



Exploring the competitive advantages and challenges in engineer-to-order (ETO) manufacturing, Thomas R. Cutler finds that lean can be just as valuable in improving production, processes and supply chain management as it is for repetitive manufacturers

ETO (engineer-to-order)

manufacturing cannot be outsourced. The unique one-of-a-kind products manufactured are often produced and completed on the customer's site and are modified as an engineered work-in-progress. It is this specific geographic requirement that provides these manufacturers a global competitive advantage.

The term engineer-to-order (ETO) denotes a style of manufacturing rather than a specific industry segment. Other synonymous terms are "project-based" or "custom" manufacturers. ETO companies typically have distinct characteristics

about the way they conduct business that differentiate them from discrete or repetitive manufacturers.

ETO companies build unique products designed to customer specifications. Each product requires a unique set of item numbers, bills of material, and routings. Estimates and quotations are required to win business. Products are complex with long lead times, typically months or even years. Unlike with standard products, the customer is heavily involved throughout the entire design and manufacturing process. Engineering changes are a way of life. Material is purchased not for

inventory but for a specific project. All actual costs are allocated to a project and tracked against the original estimate. Once complete, the product is typically installed at the customer's site. In most cases, aftermarket services continue throughout the life of the product.

Lean is a business philosophy focused on eliminating waste, and is often thought to apply only to making automobiles, washing machines and the like. Lean means doing things as simply and cheaply as possible, while providing superior quality and very quick delivery, and waste has many forms including material, time,

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idle equipment and inventory. Most companies waste a large percentage of their available resources, whether they make trucks or one-off industrial turbines. This represents a significant opportunity for cost savings. Lean manufacturing helps to improve material handling, inventory, quality, scheduling, personnel and customer satisfaction.

Much of this waste is invisible to the naked eye, so identifying and eliminating it is not always easy. Lean manufacturing uses standardized processes to remove waste from repetitive tasks, but its main principles are still relevant to ETO manufacturers, including:

- Pull scheduling (digital kanban) to reduce inventory and reduce cycle times
- Rapid setup – to reduce lot sizes and inventory
- Team development – to implement the new processes
- Value stream mapping – to identify value added and non-value-added activities
- Cellular and flow manufacturing – to reduce travel distance and simplify routings.

Dramatic improvements can be achieved from lean manufacturing implementations and continued process improvement, including 40-60 percent increases in productivity, inventory reductions in the region of 50-75 percent, lead times down by anything from 25-75 percent and quality improvements between 50-70 percent.

One of the biggest opportunities for

improvement in ETO manufacturing is in the supply chain, where procuring the right materials more quickly and accurately has a direct effect on lead times. According to Stephen Parker, CEO of Datacraft Solutions: “The role of digital kanban in the ETO environment is critical because of the complex and time sensitive nature of engineer-to-order projects. Companies are battling rising costs, fluctuating exchange rates, and increased overseas competition. Customers expect and demand quality products, short on-time deliveries, and competitive prices. Only the most efficient and flexible survive. Digital kanban is a key component that provides companies with a tool to manage costs and shorten cycle times.” Because digital kanban offers real-time information, it allows a company to produce what customers require as they require it, which is exactly what engineer to order is all about.

Just because ETO manufacturers have a unique process advantage does not preclude the utilization of lean manufacturing techniques and approaches, according to Stephen Carson, executive vice-president of ETO ERP (enterprise resource planning) leader Visibility Corporation. “There is a perception that lean is only applicable for repetitive manufacturers, and not engineer-to-order manufacturers that make unique, complex products,” he says. “Part of the problem is that many lean success stories focus on inventory reduction. This is of no interest to

an ETO company that makes many “one-off” purchases and does not hold finished goods inventory.”

As in other industries, many opportunities for improvement in the ETO environment exist in business processes and office systems, not merely on the plant floor. Eliminating non-value-added activities in engineering, estimating, customer quotations, purchasing, shop floor reporting, and accounting functionality offers dramatic improvements.

ETO companies consider themselves a hybrid of manufacturing and construction. “When it comes to solutions, these organizations can’t find a good fit,” says Carson. “Some companies that are more manufacturing-focused have implemented ERP packages and supplemented with project-based spreadsheets; others that are more of a construction company have implemented a solid project-based construction package and have left the manufacturing side alone.

During the past decade, ETO companies have spent a lot of time and effort implementing software only to have half of their needs unfulfilled. They are now re-entering the market place unhappy with their current lean manufacturing and ETO ERP solutions.

A handful of ETO vendors have tailored their solutions to meet the hybrid needs of true ETO manufacturers. ETO manufacturers often hold a project kick-off meeting where the scope of work,

Who is ETO?

With so many industry sectors addressed in the ETO manufacturing process it is often difficult to determine which firms constitute ETO. Below is a partial list of some of the ETO applications:

Dies, tools & molds	Machine tools
Industrial cranes and hoists	Farm machinery & equipment
Metalworking machinery	Construction machinery
Foundry machinery	Mining machinery
Industrial automation equipment	Oil & gas equipment
Medical equipment	Industrial tractors and trailers
Custom boat builders	Power generation equipment
Food industries machinery	Conveyors & material handling equipment
Paper industries machinery	Transportation equipment
Communications equipment	Custom sign makers

timeline and “buckets” of time and money are discussed, for instance. Traditional construction software helps manage this information; traditional ERP software does not. At the conclusion of the meeting, the department manager may work with the engineering manager to schedule 400 hours of labor within the next three months. Traditional ERP packages allow companies to slot in graphically who will work when, while traditional construction software packages will not. ETO vendors bridge the gap between traditional ERP and traditional construction software solutions.

The ETO Institute (www.etoinstitute.org) is a nonprofit organization committed to helping North American engineer-to-order manufacturers compete more effectively in an increasingly competitive global environment. From articles to white papers focused on manufacturing and, in particular,

engineer-to-order, there is also a bulletin board providing a forum for organizations to share ideas and information and to discuss challenges and business issues.

While there are many trade organizations focused on specific industries, ETO manufacturers are defined by the characteristics of their business processes rather than by a single industry group. The goal of the ETO Institute is to help companies with similar business issues, regardless of industry.

In the repetitive manufacturing world, the loss of one order may not have a significant impact on the company; in the ETO world, the loss of a single contract can be devastating. Many domestic ETO companies are weaker and some have closed their doors forever because they could not survive the loss of “the big order.” Those ETO companies that thrive are doing so in part because the products they

manufacture cannot be outsourced globally, when so much of the installation must occur on the plant floor. While this distinction does provide a competitive advantage, ETO companies must operate at optimum lean efficiency to prevail over others in similar circumstances. North American manufacturers can be competitive in the global economy but must adopt new technology and business processes.

Unfortunately many ETO companies that decide to invest in new technology make the wrong choice. This is primarily because many of the vendors that provide solutions to ETO companies are niche players in their respective markets and are not as well known as their larger rivals. ETO manufacturers’ competitive advantage will quickly evaporate if they do not find the right solutions to maintain a lean methodology and appropriate technology. ■