Demand-driven strategies for complex manufacturing

Say "yes" and mean it

WHITE PAPER

Cincom in-depth analysis and review

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Satisfying the functional need of a customer is one thing, delivering on a promise is another. We all want to say "yes" when customers make requests, which we have a tendency to do without understanding or realizing the consequences.

A Discussion paper by Chris Astall
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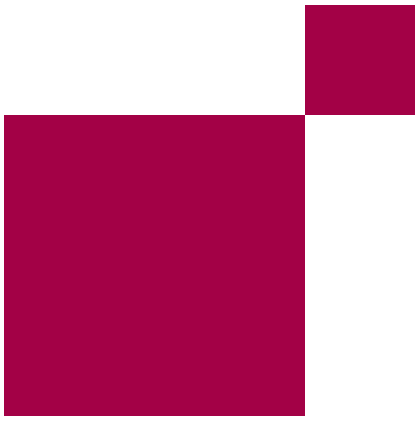

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Introduction

Many manufacturing companies have adopted or are considering the adoption of a demand-driven strategy. However, these companies also realize that simply saying, "We are only going to be driven by demand" is in itself inadequate to accomplish this goal.

To underpin their strategy, they are choosing an operating philosophy upon which they intend to base their entire manufacturing process. They are choosing Lean Manufacturing, Flow Manufacturing, Demand Flow® Technology (DFT) or maybe even Agile Manufacturing. We are not here to argue the merits of any one of these, but to recognize that if demand-driven you want to be, you aren't going to achieve it without adopting many of the tools, techniques and principles that commonly reside within all of them.

Often which strategy you choose will be driven by the degree of your desire, willingness or ability to change the way you do business. Some philosophies more than others require much more intense re-engineering of processes and products. In addition, the types of products that you offer and the way you build them may well drive you to the program that you need to adopt.

This paper addresses the various components and strategies for becoming a demand- driven organization, and how Cincom's solutions can help you achieve that goal.

The Lean, Agile or Flow conundrum

For many years, manufacturers have been subject to a constant barrage as to which of the latest and greatest manufacturing techniques, methodologies or philosophies are best for them. While some have come and gone, becoming just a distant and fleeting distraction to the process of "making stuff," others have remained and for some, become the saviors of the day.

Many of the "practices" that are familiar to us today do, without doubt, have some very common goals and objectives in respect to what a manufacturer can expect from utilizing a particular technique.

Let's just consider some of the following:

- Lean Manufacturing
- Agile Manufacturing
- Just-in-Time (JIT)
- Demand Flow Technology (DFT)
- Flow Manufacturing
- Toyota Production System (TPS)
- Advanced Planning and Scheduling (APS)

There is some significant confusion about the definitions of Flow versus Lean Manufacturing. Is Demand Flow Technology (DFT) really Lean plus Agile with a little bit of JIT thrown in? Isn't Lean really just a more generic term for the Toyota Production System?

It has been said that Flow Manufacturing is very similar to Lean Manufacturing or even Agile Manufacturing, not to mention several other manufacturing techniques. However, some might argue that the primary focus of Lean Manufacturing is the elimination of waste, and that the principle focus of Agile Manufacturing is flexibility. It is clear that Flow Manufacturing (or DFT) certainly has both of these focuses included, but exponents will argue that additional elements of focus take the principles of Flow Manufacturing well beyond those of Lean and Agile Manufacturing, although Lean Manufacturing has no doubt evolved to become a demand-driven strategy.

While the definition of what constitutes DFT and how a DFT company should operate are very clear from its developer/author John Costanza and his company JCIT, it is less clear from other practitioners, gurus, sponsors, supporters, etc. as to where they reside in regard to their definition of a particular "term."

Some of this confusion is caused by JCIT themselves. Copyright and trademark issues have forced us all to invent and use other terms such as Flow Manufacturing, Flow Management, and Manufacturing.

For the purposes of this document, we will use the term Demand-Driven Flow Manufacturing.

The complex manufacturer and Demand-Driven Flow Manufacturing

Ideally, of course, in building to actual customer demand, life would be much easier if we could build the same product day in and day out. This is where original continuous-flow production techniques greatly benefited the manufacturers of products such as TVs and refrigerators. Manufacturers who utilize more discrete-based manufacturing techniques have long sought the benefits associated with mass-production environments.

Demand-Driven Flow Manufacturing is a methodology that supports the manufacture of products only on receipt of real demand. Both products and processes are designed so that the product "flows" at a consistent rate through each step of the manufacturing process.

Let's consider the case of a typical company within the industry type known as complex manufacturing. Here we have a company that in order to satisfy their customers' needs, will offer almost infinite variations of a product. While they may also offer "standard" products, the majority of their business will come from highly configured products. Therefore the company is classed as providing products through a process of "mass customization." Our company might also class itself more traditionally as being an MTO (Make-to-Order), ATO (Assemble-to-Order) or a CTO (Configure-to-Order) or even an ETO (Engineer-to-Order) manufacturer.

Our typical company wants to reach the following goals:

- Build the product only on receipt of "real" demand.
- Build the product on or as close to the customer request date as possible.
- Build multiple products on a single line.
- Build products within the order cycle time.
- Be able to respond quickly to changing demand.
- Profitably produce and deliver a product that is of the highest quality.
- Meet or exceed their customers' expectations by keeping promises that they make.
- Gain a significant competitive edge and ultimately increase market share.

While building to actual demand is our ultimate aim, the real aim is to deliver on the promises that you provide to your customers. Determining what that promise should be while taking into account all the factors involved in a complex manufacturing environment is the challenge.

Building the demand-driven environment

So how are manufacturers in our complex world approaching the problems associated with turning their environments from a more traditional forecast-driven, schedule-based one to an environment that is demand-driven and production-sequenced?

They do this by first deciding where their current environment needs to be changed to support the goals of their chosen demand-driven strategy. This is likely to include many of the following:

- Re-design of processes to allow multiple products to flow down a single line in a sequence of predictable, equally spaced and timed events
- Re-design of processes to eliminate waste and non-value-added activities
- Reduction or elimination of the constraints that impair the ability to build any product in any sequence required
- Design of products to increase the touch points of commonality and move them as close as possible to the end of the production process and consequently as close to the customer as possible
- Development of a knowledge-based process that will enable them to interact with their customers in a way that allows easy guidance through the selection and ultimately the selling process
- Development of a method to efficiently and effectively sequence customer demand into production, using knowledge gained during the selection process along with knowledge about the production process to identify the optimum production date that will fulfill the customer's request
- Modification of the supply chain from a traditional push-style replenishment process to a pull-style environment that ensures material and component feeder lines are allowed to flow to the correct points of use within the production line
- The ability to maintain flexibility in the supply chain to allow the production process to "flex" as required in response to changing demands

The What		The How
Manage changing demand	Focus on Execution	Integrate a flexible supply chain
Move from push to pull		Automate replenish internally and externally utilizing Kanban techniques
Develop effective promises	Focus on the Customer	Understand the production constraints
Effectively manage demand		Use knowledge-based demand sequencing
Provide interactive guide selling		Use knowledge-based sales and product configuration
Get product variation closer to the customer		Increase touch points of commonality
Increase ability to build in any sequence	Focus on the Process	Eliminate constraints
Make it flow		Re-design processes, eliminate waste and non-value-added activities
Enable mixed model production		Re-engineer products and processes
Choose the right manufacturing strategy		Demand Flow Technology, Lean Manufacturing, Flow Manufacturing, Demand Flow Manufacturing

Figure 1 - Building the Demand-Driven Environment

With all this in mind, your company may well choose to adopt a program such as Demand Flow Technology (DFT). However as we stated earlier, trademark issues have led to pseudonyms of this known as Flow Manufacturing or Demand Flow Manufacturing. Demand Flow Manufacturing, or whatever your chosen flavor, will use a mixture of tools, techniques and technology in striving to get "all the necessary ducks in a row."

These tools and techniques may include but are not limited to executing some of the following tactical practices:

- Kaizen
- Kanban
- TQM
- Just-in-Time
- Cellular Manufacturing
- Continuous Improvement
- Six Sigma

Although we all know that most of the tools or techniques listed above are not new, today's gurus of any of these philosophies have learned to take the best elements from some or all of the above and mold them into a highly effective set of tools that will help your company establish the necessary manufacturing environment.

What is relatively new, however, is the extent to which we can now use technology, in the form of software applications, that supports either the establishment of the environment or the execution of business processes required to move prospective demand through to its complete fulfillment. We are likely to utilize technology to help us perform the tasks not usually supported by traditional ERP applications, such as:

- Process re-engineering utilizing line design tools
- Guided selling through knowledge-based product configuration applications
- Using rules-based demand-sequencing, demand-smoothing and demand-promising applications to manage demand
- Execution of the supply chain utilizing electronic Kanban techniques

By combining technology with changes to our operating philosophy, we are taking many of the necessary steps to make our manufacturing environment as flexible, agile and responsive as possible and as inevitably required.

How long does it really take?

One of the success factors among companies that are on the road to becoming totally demand-driven is the ability to reduce their entire manufacturing cycle time to within order lead times. Reducing cycle times within order lead times allows manufacturers to be more responsive to customers, make to demand with low inventory and react to last-minute changes without disrupting all the processes.

But while we are doing all we can to reduce our manufacturing cycle times, what are we doing about other elements of time that can drastically impact our overall ability to respond? How long does it actually take to initiate and process the sales order in the first place and following that, how long does it really take to create the plan that loads that demand into production? For many, the Sales Order Cycle can take days and in some circumstances, weeks to complete and the Demand Planning Cycle can take many hours or even days from when you receive the demand to actually loading that demand and getting ready for the manufacturing process to begin.

In some environments, the combination of those two elements alone is known to exceed the time it actually takes to make the product. Therefore, don't they deserve the same attention that you're paying to the manufacturing cycle time?

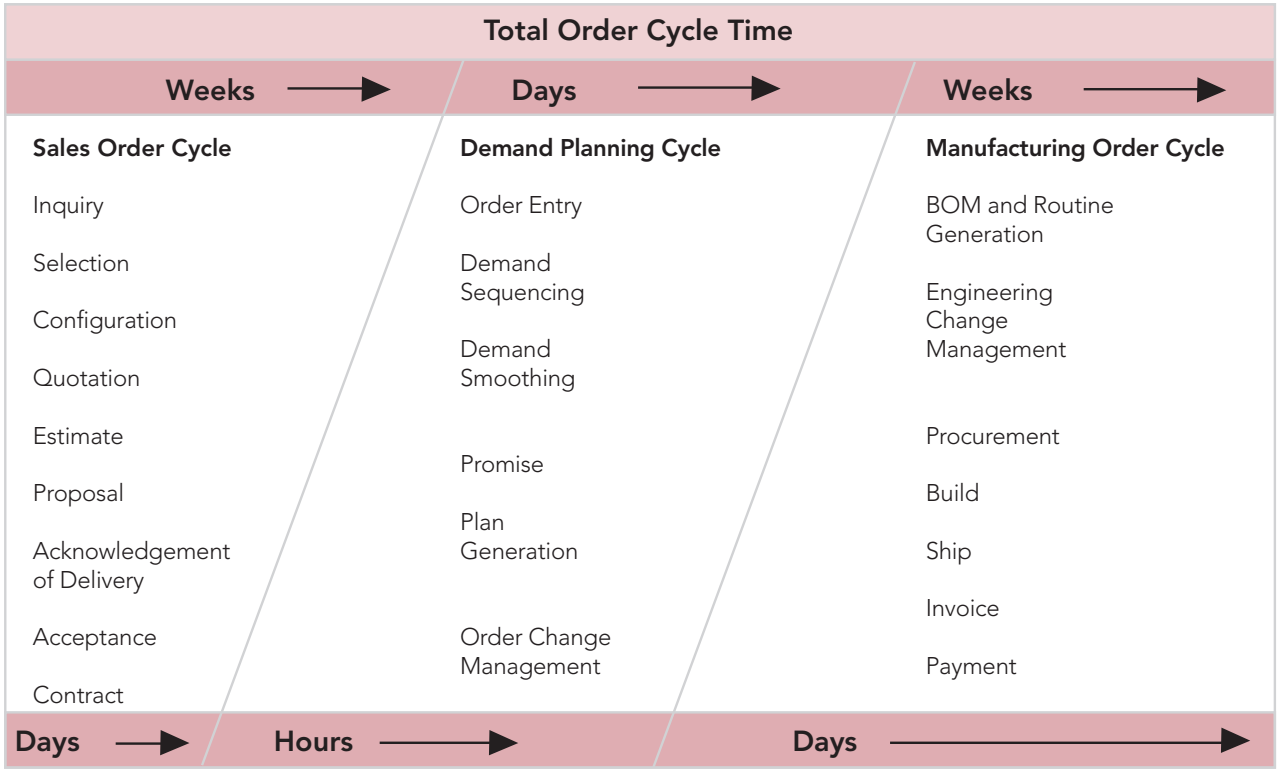


Figure 2 – Total Order Cycle Time

Making promises you can keep

Let's explore further some of the elements that are significant factors within a complex manufacturing environment. Providing accurate promise dates to customers requires many segments of information. Often many different people are involved, all with pieces of information, knowledge and expertise about the product or the process, much of it residing within their heads and not documented.

Tools that capture that knowledge and guide customers through what is often a minefield of "ifs, whats and maybes" are essential to not only ensuring that customers receive a product that will meet their specific needs but are essential to ensuring that the product is actually buildable within current processes and process constraints.

Ultimately, demand-driven companies are re-engineering in an attempt to remove all the constraints that exist within their manufacturing environments. A constraint, of course, is anything that precludes you from doing the same thing today as you did yesterday, or even the same thing now from a minute ago. Constraints will impair your drive toward ultimate flexibility, agility and responsiveness.

A production constraint can be very different from constraints seen within the selling process. In the selling process, we are dealing with the viability of a particular configuration: will A go with B, is it black or white? Within production, we are looking at things differently: do we run white before black, do we build B before A, oh and by the way, how many B's can I build a day?

In reality, the total elimination of production constraints is highly improbable, therefore we need a way to translate customers' needs and wants and understand what constraints might be related, and then understand the impact these have on our ability to promise accurately.

Therefore an essential tool is an application that will sequence demand into available production "slots" and take all the rules associated with a product line or the product itself into account in doing so. The aim must be to place the demand into the right slot and return a promise date on or as close to the customer's requested date as possible.

Tools such as these are required to more efficiently and effectively process customer demand, ultimately helping us to provide promises that can be kept.

From push to pull

OK, so we have examined how we can better process demand. But what can we do to better execute manufacturing processes?

Changing from a traditional forecast-driven, schedule-based environment that essentially pushes material and products through the process to a demand-driven environment that pulls material in response to signals from upstream demand requires us to re-evaluate our current practices. For example, changing to the use of Kanban techniques to ensure material flows to the correct points of use within the manufacturing process is an essential element of a successful demand-driven strategy.

In addition to this, we are seeing a lot of attention being paid, quite rightly, to the procurement process through various buy-side initiatives. The advent of Supplier Relationship Management (SRM) initiatives is helping us focus on dealing with the buy-side issues of our business.

As the name implies, much of our interaction with suppliers relates to setup and continuity of the relationships we have with them. The selection process, agreement management, and the approval process, quality and payments, etc. are all standard supplier management processes.

Beyond that, we still have to communicate our needs to our suppliers in the most efficient and timely manner as possible and because Kanban is fundamentally an execution tool, we should be able to quickly relay replenishment requests using electronic Kanbans to suppliers.

Therefore Kanban management and its execution will provide significant procurement process improvement benefits, becoming a crucial element within any SRM system.

The use of Kanban techniques is not new to us. Kanban has been a cornerstone of Just-in-Time implementations for over 20 years. However, it has sometimes only been used to execute the material flow process internally. Some manufacturers have gone further and used Kanban to execute the production process as well.

What is new is having the software tools available to turn what was essentially a completely manual and purely visual process into one that takes full advantage of the latest technologies to help in both the setup and execution of a Kanban management system.

What's also different is using software and technology together to turn what was in reality very much an internally focused process to one that completely enables us to "go beyond the four walls," making our internet and e-business dreams a reality.

Reaping the benefits

OK, why do companies go to all this trouble? When we make changes to anything, we do it to gain benefit. We certainly would be foolish to implement change and not get something in return. The benefits are widely reported from those organizations that are following a Demand-Driven Flow Manufacturing route.

Reaping the benefits
60%-90% reduction in manufacturing lead times
60% improvement in quality defects
Enterprise-wide reductions in inventory • 75%-90% reduction in WIP • Raw material reductions greater than 50% • Reductions in finished goods greater than 75% • Increase in inventory turns two to threefold
On-time delivery up to 98%
Reduced purchase order costs 50%-90%
Greater return on net assets • Reduced space requirements 25%-40% • Reduced inventories • Reduced working capital
Margin improvements • Improved productivity • Reduced rework • Cash flow
Increased market share • Reduced cycle time • Greater flexibility • Improved quality • Increased revenue • Value delivery

Figure 3 - Reaping the benefits (various sources)

Successful implementations of Demand-Driven Flow Manufacturing techniques are yielding some fantastic results – tremendous working capital reductions, incredible lead-time and throughput reductions, floor-space requirements being reduced, quality up, cash flow improved plus many more improvements. However, successful implementations are bringing much more than improvements in internalized metrics. What about those that are also seeing revenue and ultimately market share improvements through just being more responsive to and then delivering upon customer needs and wants?

Cincom and complex manufacturing

Cincom has long been providing solutions to companies that manufacture products within the complex manufacturing sector. While some application providers have developed software solutions to support organizations that are moving down the demand-driven manufacturing route, the solutions they provide have been, in general, developed for the less-complex and more-repetitive environments.

Cincom, however, has not only accepted, but has focused on, the challenge of providing complex manufacturers with the solutions that will bring the benefits that are available from becoming demand-driven – benefits that are more often associated with the mass production environment.

Cincom's solutions provide the tools needed to manage the complete order cycle within a complex manufacturing environment, from initial contact with the prospective buyer right through the manufacturing process to shipment and ongoing service.

For the purposes of this document, we at Cincom use the term "Demand-Driven Flow Manufacturing," however it should be made clear that in developing our solutions, we have chosen to follow the principles of Demand Flow Technology as promoted, practiced and endorsed by John Costanza, author of "The Quantum Leap" and former president and founder of JCIT.

In doing so, we believe that by supporting manufacturers who "go the full nine yards'" with DFT, by default, we can support those companies who decide that Lean, Agile or some other philosophy is best suited for them.

Responsiveness = agility + flexibility + speed

The goal of the demand-driven manufacturer is ultimately to build an environment whose sole purpose is to respond to their customers' needs and wants. If we were to look at responsiveness as an equation, surely the elements would be agility, flexibility and, of course, speed.

So how responsive are you today?

- Are you agile enough to change production to meet the needs of your customers?
- Do you have the flexibility to respond to changes as and when your customers demand it?
- Do you use speed as a weapon in today's highly competitive world?

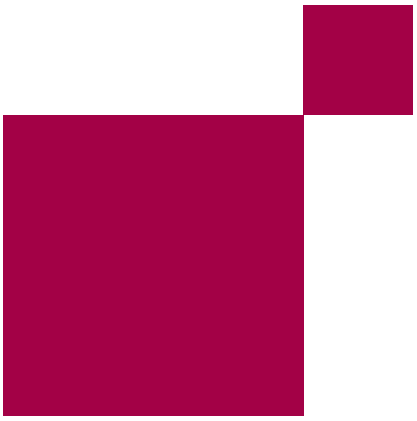
So how does Cincom help the complex manufacturer meet the goals of the demand-driven environment?

- **Knowledge-based interactive guided selling**
  In the mass customization world where products are not only complex but can be highly configurable, the task of understanding customers' needs and determining the right product that will meet those needs is often fairly complex and very time-consuming. In fact, the "Sales Order Cycle time" can often be stated in days and in some cases, weeks – usually requiring the services of many people who have the knowledge or know-how needed to respond to the specific needs of the customer. Using Cincom's knowledge-based sales and product configuration tools to capture that knowledge, which can in turn be used to guide the customer through the selection process, will not only dramatically reduce the response time but will also ensure that the product being offered is viable in its ability to meet the customers' needs and in its "buildability."
- **Constraint-based demand planning**
  Once the sales order has been received, developing the production plan becomes the next area where often problems exist in determining just when that product will or can be built. Again, people are usually centric to this process and the plan development becomes an iterative process. Master schedulers might know that capacity is available but it's the line scheduler or supervisor who refines the plan using their local knowledge. They know that on a given day, three large units and four medium units cannot all be built or that two large units cannot be built "back to back." Cincom's Demand Management application assists you in capturing knowledge about constraints and uses it to sequence demand into available production slots to help you develop and deliver on effective promises. By understanding the constraints of your production process, you can ensure that the promise you provide the customer is accurate and is based on fact not assumption.
- **Product and process management**
  Examining a complex product and its almost endless array of possible configurations today presents us with two major issues:
  - How we acquire and assemble the details we need about how a product is going to be built, its BOM, its route and relevant documentation such as work instructions, process sheets, safety sheets, etc.
  - How we maintain that information as things change along the way (the product, the process, the standards, etc.)

  So how do we assemble this information about the product? Typically our product and process experts in engineering are the ones who either do this themselves or at the very least, have to support someone else performing the task. This labor- and time-intensive task creates a huge dependence on the "local knowledge" that the engineer possesses, resulting in a huge bottleneck centered around people. The most efficient and productive way to assemble all this information in the first place is to do it using the knowledge we have gained during the sales process. Customer order attributes tell us so much such as color, size, the operating parameters such as flow rate, temperature requirements and environment, all about exclusions, inclusions, prerequisites, etc. With this information at hand, we can define the BOM, the route and the documents needed to support the product build by selecting them from our "library" of BOMs, routes and other documents. However, to allow you to do this and to make these components re-usable, manageable and practical, we really need to make sure our BOMs and routes in particular are engineered to be modular in nature and attribute-driven. Cincom's Manufacturing Enterprise Solutions and its Configuration Management capabilities have been designed to meet the needs of the complex manufacturer with the flexibility to support Product and Process Management requirements as they fit your business processes.
- **Production and material flow execution**
  All successful implementations of a demand-driven manufacturing strategy will change from a traditional "push" manufacturing environment to one that is "pull." By "pull" we mean that manufacturing will respond only to the demand of the "customer," a customer being the next point of use in the process, internally or externally. This can be a storeroom, a work cell or the purchasing customers themselves.

Cincom's Kanban Management System provides an efficient way to transfer parts from one place to another and automatically drive the replenishment of those parts in response to the consumption of material by upstream events and signals. A Kanban is the signal you need to start that replenishment process, which could be where an empty bin or container that has been returned to the beginning of a manufacturing process or where a signal in the form of a replenishment request has been sent to a stockroom or even directly to a supplier.

- **Business process optimization**
  The ability to respond quickly and efficiently to any request, internal or external, can be seriously hampered by inefficient or manually restrictive processes. While important in any organization, a critical factor for the successful demand-driven company is establishing an environment where actions that need to be taken and decisions that need to be made occur in real-time or near real-time. The building of the Real-Time Enterprise, as it is often referred to today, is a crucial component in the drive to effectively communicate and collaborate with other people, processes or systems. In this environment, events need to spawn actions, processes need to be automated, systems need to communicate with other systems and organizations need to collaborate with other organizations. Cincom's Environ is the catalyst for the event-enabled environment and is an essential element in helping you achieve your demand-driven goals.



Meeting your demand management goals

Cincom's solutions have been designed to help complex manufacturers meet their demand-management goals by:

- Effectively and efficiently processing customer demand for
  - Mixed Model Environments
  - Complex Manufacturers who build standard products
  - Complex Manufacturers who build configured products
- Helping to provide better and quicker order decisions
  - Using knowledge-based sales and product configurations
  - Using rules-based production sequencing
  - Determining the optimum build date
  - Providing the best possible response to customer order requests
  - Translating and communicating needs between the customer and manufacturing
  - Serving as the catalyst for an agile, adaptive supply chain network
  - Reducing the sales order cycle
  - Reducing the demand planning cycle
  - Reducing supply chain costs
- Helping to develop a smooth and balanced plan resulting from knowledge gained about
  - Capacity
  - Capability
  - Process
  - Constraints on the process
- Being responsive and flexible to
  - Constantly changing market conditions
  - Unpredictable demands
  - Changing priorities
- Helping to execute the plan in response to upstream events and signals
  - Using Kanban management techniques to
    - Manage the production process
    - Manage the material flow process
    - Integrate the supply chain both internally and externally
    - Automate the replenishment and consumption cycles

Simplifying our complex world

Building the demand-driven enterprise is no slight undertaking, and for complex manufacturers, the task is compounded by some pretty unique circumstances. By not having simple processes or single product configurations, they are faced with barriers not usually encountered within the more repetitive manufacturing environment. Selling products in the complex manufacturing world can be in itself a long and very expensive affair, a complicated business process that requires the knowledge and skills of many people within the organizations. The customer always has a choice and one of those choices is to go elsewhere. Satisfying customers' needs better than competitors can, surely is the number-one issue on manufacturer's agendas today.

Satisfying the functional needs of a customer is one thing, delivering on promises is another. We all want to say "yes" when customers make requests, and we have a tendency to say "yes" without understanding or realizing the consequences. Loading demand into the ERP system and then through a process of expediting and scrambling around may, if you're lucky, result in meeting the customer's requested delivery. Bridging the gap between the sales side of the business and the manufacturing side by getting a handle on demand planning is number two on the agenda. Using the knowledge of their products and processes, and understanding the constraints that may affect their ability to build any product on any day and in any quantity, is critical to not only developing a viable production plan but is essential to the manufacturer's goal of making promises they can keep.

The manufacturing process in our complex world has many bedfellows. We need effective ways of dealing with product and process management. We also need to optimize our internal and external business processes, have an integrated and responsive supply chain and be able to execute production plans efficiently as demand dictates. Changing from a "push" to a "pull"-driven manufacturing world that is flexible, responsive and agile enough to meet customer demands is essential to the demand-driven environment.

In building or maintaining your competitive edge through adopting a demand-driven strategy, you will identify many critical success factors. Using applications that have been developed specifically to meet the needs of the complex manufacturer is just one. Cincom Systems is focused on helping complex manufacturers by providing solutions that will help them achieve their goals in becoming demand-driven and ultimately develop or maintain that competitive edge.

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