An ERP Guide for Engineer-to-Order (ETO) Manufacturers

OmegaCube
Technologies

Engineer to Order (ETO)

is a manufacturing approach that is mainly driven by customer demand and highly flexible manufacturing processes.

Customers opt for ETO manufacturing when they need a product that is tailor-made to suit their requirements or want to transform a concept into a final product.

ETO manufacturers have in-depth knowledge and expertise to understand customer requirements and transform them into fully functional products from conceptualization to the final product. ETO manufacturing is more prevalent in the B2B segment compared to the B2C segment.

Some common examples of ETO manufacturing,
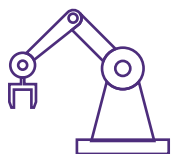
Industrial Equipment & Machinery
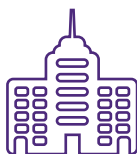
Large Structural Components

Aeroplanes, Drones, Helicopters

Customized Vehicles

Custom Clothing & Accessories

ETO vs. ATO vs. MTS vs. MTO

There are various manufacturing principles and each one is influenced by the nature of the product, customer requirement and market demand. Manufacturers also use a combination of these principles to optimize their workflows and meet customer's/market's product needs quickly.

Make to Stock (MTS)

Products are manufactured in bulk and stocked in warehouses. They are then dispatched to customers against each customer order and the stocks are replenished by manufacturing more such products.

MTS manufacturing depends on sales forecasting and market demand for mass production.

Make to Order (MTO)

Products are manufactured after a customer order is received. The product is manufactured based on the customer's requirement and is a combination of standard and customized parts/components.

Examples of MTO manufacturing are, aircrafts, automobiles, FMCG products etc.

Assemble to Order (ATO)
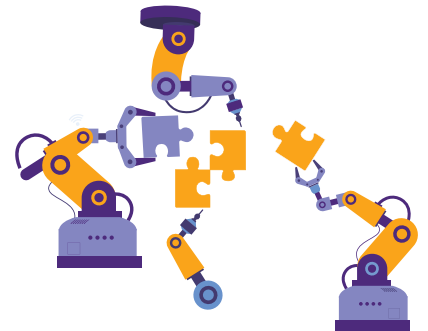
Products are assembled as per customer requirement after an order is placed. The manufacturer stocks critical components, sub-assemblies and parts in anticipation of customer orders.

Typical examples of ATO manufacturing are personal computers, high-end sports cars, and food products.

Engineer-to-Order (ETO)
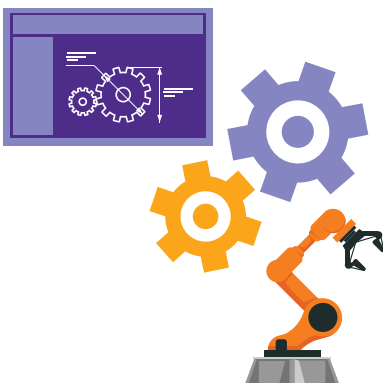
The concept, design and manufacturing of a product starts after the receipt of a customer order.

Customers opt for ETO manufacturing when they need a product that is tailor-made to suit their requirements or want to transform a concept into a final product.

Each order is unique and requires a completely new set of design, BOM, parts and routing. Every ETO process from start to finish is time-consuming and subject to change at any point of time.

Processes in ETO Manufacturing

Unlike conventional, discrete manufacturing, ETO manufacturing involves highly iterative processes that are design oriented and client-centric. There is a lot of creativity involved as engineers try to convert clients' concepts into reality through continuous collaboration right from design to delivery.

In simple terms, a generic ETO process involves,

Niche/customized product requirement by the customer to the ETO manufacturer.
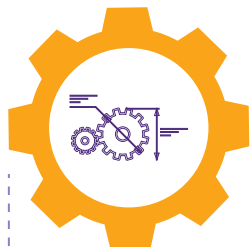
Product research and design by the engineering team in continuous collaboration with the customer.

Design review by the customer followed by changes if any, and the final approval.
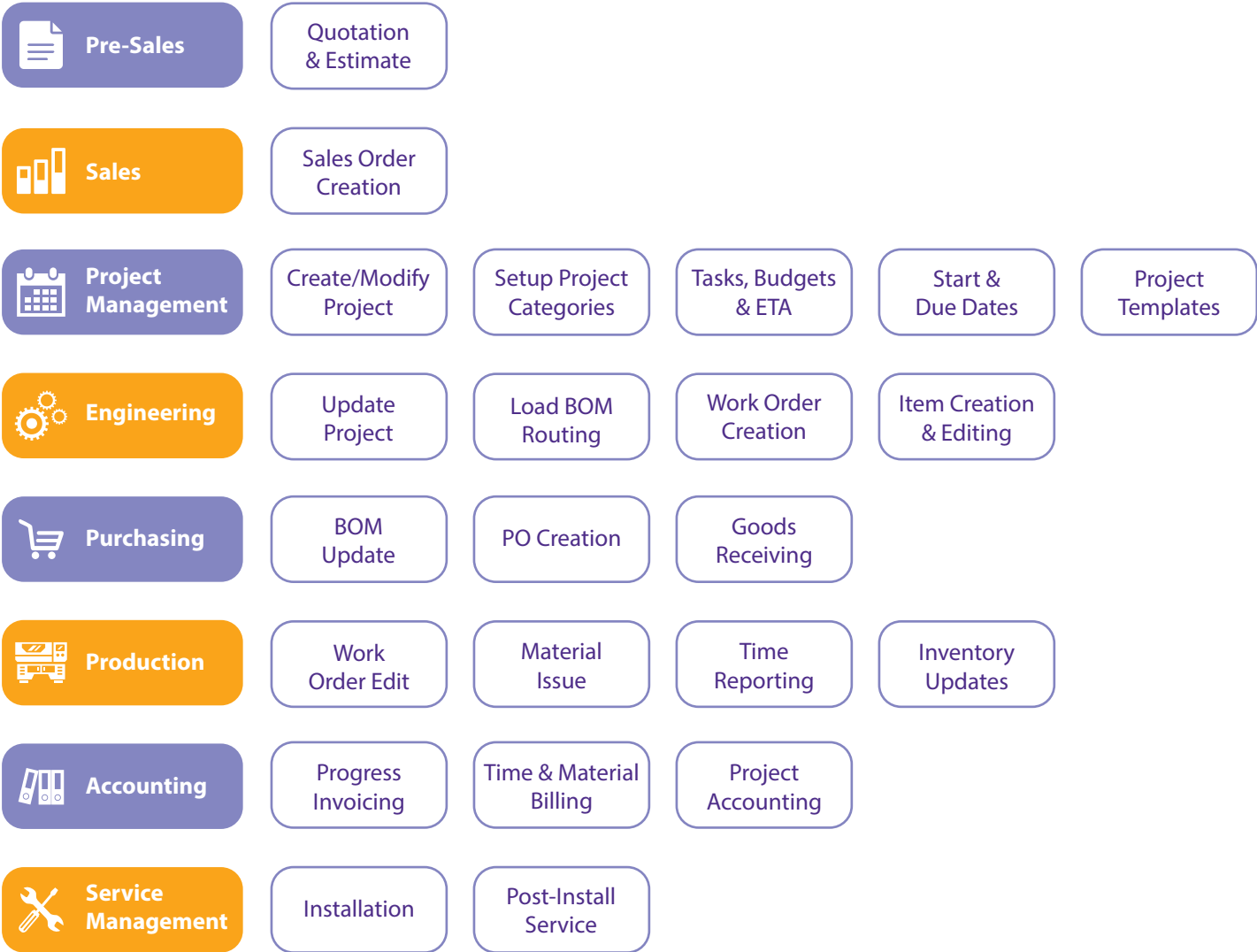
Production planning and manufacturing by the production team.

Quality checks and shipping of the final product to the customer.

As easy as it sounds, ETO manufacturing involves a lot of complex processes that require complete support and collaboration of all departments, third-party vendors and the customer. The below flowchart illustrates the end-to-end ETO manufacturing process.

Pre-Sales	Quotation & Estimate				
Sales	Sales Order Creation				
Project Management	Create/Modify Project	Setup Project Categories	Tasks, Budgets & ETA	Start & Due Dates	Project Templates
Engineering	Update Project	Load BOM Routing	Work Order Creation	Item Creation & Editing	
Purchasing	BOM Update	PO Creation	Goods Receiving		
Production	Work Order Edit	Material Issue	Time Reporting	Inventory Updates	
Accounting	Progress Invoicing	Time & Material Billing	Project Accounting		
Service Management	Installation	Post-Install Service			

Let us look at each process in more detail.

Pre-Sales

Every customer order begins with a Request for a Proposal (RFP) from the customer followed by a proposal, quotation and sales order creation.

This phase takes up immense time and resources due to the involvement of multiple departments. Manufacturers strive to create a proposal that is cost-effective for the customer and profitable to them at the same time.

Sales Order

After the customer approves the proposal, a sales order is created that includes the cost as per the shared quotation, design-to-delivery time, rework & scrap costs, and the entire Work Breakdown Structure (WBS).

Project Management

A project management team is a vital department that successfully drives the entire project from start to finish. A project manager is an important link between the ETO manufacturer and the customer.

The PM team,

✅ Oversees and manages end-to-end project-related activities from sales order creation to product delivery to the customer.

✅ Creates project milestones and the means to track milestone achievement.

✅ Manages financial aspects of the project and keeps expenditures in check.

✅ Coordinates and communicates with various departments and gets the required updates to ensure the timely completion of the project.

✅ Actively engages with the design and engineering team to identify project deviations and rectify the same.

✅ Collaborates with all departments to improve process and project efficiencies.

✅ Collaborates with third-party vendors for components and parts procurement.

Design

This is the most crucial and time-intensive phase of the project where design engineers and the customer collaborate to transform the initial concept into an actual design. This is a continuous, iterative process and the design goes through innumerable changes before it is finalized and passed on to the production phase.

Product Configuration

Product configuration plays a major role in ETO manufacturing as custom products require a different quotation and price estimation approach. For each product, BOM configuration, sales pricing, discounting, machine, material and labor capacity needs to be decided and configured from scratch.

To reduce the quotation cycle, manufacturers can use pre-decided templates to quickly arrive at accurate quotes and price estimates using the product configurator tool.

They can easily configure and automate sales pricing, discounting and quotation workflows. They can also configure complex product designs and generate custom BOM and routings using pre-configured templates.

Procurement

During the design stage, the design team creates a detailed Bill of Materials (BOM) that encompasses all parts, assemblies, and sub-assemblies. Based on this BOM information, the procurement team places a purchase request with preferred suppliers/sub-contractors to procure the required materials well in advance.

For each part/component to be manufactured, the engineering team plans and creates work orders in advance. PO creation is expedited for the materials to arrive on time. Goods receiving and quality control processes are kept in place to ensure adequate documentation and optimum quality materials.
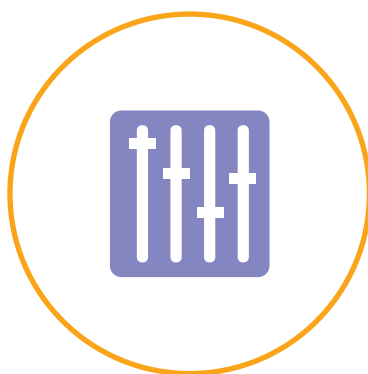
Production

The production team finalizes the production schedule, labor, machine and material availability for the manufacturing/assembly to begin. They initiate shop-floor operations and track them at each manufacturing phase. Work orders are continuously updated to ensure production happens in clockwork precision.

Inventory levels are constantly updated and monitored to prevent shortfalls. Timesheets are updated and tracked to ensure maximum labor utilization. The maintenance team is always on standby to prevent breakdown/idle times. The production team also keeps contingency plans and adjustments in place to face probable product design changes that might arrive during the manufacturing phase.

Accounting

The accounting team works in tandem with the production team to carry out progress invoicing after the completion of each manufacturing phase as per the production plan. The team also keeps a track of project expenditures and derives trends to see whether they exceed the budget. Time and expense billing are collated and also accounted for.

Product Delivery & Installation

This is the most critical phase of the project. The manufacturing team ships the components, assemblies, and sub-assemblies to the customer's location and does the necessary installation. The product is comprehensively tested and necessary steps are taken to resolve any errors or deviations.

The entire process can take up to days and months depending on the complexity of the product and the customer's location.

Service Management

Post-installation, the manufacturer takes the necessary steps to resolve any issues that arise during the initial product operation. This can be related to a particular component or a sub-assembly and will have to be repaired or replaced at the earliest.

Apart from this, the manufacturer also conducts intense training sessions for personnel who will operate the machinery. Standard Operating Procedures (SOPs), user guides, maintenance documentation and emergency response steps are handed over to the customer at the time of product delivery.

The manufacturer usually takes care of the maintenance through AMC agreements with the customer.

Project Closure

The project is deemed completed as soon as the customer makes the final payments against the invoice generated by the manufacturer.

Challenges in ETO Manufacturing

Engineer to Order manufacturers face immense challenges in their day-to-day operations right from customer proposal to production. Let us look at a few of these.

Time-consuming Proposal & Quotation

One of the key challenges ETO manufacturers face is the quick generation of proposals and accurate quotations. They take up a lot of time, manpower and effort to arrive at accurate quotations and estimates.

This is primarily because the products are highly complex in nature requiring multiple sub-assemblies and parts that need to be designed from scratch. Every product is different, requiring new processes, manufacturing capabilities and deployment approaches. Therefore, manufacturers typically spend months arriving at an accurate proposal that is cost-effective and profitable.
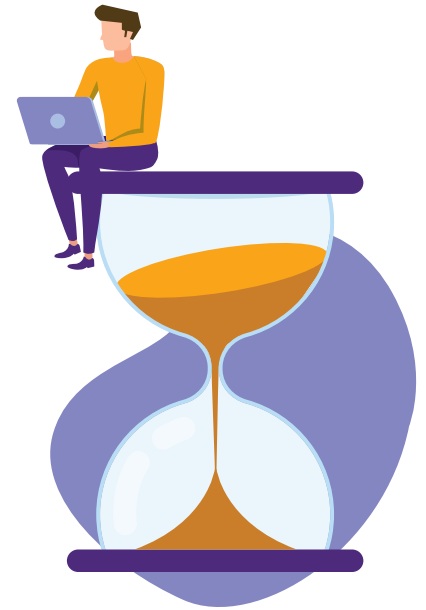
In the absence of proper quotation software, manufacturers resort to manual methods of data collection and retrieval. This leads to data duplication, human errors, loss of data, and delays in data retrieval, thereby impacting quotation numbers.
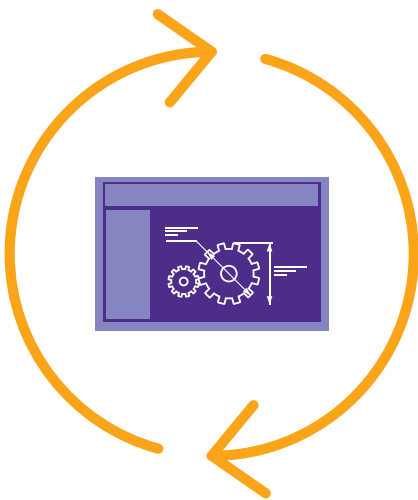
Extensive Product Design

The success of the entire project depends on the product design phase. This phase takes up the longest amount of time as it involves creating the preliminary design followed by multiple design iterations due to constant requirement changes.

Customers themselves are deeply involved in the design process from start to finish. Therefore, the number of design iterations increase considerably leading to a stretched design phase. Each design goes through a thorough review process and testing. Any changes require the design team to go back to the drawing board to make the necessary changes and re-submit for the customer's approval.

Extensive Collaboration with Departments and Vendors

Unlike conventional discrete manufacturers, ETO manufacturers have to extensively drive collaboration between departments and third-party vendors in order to meet customer requirements from design to delivery.

In the absence of an automated system, manual methods are used to communicate and maintain documentation. This leads to miscommunication, missing information, and human errors thereby delaying the project. Therefore, a comprehensive ERP system is necessary to automate communication and ensure an error-free environment.
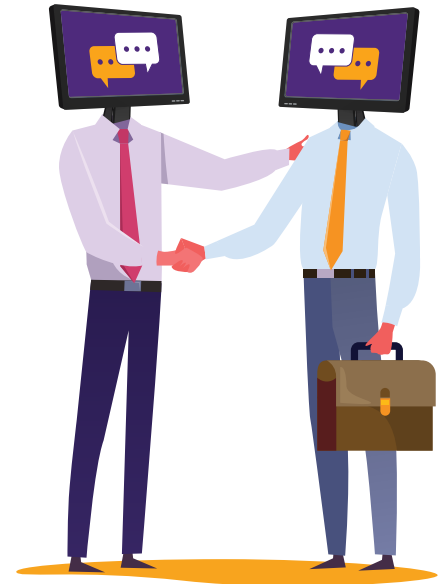
Order-to-fulfillment Ratio

ETO manufacturers race against time to deliver the products to customers on time as committed. Their primary challenge is to reduce the order-to-fulfillment ratio and thereby reduce overhead and operating costs. However, the process of designing, material procurement, production, and testing along with constant design changes makes it difficult for manufacturers to deliver the products on time.

With paper-based tracking and in the absence of good ERP software, they find it even more difficult to get a real-time view of day-to-day operations and prevent bottlenecks that disrupt the project.

Procurement

ETO manufacturing runs on the principle of a pull system, where products are manufactured based on the customer's requirement. It is the opposite of the push system in conventional discrete manufacturing where the products are manufactured in bulk and sent to retailers for further sales. Here, inventory procurement is entirely based on production planning that is derived from the sales forecast and customers' consumption behavior.
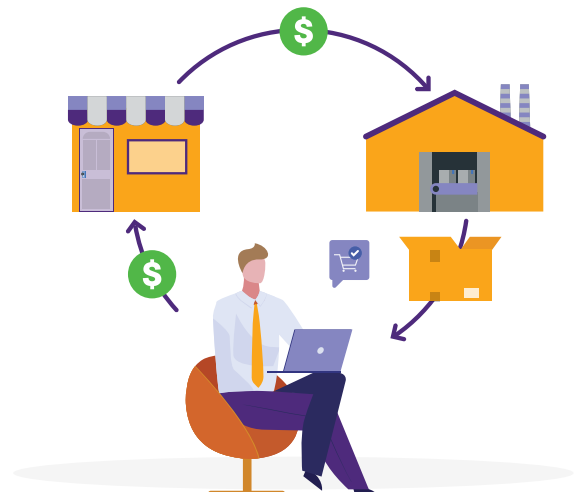
In the ETO environment, the pull system poses a challenge as the material and parts requirements are not known in the beginning. It is only after the design and BOM creation stage, that the actual requirement is known. Considering that the production stage is very close, it becomes a tricky situation as the manufacturer has to procure the required materials and tools at lightning-fast speed from their suppliers, that too at the best price. Also, with multiple iterations of the product design and BOM, manufacturers have to ensure that suppliers are flexible enough to deliver the necessary goods.

To tackle this challenge, manufacturers need to have a robust, real-time communication platform with their suppliers. Constant exchange of planning and requirement data right from RFQ to Sales to Design to Delivery ensures that all stakeholders have the same information in real-time enabling them to take swift decisions.

Engineering Change Management

For ETO manufacturers, Engineering Change Management (ECN) is the most critical process as they deal with constant changes from design to production. If there is a design change to a particular part or a sub-assembly or the material used, it has to be properly documented and tracked. Revisions have to be tracked for BOMs, finished products, and routing changes and revision numbers have to be tracked at every BOM level. Any change to BOM or routing has to be automatically reflected in the product cost.

In the absence of powerful ECN management software, ETO manufacturers cannot stay on top of their item, component, and material changes at any production phase. With no proper change documentation and tracking, there will be utter chaos as personnel will scramble to retrieve the latest data and update it with any changes that affect the end product.

Cost Control & Profitability

Every ETO manufacturer wants to control and reduce its costs to improve its bottom line. However, to do this accurately and consistently is their biggest challenge. Most ETO manufacturers do not have a proper system or use legacy accounting systems to capture costs. These systems don't give a real-time view of their enterprise's financial health as they are based on legacy, outdated technology. The accounting methods are archaic and they don't provide the means to manage complex, multi-customer, and multi-year customer projects.

In the absence of a proper costing system, manufacturers struggle to input, modify, retrieve and analyze project costs which lead to an increase in costs and loss of profitability. ETO manufacturers need a powerful ERP that has comprehensive functionality to capture costs and turn them into valuable data using in-built data analytics and business intelligence features.

How does ERP Solve these Challenges for ETO Manufacturers

An ERP software has comprehensive features that enable ETO manufacturers to substantially reduce design-to-delivery lifecycles, and delivery high-quality, custom-products to their customers on time, every time.

Let us look at some key ERP features that help them solve critical industry challenges.

ETO manufacturers can,

▶ Swiftly create accurate quotations using ERP's Product Configurator tool.

▶ Generate quotations using customer's unique product requirements & pricing options.

▶ Configure pricing, discounts, & quotations for custom products.

Quotation & Estimation

▶ Create a sales order that includes agreed upon costs, delivery timelines & WBS.

▶ Track sales pipeline data from RFQ stage to sales order confirmation to production and customer delivery.
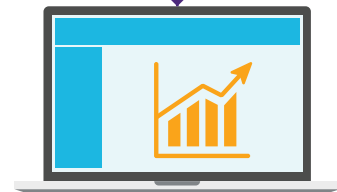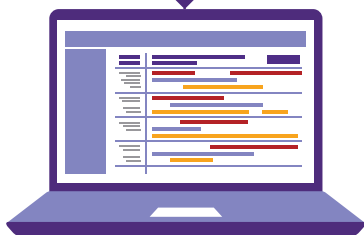
Sales Management

▶ Create a project for an ETO order within the ERP.

▶ Setup project deadlines, budgets, schedules, tasks, categories, tracking mechanisms etc.

Project Management

▶ Allocate personnel, machinery and materials and track utilization.

- Create BOM in CAD software & import BOM to the ERP.

- Instantly share designs with customers through EDI.

- Instant auto-updates of design changes across master docs, work orders & sales orders.
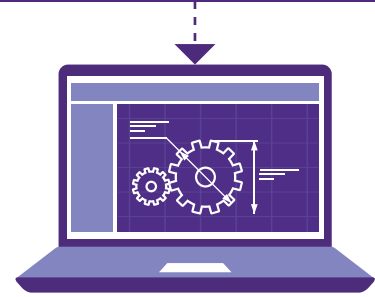
CAD Integration
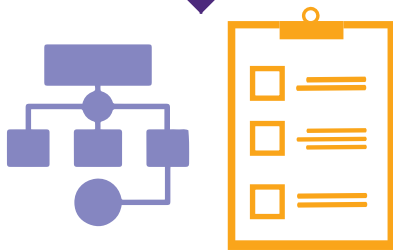
- Generate single or multi-level BOM or import them from CAD software.

- Create work orders against the BOM & allocate to the shop-floor/procurement team.

- Auto-update of inventory based on BOM creation/update within ERP.

BOM & Routing

- Create purchase order with preferred suppliers to procure required materials.

- Receive goods & record goods info using portable bar-code scanners.

- Update BOM with procured goods info.
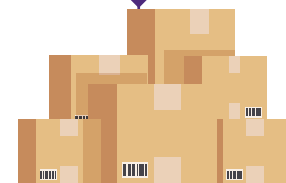
Purchase Management

- Create production schedule using ERP's planning & scheduling and MRP.

- Track shop-floor operations, machine, labor and material utilization in real-time.

- Monitor material consumption and goods movement with inventory module.

- Maintain equipment and tools to ensure uninterrupted production.

Production Management

- Carry out progress invoicing after the completion of each manufacturing phase.

- Collect time and expense info for each project phase.

- Collect costs for purchases, manufacturing and outside services.

- Arrive at project profitability based on actual costs collected from each department.

- Maintain accurate records of AP, AR and General Ledger.

Accounting & Finance

- Enable shipment tracking using bar-code and RFID integration.

- Track customer shipment using shipment applications such as FedEx, USPS, UPS, and Starship.

- Generate material certifications, Bill of Lading, invoice, and other shipping documentation.

- Enable customers to access shipment data, tracking numbers, sales invoices, documents etc. via self-service portals.

Shipping & Logistics

- Installation of product on customer's premises.

- Create service tickets, assign service personnel and schedule service visits as per customer requirement.

- Enter time and expense data for service tickets directly into the ERP.

- Manage spare parts inventory and initiate procurement from dealers.

Service Management

OmegaCube ERP

is specially designed keeping the complex requirements of Engineer-to-Order (ETO) manufacturers. OmegaCube ERP with its workflow automation capabilities and powerful functionalities allows ETO manufacturers to reduce overall design-to-delivery lifecycle and deliver high-quality, custom products to customers on-time.

They can take their enterprise operations more efficient and profitable with advanced functionalities such as Project Management, Project Accounting, BOM Management, ECN, Revision Control, Product Configurator, CAD, and Nesting.
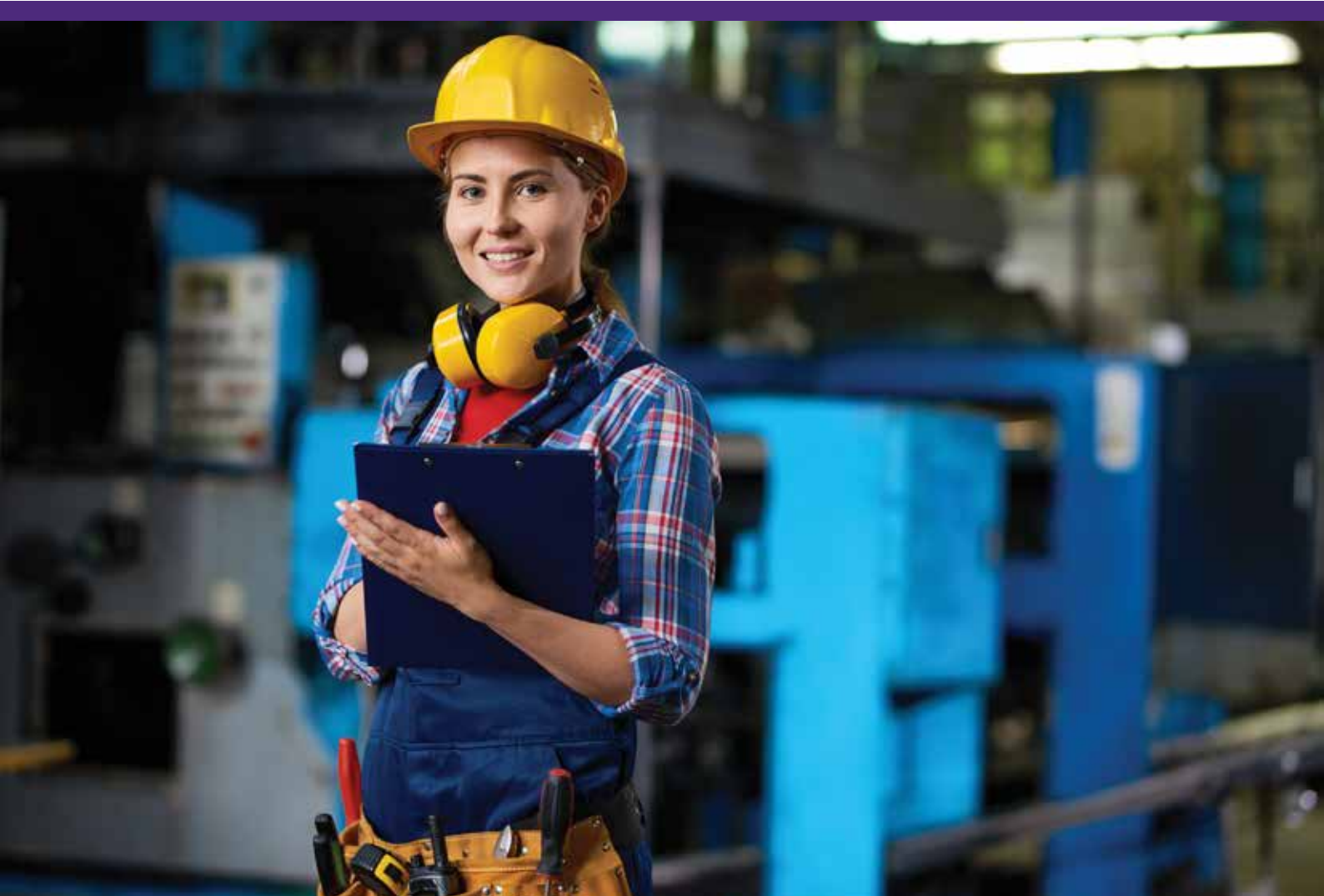
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OmegaCube ERP for Engineer-to-Order Manufacturing

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www.omegacube.com
(630) 250-0002
info@omegacube.com

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