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Rules-driven Product Management

**Achieving Greater Value from
Customer-Specified Products**

Executive Overview

Commoditization. Globalization. Margin shrink. Increased competition. These are the watchwords for manufacturing today, and manufacturing executives are charged with achieving a profitable business despite these challenges. One way that companies are addressing this situation is by developing products that align more exactly with customer needs. Many companies, in fact, are moving towards making their products to exact customer specifications to maintain or recover elusive margins—and better yet—drive business growth. While not all industries offer the opportunity to tailor each delivery to exact customer specifications, moving products closer to that model can provide significant return to manufacturers in many industries.

Many companies are moving towards producing their products to exact customer specifications in order to maintain or recover elusive margins—and better yet—drive business growth

This approach has its challenges, as many naysayers will be quick to point out. Typical arguments against a “to order” strategy include the belief that customizing products is too expensive, not achievable within allowable delivery lead times and causes havoc and disruption in the manufacturing plant. Unfortunately, without an innovative approach there is truth behind these objections. But, on the positive side of the argument lies an increased ability to differentiate products, an enhanced ability to meet customer needs, increased sales and the potential to charge a price premium. The challenge, of course, is to maximize the ability to achieve the positive impacts while minimizing or alleviating the negatives. Perhaps that approach is obvious, but the solution may not be.

Rules-driven Product Management (RPM) provides the ability to deliver the benefits of customized products without paying the high penalties traditionally associated with customization

This paper will review one approach, Rules-driven Product Management (RPM). RPM provides the ability to deliver the benefits of customized products without paying the high penalties traditionally associated with customization. For companies that are already providing products to customer specifications, RPM offers the ability to streamline processes, reduce cost and improve lead times. For companies that are not already providing customized products, RPM offers the ability to capture additional revenue potential by providing more specification options to the customer without increasing manufacturing costs.



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Eliminating Product Management Guesswork

Product managers and product designers are constantly faced with making choices for their customers. Manufacturers must choose what features will be included in a product, what final dimensions will be offered, what combinations of capabilities the product will include and other important product characteristics. As good as any company may be at predicting customer behavior, a guess is still never as good as knowing the answer. Imagine delaying the final feature specifications for a product until the customer orders a product. For many manufacturers, this is a compelling idea. For others, this is an inherent requirement of their business. Instead of offering a predefined set of features to their customers, manufacturers can offer a choice of capabilities that can be designed to order. Products must be defined with constraints that ensure an ordered product can be manufactured with quality and at a price that will return a reasonable margin.

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A Different Product, Every Time

Unlike traditional Made-to-Stock (MTS) product lines, where identical products are repeatedly ordered with no modifications, Engineer-to-Order (ETO) or Made-to-Order (MTO) manufacturers face the seemingly daunting task of configuring or designing a completely different product each and every time. While some ETO product lines are simple variations on a theme—changing style, size, or other well known-features—many others require significant alteration or redesign. In many cases, each order requires product engineering because of the ever-changing nature of customer demands. In addition, size limitations, governmental regulations and operating loads—to name a few of the long list of potential design variables—differ widely from customer to customer. A job may just require configuring a previous order differently, or sometimes, a job may require a completely new design. In either scenario, designing customized products to order means manufacturers have to utilize their product knowledge and experience for every product they develop because every product has some level of uniqueness.

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Customization without Sacrificing Responsiveness

Responding quickly to customer requests for proposals in a competitive bidding environment is a challenge for ETO manufacturers. Frequently, these proposals must include detailed information regarding the proposed design, including detailed engineering drawings, a detailed BOM, 3D models, color product mockups and other engineering information. The manufacturer must not only reconfigure or custom-design each product, they must do so under relatively short deadlines. These deadlines typically range from less than a day for simple products to eight weeks for more complex requirements. ETO manufacturers require automated design processes and the ability to tap their product knowledge to accelerate the rate of proposal development. In order to compete, manufacturers can not afford to design each product order as a unique project, but must look for ways to leverage existing designs, concepts, rules and knowledge.

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Proposal Speed without Sacrificing Margins

In today's competitive manufacturing environment, companies often do not have time to manually pre-engineer every system that could be sold. This causes many companies to guess at costs at the proposal stage, only to discover these estimates frequently take away margin later, when errors related to early assumptions are addressed. In addition, lack of communication has traditionally caused people involved in sales to make product decisions without enough information, leading to costly guesswork, inaccurate estimates, and unnecessary trial and error. Studies have shown that the earlier an error is made in the product development process, the greater the cost will be downstream. In addition to creating unnecessary costs, design errors made in the sales process can have a negative impact on product quality and customer satisfaction, both of which can hurt business over the long term.

For ETO manufacturers to win orders, make a profit, and stay in business, they must effectively analyze their cost structures and accurately estimate proposed bids

For ETO manufacturers to win orders, make a profit, and stay in business, they must effectively analyze their cost structures and accurately estimate proposed bids. If they are conservative and overbid to try to account for the unanticipated, their bid may be too high and they will not win much business. If they are liberal and underbid hoping to find cost savings somewhere in the product development process, they may either fail to make a profit or lose money. ETO manufacturers must be able to capture and access their product knowledge and understand current resources and capabilities in order to estimate and bid jobs more accurately.

Delivery Speed without Sacrificing Design Quality

Even after their proposal generates a contract to produce a product, ETO manufacturers need to follow through on final design and production to deliver on the proposal before recognizing a profit. Unfortunately, manufacturers often encounter issues during final design and manufacturing that were unforeseen or overlooked in the development of the proposal. In these cases, they may either have to negotiate design changes with the customer—a disruption no manufacturer wants to contemplate because of the potential impact on future business—or absorb the unanticipated costs. ETO manufacturers must leverage product knowledge to ensure little variation between proposed and final designs so they can manufacture products on schedule and on budget.

ETO manufacturers must leverage product knowledge to ensure little variation between proposed and final designs

ETO manufacturers also need to ensure consistent quality and reliability in their products. They do not have the luxury of using product recalls or retrofits to address product quality issues late in the development cycle. Customers make judgments on product quality on every single project, and manufacturers must ensure product quality across all projects to continue to enjoy repeat business from long-term customers. In short, ETO manufacturers need to implement and enforce best practices and lessons learned in product development to ensure the lowest probability of inconsistent quality or product reliability problems.

Quality without Sacrificing Efficiency

In the same way that quality can be designed into a product, manufacturing efficiency can be designed in as well. Many manufacturers do not design for manufacturability and therefore develop product designs that function but are difficult to produce using standard tooling and equipment. The need for specialized tooling is expensive and often leads to delays associated with insufficient plant capacity, which can result in a negative impact on customer relationships. Manufacturing constraints must be designed into the product in advance, eliminating expensive surprises when the order gets to manufacturing.

Designs can provide manufacturing efficiency in other ways as well. Customizing design documentation for each order is a costly task, so manufacturers in many “to order” environments are forced to rely on generic designs with a copy of the customer specifications attached. This requires that shop floor personnel adjust the design based on customer specifications and their knowledge, relying very heavily on highly trained, experienced and knowledgeable plant personnel. Even with experienced personnel, this approach introduces inefficiency and errors to the manufacturing process.

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Leveraging Corporate Product Knowledge

Experience and knowledge are important within a company, but many companies rely too heavily on people-dependent processes. Within an ETO manufacturing enterprise, there is typically a “guru” or a “brain trust”—an engineer or a group of engineers who possess the broadest range of knowledge and experience regarding the particular types of products the company designs and manufactures. These companies rely heavily on the knowledge of these engineers to run their businesses. Unfortunately, people may retire or change jobs. Losing a design “guru” can mean that the company’s valuable intellectual capital, know-how, and experience are lost forever. ETO manufacturers must capture and secure their product knowledge and experience in a permanent repository to avoid the loss of valuable product expertise.

***ETO manufacturers must capture and secure their
product knowledge and experience***

Rules-driven Product Management

Clearly, there are some major challenges to offering customized products. Fortunately, a class of software solutions is coming of age that provides solutions to many of these challenges. Rules-driven Product Management (RPM) is a business philosophy and approach that allows manufacturers to deliver customer-specified products without the traditional penalties associated with customization. RPM enables a new design approach and automates design tailoring processes. When products are designed in a way that captures capabilities and constraints in the form of rules, it allows customers, sales partners or sales engineers to easily configure the product that will best fit the customer needs. Because the rules are defined to include all varieties of engineering and manufacturing constraints, the product is ensured to be manufacturable. In this way, customer-specified orders can be quickly captured and validated.

***Rules-driven Product Management (RPM) allows manufacturers
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At this point, design automation becomes critical. Manual redesign processes are too costly, time-consuming and error prone to support an ETO environment. Customer specifications must drive design rules that manipulate the design quickly and accurately. These modified designs then produce specific, detailed, three dimensional design models that represent the product to be manufactured. This design can then be utilized to provide detailed, accurate cost estimates and drawings. By rapidly generating actual product designs in an automated way, quotations created with RPM solutions are not only fast—they are accurate. Accurate quotes mean fewer costly surprises later in the process and the ability for manufacturers to accurately predict their profit margins and price their products appropriately.

Quotations created with RPM solutions are not only fast—they are accurate

3D product designs from an RPM system can also be used to generate manufacturing-ready product documents such as drawings, material lists, shop floor routings, and test plans. By automating the translation of customer specifications into product designs, RPM enables the engineering process to become far more efficient and less prone to manual error. Manufacturing now has access to order-specific documentation and designs instead of having to work from generic—or “family”— design documents and make calculations and decisions on the shop floor. RPM automates these decisions and provides order-specific documentation—reducing the opportunities for mistakes to be introduced into the process, increasing productivity and improving product quality.

***RPM enables the engineering process to become
far more efficient and less prone to manual error***

Table 1 below summarizes some of the challenges of ETO manufacturing, the impact of those challenges on the business and the potential that RPM processes and tools offer to reduce or eliminate those impacts:

ETO Challenge	Impact	RPM Approach
Long quote lead time	Missed orders Unsatisfied customers	Automation allows for rapid, error-free quotes based on actual designs
Inaccurate quotes	Missed orders due to high safety factors in pricing Unprofitable orders due to low safety factors in pricing	Automation allows for rapid, error-free quotes based on actual designs and shop floor capabilities, eliminating the need for pricing safety factors
Long order design lead time	Late orders due to order engineering backlog Missed orders due to long delivery lead times	Automation compresses the order design lead time to minutes
Overburdened engineers	High engineering costs Reduced focus on product innovation	Automating the order design process frees up engineers to work on more interesting, valuable and innovative design work
Customer order errors	Customer dissatisfaction because their errors were not caught in advance	Accurate mockups and drawings provided at quotation time based on real designs provide the ability for customer to review and revise designs early on to eliminate errors
Errors communicating specifications to manufacturing	Cost of rework Increased warranty, installation and field support expense Cost of returns Customer dissatisfaction	Automatically validates and captures specifications Translates customer specifications to product design Generates detailed, customized design and order documentation
People-dependent design	Intellectual property risk because design knowledge is in the heads of a few key people	Design knowledge is captured, stored and version-controlled for consistency and safety

Table 1: RPM Approach to ETO Challenges

An RPM Example

Interior Concepts makes furniture for educational facilities and call centers. These products are assembled from a variety of different components, and can be configured in millions of ways to meet the unique requirements of the customer and facility they are intended for. Trent Debrot, sales engineering manager for Interior Concepts, described their previous processes as “*disconnected*” and “*manual*.” The process involved a quoting system that would make mockups of generic panels to develop a picture for the quote. After the fact, engineering developed the real design by adding in joints, tubes, and other required elements that made the design producible. The process was disconnected and inefficient. “*Every job was built back up from scratch, there was a lot of room for errors,*” Mr. Debrot stated, “*and we realized that if we could engineer the order at quoting time, we could save 90% of the engineering time.*” Saving time in the engineering cycle was important, according to Debrot, because customer lead time demands are continually shrinking.

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- Trent Debrot, sales engineering manager Interior Concepts

Interior Concepts adopted SolidWorks as their Computer-Aided Design (CAD) Solution, and was looking for ways to further improve the product customization process. Because their product set is inherently customizable, Interior Concepts can offer many options. Each station has 8 million combinations with sizes and different electrical options. “*We can do so many different things, but it was never written down,*” Debrot recalled. “*We didn’t really have a name for it, but we were looking for a rules-based program that would enable us to put in parameters and let the program build the design based on those rules, so nobody has to worry about the little details.*”

“Now, a design that would have taken hours takes 20 minutes”

- Trent Debrot, sales engineering manager Interior Concepts

Interior Concepts’ search for a more efficient design process led them to RuleStream. “*Now, a design that would have taken hours takes 20 minutes,*” Debrot said, “*and we have designs that are being developed completely error free.*” He pointed out that the increased efficiency means that engineers can spend time on other priorities like product innovation. He also highlighted the improvements in lead times. Interior Concepts’ goal for the future is to extend their current capabilities to their website to allow users to get prices, develop layouts instantly and send them back SolidWorks e-drawings with the exact detail of their orders.

***“We have designs that are being developed completely error free”
- Trent Debot, sales engineering manager Interior Concepts***

“Writing the rules is pretty straightforward,” Debot summarized, “and we are expecting to continue to gain significant improvements and savings.” Although Interior Concepts did not know what to call the solution they were seeking, they have proven the value of RuleStream’s Rules-driven Product Management solution and are reaping the rewards as a competitive advantage.

***“We are expecting to continue to gain significant improvements and savings”
- Trent Debot, sales engineering manager Interior Concepts***

Summary

Manufacturers of customer-specified, MTO or ETO products have long faced a unique set of challenges and have operated far differently than businesses with traditional product development environments. These challenges have frequently caused manufacturers to trade speed for accuracy, particularly at the proposal development stage, often resulting in costly, unanticipated errors and inconsistent product quality.

Rules-driven Product Management addresses the challenges unique to ETO manufacturers because it captures, applies, and retains design knowledge—enabling manufacturers to automate design and implement best practices for manufacturing. With RPM, manufacturers can be both fast and accurate, responding quickly to customers with fully engineered concepts based on the manufacturer’s best practices and intellectual property.

RPM can help manufacturers of customer specified products to:

- Increase sales
- Achieve higher profit margins
- Improve design and manufacturing productivity
- Enhance quality, reduce rework and avoid returns
- Minimize warranty, installation and field support expenses

With the RPM approach, manufacturers have the opportunity to address the challenges of commoditization, globalization, margin shrink and increased competition by providing a more compelling offering to their customers in the form of customer-specified products—without the traditional pain of customization.

About the Author

Jim Brown has over 15 years of experience in management consulting and application software focused on the manufacturing industries. Jim is a recognized expert in software solutions for manufacturers and has broad experience in applying enterprise applications such as Product Lifecycle Management, Supply Chain Management, ERP, Product Configurators and Customer Relationship Management to improve business performance. Jim began his professional experience at General Electric before joining Andersen Consulting (Accenture), and subsequently served as an executive for software companies specializing in PLM and Process Manufacturing solutions.

Jim is the president of Tech-Clarity, a research and consulting firm dedicated to making the value of technology clear to business, where he is a frequent author and speaker on applying software technology to achieve tangible business benefits. Jim also serves as the PLM Analyst for Technology Evaluation Centers and The PLM Evaluation Center.

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