WHITEPAPER

Improving MES Efficiency & Savings through ERP and Integrated Technologies

Introductory Note

A Shop Floor is the heart of any manufacturing enterprise and the way it is operated determines the organization's business and financial health.

The shop floor is where core manufacturing elements such as sales orders, work orders, demand & sales forecast, production planning, inventory management, resource management, MES etc. culminate into a final product that gets manufactured.

Therefore, it is very critical for manufacturers to efficiently manage shop floor operations so that they can weather the storm in the form of market uncertainty, increased competition, fluctuating demands etc.

Also, an efficient shop floor means increased manufacturing agility, decreased product cycles, production costs and increased profitability.

Challenges on the Manufacturing Shop Floor

The main cause of these issues are limited visibility of what's happening on the shop-floor and the lack of communication between machines and personnel. In a conventional shop floor setup, machines operate individually and are not connected to a particular monitoring system.

Due to this, the shop floor worker has to constantly, manually keep tabs on machine performance, availability and ensure that work order allocation happens evenly across all the machines. This is easier said than done, as there are multiple orders to attend to simultaneously and multiple machines to monitor. In the rush of completing customer orders, machines are over-worked leading to their breakdown and production disruption. Also, the reverse is also possible where machines go idle when they can be utilized better. This clearly shows the lack of monitoring, order prioritization, timely allocation, resource utilization etc.

Today's shop floor environment is complex. Not every order is the same. Orders differ in terms of number of products, product type, delivery date, shipping requirements etc. With the changing nature of orders, the shop floor has to be on its toes in deciding order prioritization based on delivery date, material required for all of them, allocation of machines and personnel etc. All this must be done in a manner that material wastage is kept to a bare minimum, machine and personnel utilization is at its highest, and high-quality products are manufactured to suit customer requirements.

To do this, a real-time system that provides minute by minute updates of what is happening at the shop-floor along with other critical information is necessary. This ensures that personnel take quick calculated decisions and take appropriate actions based on real-time information.

These proactive measures and quick decision-making ensure that,

- Machine availability and utilization is at its peak at all times and achieve near-zero downtime.
- Work Orders are seamlessly prioritized, executed with real-time status on progress/completion, thereby reducing machine idle time.
- Shop floor has the latest information on materials consumed, available inventory, scrap generated, rework to be done etc., for effective inventory deployment and costing.
- Information is displayed in different forms for various levels in the organization e.g. plant supervisors, shop floor personnel, shop owners etc.
- Changes in manufacturing processes, shop floor management, material management, and personnel training & management are based on data insights.
- Overall it increases manufacturing agility and efficiency. And all this can be done with the help of a Manufacturing Execution System (MES).

Manufacturing Execution System (MES) An Introduction

Manufacturing agility is achieved when all facets of manufacturing (i.e. machine, manpower and materials) are connected and made to function in equal conjunction with each other. The connection is made through a robust communication network established between machines and personnel spread across different departments, all linked to a single or to a network of centralized software. In the manufacturing industry, such an arrangement is called Manufacturing Execution Systems (MES).
As per the Manufacturing Enterprise Solutions Association (MESA),

MES is a dynamic information system that drives effective execution of manufacturing operations. Using current and accurate data, MES guides, triggers, and reports on plant activities as events occur. The MES set of functions manages production operations from the point of order release into manufacturing, to the point of product delivery of finished goods. MES also provides mission-critical information about production activities to others across the organization and supply chain via bidirectional channels."

Which, for a manufacturer, means MES is a vital cog in their enterprise operations 'wheel'. An efficient MES monitors and manages production planning & operations in a manner that minimizes disruptions and increases productivity. It relies on a two-way real-time data flow between machines and an ERP/MES software to churn out vital operational statistics that drive quick, proactive decision-making by shop floor personnel.

Components of MES

Previously, MES was designed as a separate system to meet shop floor requirements, as ERP systems could only support strategic business requirements. This created a bit of void between the two as both systems were functionally separate, and designed differently. Either they had to be integrated with each other or the void had to be plugged by manual, redundant processes.

However, today's ERP systems are a much-evolved lot and have MES as a in-built module within them. This eliminates the plug-in systems required to integrate MES and ERP software. Also, the MES module would be designed to collaboratively work with other modules such as Inventory, Sales & Purchasing, Shop Floor Management, Planning & Scheduling, Quality Management, Business Intelligence etc. for a more streamlined production management.

Let us look at some ERP modules that are a part of core MES functionality:

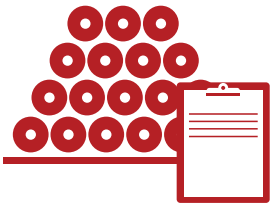
Inventory Management and Product Traceability

Inventory Management is one of the most important aspects of MES. Shop-floor personnel need to know the latest inventory levels at all times so that they can easily make necessary changes to machine & personnel allocation, and work orders.

The ERP tracks a raw material from the time it is procured till its consumption into a semi-finished or final product. With barcode integration, you can generate barcode labels for each item and track them throughout the process. You can pinpoint to the right job where a particular raw material/semi-finished product/part has been consumed into production. Every time the stock levels fall below a certain threshold, you get automated alerts enabling you to place re-orders.

Based on the number of orders on hand, you can maintain optimum inventory levels thereby reducing storage costs, and at the same time managing purchase orders efficiently.

Real-time updates to BOM helps manufacturers trace raw materials and semi-finished goods even after products are sold. This makes product recalls easier and quicker thereby reducing costs, maintaining reputation and customer trust.

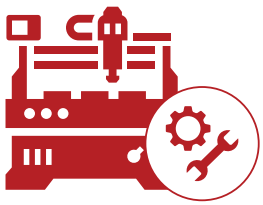


Material Requirement & Planning

For a manufacturer, material management and production scheduling are two of the most challenging areas. Getting the right material to the right place at the right time has a huge impact on customer delivery, that in turn impacts your market reputation and future orders.

An effective Material Requirement Planning (MRP) within an ERP helps identify sources of material demand and instantly triggers purchase order(s) if the existing inventory levels do not meet the demand.

MRP makes you proactive, as you can anticipate your requirements well in advance based on demand and purchase trends, and reduce inventory overstock. This significantly reduces storage, maintenance and transportation costs.



Maintenance, Repair & Overhaul (MRO)

One of the primary causes of abrupt machine breakdowns is untimely maintenance and upkeep of machines, manufacturing equipment, gages, and tools on the shop floor.

A comprehensive preventive maintenance and repair program that ensures frequent and timely maintenance of shop floor assets, Standard Operating Procedures (SOPs), emergency repairs or maintenance etc. helps realize maximum availability of machines and other equipment.

This leads to maximum Overall Equipment Effectiveness (OEE), including reduced breakdowns, reduced maintenance costs and continuous production.

Quality Management

Quality is paramount in Manufacturing. There are strict compliance regulations set by every industry segment and manufacturers have to abide by them.

Therefore, it is crucial for manufacturers to have stringent mechanisms that ensure right quality standards are maintained at every step of manufacturing.

An ERP takes these quality standards into account and can offer a comprehensive compliance system that is integrated with core Manufacturing Execution System (MES).

It continuously measures quality parameters at every step to ensure immediate corrective measures in case of defects.

Product traceability, with the help of bar-coding/labeling technology, helps ensure quick-recall and defect-resolution thereby enhancing customer-relationships & market-reputation. From attaching inbound material certifications to first piece inspections to SCARs to final deliverable quality checks, ERP manages everything flawlessly.

Third Party Software Integration

An ERP can be integrated with a range of third-party systems such as,

- Nesting
- Bar Code
- RFID
- Machine Monitoring
- Shipping & Logistics

Nesting

An ERP has the capability of integrating with various nesting applications to track information such as yield optimization, material consumption, scrap generated etc. It can group various work orders into a single nest based on their respective due dates.

It can receive and process data automatically from the CNC machine to trigger part completions and update material usage data. It is capable of capturing completions, part weight, labor and drop information from the machine controller.

Bar Code

Shop floor personnel can streamline material handling and inventory movement by integrating bar-code technology with an ERP.

They can use barcode to track raw material and inventory movement from procurement till delivery, track movable machine assets, and products post-delivery (for easy traceability and quick recall in case of defects).

RFID

An ERP can be integrated with RFID printing software and printers. Shop floor personnel can then track production and inventory assets with RFID technology. They can automate data collection at every manufacturing stage and improve product traceability, material control, asset & material utilization, inventory turnover, shipping efficiency etc.

Machine Monitoring

A Machine Monitoring System is an integrated technology set that enables machines to continuously talk to machine control devices and provide minute-by-minute data about the processes they are running, time to complete an activity, material quantity/number they are processing, personnel operating it and reasons for idle/downtime.

This data is continuously relayed to shop-floor supervisors & operating personnel, plant managers and shop-owners in different forms to help them monitor machine setup, production, output quality, downtime and allowing them to quickly respond to disruptions, make informed decisions on customer orders and prioritization, and increase production up-time. In all, it helps increase Overall Equipment Effectiveness (OEE) and factory performance.

Machine monitoring technology can be easily integrated with ERP through Modbus serial or TCP/IP protocols. The machine controller interfaces can be easily customized to accommodate XML, CSV, Text and SQL formats.

Shipping & Logistics

An ERP can be integrated with shipping interfaces to get a complete visibility of the product transit between your shipping facility to the customer. One can send address and weight information and receive shipping charges, actual weight and tracking numbers to streamline shipping and delivery

Advanced Data Analytics

An ERP provides comprehensive real-time visibility of all facets of manufacturing to the entire organization. The manufacturer has all the freedom to build their own reports and dashboards that provide valuable intelligence to each and every department in the organization.

The senior management gets an overall view of sales, production performance, overhead costs and overall profits from their day-to-day production.

The plant managers get real-time view of what is happening on the shop-floor, movement of materials within their facility and between warehouses, movement of goods, products shipped to customers etc.

The shop floor supervisors get a minute-by-minute update on the health and performance of machines, production status, machine idle or breakdown time, personnel availability, inventory levels etc.

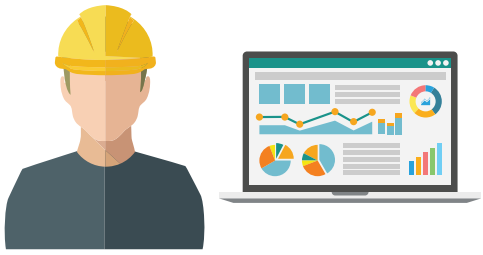
The floor operator gets real-time updates on their devices, machine consoles such as upcoming work-orders, pick lists, manufacturing configurations etc.

Being a centralized system, the ERP allows personnel to drill down from summary to each transaction instance thereby increasing their accessibility and enabling them to take quick, calculated data-based decisions.

How MES Works?

1

Customer places an order via Call, Email or E-Commerce Platform



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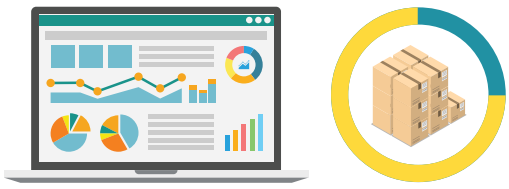
The order is manually entered by an operator in case of call or automatically reflected (email or e-commerce platform)



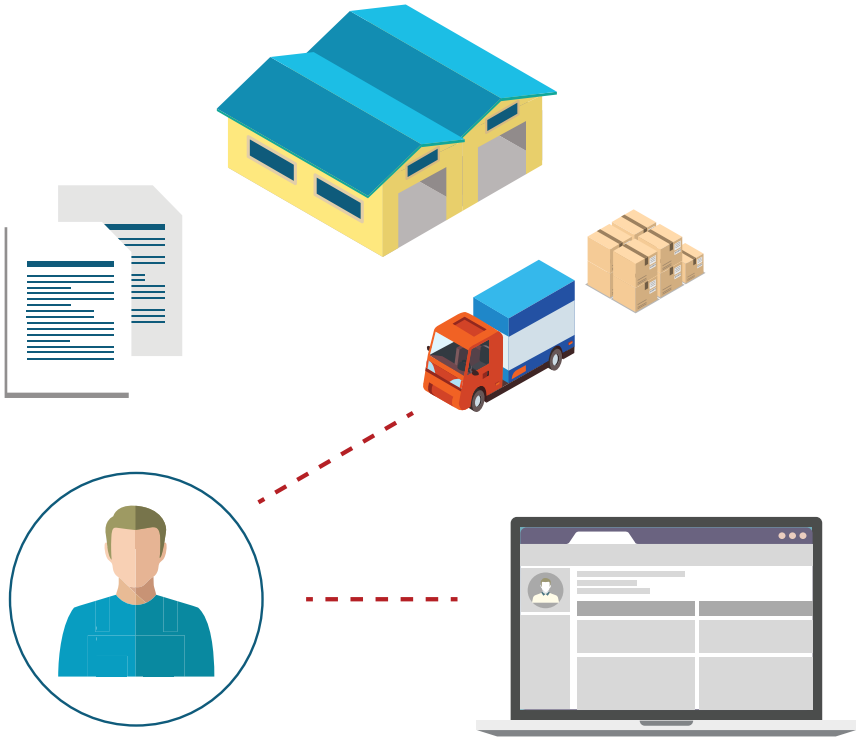
3

ERP checks the inventory levels to see if the product can be shipped froam existing stock or needs to be manufactured

If the Product is in Stock

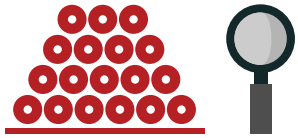
ERP initiates procurement from the Warehouse

Packing slip is generated, product is shipped to the customer



The shipment details are sent to the online shopping platform which in turn makes it visible to the customer.

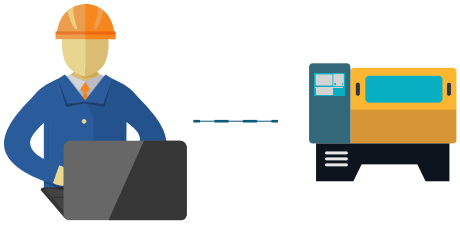
If the Product is not in Stock



ERP checks for sufficient raw material to initiate production

ERP creates a Work Order for the shop-floor personnel & displays it on their hand-held devices

Production is initiated along with other similar work orders & product configuration.

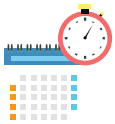


Packing slip is generated, product is shipped to the customer

The shipment details are sent to the online shopping platform which in turn makes it visible to the customer.

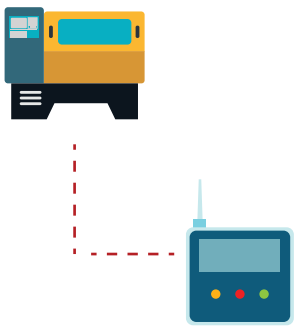
ERP places a procurement order with the supplier to urgently ship the material

The order due date is modified based on arrival of materials & total manufacturing time



Once the materials arrive

Real Time Production Update for Improved MES

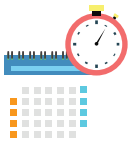


- Setup Start & End Time
- Job Start & End Time
- Idle Time

Operator alert in case of machine breakdown between a job operation or other factors

Machine Control device connected to each machine tracks various machine parameters and alerts the operator in case of any deviation.

Operators have an option to record production data on their consoles that directly gets updated in the ERP.



- View production data on the shop-floor in real time.
- Daily, Weekly, Monthly and Yearly data from summary to transaction level.
- Analytical dashboards for in depth analysis by supervisors

- Get yield quality through in-process Quality Controls.
- % age of Produced Goods | Needs Rework | To be Scrapped
- Cause of Low Yields for immediate rectification.

- Track raw materials, semi-finished goods & final shipment with the help of bar codes.
- Quickly recall products & trace defect to the correct batch of raw materials & semi-finished parts.

Complete Control in Manufacturer's Hands

Many manufacturers have realized the potential of automating their factory operations through MES and ERP. The shop floor being a critical area in manufacturing, manufacturers have to pay extra attention by identifying areas of improvement and automating workflows and business processes. Through MES, they get enhanced visibility to operations and therefore, can identify areas of improvement and avenues of cost reduction that previously, were not seen or observed.

Plant managers and senior executives can devise product and sales strategies based on the real-time information they get from MES. They can make informed, calculated decisions based on data and address production costs, quality issues, productivity on the shop floor. A well-oiled shop floor has a direct impact on customer satisfaction and MES provides you complete control over it.

Right from customer order till production, each phase is seamlessly handled by the system thereby increasing capacity leading to more sales per employee, faster production, near perfect on-time delivery, reduction in overhead costs, increased profitability and happy customers.

About OmegaCube

Since 1999, OmegaCube has delivered enterprise-class ERP software for our customers with a single focus,

"No two companies operate exactly the same and they need flexibility in their systems in order to maintain their competitive edge".

You know your business inside-out and would definitely want your ERP software to treat you in a manner you like, and not exactly as it treats your competitor. Our flagship product, OmegaCube ERP seamlessly adapts to your business. With best industry practices built into the product, coupled with extreme flexibility,

OmegaCube ERP can do things better than you currently do and at the same time, adapt to what you do best. This has helped our customers from diverse industries, realize their strategic goals such as, workflow automation, centralized operations, cost reduction, increase in production, knowledge centralization, and effective resource & manpower utilization. Our strong expertise in advanced ERP technology coupled with immense manufacturing & distribution knowledge allows us to deliver quality enterprise solutions that help you gain competitive edge in the market and achieve your business goals.

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