



**Why Lighting
Manufacturers need
Flexible
Manufacturing
Operations
Management (MOM)
Systems**



Move away from silos created by legacy custom-built Manufacturing Execution Systems (MES) to increase collaboration and efficiency with Flexible Manufacturing Operations Management (MOM) Systems

Trends like smart lighting and human-centric lighting are pushing lighting companies to design, manufacture and ship an increased number of product variants. This increase in demand for custom lighting products is reducing batch sizes and increasing production costs across lighting manufacturers. Traditionally, the entire manufacturing supply chain in the lighting industry has been built for certainty but demand in the VUCA (volatile, uncertain, complexity and ambiguity) world is pushing manufacturers to transition to more flexible manufacturing systems and newer business models.

Traditional Manufacturing Execution Systems (MES) either homegrown or custom-built by the machine builder have serious limitations to adapt to this shift in business models for lighting manufacturers. This paper gives leaders and decision-makers in the lighting industry an overview of what flexible manufacturing operations management systems (MOM), popularly known as "MOM/MES," is and how it can accelerate your transition to flexible manufacturing systems.



Traditional & Legacy MOM/MES

A traditional MOM/MES is a homegrown or custom-built system provided either by an automation vendor, machine builder, or a bespoke software development company. A legacy MES connects to your machines or a SCADA system to provide manufacturing professionals, including operators, visibility on what is happening on the shop floor. Production control requirements like machine utilization, availability, Andon status, parts per hour, etc. are definitely visible in a traditional MES system. Such systems even after modernization to cloud-native SaaS (software-as-a-service) option remain very limited in flexibility to make changes on the go.

Modern flexible MOM/MES

A manufacturing operations management (MOM) system also popularly known as MOM/MES is a software platform that allows you to configure and model your manufacturing operations and change them as business needs change. MOM/MES also allows you to connect the physical resources (machine, sensors, people) in the factory to any IT business application in the factory like ERP, PLM, MCS, and CMMS systems. A modern MOM/MES has the ability to manage, sequence, track, trace, control and audit all products manufactured in the factory on the same platform. All the department silos that often exist today in factories are hence broken to improve collaboration.

Trends in Lighting Industry

New products are being designed by lighting manufacturers at a much faster pace than ever. Demanding factories to reduce their lead times for new product introduction and delivery while being cost effective.

Traditional light bulbs including halogen bulbs and fluorescent lights will soon be banned. By soon in the United States, we mean August 2023. Also, 137 countries worldwide have agreed to phase out major category fluorescent light bulbs by 2025. The LED Lighting Industry hence is forecasted to grow at a minimum of 10 - 11 % CAGR annually with the current formal industry size approximated to be 75 billion USD worldwide. Some of the trends that will dominate the lighting industry are:

Increase in human-centric lighting products.

The kind of lighting in our environment influences our physical and emotional state, refines the space, and alters how architecture is perceived. Dim and slight flickering of old fluorescent lamps can lead to corrosive concentration and unrest, whereas spaces with the best lighting evoke positive emotions of happiness and enthusiasm.

As architects, designers, and builders understand light's effects on humans, they are increasingly adopting human-centric lighting to help people become more efficient and productive.

Whether it's healthcare, workspaces, or education centers, LED-based human-centric lighting (HCL) has powerful applications.

Increasing in special purpose lighting products for indoor farming and automobiles

The global food system accounts for a quarter of the world's greenhouse gas emissions. Besides, the expansion of metropolitan hubs is gradually reducing arable lands, creating the need for more alternative farming practices such as vertical and indoor farming. Increased efforts towards sustainable agriculture have led to increased indoor farming adoption that utilizes less energy, water, and land than traditional farming methods. Using artificial LED lights in horticulture, farmers can either supplement natural daylight or replace it entirely to produce a wealth of benefits, such as the ability to fine-tune quality and increase yield.

LED lights continue to mark their entry into the automotive industry due to their benefits, such as enhanced brightness, which facilitates safer driving. Automobile manufacturers are incorporating intelligence into their lighting systems and leveraging advanced technology like Adaptive Driving Beam for improved safety of drivers. Digitalization of cars is driving the megatrend of Advanced Front Lighting Systems that introduce new approaches to safety, comfort, and communication capabilities and put great emphasis on exterior lighting.

New product Innovations with IoT-based smart lights.

The manner in which light is produced and delivered has made incremental improvements. As business owners and facility managers are becoming more conscious of the economical, convenient, and safe use of energy, they are implementing some type of lighting control system as a part of the building management system (BMS). The smart lighting system helps managers create a set schedule for the lights to save energy and reduce costs. LED bulbs are at the center of intelligent lighting strategy as they use up to 75% less energy than incandescent bulbs, last 25 times longer, and produce better quality light. The smart LED bulbs consist of software that connects to an application or smart home assistant or other accessories, which gives one the flexibility to control the lights remotely, eliminating the use of traditional switches. With the rising penetration of connectivity such as cameras, audio equipment, thermostats, or home assistants, the use of smart lighting systems is set to increase in the coming years.

New market Innovations with LED as a Wi-fi communication device (Li-Fi)

LiFi is a novel lighting technology that ensures high-speed, bi-directional, and wireless data communication faster than conventional Wi-Fi internet connectivity. LED capabilities with IoT connectivity enable design engineers to simultaneously provide illumination and transmit data. Integrating LiFi into the LED lighting world creates an alternate path for internet connectivity in commercial spaces and offices. While Wi-Fi uses radio waves for data transmissions, LiFi uses infrared, ultraviolet, and visible light waves, providing high-quality transmission speeds up to >30Mbps. Besides, the data can be stored anywhere there is LED light, which also applies to streetlamps that can be used as LiFi hotspots. LiFi solutions are expected to witness growth in the years owing to their greater efficacy and the advent of machine-type communication (MTC). As governments are increasingly taking initiatives in the ICT sector to improve the functioning of the electricity grid and optimize the efficiency of city operations, the market players are forced to invest and innovate in LiFi.



The role of Manufacturing Operations Management (MOM) Systems

MOM creates a digital foundation for enabling enforceable, proactive, and paperless manufacturing. It identifies, analyzes, and prevents errors, integrating advanced planning and scheduling as well as manufacturing intelligence capabilities to create the most efficient production environment possible. It is built for manufacturers who want one system to optimize their entire factory and provides capabilities that can help increase productivity, reduce loss, and lower production costs.

Manufacturing Operations Management (MOM) enables organizations to analyze and generate accurate schedules that consider constraints around resources like people, machines, tooling, and materials. Manufacturers are then able to ensure they obtain the best use of their available capacity to deliver to customers on-time and in the most cost-effective way, with reduced production costs.

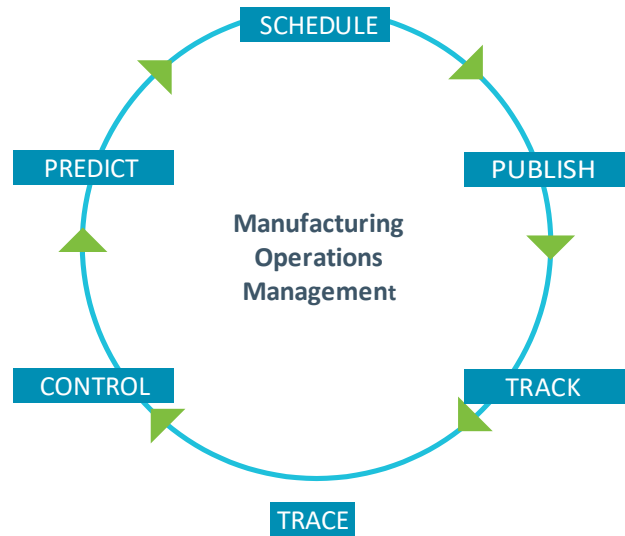
Five key capabilities of MOM for lighting manufacturers:

- **Orchestration** – MOM provides the orchestration and planning of manufacturing and quality operations.
- **Vertical integration** – MOM bridges the gap between enterprise systems and shop floor automation.
- **Genealogy** – MOM automatically generates the electronic records using e-signature, supporting more rapid compliance processes.
- **Digital twin** – MOM implements the comprehensive digital twin of the physical production realm, creating a digital representation of the manufacturing process.
- **Analytics** – MOM transforms big data into IoT actionable information (smart data) and provides continuous improvement and innovation intelligence.

A 360° View of Production

Manufacturing Operations Management (MOM) supports your complete manufacturing lifecycle, providing you with a 360° view of your production processes. The solution enables you to connect with your machines and read real-time data allowing accurate management decisions.

- **Schedule** – Accurately sequence work order batches considering manufacturing constraints and business rules to align production to dispatch.
- **Publish** – publish schedules, tasks, and work instructions to the shop floor.
- **Track** – collect all types of data from the shop floor i.e., employees, machines, tools, inventory, and quality.
- **Trace** – Control non-conformances, reduce rework and rejections, and quickly identify bad lots during recalls.
- **Control** – Be cost-effective by measuring schedule attainment, overall equipment effectiveness (OEE), and cost of poor quality (COPQ).
- **Predict** – Build intelligence on the platform and combine it with generative AI to predict problems before they are about to occur.



MOM/MES Use cases in the Lighting Industry

Given the complexity of both products and the increasing regulatory environment, MOM/MES capabilities are essential for any lighting manufacturer from large enterprises to SMBs. The lighting industry use cases provide an understanding of the benefits MOM/MES can bring to a lighting manufacturer.

Remove silo systems from the factory: The lighting industry uses highly automated machines like SMT machines to make the PCBs and depending on the type of lighting manufactured, box-build assembly operations could be manual or automated. Legacy MES systems have primarily existed on the SMT lines with barcode systems or spreadsheets in downstream operations. Integration of MOM/MES to the ERP and to the automation layer that collects data from PLCs, sensors, and barcode systems removes multiple master maintenance and possibilities for data duplication. This is a foundational use case in starting a digital transformation journey.

Split production orders into batches: Production in reality never flows in the same way a production order is defined. 10,000 LED lights may be one production order in the ERP, flows as a batch of 2,000 units but is actually produced in lots of 500. This unit of measure changes across the production process but there is additional complexity when it comes to traceability. For genealogy, this unit of measure has to extend until lot size 1 to achieve single-piece flow traceability. MOM/MES is capable of defining such complex containers of the unit of measure to create an audit trail that is compliant during recalls, rework, or rejections.

Production Scheduling: Sequencing traditionally has been left to production supervisors based on a dispatch plan for each supervisor who is tasked with maximum capacity utilization in their own area. SMT machine departments in the lighting industry set up each department as a mini factory. PCB manufacturing machines will produce to serve a Kanban supermarket and box build assemblies based on the dispatch plan consumes from the supermarket. MOM/MES provides the ability to publish a production schedule for all departments considering material availability, manufacturing constraints, and dispatch plan dates. Planned schedule vs. actual can provide insights into profitability through metrics like schedule attainment, the impact of rush orders on delays, and overall capacity utilization.

Material management: This capability provides full visibility into the movement and consumption of materials across the factory. Material management is critical for factory productivity, tracking the use of materials, evaluating production line capacity, and replenishing material as needed.

Self-auditing electronic batch records (eBR): Electronic batch records are paperless electronic systems in the MOM/MES that enforce production processes and capture all information associated with as-built production records. The self-auditing nature of electronic batch records (eBR) refers to its capability to error-proof and provide real-time visibility to produce consistent product quality. Should product quality issues arise, eBR can quickly contain suspect products, either in process or in the field, to take action to address the issue.



Tracking-and-tracing: Tracking the status of production and the disposition of work creates the foundation for the eBR. Status information on qualified personnel, component materials, production conditions, alarms, rework, or other exceptions related to the product (essentially the as-built record) is tracked in the system. This detailed production information enables forward and backward traceability of components and their use in each end product.

Sample data collection: MOM/MES data collection and acquisition capabilities track the real-time status of production equipment and processes as part of the production history. This capability saves time and prevents errors due to manual processes, maximizing productivity while building quality into your products.

In-line statistical process control (SPC): Manufacturers can solve production problems before they decrease quality, yield, or throughput by using live production information. Operators view real-time charts that provide immediate feedback and engineers can review historical charts when analyzing specific events. Leveraging industry-standard statistical analysis tools makes it possible to recognize adverse trends before they lead to poor quality.

Nonconformance management: MOM/MES improves quality consistency by adhering to global quality policies and orchestrating quality operations. When deviations are detected, nonconformance management capabilities provide exception management and enforce protocols to correct the non-conformance. All collected data on the shop floor can be reused to initiate a problem-solving process CAPA by supporting root cause analysis, identifying the proper CAPA, and initiating the change management process. This enables the changes to be distributed to all stakeholders in the loop so that the product development process continuously improves. This focus on prevention further reduces the cost of quality, streamlines compliance, and reduces regulatory and product risk. This allows the product development process to be continuously improved.

Electronic work instructions (EWI): Comprehensive manufacturing work instructions are provided for the shop floor to create clear process steps. As a result, most of the current work instructions are instantaneously available where they need to be. Process documentation is automatically updated with revision management, enforcing changes quickly and easily.

Electronic Kanban (eKanban): eKanban allows manufacturers to efficiently manage their inventory locations and properly replenish support material. eKanban helps control the flow of consumable materials on the manufacturing floor, supports lean manufacturing, and provides automatic consumption of materials per product bill-of-materials (BOM). Multiple manufacturing process styles are supported, from discrete, to batch processes. Given the growing and hybrid nature of the lighting industry, this cross-functional support is critical.

Maintenance management: Track equipment usage and manage preventive and corrective maintenance and calibration activities. It enables you to automatically detect conditions that necessitate maintenance to keep equipment performing at peak efficiency. It enables you to define and track resource-centric maintenance requirements based on the calendar date, usage time, and throughput. After maintenance or calibration, requirements are assigned to resources (enforcement occurs during manufacturing).

Training and certification management: Establish manufacturing roles, define training requirements for various roles and process certification requirements, maintain training records, and establish certification expirations. This eliminates errors due to expired training and makes sure you are not at risk for processing issues and non-compliance.

About SNic Solutions

SNic Solutions is a global digital transformation technology provider focused on manufacturing operations management (MOM) systems to accelerate Industry 4.0 adoption in manufacturing organizations.

SNic focuses on its expertise in MOM/MES and Advanced Planning & Scheduling (APS) systems and brings in Supply Chain Planning (SCP), Enterprise Resource Planning (ERP), Product Lifecycle Management (PLM), and Industrial Automation partners to take up end-to-end IT-OT transformation projects.

For high-mix-high/low-volume manufacturing enterprises globally, SNic goes to market using “Opcenter MOM Software” and is an expert partner to Siemens Digital Industries Software for Opcenter MES and Opcenter APS.

For Automotive tier I and 2 suppliers in India, SNic goes to market with “Plex” MOM software from Rockwell Automation.

A combination of manufacturing domain knowledge, production know-how, software implementation services, and the ability to build industry-specific accelerators makes SNic Solutions the go-to partner of manufacturing organizations across the globe.

With customers in over 12 countries across six continents – SNic Solutions offers guidance and support every step of the way as a trusted advisor.

For more information, visit www.snicsolutions.com



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