"We're Lost, But We're Making Good Time"

E. Mark Quinn
BDO Seidman

Introduction

In the movie "City Slickers," Billy Crystal finds himself, a group of friends and a herd of cattle on the plains of the southwest, abandoned by the experienced guides that could lead the party to its final destination. Looking around and realizing no one in the crew has any idea where the cattle drive is headed, Billy Crystal remarks "We're lost, but we're making good time."

This observation accurately describes the state many organizations find themselves in today. Though they currently survive by meeting the fundamental business objectives of shipping product and delivering services, they find profit margins and market share eroding as they struggle to meet changing customer expectations and challenge the improved capabilities of competitors. In many instances, these organizations continue to practice antiquated "business as usual" processes that were not engineered to efficiently and cost effectively meet today's customer expectations. By not visualizing and eliminating these inefficiencies, an organization will see the complete erosion of profit margins and market share.

To provide this visibility to an organization, the concept of business process re-engineering has been developed. Business process re-engineering can provide significant cost savings through process simplification, reduction of redundant activities and improved process control. Process inefficiencies and discrepancies that prevent meeting business goals and objectives are identified, and these processes are re-engineered to eliminate these inefficiencies and discrepancies. Regardless of the industry or size of an organization, business process re-engineering offers the opportunity to conduct a detailed analysis of current and proposed business processes to determine the need and scope of modifications.

To better understand all of the elements involved in the process, we are going to examine a case study of a business process re-engineering project. It was conducted for a plastic molding injection firm, a high volume manufacturer of plastic products, by a project team consisting of personnel from the BDO Seidman Manufacturing Consulting Group in Chicago. The team re-engineered selected business processes and installed advanced finite capacity planning and scheduling software to both realize and manage the benefits of reduced customer lead times, lower inventory carrying costs and improved production/material handling efficiencies.

As-is Environment

The first step in the re-engineering process is an analysis and documentation of existing operations and selected business processes. This effort is typically described as constructing an as-is model of the organization's business processes. This model serves as a benchmark for comparing existing business processes to proposed modifications and customer requirements.

In the case of this manufacturer, the as-is model of the production area demonstrated that customer orders were pushed from one department in the shop to another. Since the operations of injection molding, assembly, and warehousing were managed and scheduled by separate department personnel it was as if three unique companies were operating within the walls of the same facility. This lack of visibility between the three departments complicated the completion of an order as it moved from plastic molding into WIP warehousing and, finally, assembly. The result of these difficulties was the accumulation of 60 million items in work in process (WIP) inventory. This high WIP consumed valuable floor space, complicated material management and consumed capital that the firm could invest elsewhere at a higher rate of return.

The challenge facing the design team was to devise a methodology for scheduling a customer order that would minimize the requirement to warehouse WIP. High WIP inventory levels had always been a problem for this firm. The design team felt that the intermediate step of warehousing WIP items between plastic molding and assembly could be eliminated. In addition to the savings available from reduced inventory carrying costs, smaller quantities of WIP inventory would free-up valuable floor space and reduce material handling requirements (see Figure 1).

The accumulation of WIP inventory was primarily the result of a difference in cycle times between the automated assembly and plastic molding machines of three to one. To keep pace with the assembly machines, the molding department was run three shifts a day, seven days a week. Build-to-stock molding jobs were run in anticipation of customer orders and to provide a buffer so as not to starve the high-speed assembly machines. The net result of these decisions was the accumulation of excessive WIP inventories, which, surprisingly, did not have a significant impact on reducing customer lead times.

Additionally, the measurement system used by management to evaluate the performance of production management personnel in the molding and assembly departments was machine efficiency. As a result, the entire organization was driven to build WIP inventory levels to maintain high machine efficiency ratings. WIP inventory levels grew and machines were highly efficient; yet customer lead times increased.

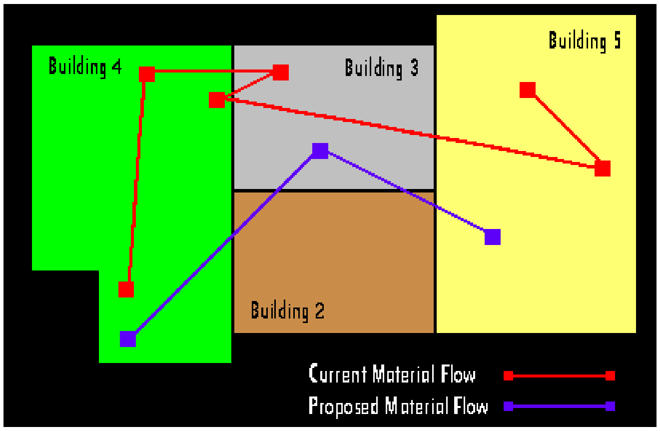

***Figure 1** – As-is material flow. The operation was run using push scheduling. This required that a pallet be moved two times more than if it were assembled using flow/demand pull scheduling. Push scheduling resulted in higher labor, inventory and material handling costs.*

To-be Model

After construction of the as-is models, the design team began construction of a to-be model that represented proposed modifications and goals for the selected business processes. One of the principle goals set by the project team was the development of a scheduling and operations methodology that would reduce lead times and WIP inventory levels. To accomplish these goals, the organization needed a system that would provide the capability to produce the right product at the right time for the right customer. This would require re-engineering several aspects of the selected business processes that included the elimination of long established shop floor scheduling, performance measurement and production methodologies.

As solutions to minimize and manage WIP inventory levels were explored, pull scheduling became a viable alternative to the existing push scheduling methodology. Since the part routing for an item consisted of only two operations (molding and assembly), the visibility up-stream from the last to the first process was not difficult. Pull scheduling from the assembly machines could be done very easily. The design team decided that when a customer order was released to the shop floor, scheduling of that order would begin with the final operation-assembly. The order would then be scheduled upstream through plastic molding and tooling. The result would be a more streamlined movement of the product through the facility.

The project team was still faced with the challenge of reducing and managing WIP inventory between two departments with such a large variance in production capacity. Many different options from conventional storage to an automated storage and retrieval system (ASRS) were considered. Eventually, the design team selected WIP staging lanes as the best solution for managing WIP inventory. Staging lanes were designed between the two departments and assigned to specific assembly machines. The size and quantity of staging lanes that fed an assembly machine were determined by the quantity of products assembled at the machine and/or the number of presses that fed the assembly machine. Those items that ran the most active product lines received more staging lanes.

One advantage to the staging lane concept is the flexibility it provides for staging the orders of varying lot sizes. Certain staging lanes were identified as "wild card" lanes, meaning they could be assigned product and material for any order destined for any assembly machine. These "wild card" lanes provide the flexibility to respond to any order lot size that may be run in the facility. Staging lanes can also be combined for large production runs.

A second advantage to the staging lane concept was that it established a finite capacity for storage of WIP. In the past, large quantities of WIP were stored seven to eight tiers in height throughout the warehouse. The staging lanes minimized and dedicated space for floor storage of WIP. This provided production personnel with improved visibility to monitor, schedule and control WIP levels.

As part of the pull scheduling methodology, the design team re-engineered the process of moving WIP inventory from the molding department through the staging lanes and into assembly. A Kanban card system was developed that controlled and simplified material movement. Using a Kanban card and the raw material required for the assembly operation, staging lanes were dedicated to specific customer orders. Once a lane became available, that lane was assigned an order by moving raw material with the Kanban card to the staging lane. This signaled that molding of product could begin in the press department. The Kanban card, with the job number and raw material, was prominently displayed at the staging lane so that material handling crews moving cartons from molding to assembly would know which staging lanes had been assigned to specific customer orders. This system not only simplified the staging of product from molding, but also facilitated the reduction of WIP inventories and product lead times.

Finite Capacity Planning and Scheduling

Once a model was developed for operating and scheduling products in the shop, it became necessary to re-engineer the computer system that supported the new production model. The design team wanted an automated method of scheduling the inter-relationship between the press department1 tooling room, staging lanes and assembly.

This was accomplished through the application of the advanced finite capacity planning and scheduling software TACTIC from Waterloo Manufacturing Software of Wellesley, MA. TACTIC provided a link between customer orders and the shop floor. Using TACTIC, customer orders were scheduled based on the finite capacities of the presses, tooling and assembly machines.

TACTIC is a PC-based advanced finite capacity planning and scheduling software package designed to integrate with ERP/MRP II systems in development of detail production schedules. It is used by schedulers to both develop detailed dispatch lists for the manufacturing shop floor and to help identify and resolve shop floor problems.

Using the interface capabilities of TACTIC, customer orders are passed daily from the ManBase MRP II system. TACTIC schedules the customer orders across the press department, specifying the press and tooling required to run the customer order. TACTIC provides the visibility to manage the interrelationship between the press department, tooling room, staging lanes and assembly. Contention between customer orders for tooling and machine time is also identified by TACTIC. Schedulers can identify these contentions and quantify the impact on promised customer delivery dates. What-if experiments can then be run to consider optional scheduling sequences to minimize or eliminate late customer order shipments.

Once the what-if experiments are completed and the desired schedule selected, TACTIC prints out a detail production schedule that is used to sequence work orders through the shop. This process provides the schedule integrity that is critical to the efficient operation of the press, tooling and assembly departments at minimum WIP levels.

Cellular Manufacturing

One of the most popular methods for reducing inventory levels and customer lead times is cellular manufacturing. It provides a manufacturer with the ability to streamline and combine the isolated functions that make-up a manufacturing process and eliminates non-value-added activities the essence of business process re-engineering. For example, material handling and changeover time can be reduced by grouping products into production families that can be produced across a single line or cell of machines. Many who implemented cellular manufacturing have significantly reduced inventory and customer lead times.

The project team was anxious to realize the benefits of cellular manufacturing. As a result, a Pareto analysis of the product line was conducted to identify those items that accounted for the highest production activity for the company. This analysis indicated that 30 percent of the items accounted for 76 percent of the total production volume. This provided the opportunity for the design team to dedicate individual presses and assembly machines to specific items.

The project team was able to physically locate these machines together in cells, eliminating the need for staging lanes for these items. It also minimized even more of the material handling and warehousing requirements of the facility.

Implementation Benchmarking

Once the to-be model was constructed, the design team selected representative products to run through prototype cells for the purpose of initializing implementation. As the new business processes were operated during implementation, critical measurements were kept to benchmark the performance of the to-be model against the as-is model. As unforeseen difficulties and inefficiencies were identified upon implementation of these prototype cells, the to-be model was corrected and future manufacturing cell implementations modified accordingly.

Full implementation of the to-be model was completed nearly one year after initiation of the first cell. Benchmarking of the company’s operations continues even today to maintain management’s commitment to continuous improvement.

Project Results

The results of this re-engineering project are dramatic. Finished goods inventory turns have increased from 10 to 40, WIP levels have been reduced from 60 million to 12 million items and production lead times on many items have shrunk from weeks to days. Inventory reductions have been so significant that floor space previously used for warehousing WIP, has now been converted to manufacturing space with the procurement of four new injection molding presses. These presses have increased the capacity of this manufacturer to service new clients and to further balance the flow of product between molding and assembly. The results of this case study illustrate the successes that can be realized by an organization that is committed to the concept of continuous improvement and customer service.

Business process re-engineering, when done correctly, forces an organization to benchmark business goals and objectives against the existing processes that support accomplishment of these goals and objectives. In the case of this organization, this introspection yielded significant efficiency and cost savings that will return yearly dividends. It has also created an environment of empowerment among employees that will facilitate the process of continuous improvement that is essential to an organization that must adjust to meet the changing needs of a dynamic market place. This organization is not only making “good time” through these process improvements, it also has a clear vision and understanding of its position and capabilities in a fiercely competitive market place.

About the Author

E. Mark Ouinn is a senior manager in the Chicago manufacturing and consulting practice of BDO Seidman. He has over 12 years experience in the analysis and design of manufacturing systems.

More Information

This Paper was published in APICS The Performance Advantage. It is being provided with compliments from Waterloo Manufacturing Software. For more information about Waterloo Manufacturing Software’s TACTIC product, contact:

Waterloo Manufacturing Software
P.O. Box 81264
Wellesley, MA 02481-0002

Voice: 781-237-2678
Fax: 781-237-9999
E-mail: sales@waterloo-software.com
Web: www.waterloo-software.com