2815 Coliseum Centre Drive, Suite 600
Charlotte, NC 28217
(704) 227-6600
http://www.camstar.com

5933 West Century Blvd.12F
Los Angeles, CA 90045
(310) 338-8444
http://www.adexa.com

Planning and Execution for the Real-time Enterprise

Table of Contents

Introduction

Global competition has generated unique pressures for each manufacturer who chooses to play in the broader economy. For some, tapping into new markets has meant dealing with customers around the world that expect the same flexibility as their domestic accounts. For others, cost performance has translated into locating operations closer to sources of supply or product demand around the world. If that weren't enough, customers are increasingly demanding specialized products and services that require fluid operating models to support Make-To-Order and Assembly-To-Order strategies. This all means that manufacturing complexity is on the rise and to stay in the game, your enterprise has to adopt change as a way of life.

Accurate and timely information have always been effective weapons to manage complexity. In the 1990's, CIO's moved to replace out-of-date business systems with broad implementations of ERP. ERP vendors promised to lower enterprise computing cost and to increase visibility across the entire company. Many of these ERP purchases were justified on the promise of lowering inventories and increasing factory productivity. In this arena, ERP fell flat. In fact, many ERP implementations have yielded negative ROI. Misaligned goals, suboptimal planning, and not fully integrating information from the plant floor have been the blamed for these less than successful results. Yet, executives are still scratching their heads and asking, "What's the solution?" As you might suspect, there is no ONE solution. Further, its clear that executives can no longer treat the manufacturing process as a "black box"…a second thought in the enterprise application deployment strategy. This paper will answer the question by characterizing the solution we call **Real-time Order Fulfillment** and the role it can play in synchronizing your factories with the rest of your manufacturing supply chain. If you read on, you will learn how Camstar's **InSite™** Manufacturing Execution System (MES) solution has been successfully integrated with Adexa **eGPS** planning solutions to generate significant profitability improvements in a build-to-order environment.

Business Overview

The phrase, “The left hand doesn’t know what the right hand is doing”, is a metaphor about coordination or the lack of it. Unfortunately, it accurately describes many manufacturing organizations…especially those with multiple factories in multiple geographies. Frustrated manufacturing executives, know that a lack of coordination across their manufacturing processes can, at a minimum, create margin eroding inefficiency and under certain business conditions, can paralyze them completely.

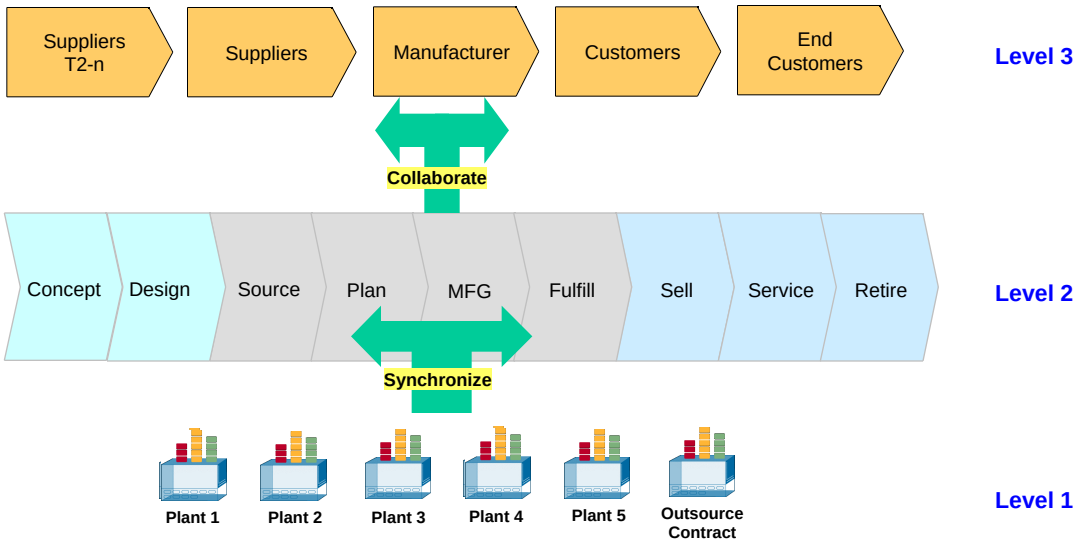
Functional silos tend to form organically in most companies resulting in the isolation of Customer Service, Production Planning, and Manufacturing organizations. Over time, this separation of demand management, production planning, and manufacturing execution has led to a “throw it over the wall” mentality in which information is supplied in batches and rarely represents a true picture of the business.

What is Real-time Order Fulfillment?

Put simply, this solution represents a seamless flow of information between the major business processes that comprise the order fulfillment cycle. As demand patterns shift toward mass customization of products and services, the order fulfillment processes will have to interoperate on a real-time basis. The days of batched information and standalone factories are rapidly coming to an end. Take, for example, the industries whose demand is shifting from stock replenishment to higher and higher percentages of custom orders and specialized configurations. These custom orders are being forced into functional silos designed for predictable demand and large lot sizes.

> “Transformation to small lot production triggered by actual customer orders is required for leaner, more-nimble manufacturing environments. Enterprises should unlock the value of working capital through visibility into material stocks and automated workflows to trigger replenishment according to actual demand.”
>
> Gartner, 2002

Today, make-to-forecast (stock) strategies are being mingled with postponement and assemble-to-order strategies often on the same production resources. To make this feasible, thought leaders in manufacturing have had to overcome inflexible processes and outdated manufacturing systems. This trend has been ramping in the supply chains for furniture, consumer electronics, apparel, durable goods, and automotive for some time now. In the future, it's hard to imagine any industry segment that won't be affected by mass customization and globalization.



What's at stake? Manufacturers that are aligning their order fulfillment organizations and manufacturing systems understand the power of synchronization. They know that as planning cycles approach real-time, data inputs for inventory, capacity, and demand must be available in real-time and that the benefit of real-time data coupled with well-designed

processes will drive value at different levels of their business. The chart above illustrates three levels of the potential value:

1. Shop Floor – this is a very dynamic and constantly changing environment. The focus of this level is to improve cycle times, produce higher yields, and to maximize capacity…a job made more difficult by demand fluctuation. Detailed tracking and data collection within the plant will produce better visibility of events that impact product quality, schedule adherence, and response time.
2. Enterprise – this level represents the internal supply chain or the synchronization of all activities within the order fulfillment cycle. This level is focused on the alignment of materials, specifications, and resources to meet customer expectations. An aggregate view of all manufacturing resources will provide greater visibility of shop floor activity. This real-time data can be used to coordinate with other business processes such as procurement, customer service, and quality control. In addition, centralized management of the production model will ensure consistent execution and effective change management across the manufacturing network.
3. Supply Chain – each trading partnership in the supply chain is critical to the success of the order fulfillment process. Through collaboration, the external supply chain also represents an opportunity to lower operating costs, reduce lead-time, and increase customer satisfaction. In general, supply chain relationships are information-based. By supplying appropriate visibility to key partners, collaboration will lead to decisions that optimize the entire supply chain.

Enabling Lean Manufacturing

Lean has become synonymous with the elimination of waste in all its forms…inventory, time, activity, cost, and WIP. In the strictest sense, waste is defined as any activity not viewed as adding real value to the product. Manufacturers have deployed this business strategy in an attempt to reduce the time and cost between customer order acquisition and shipment of product.

There's a logical connection between achieving Real-time Order Fulfillment and Lean Manufacturing. It is the merger of solid manufacturing process strategy with advanced information technologies that do much more than track a WIP item. With manufacturing cycle time moving from days to hours, what's to track?

In lean operations, the benefit of real-time order fulfillment is not to track units of production. Lean manufacturing concepts can and should be implemented in most all manufacturing environments due to their inherent advantages over division of labor, but these concepts need to be supported by data collection that assists in problem resolution and in creating a database of manufacturing trends. After all, how do you improve a process without benefit of accurate data?

> "Data accuracy is even more important with lean because there is no buffer inventory to cover errors, yet less data is required if the process has been simplified. Still, metrics are key to measuring and improving the lean manufacturing process, as is access to underlying data for root-cause analysis."
>
> AMR Research, 2002

For years, successful lean deployments have been characterized by the ability to simplify process and organize workers into highly responsive teams. How will these strategies deal with the rising mix of custom products and unpredictable demand? There is an inflection point between good process and the need for enabling technology.

According AMR Research, "Manufacturers most challenged in deploying lean have complex manufacturing processes, often engineer-to-order and build-to-order, where product variability is early in the manufacturing process." Managing these dynamic environments without information systems have pushed plant managers to the breaking point. Clearly, the

goal of lean manufacturing and real-time planning are the same. With complexity knocking at every plant manager's door, there will be an intersection where lean deployments will need information-based tools to support the uncertainty that is manufacturing.

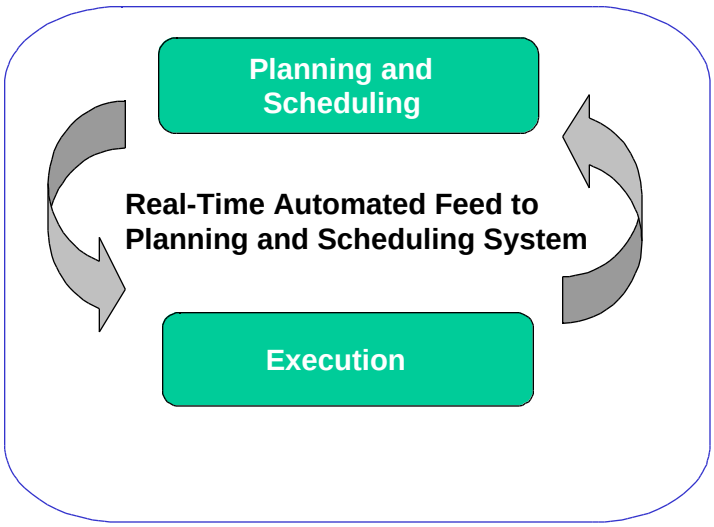
Solution Overview

In their (Inter-) Enterprise Synchronization Report, IT research firm, Gartner, characterized six common practices that contribute to data latency and that cause SCP initiatives to fail:

- Manual adjustments to inventory
- Relying on annual physical inventory
- Delaying material receipts and issues
- Ignoring rescheduling and exception messages
- Production reporting only at the end of the line
- Using “dummy” sales and/or purchase orders

Usually, such practices represent a system limitation in the ERP or Inventory Management application for which an end-user is trying to work around. In some cases, poor procedures or a complete lack of enforcement generate “spotty” material reporting. The net result is inaccurate picture of the business and an unacceptable set of inputs to the planning process. The key to architecting a successful planning solution hinges on the availability of real-time data and the integration capability of SCP and MES solutions.

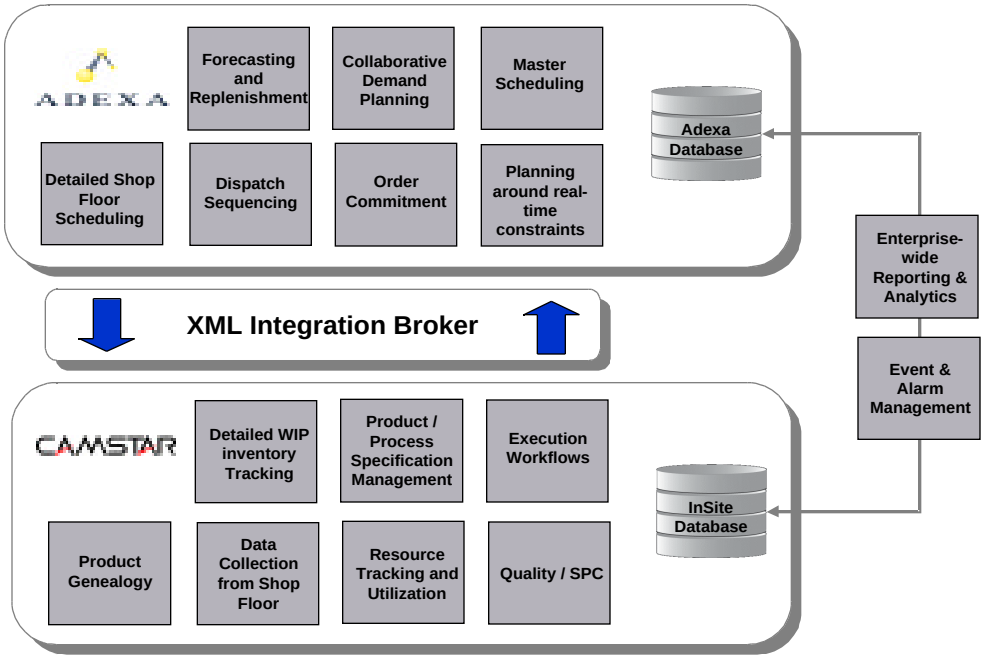
In a real-time order fulfillment environment, the up to the minute shop floor information on actual cycle times, current yield rates, resource availability, and up-to-date WIP information is used to create production plans that are feasible and most optimal.



The Complete Solution

With so much value to be gained from real-time planning solutions, the alignment between Adexa and Camstar provides complex manufacturers with new tools to gain competitive advantage in a crowded marketplace. Our open architecture and comprehensive solutions allows the two companies to work with manufacturers to integrate real-time supply chain and production information into existing ERP systems.

Adexa's eGPS suite creates a fully constrained production plan both at the supply chain and the factory level, it sequences work orders to optimize the schedule at the work center or machine level, and provides real-time ATP and CTP that starts the order fulfillment process. Camstar's InSite MES manages and controls the production and fulfillment processes within the individual factories by providing live work-in-process tracking, product genealogy, inventory visibility, parametric data collection, and detection of events that warrant a reschedule response. The resulting technologies will achieve new levels of excellence in Collaborative Planning, Order Commitment, Resource Optimization, and Detailed Scheduling.



The Business Case

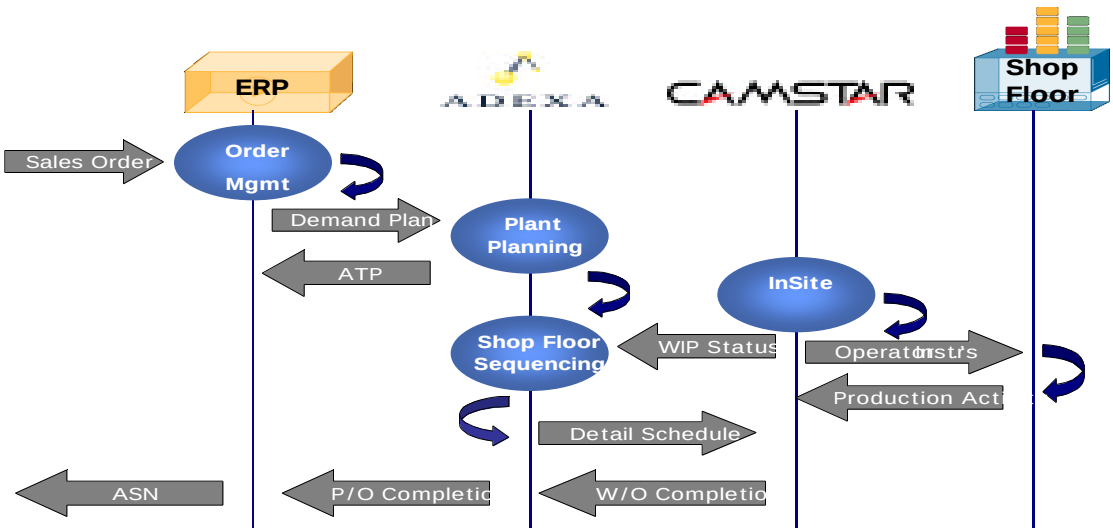
In January 2002, Camstar and Adexa joined forces to bring a real-time planning solution to bear on the business issues faced by a leader in the optical fiber industry. Faced with shrinking margins and intense competition in an "over capacity" market, our customer had to re-engineer their global manufacturing operations to differentiate themselves in this crowded landscape. Their goal was to drive past the competition by achieving:

Unparalleled Customer Service – use the most up-to-date information to make ATP (Available-to-Promise) order commitments and to manage the execution of the order to assure the ship date is met.

Maximum Resource Utilization – engineer processes and deploy advanced technologies to predict bottlenecks and inventory shortages. The by-product of better information will support lean manufacturing by improving load balancing and driving non-value-added cost out.

Accelerated New Product Introduction – align product development with manufacturing so that niche and specialty products could be brought to market faster. The resulting customer responsiveness and higher margin products will drive new business and generate higher profitability.

Lower Inventory – achieve synchronization between planning and execution to reduce the amount of "serialized" inventory carried in raw, WIP, and finished goods.



To ensure that the final solution would meet the customer's objectives, Camstar and Adexa consultants worked jointly to create a messaging architecture that would provide seamless integration between the application components. For managing transaction flow between each business application, the client had standardized on Vitria™ as its integration hub technology. OAG standards were used to define the format of each XML business message. The chart below represents the messages that were incorporated into the design:

Information Flow	OAG message(s)	Publishers	Subscribers
Item Master	Sync_Item	ERP (Oracle, SAP)	MES (Camstar), APS (Adexa)
Bill of Material	Sync_BOM	ERP (Oracle, SAP)	APS (Adexa) MES (Camstar)
Demand	Sync_Salesorder	ERP (Oracle, SAP)	APS (Adexa)
Inventory	Sync_Inventory	MES (Camstar)	ERP (Oracle, SAP), APS (Adexa)
WIP	Show Wipstatus	MES (Camstar)	ERP (Oracle, SAP), APS (Adexa)
Availability Dates	Show Shipschd	APS (Adexa)	ERP (Oracle, SAP)
Work Orders	Sync_Prodorder	APS (Adexa)	MES (Camstar)
Work Order schedules	Show Prodorder	NA	NA
Resource Status	Create Maintorder	MES (Camstar)	APS (Adexa)
Raw Material Data	Show Shipment	Suppliers	MES (Camstar), APS (Adexa)

The order management module within ERP is responsible for booking sales orders, capturing customer specifications, and segmenting the multi-line sales orders by item into production orders. From that point, the planning cycle begins. Adexa's Plant Planning and Scheduling™ system develops the long-range master production plan based on time-phased material and capacity availability. Raw materials are allocated based on fiber characteristics allowing the customer to significantly reduce the number of component items. ATP acknowledgements are then passed back to ERP to confirm order dates. Camstar's InSite™ MES solution controls all production dispatching, collects all process data, and manages the serial number controlled inventory items. To achieve optimal resource utilization, InSite periodically transmits the status of work orders by operation to Adexa's Plant Planning & Scheduling™ system. This system relies upon engineering and prioritization rules to completely re-schedule the operation. This innovative re-scheduling

capability confirms material availability, minimizes machine setup time, and ensures schedule adherence all based on the current operating environment.

As with any ROI conscious company, this customer had benchmarked their pre-implementation performance and set expectations for improvement. The resulting real-time planning solution met or exceeded those benchmarks:

- Reduction of Raw and WIP Inventory by 30%
- Increase in 1st Pass Yield by 3%
- Virtually a Paperless Factory
- Improved Resource Utilization to 93%
- Product Launch Cycle Cut in Half

Conclusion

Whether you have already invested in planning and execution tools or are considering these technologies as a future enhancement to your enterprise portfolio, an already integrated planning and execution system can be the quickest route to maximum ROI. Manufacturers who combine lean manufacturing concepts with real-time planning and execution solutions will define success in this new era of mass customization. Their success will be measured by the ability to synchronize complex processes across dispersed locations and to do so in an atmosphere of continuous improvement. Camstar and Adexa have proven the real benefit to a lean manufacturing operation lies in combining planning and execution in real-time.

If you are a global manufacturer and any of the points discussed in this paper represents a gap in your own capability, significant “hard dollar” benefits from a Real-time Order Fulfillment solution are likely within your reach. To find out more about how to achieve manufacturing synchronization or to investigate more about the merits of Real-time Order Fulfillment, contact us at www.adexa.com or www.camstar.com .

About CAMSTAR

Camstar is the leading provider of Enterprise MES solutions for global manufacturers. Only Camstar, with customers around the world, enables manufacturers to fully leverage live production information across the enterprise and supply chain. Camstar's InSite™ solution makes the enterprise live by managing multiple manufacturing locations, processes and companies as a single virtual factory. Major manufacturers like Agilent, Amkor, ALZ Steel, Corning, JDS Uniphase, La-Z-Boy, and IBM have joined with Camstar to lead the live revolution. The company is headquartered in Campbell, Calif. For more information about Camstar and Enterprise MES, call 1-800-237-2841 or visit www.camstar.com.

About Adexa

Founded in 1994, Adexa delivers solutions that synchronize corporate planning with operations planning and execution, to ensure assets are utilized to achieve strategic objectives. Adexa helps companies reduce the cost of goods sold, shorten lead-times for orders and reduce inventory costs through improved supply chain collaboration and management. Adexa's Enterprise Global Planning System (eGPS) analyzes and benchmarks enterprise performance against competitors, at a fine level of detail, to set attainable objectives that deliver the greatest return on assets. eGPS aggregates supply and demand information, measured against material and capacity constraints, for the rapid development of integrated, accurate and flexible planning and execution scenarios.

Adexa's global customer base includes AMD, CNH, Firmenich, General Motors, Hitachi, Johnson & Johnson, Lucent, Maytag, Philips, Pulse, Siemens, Teijin Limited, TSMC, Unilever, and Xerox. For more information visit www.adexa.com