SIEMENS DIGITAL INDUSTRIES SOFTWARE

Flexible Manufacturing

Driving adaptable production execution to new levels

Executive Brief

In recent years, consumer products companies have experienced a stock keeping unit (SKU) number explosion. This is largely due to the production model shift the industry is facing, from large-scale production of a single product to small-scale production of many variants, including personalized products. Companies are realizing they need to update and enhance their manufacturing environments and processes to stay ahead.

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> Existing manufacturing processes and production systems are unable to supply the necessary flexibility

Addressing manufacturing complexity at scale
Over the past 20 years, leaders in manufacturing have invested heavily in machinery and line configuration with the goal of driving massive scale. With efficiency and production cost reduction in mind, some of these lines have been optimized to produce up to 2,500 units per minute. But manufacturers today are beginning to realize that existing manufacturing processes and production systems are unable to supply the flexibility necessary to adapt to a rapidly changing production, mass product customization and increasing numbers of SKUs.

Achieving agility and flexibility to meet demands
Factories including the lines, machines, logistics systems, software, automation, and specialized personnel are the most expensive assets that consumer products companies have in place. Although a minority of industry leaders can afford to frequently obtain new, smarter equipment, most companies are seeking more affordable paths to Industry 4.0 and flexible production.

At the same time, some more nimble competitors are taking a different approach to address complexity. They are introducing new innovative operations, with more modern equipment and approaches. This has allowed emerging, agile industry players to gain market share rapidly and generate new products faster. As a result, companies with older manufacturing facilities are now at serious risk of losing their competitive advantage.

The industry is looking for solutions to modify existing equipment and lines to enable new capabilities that were not envisioned when originally built. Doing so would bring far greater flexibility, intelligence and automation to their manufacturing. But the lack of seamless connections between design data and manufacturing execution prevents companies from smoothly transitioning products to the manufacturing layer. This transition from design to manufacturing often doesn't come with the speed required in a new environment where more diverse products must be manufactured.

Companies need to shift their mindset and understand that manufacturing does not only pertain to the machine and the shop floor. Manufacturing is a discipline that must be considered throughout the product lifecycle and connected to the entire thread of information. The silos between design validation and manufacturing need to be converged in order to enable a smooth transition from research and development (R&D) to the shop floor.

Introducing flexible manufacturing as a new path forward
Flexible manufacturing is a novel approach that incorporates a concurrent digital thread across an organization. This seamlessly connects product lifecycle management (PLM) to shop floor operations. It brings visibility, intelligence and connectivity to manufacturing processes to enable flexibility. A comprehensive digital twin for manufacturing provides companies with a holistic view of all manufacturing data,

processes, equipment and automation. This ensures open lines of communication between functional areas and the ability to validate and adjust flexible production lines in accordance with new product requirements.

Optimizing production plans for success
Connecting production planning and scheduling with manufacturing execution systems (MES) is key to facilitating flexibility. By optimizing production scheduling, companies can plan and ensure maximum throughput. When machine capabilities are activated by the production orders defined in the plan and validated upfront in PLM, coordinating parallel production orders can be executed in real-time, which provides a new level of flexibility in production lines and enables the production of smaller and more diverse batches.

Effectively managing production orders
With a connected and comprehensive digital twin, companies can manage all production orders across the plant and sequence manufacturing operations and work-in-process (WIP) to help operators perform the right job at the right time. Driven by intuitive task management, this connects manufacturing execution to the rest of the value chain so any changes to production can be implemented efficiently.

Smart automation
The industry needs to embrace innovative operations and consider recent advances in cloud-based intelligence and industrial edge devices that are providing new and improved opportunities to the shop floor. The industrial edge allows a company to run cloud and information technology (IT) applications on a protected operational technology (OT) layer. For example, companies can leverage edge computing to add real-time intelligence to existing machines or lines, allowing adaptive production execution to be possible even with older equipment. This allows companies to achieve more machine flexibility with their current equipment.

Quality and flexibility in executing orders
During the production process, quality management must be integrated with laboratory testing. This allows product designs to remain in line with quality and regulatory requirements and enables the smooth integration and alignment of R&D, manufacturing and production data.

Conclusion

Flexible manufacturing becomes a necessity

The majority of consumer product and retail companies are beginning to view flexible manufacturing as an enabler and the solution for producing various personalized products at the speed and cost of scale. This will help companies to compete with agile startups that invested in smart equipment and automation from the beginning.

The overarching benefits include:

- The ability to manage production complexity, ensuring efficient and profitable delivery of any lot size
- Activate required capabilities to schedule operations in real-time with automation, eliminating down time
- Flexibly and dynamically move production to a new facility or change the product mix at an existing facility to achieve growth goals by connecting the context of manufacturing with the entire product lifecycle management thread.

Flexible manufacturing sets a new standard in adaptable production execution by orchestrating automation, systems and operations across all consumer product types.