling orders is crucial to meeting customer demands related to time, quality and cost. While ERP systems are designed to optimize business processes, an integrated MOM optimizes scheduling and order sequence for the production floor. Order planning and scheduling can be based on different optimization algorithms and constraints. It is possible, for example, to maximize the utilization of the filling line, or the buffer capacity as a scheduling constraint. Integrated MOM can even help reduce energy consumption and material waste due to proper scheduling of assets and the best possible product sequence.

Integrated MOM supports efficient changeover to accommodate a rising number of products. With real-time asset and production monitoring, integrated MOM helps to minimize equipment downtime, troubleshooting and other nonvalue-added tasks. Efficiently identifying root causes of asset inefficiencies and failures enables an integrated MOM to make prompt corrections and enhance optimization.

Product and process consistency

In process manufacturing, an integrated MOM helps ensure that tasks are performed at the right time and for the right duration with the right materials, assets, settings and processes. It also provides visible material tracking, which ensures efficient use of the correct raw materials. When called for, the system immediately provides the correct materials and processes to be used. As a firm extends manufacture of a particular product across multiple plants in diverse geographic locations, digital standardization enables optimized cost of rollouts and ensures product consistency.

Conclusion

This whitepaper aptly describes both the pressures that CPG manufacturers face and the opportunities they can seize to gain significant advantages over the competition. An integrated MOM that is implemented via incremental investment in MES, APS, QMS and EMI represents a strong set of steps toward full digitalization and becoming a digital enterprise. An integrated MOM both addresses the pressures and brings the opportunities to fruition.

With each MOM software solution, you can incrementally digitalize and seamlessly integrate product and production lifecycles for flexible, scalable production processes that maximize your responsiveness to real-time market and manufacturing events.

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Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Xcelerator, the comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software, helps companies of all sizes create and leverage a comprehensive digital twin that provides organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software products and services, visit siemens.com/software or follow us on LinkedIn, Twitter, Facebook and Instagram. Siemens Digital Industries Software – Where today meets tomorrow.

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