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# What's working for U.S. manufacturers: the latest census of manufacturers reveals that lean is still the most popular improvement method.(CENSUS OF MANUFACTURERS)(Survey)

From: [Industry Week](#) | Date: [October 1, 2006](#) | Author: [Blanchard, David](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

The State Of U.S. manufacturing in 2006 can be summed up as simply this: leaner and meaner. Based on the results of the 2006 IW/MPI Census of Manufacturers, lean manufacturing has significantly increased in popularity over the past year. In 2006, 40.5% of all manufacturers surveyed have adopted lean as their primary improvement method, a jump of nearly 5% from the 35.7% reported last year. That explains the "leaner" part.

The "meaner" part, admittedly, is open to interpretation, but compared with last year's responses, the focus of U.S. manufacturing has shifted slightly from several typical customer-focused areas. "High quality," "service and support" and "fast delivery" all saw a decline in their numbers from the previous year, indicating if nothing else that other concerns (such as "innovation") are occupying an increasing amount of attention from companies.

While the choice of improvement methods and strategic initiatives fluctuated in numerous ways over the past year, it all added up to a healthy advance toward world-class status. The percentage of companies indicating they have either made "significant progress" toward or have "fully achieved" world-class status jumped from 23.6% in 2005 to 26.1% in 2006. Looking at it another way, the number of companies who say they've made "no progress" on the road to world-class dropped from 23.9% last year to 19.6% this year.

We'll be looking at specific metrics and the impact of various efforts on manufacturing performance in special Census reports in the coming months. Stay tuned.

## METHODOLOGY:

The IW/MPI Census of Manufacturers was conducted in late spring/early summer 2006. We asked more than 100 questions of manufacturers across the United States. There were 801 respondents (415 online and 386 by mail), and all responses were anonymous.

The Manufacturing Performance Institute (MPI) is a Cleveland-based research organization specializing in research development, analysis and communications. Details on how to obtain the complete 2006 IW/MPI Benchmarking Toolkit are available at [www.mpi-group.net](http://www.mpi-group.net).

## PRIMARY IMPROVEMENT METHOD

	2006
Lean Manufacturing	40.5%
Total Quality Management	9.9%
Lean and Six Sigma	12.4%
Other	5.2%
Agile Manufacturing	3.8%
Theory of Constraints	3.0%
Six Sigma	3.1%
Toyota Production System	3.1%
None	19.1%
	2005
Lean Manufacturing	35.7%
Total Quality Management	15.9%
Lean and Six Sigma	8.0%

Other	7.0%
Agile Manufacturing	4.4%
Theory of Constraints	4.0%
Six Sigma	1.5%
Toyota Production System	1.5%
None	21.9%

Note: Table made from pie graph

FOCUS OF MARKET STRATEGY  
2006 2005 (MULTIPLE RESPONSES POSSIBLE)

	2006	2005
HIGH QUALITY	71.1%	71.8%
SERVICE AND SUPPORT	54.3%	56.4%
TOTAL VALUE	40.3%	39.0%
FAST DELIVERY	32.3%	35.3%
CUSTOMIZATION	28.9%	32.4%
LOW COST	27.1%	26.5%
INNOVATION	24.9%	21.6%
PRODUCT VARIETY	16.2%	14.1%
NONE OF THESE	0.3%	0.2%

Note: Table made from bar graph

STRATEGIC PRACTICES  
2006 2005 (MULTIPLE RESPONSES POSSIBLE)

	2006	2005
CONTINUOUS-IMPROVEMENT PROGRAM	72.9%	66.5%
QUALITY CERTIFICATIONS (e.g., ISO)	50.6%	45.4%
CUSTOMER SATISFACTION SURVEYS	45.9%	45.1%
BENCHMARKING	35.2%	34.6%
ENVIRONMENTAL MANAGEMENT	32.4%	25.3%
TOTAL PRODUCTION MAINTENANCE	24.5%	21.7%
ENERGY MANAGEMENT	23.4%	16.1%
OPEN-BOOK MANAGEMENT	18.3%	15.0%
NONE OF THESE	10.3%	13.6%

Note: Table made from bar graph

PROGRESS TOWARD WORLD-CLASS STATUS

	2006	2005
SOME PROGRESS	54.3%	52.4%
SIGNIFICANT PROGRESS	24.7%	21.6%
FULLY ACHIEVED	1.4%	2%
NO PROGRESS	19.6%	23.9%

Note: Table made from pie chart.

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## Eicher buys gear unit of British Motor.

From: [Times of India \(New Delhi, India\)](#) | Date: [November 2, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Nov. 2--NEW DELHI -- The Eicher group on Wednesday announced the acquisition of the commercial vehicle gear unit of one of its key suppliers British Motor Car Company for an undisclosed amount.

Eicher Engineering components (EEC), the automotive component division of Eicher Motors has acquired the Dewas (Madhya Pradesh)-based transmission gear business.

"The acquisition is part of our plan to expand the auto component business of EEC. It augurs well with our business as Dewas unit has a capacity to make five lakh gears a year and the facility is geographically close to our commercial vehicle plant," Eicher Motors CEO Siddhartha Lal said.

Lal, however, refused to divulge details about the transaction value. "Our engineering components business has a portfolio of products ranging from differential and transmission gears to gear boxes. Due to its excellent track record of developing and supplying transmission gears for medium and heavy commercial vehicles, BMC has been an established supplier to our CV division since 2004," he said.

The newly-acquired Dewas gear unit, he said, will add to the manufacturing muscle of EEC, which already has two units in Gurgaon and Thane to manufacture transmission and Differential Gears as well as gearbox assemblies.

The Eicher group had sold off its tractor business to Tafe and decided to focus on commercial vehicle market.

Under this exercise, the group is also revamping its gear business and had appointed **Goldratt** as a consultant to aid the process of turning around the unit.

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# Delivering projects on time: risk management can help managers anticipate the delays that make their development projects late.

From: [Research-Technology Management](#) | Date: [November 1, 2006](#) | Author: [Christensen, David S.](#) | More results for: [Goldratt or "Theory of Constraints"](#) or ["Critical Chain"](#)

OVERVIEW: Meaningful risk analysis can dramatically improve the likelihood of project managers delivering major system development projects' on time. At issue are the questions, "Which risk events" are most likely to occur?" and "Which risk events" will have the most severe impact on the project schedule? " A study of 22 major aerospace system development programs produced a prompt list to support project managers engaged in risk identification. The study also yielded a risk map based upon an empirical study of the reasons for adverse schedule variances on the 22 programs over a ten-year period. The lack of required parts and materials' when needed, a lack of requisite information, design changes, and difficulty starting, are among the risk events that most warrant managerial attention and appropriate risk mitigation and control.

KEY CONCEPTS: schedule risk, project delays, risk assessment.

It is a rare manager who embarks upon a new project intending to complete it late. Yet, historically, the timely delivery of project solutions has proven elusive for many project managers (1,2). In many cases, they are confounded from the start by managerial pressure to win a contract or to move too quickly into development. In other cases, the causes of delay may be external.

Regardless of the cause of delay, effective risk management practices hold promise for managers confronted with the challenge of successfully completing their projects on time. By anticipating events that may cause project delays, project managers can employ proactive measures to avoid, mitigate and control adverse impacts on the schedule.

The objective of this research is to provide empirical support to project managers who must estimate the probability and consequence of risk events. The contribution of the study is a prompt list that presents 26 risk events that may result in poor schedule performance. Additionally, the study provides a risk map of the relative likelihood and severity of these 26 events based upon an analysis of 547 incidents of adverse schedule performance on 22 major aerospace system development programs (see "How the Study Was Conducted.")

## Anticipating Delays

Risk assessment is an integral part of the risk management process. The main objective of risk assessment is to identify and analyze project risks so that the project team can control the most critical among them (3). Risk identification begins by compiling the project risk issues or potential risk events (3) and then understanding the consequences or alternatives if the event occurs (4).

Many techniques are used to support risk identification. One effective approach is to systematically evaluate the elements of the project work breakdown structure (3). Smith and Merritt (4) normally prefer to use the project schedule as the catalyst to identify risk events. Project teams may also rely upon brainstorming, expert opinion, lessons learned from previous projects, and prompt lists to identify candidate risk events (3-5).

Risk analysis proceeds from the completion of the team effort to identify the candidate risk events. The objective of risk analysis is to collect enough information about the risk events to estimate the probability or likelihood of occurrence and the impact or consequence on project objectives, including performance, cost and schedule, if the risk event occurs (3-5). These two dimensions--probability and impact of risk--are applied to specific risk events rather than to the overall project (5). Risk analysis using probability and impact helps to identify those events that should be managed aggressively (5).

Project teams that perform risk analyses frequently rely upon detailed information from many sources to estimate the probability and impact of risk events. These information sources include comparisons with analogous systems, lessons learned from previous projects, test results, engineering data, expert opinions, and simulation modeling (3). Conrow cautions that risk analysis results often involve uncertainty, and recommends that project teams estimate and present this uncertainty to key personnel who are responsible for making critical project decisions (3).

Risk assessment culminates in the prioritization of the project risk events. The objective of the prioritization effort is to cull from the long list of events a short list that the project team will actively manage (4). This step is important because project teams will have only limited resources to dedicate to the management of risk events.

Risk ratings are typically used to support the prioritization process. These ratings typically measure the likelihood and consequences of the risk event to provide an indication of the potential loss or impact to the project (3,4). Risk ratings are often expressed using an ordinal scale that ranges from low to high with several intermediate values (3). Smith and Merritt advocate the use of a risk map to support the risk prioritization effort (4). The risk map displays the total loss or impact on the x-axis and the likelihood of the risk event on the y-axis.

Once the risk map is developed, the project team can use it to develop a prioritized list. Ultimately, the risk prioritization effort yields the events that should be actively managed. The project team should develop actionable plans to resolve and monitor each of these high-priority risk events (3,4).

### Support for Risk Identification

In order to develop effective risk response strategies, project managers need to know which risk events might reasonably occur during the course of the project. We have developed a prompt list (Table 1) that includes 26 risk event categories based upon our review of eight studies (4, 6, 7,8-12). Because our study focuses specifically upon events that may cause adverse schedule performance, our literature review focused on those studies that address schedule performance.

Additionally, in order to effectively prioritize the effort dedicated to risk response, project managers need to know the likelihood that a given risk event will occur, as well as the potential severity of that event. We conducted this study to address this critical need.

The illustration, next page, shows the risk map we prepared from our analysis of all 547 cases considered in this study. The frequency that each risk event occurred is presented on the y-axis in terms of the number of cases assigned to each category. The severity of each risk event is based on the mean schedule variance in \$1,000 of all cases assigned to the risk event category. The gray region contains those risk events for which either the frequency or the median schedule variance is below the median value for each of those parameters. Consequently, the risk events that deserve the most attention are clearly labeled in the region in the upper right-hand portion of the illustration with the unshaded, white background.

### Eight Causes of Delay

So, what are the leading causes of delay in major system development projects? What can managers do to reduce the likelihood and severity of delays that result from these leading causes? The eight leading causes of schedule delays are listed in Table 2 and described below. Additionally, promising risk avoidance or mitigation strategies are drawn from previous studies to help development project managers deal with the leading sources of schedule risk.

#### 1. Lacking parts and materials

There were 72 cases assigned to the category of "lacking parts and materials." The mean schedule variance for these 72 cases was \$337,000. The parts and materials delivered late included raw materials and engineering materials. Standard parts including items such as connectors and breadboard parts were also delivered late. In some cases, software was reported late, and in several cases hardware, including fuel controls, sensors and high-speed memory units, was delivered late. Finally, a review of the reports where parts and materials were lacking reveals cases where tooling, test equipment and government-furnished equipment were delivered late, and hence not available when needed by the project teams.

Several strategies endorsed in prior studies should be considered to reduce the incidence and impact of delinquent material and parts deliveries. First, project managers can establish long-term relations with conveniently located suppliers (14). They can also bolster these long-term relations by working closely with proven suppliers rather than pursuing competitive bidding relations.

To improve supplier selection, project managers can develop and administer supplier certification programs (15,16). Similarly, they can consider references, past performance and compatibility during the selection process (10). There is also evidence that selecting suppliers with strong technical capabilities is associated with reductions in delays (17).

The structure of the contract represents an additional opportunity to place greater emphasis upon control of timely deliveries. The request for proposal (RFP) may stipulate shorter lead times with hefty penalties (18). Alternatively, project managers can negotiate shorter delivery times in return for higher profits.

Ultimately, one of the most promising strategies is to forge a strong partnership with the component suppliers (19). This partnership may include the addition of supplier personnel to the development team (19,20). Further, there can be greater sharing of information between partners to include business plans, cost data (19) and interim supplier results (20).

## 2. Lacking information

The effective management of information has received considerable attention in recent years, and the late delivery of information proved to be a cause for poor schedule performance in 51 separate cases. The mean schedule variance for these 51 cases was \$221,000. In some cases, the late information involved specifications or requirements documents necessary to define the design effort. In many cases, data were lacking, including engineering data, design data, intelligence data, vendor data, systems data, and interface data. Drawings and layouts were also delivered late, hampering progress on scheduled engineering work efforts.

There are many steps project managers can take to ensure that information is available where and when it is needed. Electronic communications tools increase the potential for richer, more frequent and more timely communications among team members (15). Computer-aided design systems and shared electronic databases and files further enhance the opportunity to share important design data in real time (15). Focused attention on improving team member communications can also play a key role in managing the flow of product development information (12). Further, project managers can purposefully assess and prioritize the information needs of the project to minimize the quantity of documentation generated (12).

[GRAPHIC OMITTED]

## 3. Design changes

Design changes were cited as the principal cause for adverse schedule variances in 50 distinct cases, with a mean variance of \$282,000 reported. The source of the design changes included changes in product definitions, technical data, drawings, and changes resulting from system integration efforts. Many specific changes were described in the narratives of the status reports, ranging from changes in the location of strain gauges to changes in the symbology used for Heads-Up Displays. The mechanism of the delay was explained by the need to defer ordering or assignments until a greater degree of stability was achieved, the need to conduct further analysis to integrate the change, and the need to accomplish rework to effect the design changes.

Strategies to reduce the frequency and severity of design changes begin with the involvement of customers and suppliers in the development process (19). Increasing the customer information that is available early (21) to develop precise and clear requirements (18) and better specifications (12) can set the project on a sounder footing from the beginning. As the work proceeds, the project manager can reduce the complexity of the customer interface (12) and give users early working prototypes to help identify needed changes sooner (19), thereby reducing the impact of any required changes.

Paying attention to features of the development process also holds the potential for reducing the impact or severity of design changes. To this end, project managers can employ rapid prototyping (15) or incremental development (10). Further, they can address manufacturing concerns early in the design stage (19) and test products in user facilities during development (19).

Finally, project managers can establish greater design stability to reduce the occurrence of changes. Accordingly, they can establish high change thresholds (10) to reduce design volatility (12). They can also reduce design complexity (12) as well

as the extent of technical invention required (22). And whenever possible they can reduce the design risk by reusing proven designs, specifications and test protocols (12).

#### 4. Difficulty starting

There were 30 cases where the adverse schedule variance was attributed to difficulty in starting a particular effort. These 30 cases resulted in an average schedule variance of \$290,000. In most of these cases, the difficulty resulted from delays associated with obtaining vendor quotes, selecting sources, awarding contracts, or placing subcontracts.

Confronted with the challenge of initiating work by subcontractors and suppliers, project managers can strive to develop strong communication systems with vendors that provide prior notice of design requirements (18), support requirements and anticipated contracting milestones. In many cases, delays in starting work are tied to cumbersome contracting processes. Attention to streamlining these processes can pay dividends on current as well as future projects.

Finally, project managers can leverage computer-based tools to facilitate the planning and execution of development projects (15). In particular, project scheduling applications can simplify the management of the development process and identify activities, such as initiating and awarding contracts, that are critical to the timely execution of the project and hence deserve the most attention (15).

#### 5. Subcontractor performance

Subcontractor performance was cited as a primary source of poor schedule performance in 26 cases. The mean schedule variance in these cases is \$537,000; however, we stress that a single outlier largely influences this variance. Perhaps a more realistic indicator of severity for this category is the \$270,000 median schedule variance, which is still large enough to warrant attention as one of the more important risk events. A detailed review of the specific narratives for the cases assigned to this category reveals that the subcontractor delays impacted the development process beginning in design and progressing through development to include fabrication and testing.

Many of the strategies we identified to reduce the incidence of delinquent materials and parts are equally applicable to reducing the incidence of substandard performance on the part of subcontractors. The principal difference between these two categories is whether the role of the supplier was to provide parts or to provide technical services. Strong and enduring relationships with subcontractors that increase involvement and information sharing throughout the development process hold substantial potential for reducing the delays that stem from poor subcontractor performance (19). Diligence in the selection process (10), and consideration of appropriate contract terms, structures and incentive arrangements are also valuable strategies (10,18).

#### 6. Poor performance

In many cases, work simply proceeds more slowly than planned. Slow or poor schedule performance was identified in 24 cases with a mean schedule variance of \$283,000. One of the most common efforts to suffer from slow progress was software development. Additional tasks identified in the narratives of the schedule status reports included the building of components, the design of test equipment, and the development of technical manuals and support equipment.

Leadership by the project manager is crucial to avoiding and reducing the delays that result from poor performance. One of the most effective ways to reduce delays and product development time is to build strong cross-functional teams that work well together (23). To focus the efforts of the team, project managers should establish clear and explicit goals and objectives (15). They should also strive to recruit and hire the best designers and developers, and provide the necessary training (12).

The team selection process should also recognize that whether the project is technologically routine or requires radical innovation will impact the desired characteristics of both project managers and team members. Selection decisions informed by this knowledge are associated with reduced cycle times (22).

Project managers should also create a good work environment and provide team members with tools to improve performance (12), including simulation, benchmarking, modeling, and prototyping (10). Finally, project managers should work with their teams to improve processes (12) to simplify and speed steps and ultimately eliminate delays (24).

## 7. Unrealistic schedules

Unrealistic schedules accounted for 21 cases at an average schedule variance of \$298,000. The most typical reported errors involved schedules that were overly aggressive or underestimated, efforts that suffered from rescheduling, and cases that suffered from a lack of integration between related efforts.

The project manager must assume responsibility for the development of accurate project schedules, the development of contingencies, the management of resources during schedule-intensive periods, and the practical resolution of unavoidable delays. During the development of the initial project schedules, project managers may find computer-based project scheduling applications very beneficial (15). Additionally, managers should seek multiple sources of schedule estimates and scrub all project requirements (10).

Allocating resources in advance of the project work can serve to buffer against unrealistic schedules (12). As the work proceeds, project managers should constantly communicate project status and anticipated needs to external personnel who are in a position to influence project success (21). Further, the manager can attach big bonuses to early completions and big penalties to delays (18). In more aggressive circumstances, the manager may need to resort to overtime and the application of direct schedule pressure to members of the team (12). Ultimately, when it becomes apparent that schedule delays are likely, project managers will need to reprioritize tasks, renegotiate plans and schedules, and perhaps even postpone features and upgrades to the next version of the product (12).

## 8. Quality problems

Quality problems were reported in 19 specific cases, with a mean schedule variance of \$307,000. Some of the quality problems were associated with the performance of components or equipment items, such as timing variances or speed problems reported with computer chips. In other cases, the hardware items were incomplete or missing parts. Quality problems also impacted documented specifications. As a consequence of failures such as these, the narratives frequently mentioned the need for rework to correct the deficiencies. The narratives also indicated the need for excessive testing or for additional testing before the quality problems could be considered resolved. Such rework and testing activities contribute to the severity of the delay for this category.

Project managers seeking significant gains in product quality and development speed may focus on improving product designs, and considering manufacturing and assembly requirements during the design stage (19). They may also adopt concurrent engineering (19), Quality Function Deployment and Design for Manufacture methodologies--approaches believed to minimize product and process design errors and the associated rework (15). Finally, improving processes and implementing diligent design reviews, inspections and quality assurance activities help to reduce both the incidence and severity of quality problems that emerge from the development process (12).

## How the Study Was Conducted

Our study examined adverse schedule variances in 22 aerospace systems development programs managed by the Aeronautical Systems Center (ASC) of the United States Air Force (13). The systems studied are reasonably diverse, and include aircraft (fighters, bombers, transports, trainers), aircraft equipment, communications equipment, missiles, major aircraft upgrades, and simulators. Each of these development efforts cost in excess of \$40 million and was active between 1985 and 1994. Roughly half of the programs employed fixed price (incentive) contracts, and half employed cost reimbursable contracts (13).

In order to obtain reasonably consistent, credible and available data on the reasons schedule problems occurred, the study examined Cost Performance Reports (CPRs). These reports are regular, monthly reports that have a reasonably consistent format across programs. We examined a random selection of nine CPRs for each of the 22 programs for a total of 198.

The primary measure of schedule performance used in this research is the schedule variance (SV). Schedule variance measures the difference between the planned value of work to be accomplished and the earned value of work actually accomplished over a given period of time. The common practice when earned value reporting is levied on a contract is to stipulate a threshold that when breached constitutes a reportable schedule problem. When the schedule variance is used as a trigger, these thresholds are typically based on a discrete dollar value. The observations examined in this research are composed of each incident within the 198 cost performance reports examined that a schedule performance threshold was breached. Specifically, this study includes 547 observations or cases.

In each case that a schedule performance threshold is breached, the Cost Performance Report includes a detailed narrative that describes the reason(s) for the schedule performance problem. Additionally, the Cost Performance Report provides the specific amount of schedule variance. These explanations, recorded at the time of the schedule problem, served as the basis for discernment of the reasons for adverse schedule variances in this study and the subsequent assignment of the observations to schedule risk categories presented in the prompt list (Table 1) K.P.G., W.M.C. and D.S.C.

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## Seeking operational nirvana.(PRIME NUMBER)

From: [Industrial Engineer](#) | Date: [November 1, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Continuous improvement methods are being applied by 80% of manufacturers, with lean manufacturing, Six Sigma, total quality management, and the **theory of constraints** being the most popular programs to improve operational performance.

Source: "Continuous Improvement Systems Worldwide Outlook," ARC, 2006

# Critical chain project management flies.(SOLUTIONS IN PRACTICE)

From: [Industrial Engineer](#) | Date: [November 1, 2006](#) | Author: [Best, William D.](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

In 2004, the Warner Robins Air Logistics Center in southern Georgia was flying high. Officials had significantly reduced the number of days required for the repair and overhaul of the C-5 Galaxy aircraft from nearly 360 in late 2000 to about 240 today. The reduction was accomplished through a concerted lean initiative that established cell teams, standard work within each cell, parts kits, materials at point of use, modified 5S initiatives, method sheets, and pull systems.

[ILLUSTRATION OMITTED]

These efforts also reduced the work-in-process, namely the number of aircraft in the center awaiting repair and overhaul. In 2001, the average WIP was 16 aircraft. By end 2004, it was 12.5.

These efforts led to the air logistics center winning the Shingo Gold Prize in 2005, marking the first time it was awarded to an organization in the public sector.

Despite these improvements, the center faced pressure to reduce flow days and WIP further. The U.S. Air Force had only 114 C-5s in its fleet. The 12 to 13 aircraft in WIP accounted for more than 10 percent of the entire fleet. To address the need of the Air Force, the Air Logistics Center revisited the C-5 repair and overhaul process to assess where improvements could be made for other aircraft projects.

## Fighting procrastination

A study in December 2004 revealed a number of problems. In the presence of resource contention, the tendency was to give priority to working on aircraft that were closest to completion even if they were ahead of schedule. Such a decision, however, delayed other aircraft that warranted higher priority because they were behind schedule.

As delays mounted, a firefighting mode of operation promoted a tendency to begin work on aircraft or tasks as soon as possible, which led to many aircraft in various stages of repair. The resulting competition for mechanics, parts, and other elements led to more firefighting, multitasking, and delays.

Due to uncertainties in task durations, task times had been buffered to protect against uncertainty. Furthermore, all tasks were scheduled and managed using milestones that specified when they should begin and end. That led to numerous behavioral problems, including Parkinson's Law--the tendency for work to expand to fill the time available for completion--and the Student Syndrome, in which people put off working on a task until the due date draws near.

Amid the operational disillusionment, a C-5 aircraft was scheduled to arrive for repair and overhaul approximately every 22 days. The mechanics took 22 days in the disassembly phase even though they could have done it much faster because they knew the next aircraft would not come for 22 days. When some personnel postponed working on tasks, others were forced to multitask. However, multitasking only served to delay each of the tasks being worked on. With the C-5, the study revealed a lot of multitasking with sheet metal work.

## Critical chain gang

In January 2005, the Air Logistics Center decided to adopt critical chain project management to manage the repair and overhaul process. The center contracted with Realization Technologies to implement the project management method.

The first step in the implementation was to form a dedicated cross-functional core team. After considerable discussion, the core team arrived at an aggressive target of 160 flow days (including the project buffer) for repairing and overhauling the C-5. A network incorporated a **critical chain** length of 105 days and a 55-day project buffer.

Implementation sparked numerous challenges, the first of which was to reduce WIP without incurring additional overtime or personnel. A second challenge was to break a cultural barrier by moving away from aircraft-level priority to task-level

priority. This was especially difficult when an aircraft was at functional test ready for test flight, but the information indicated that scarce resources should go to an aircraft that just arrived and the jet at the functional test should sit idle. A third challenge was to overcome a date-driven mentality, dislodging the notion of working toward milestones.

Prior to the implementation of **critical chain** project management, each cell had its own cycle time and milestone end date. That resulted in Parkinson's Law and the Student Syndrome, with each cell using up at least the amount of time allotted to the cell. After implementation, the facility moved away from cell cycle times to one cycle time for the entire aircraft. The Air Logistics Center now works with just one date in sight: the customer delivery date.

#### Freeing up time

Through **critical chain** project management, flow days were reduced from 240 to 160 within eight months without additional overtime or personnel. Much of the credit for that goes to the elimination of multitasking. The reduction in flow days allowed the Air Logistics Center to release five additional C-5 aircraft back to the Air Force's operational inventory and provided additional revenue to the Transportation Working Capital Fund, estimated at \$49.8 million annually. The replacement value for these aircraft is estimated at \$2.37 billion.

The implementation provided numerous additional benefits. It re-energized lean and corrected process inefficiencies. For example, personnel resources were aligned by skill for much better task completion efficiencies, resulting in a faster pace of maintenance. The implementation also yielded efficiencies in labor that routinely allow the C-5 team to address additional unexpected work for the aging C-5 fleet. **Critical chain** project management identified the paint barn as a constraint, leading to a reduction in lead-time for aircraft in the paint barn by 45 percent. The Air Logistics Center is now able to paint the C-5 in less than half the time of the benchmark commercial facility, and for much larger aircraft. The increased efficiencies allow other aircraft to be painted in the barn.

Energized by the success with the C-5 line, plans are under way to implement **critical chain** project management in other critical areas that require better performance to meet growing demands in the future.

--William D. Best is deputy director of 402nd Aircraft Maintenance Group at Warner Robins Air Logistics Center in Warner Robins, Ga. Mandyam M. Srinivasan is the Ball Corp. Distinguished Professor of Business at the University of Tennessee in Knoxville.

#### SPREAD THE NEWS

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## Maintenance Center gets new leadership.

From: [Desert Dispatch \(Barstow, CA\)](#) | Date: [September 28, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

Byline: Adrienne Ziegler

Sep. 28--BARSTOW -- Under the shadow of Building 573 at the Maintenance Center Barstow, Col. Arthur Sass retired after 30 years in the United States Marine Corps.

Sass, who has commanded the MCB for the past two years, passed the reigns on to Col. Scott Dalke during the change of command and retirement ceremony at the Marine Corps Logistics Base -- Barstow, Yermo Annex.

"I'm looking forward to working with 'Team Barstow,'" Dalke said following the ceremony. He added that his focus will be ensuring that the equipment is prepared and ready to protect those Marines and military serving in combat zones.

Another speaker at the ceremony said that Dalke has the support he needs to face any roadblocks ahead.

"I think you have some challenges, but I think you have the horses behind you to meet each and every one of those challenges," said Maj. Gen. Willie Williams, commanding general of Marine Corps Logistics Command in Albany, Georgia, who spoke at the ceremony.

Dalke, who recently returned from a tour of duty in Iraq, said he is looking forward to spending some quality time getting to know the community and settling in. He and his wife, Sarah, hope to stay in Barstow for about three years -- a welcome change from the constant moving around they've done recently.

A major concern for community members working at the base is the Department of Defense Base Realignment and Closure (BRAC), which could affect the number of civilian jobs on the base.

Dalke said he thinks the Department of Defense understands the importance of the MCLB and its usefulness to the overall mission.

"I think that this last BRAC process recognized the value to the corps to maintain the Maintenance Center," Dalke said.

Leaving behind Barstow and a life in the desert, Col. Arthur Sass will be moving on to Columbia, South Carolina, with his wife, Myra.

He said he believes the legacy he leaves will be one of change.

"My legacy will not be what was accomplished," he said after the ceremony. "It will be what was introduced."

The entire logistics defense industry has been overhauled over the past few years, Sass said, with an entirely different paradigm, such as "lean thinking" and the "**theory of constraints**," two economic means of eliminating waste and increasing production in manufacturing. "New technology, new processes, a new way of doing the business that we do," Sass said. "I think that will be what I leave at the Maintenance Center."

Sass has been in the Marine Corps for 30 years. In the past, Sass has been awarded the Legion of Merit, Defense Meritorious Service Medal, two awards of the Meritorious Service Medal and the Navy Commendation medal. "I am proud to have been here," Sass said. "This is a wonderful community with wonderful people."

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## Jordan Times, Amman, Ammar W. Mango Column

From: [Jordan Times \(Amman, Jordan\)](#) | Date: [September 8, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

Byline: Ammar W. Mango

Sep. 8--The **Critical Chain** Method (CCM) is a relatively new project management technique that dramatically reduces project duration.

The technique responds to risks that cause delays on projects. It removes wasted buffers from the project activities, and manages a project by focusing on the parameters that lead to the project success. It also transforms the traditional mistrust-based attitude between management and team members into one based on trust, cooperation and shared interests.

Results reported by organisations and projects that have used this technique might seem too good to be true. Some reported savings of two thirds of the traditional time that projects used to take them by using this method. This means that a nine-month project can be finished in three.

Before getting too excited about the technique, it is necessary to recognise that it requires full support and commitment from upper management and all other stakeholders on the project. It also requires a major shift in attitude on how to plan and control a project and how to deal with team members and suppliers.

Applying the CCM to a project starts with an agreement between the project manager and management to apply the rules of **critical chain**. They also need to agree on how important it is for the project to save time or finish on time, and accordingly agree on bonuses for team members and suppliers. Bonuses set under this method are based on the ability of the whole team to deliver on time, not on individual performance. This means that no one gets a bonus if the organisation misses on the project's deadline, even if a team member performs really well on his own.

After an agreement is reached with management, the project manager works with the team members to reduce the project schedule or duration by asking all team members to remove safety time they have added to their project tasks. The technique assumes that all team members add time safety to their tasks to deal with risks and with management's traditional negative behaviour in dealing with deadlines and activity duration. In return, team members are offered a clearly set bonus if they meet the set objectives.

To help team members meet the objectives, the project manager adds a buffer to the overall project. This buffer prevents project delays caused by the impact of negative risks occurring during the project. The technique calls on the project manager to allocate as much as one-third of the project duration as a buffer. This is feasible given that the theory assumes that removing activity buffers will save as much as two-thirds of the original exaggerated project duration.

Once the project work is started, the project manager focuses on managing several buffers placed in the project to protect it from risk and loss of critical resources. The project manager trusts team members to finish tasks as soon as they can, and does not penalise a team member for being late on his task. The project manager must trust team members, knowing that the objectives of the team members are completely aligned with those of the project, due to the incentives promised to the whole team, if they finish on time.

There are many other important rules used in CCM. Most of them can be used even if one cannot apply the whole technique. These include how to work with team members and management to eliminate buffers placed by team members on individual activities. Project managers can also learn how to respond to risk by adding a buffer at the project level, not the activity level. Avoiding multitasking is another interesting and valuable concept one can learn from this technique. Multitasking means giving a team member more than one task to work on at the same time. This is considered a bad practice and should not be allowed during the application of the CCM as it leads to project delays. The CCM also encourages focus on critical tasks and resources while accepting the probability of delay, or even forcing delay, of less critical tasks. Results of the proper application of the CCM are very impressive, given how much organisations lose from project delays which lead to loss of market opportunities and revenues.

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## Air logistics center (May 5, 2006): Franz Edelman Award recognizes streamlining efforts.(Acquisition & Logistics Excellence)

From: [Defense AT & L](#) | Date: [September 1, 2006](#) | Author: [Birdsong, John](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

ROBINS AIR FORCE BASE, Ga. -- The Institute for Operations Research and the Management Sciences announced May 1 that Warner Robins Air Logistics Center has won the 2006 Franz Edelman Award for Achievement in operations research for its entry "Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center."

The culmination of a rigorous competition referred to as the "Super Bowl of Operations Research," the Franz Edelman Award brings together the very best examples of innovation in the discipline from large and small, for-profit and nonprofit, corporate and governmental organizations around the world.

Past winners in the 35-year history of the Franz Edelman competition have included GM, Motorola, Continental Airlines, the New Haven Health Department, and the City of San Francisco Police Department.

The 2006 Franz Edelman Award winning entry, "Stream-lining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center," was presented by Ken Percell and Bill Best of Warner Robins Air Logistics Center, Prof. Mandyam Srinivasan of the University of Tennessee, College of Business Administration, and Sridharan Chan-draseskaran, vice president of strategic services for software provider Realization Technologies, Inc.

The winning entry discussed how Warner Robins Air Logistics Center used Operations Research in 2005 to arrive at a radically different approach to manage the repair and overhaul activity on its C-5 transport aircraft.

The air logistics center used an operations research technique called "**Critical Chain**" to reduce the number of C-5 aircraft undergoing repair and overhaul in the depot from 13 to seven in just eight months.

The time required to repair and overhaul the C-5 aircraft was reduced by 33 percent. The five additional aircraft now in operation have generated immediate additional revenue of at least \$49.8 million per year. The replacement value for these aircraft is estimated at \$2.37 billion.

The additional workload the center is accommodating will bring in additional revenue of \$119 million through 2008, with this number projected to increase to \$248 million by 2009.

In accepting the award, Ken Percell, the executive director and senior civilian at Warner Robins Air Logistics Center stated, "Warner Robins is extremely pleased to receive the Franz Edelman Award for our work on reducing flow days for the C-5 aircraft line.

"The results underscore the gains that a proper application of these tools can offer to the Air Force," he said. "This accomplishment should reinvigorate the use of Operations Research in the Air Force and across all branches of the military in general."

"To be recognized by the business and academic communities for improvements we've made at this center, especially with aircraft maintenance operations, is quite an honor," said Bill Best, deputy director of the 402nd Aircraft Maintenance Support Group.

"This is what happens when the most capable people use the most innovative and advanced tools for this highly complex operation," he noted.

**Critical Chain** Project Management is a means of using resources in the most expeditious way possible. The adoption of this management tool has allowed major reductions in flow days. It makes use of the Concerto computer software, which gives a visual depiction of the aircraft, tasks, and status. The lists of tasks are color coded as to urgency, alerting maintainers to the most important things to do.

"On behalf of the entire C-5 enterprise, we are thrilled to win the 2006 Franz Edelman Award for Achievement in Operations Research and the Management Sciences," said Col. David Holcomb, C-5 system program manager. "The use of **critical chain** project management to reduce the time required for depot maintenance is a key element of our plan to increase aircraft availability," he noted.

"The 402nd Maintenance Wing at Warner Robins has executed **Critical Chain** Project Management brilliantly, resulting in additional C-5 aircraft available to accomplish our Rapid Global Mobility mission," Holcomb said.

"This initiative has provided our Mobility Air Forces with five additional aircraft to provide intertheater airlift support to our troops around the world," he emphasized. "The team's outstanding contribution to our nation's security warrants this prestigious award."

The other finalists were Animal Health Institute and Cox Associates; The U.S. Commercial Aviation Partnership, comprising Airports Council International-North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and More Research/Molde University College, and Travelocity and Sabre Holdings.

The Institute for Operations Research and the Management Sciences is an international scientific society with 10,000 members, including Nobel Prize laureates, dedicated to applying scientific methods to help improve decision-making, management, and operations.

Institute members work in business, government, and academia. They are represented in fields as diverse as airlines, health care, law enforcement, the military, financial engineering, and telecommunications.

Birdsong is with Warner Robins Air Logistics Center Public Affairs.

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# Optimizing project portfolios: engineering productivity and effectiveness can be improved by applying the Theory of Constraints.

From: [Research-Technology Management](#) | Date: [September 1, 2006](#) | Author: [Seider, Ross](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

OVERVIEW: Multi-project organizations must carefully balance pressures to commission new initiatives against engineering's capacity to effectively execute the projects. Although absorbing new projects in constrained organizations can devastate overall department performance, few organizations actually measure development capacity or properly evaluate the impact of adding new initiatives on commitments already in progress. This paper describes how Eli **Goldratt's Theory of Constraints** can be applied to the management of a portfolio of projects. A scenario generation technique and capacity visualization model allows executives to anticipate the impact of future constraints and take corrective steps that optimize engineering performance.

KEY CONCEPTS: engineering constraints, project portfolios, engineering capacity.

Organizations have long struggled to reduce the uncertainties of new product development. Numerous knowledge sources have validated management's heightened attention to the truly debilitating costs of product slippages, launch failures and reduced market penetration. For example, a study by PRTM Inc. found that 70 percent of companies it surveyed were dissatisfied with their results in managing new product development (1).

Countless papers have been written on improving project execution, but relatively few provide guidance to executives trying to manage resource conflicts arising in multi-project environments. Enterprise resource planning (ERP) software and development chain management (DCM) tools are expensive, address broader business issues and do not provide much insight into this particular problem. Project management software (e.g., MS-Project) provides some capacity management tools, but is clumsy to use and not helpful in communicating results to operations management. In short, there are few tools or metrics associated with project portfolio management or development department utilization that are useful for real-time decision support.

Eliyahu **Goldratt** is generally credited with the mathematics and concepts behind the **Theory of Constraints** (2). His work describes how to optimize the performance of complex systems through management of critical constraints. This paper applies his techniques to a portfolio of engineering projects. It suggests metrics of development capacity and a capacity-modeling procedure that identifies both constraints and under-utilized assets. It discusses an interactive tool that evaluates different portfolio scenarios. Use of similar tools has reduced chronic planning miscalculations and improved the performance and predictability of engineering teams.

## Constraints

A development organization decomposes into collections of assets with differentiated skills and capabilities. (In this context, assets can be people or capital equipment). Some assets are dedicated to a single project while others are shared among multiple projects. But even people dedicated to a single project can have legacy responsibilities that can interrupt their focus and progress. Constraints are not static. Assets constrained during one time period may be different from assets constrained in another.

At the concept level, the **Theory of Constraints** describes a dynamic shown in Figure 1. For a multi-project development organization, increasing project load forms the X-axis and increasing results forms the Y-axis. At modest loads, the organization is under-utilized and the delivered results can linearly track increases in load. This relationship continues until the first constraint is reached. At this point the organization's ability to deliver results in additional projects begins to flatten. Somewhere near this point, the total delivered result peaks (arrow). If projects continue to be added, inefficiencies due to multitasking and inter-project interference occurs. More assets become saturated. Soon, delivered results decline. The **Theory of Constraints** demonstrates that the decline begins well before the 100 percent load point (represented by the dotted line).

[FIGURE 1 OMITTED]

A good analogy is a superhighway. The theoretical maximum traffic load on a multilane superhighway is greater than the actual sustainable traffic load. As traffic flow approaches the theoretical maximum, any driver touching his brakes, or slowing down, will result in the cars around him doing the same. This collective behavior creates traffic oscillations, i.e., variations in flow familiar to anyone who has driven in heavy traffic. The net sustainable volume flow stabilizes at a point well below the theoretical limit. If additional drivers attempt to enter the highway, the volume flow is further reduced.

The **Theory of Constraints** describes how to best attack a multiplicity of constraints. It requires management to focus on and break through the most constraining limitation. Until this is accomplished, effort spent on overcoming secondary constraints will yield no business benefit. These principles can be applied to managing a portfolio of projects in an organization facing constraints on its ability to perform the work.

A study of 205 companies by Cooper, Edgett and Kleinschmidt, found that many organizations "... have too many projects underway, given the level of resources. This explains, in part, why so many projects deliver behind schedule." They observed that metrics on project portfolio management were "... the weakest of six commonly used development measurements...." at these companies (3).

Other studies have noted that an organization's culture often drives development demands beyond the 100 percent point. Development managers frequently succumb to management pressure and over-commit their teams when just the opposite behavior may be called for. While counter-intuitive, organizations operating in the regions to the right of the arrow would achieve better results from 1) stopping work on some projects, or 2) delaying the start of new projects.

### Productivity Effects

Most multi-project companies create development teams that include shared resources, frequently centralized services or areas of particular technical expertise that the project needs for a short period. Even engineers assigned fulltime to a new project are, in practice, part-time as they have residual responsibilities from previous programs. Project planners have long understood the need to "derate" the anticipated productivity of staff assigned to their project based upon other responsibilities. They also strive to compensate in their planning to account for shared resources that may not be available in a timely manner. Unfortunately, their visibility into upcoming conflicts is limited in organizations that do not manage the engineering project portfolio, so nasty surprises can occur despite their best efforts.

Untimely availability of an upstream resource can cause exponential degradation of a project, especially if critical path tasks are forced to spin their wheels. In a study of project postmortems conducted by the author's business unit at Motorola, untimely availability of assets was the third most frequently cited cause of schedule slippage (4). Other studies of project failures show a similar result.

As development organizations face increasing workloads, they begin to multi-task. Multi-tasking causes well-understood losses of effectiveness. Gerald Weinberg found that engineers multi-tasking across two simultaneous programs lose 20 percent of their effectiveness, and engineers multi-tasking across three simultaneous projects lose over 40 percent (5).

Loss of productivity and availability are not the only effects. Chronic overloading can cause team burnout, lack of competitiveness, increased turnover, and lower creativity. If new product development is one of the "engines" of the business, it is critical that it run effectively and creatively.

### Current Portfolio Management Practices

There are two common practices used to manage development capacity. The first is closely linked to the corporate budgeting process and the second is done as part of the product development lifecycle. For different reasons, neither works especially well, particularly in fast-moving environments.

Well-managed organizations spend considerable effort during budget-setting time balancing their product portfolio strategy with their capacity for new product development. This effort has a financial focus, but it serves to test the affordability of the product strategy and the development tactics to be employed to achieve the desired results. The success of this effort varies, but in many cases falls short for one of the following reasons:

\* Once-a-year evaluations may be too infrequent. Business conditions change, rendering planning assumptions obsolete, sometimes before the ink dries on the current plan.

\* The evaluation doesn't fully consider engineering overhead activities. Because the planning has a revenue focus, the bulk of management's attention involves new revenue opportunities. Planning assumptions and set-asides for factory support, cost reduction, quality improvement, etc., are not scrutinized.

\* Too many projects are priority ones; more granular development scenarios aren't considered. There may be more subtle scenarios where better results are delivered. If analyzing the scenarios is complex or time consuming, different approaches may not get evaluated properly.

\* Constraints are not identified or challenged. Planning activities should identify constraints and workarounds suggested. A small change in constraints may yield dramatic improvements in performance.

The second common practice complements the budgeting process. It strives to manage development capacity in "real time" as part of the enterprise's product development lifecycle, for example, within a gated development process. A gated development process requires business go/no-go reviews at different points (gates) in a development life cycle. The purpose of the business review is to ensure the project continues to meet the corporate goals. In principle, this review ought to include project portfolio management decisions; in practice, there are systemic characteristics of gated development processes that make them relatively ineffective in managing capacity:

\* Gated development reviews are performed serially, one project at a time. Evaluating a project's interaction with other projects requires a parallel perspective.

\* Gated development reviews are not usually conducted for overhead projects and activities. Because such efforts do not generate revenue, customary business justifications are less useful in deciding their merits. Senior sales and marketing management executives rarely get go/no-go votes into these efforts.

If resource capacity is not rigorously considered in gate reviews, more projects tend to be commissioned than the organization can execute efficiently. The gated development process becomes part of the over-load problem rather than part of the solution.

PRTM has found that gated development reviews often degenerate into a process checklist verification exercise rather than an activity that drives business tradeoffs. Analyzing and making portfolio decisions takes more time and focus than project gate reviewers can afford. Often the individuals most capable of making the portfolio tradeoffs are not the same people as the executives conducting the project gate review.

## Scenarios

Project portfolio management requires a blending of sales, marketing and engineering strategies and tactics. It is best accomplished using scenario analysis and visualization models. Good visual models can reduce complex system behaviors to relationships more easily understood by practitioners and executives. Interactive visual models are helpful in evaluating one scenario versus another.

For any portfolio of projects there are many reasonable implementation scenarios. Having an effective visualization model allows scenarios to be more easily evaluated. An easy-to-understand model allows non-development groups to bring different expertise into the analysis. These groups benefit directly by gaining greater insight into constraints in the development chain. As a result, team decisions are better thought out and better understood by the organization.

A well-built portfolio management model makes all key management "levers" available to scenario builders. "What-if" questions can be rapidly analyzed and further refinements tried. The model must support all types of projects (revenue producing and non-revenue producing) as well as overhead activities that reduce the throughput of product development. The model should drive explicit decisions on project priorities as well as changes in staffing; it should clearly identify key constraints.

The model described below uses both color and geometry to represent the results of a given scenario. Color indicates the availability of assets to meet a project's needs, and the geometry represents the degree to which the utilization of asset types is balanced across asset categories. Simple models can be built quickly with standard Excel conditional formatting capabilities, while more sophisticated models require custom macros, Visual Basic for Applications (VBA) coding and more development time. The models presented below illustrate that key insights can be gained from simple capacity views of a portfolio.

## Portfolio Views

Figure 2 presents a traditional (and simplified) schedule view of a project portfolio. This summary view might be developed during a yearly planning effort. It shows two engineering projects underway in the current year, both extending into the upcoming year. One of these projects (project B) will complete in quarter one, and three new projects will start (projects C, D and E). The end dates suggest times when incremental revenue might be obtained.

[FIGURE 2 OMITTED]

The schedule-oriented view, useful for financial planning purposes, is ineffective in representing the operational constraints occurring with engineering. This view may not include all activities underway within development, for example, training, factory support, etc. It does not describe whether each project is fully staffed and running at full speed, or whether non-revenue considerations were important in creating the mix of projects. In contrast, a capacity management view focuses on one particular time period and more deeply examines project and resource dynamics. For the sake of discussion, Figures 3 and 4 (again, simplified) depict the potential development activity being considered in the upcoming first quarter.

[FIGURES 3-4 OMITTED]

Development assets form the spreadsheet columns. The amount of the asset (headcount) on hand, and the units of capacity are shown beneath the heading. The units can be in staff-days, staff-weeks, machine-hours, etc. Each project consumes a spreadsheet row. The project's need for resources during the quarter is numerically characterized in the intersecting column and row cell. The project's hierarchy in the spreadsheet represents the project's business priority to the company. The gray background represents when the available resources run out or when a project is constrained. The geometry formed by the gray color's edge represents the asset utilization balance across the asset types. A flat geometry represents even utilization while a hilly geometry represents an uneven utilization. Scenarios that have flatter geometries represent a better workload-balanced organization.

Applying the model to the project portfolio described in Figure 2 yields the first scenario, Figure 3. This view shows more details of the pressures and constraints faced in the first quarter. For instance, the on-going demands of projects A and B consume much of the quarter's resources. Projects C, D and E do not commence cleanly.

They face constraints in four different resource groups (App, CAD, SQA and Doc). Projects F-J make no progress during the quarter. They may be very desirable projects, but the resources are virtually fully consumed with higher priorities.

Figure 3 may not represent an acceptable implementation of the enterprise's first-quarter plans. As much as senior management may desire, projects C, D and E cannot be fully supported without some change in constraints. Planners might question how the scenario could be improved with a different set of development tactics. The view clearly shows the organization's most critical constraints, and other constraints likely to limit the results of alternative scenarios. The hilly geometry indicates a degree of underutilization of total assets. Planners might investigate the following alternatives:

- \* Hire additional resources.
- \* Shift resources from one group into a constrained group.
- \* Maintain the project hierarchy and resources, and adjust the project plans and schedules to account for delayed ramp-up's of projects C, D and E.

\* De-prioritize project C below projects D and E.

The last alternative is depicted in Figure 4. It shows that projects D and E are now able to start up cleanly. Project C is de-prioritized and would receive little attention during quarter one. The resulting geometry is considerably flatter. Based solely on capacity considerations, this scenario might represent a better operating plan for the first quarter. To decide, the full business implications must be evaluated.

The analysis of scenarios and their business-wide implications is an activity that must involve sales, marketing and engineering (and may involve manufacturing, service and finance). While "real life" scenarios are considerably more complex than this example, one can observe how the capacity management model provides a comprehensive view, enabling all functional groups to meet and discuss alternatives.

Beyond identifying constraints and workarounds, a project portfolio management process can reveal other important dynamics. For example, the level of resources being consumed by poor product quality, or customer support and factory support expenditures, is often a shock to executives. Discovering that a high-priority project is not fully staffed or that "urgent activities" (marketing support, factory optimizations, sales support, etc.) are getting in the way of important "strategic developments" can be an ugly surprise. The good news is that once the surprises are brought to light, decisions to change tactics can gain traction and executive support.

Also, project portfolio management results can provide crucial guidance to project managers in improving the predictability of their project plans. Rather than assuming the availability of shared resources, they can create schedules and contingencies that better represent reality. For on-going projects that are not fully funded in a planning period, astute project managers can sometimes recover schedule in later periods, especially if the critical path is not impacted.

### Distributed Capacity Management

A portfolio management process is highly cross-functional and typically led by the senior operations manager. It is a comparative, scenario-based process intended to drive resolution of constraints and priority conflicts. It serves to validate that plans and tactics employed are consistent and achievable.

The iterative/scenario-based method can be challenging to manage. Hundreds of different scenarios might exist. Subject matter experts might be better able to analyze alternatives than functional managers. For efficiency, one would prefer to decentralize analysis, with conflicts resolved centrally. Most project tradeoffs are straightforward and can be made in a rapid manner. But some represent boundary conditions or cross-group constraints that require a focused, efficient and rapid resolution method. This is where senior management attention should be most valuable.

Project portfolio management is a "zero-based" activity. For each iteration, projects must re-establish their value and importance relative to every other existing or proposed new project. The model forces a project prioritization to take place. Getting multiple product-line managers or business-unit general managers to agree on a business-wide prioritization is challenging, but, once done, proves highly valuable to the organization.

While the process is being executed, it is intense and consuming. Because the process evaluates the entire portfolio, it can involve many in middle management and most of the company's subject matter experts.

The process should be run at regular intervals--Nannually for some companies, quarterly for others. The need for efficiency is particularly important the more frequently it runs.

### Avoiding Pitfalls

Executing the capacity management process in larger organizations frequently requires employment of loosely coupled teams, each expert in their particular market segment or product set. When the process is driven in this distributed, rather than centralized, manner it facilitates execution speed and precision. But these benefits can be jeopardized if the teams base their decisions on inconsistent assumptions. To compensate, the senior operations manager should provide extensive starting guidance to the process participants. This guidance should eliminate impractical scenarios from consideration and

establish global common assumptions, for example, hiring allowances, permissible assets movement during the planning period, and non-negotiable activities and projects.

A distributed process requires distributed team leadership. Because both technology and business experts may be involved, it is important to avoid conflicts of interest. The team leader has a full-time job elsewhere. The fulltime accountabilities should not color the portfolio management decisions being made. If these issues cannot be controlled, a different leader would be a better choice.

Another pitfall to avoid is biased effort estimations. Estimation inaccuracy can arise from honest differences among engineers, or from more insidious behavior arising from personal agendas. Such behavior could impact the integrity of the capacity planning process. Having estimates reviewed by subject-matter experts and senior staff reduces the likelihood of bias. Comparing estimates to alternate sources of project data is another mitigation.

Bias in the form of "pet projects" or protected activities can distort the project rankings. To the extent possible, objective business criteria should drive the project priorities. If both the objective criteria and the resulting rankings are reviewed with sales management and senior executives, the impact of bias can be mitigated.

Team leaders must also recognize when a scenario is "close enough." Understanding the point of diminishing returns takes experience. Different team leaders will frequently disagree on when this occurs. Thus, during the first few cycles, the senior manager must monitor this dynamic closely. Enforcing a deadline drives conclusions that are probably "close enough."

Once the planning cycle is concluded, implementation can proceed with confidence in the project's priority and resources. The plan of record should be frozen and new projects and scenarios placed in a queue for consideration during the next planning period. If a new idea requires immediate attention, the interactive model allows for quick evaluation of the proposed idea's impact on the projects already underway.

Deciding to absorb new projects into the existing portfolio of work injects new risks and inefficiencies but is sometimes necessary. If this occurs frequently, management should shorten the planning period and increase the frequency of the process.

Finally, at the start of the next capacity management planning cycle, it is useful to critique the most recent plan against what was actually accomplished. Organizational learning can make subsequent cycles more effective, efficient and timely.

#### Bottom Line Benefits

1. Accountability.--At the conclusion of the process, the operations team has converged on a plan that has been measured and modeled against other potential scenarios and represents a well-considered set of business tradeoffs. Multiple groups have participated in the plan's generation and the results have been communicated to senior management. If adhered to, project slippages due to unplanned resource constraints should be virtually eliminated.
2. Synchronization of the organization.--The organization has bought into the portfolio of projects and understands the constraints that drove the decisions. All groups understand the relative priority of each project and which projects are not to be addressed.
3. Residual constraints are accepted by the organization.--Executives understand the remaining constraints and will avoid commissioning new projects that overstress these assets.
4. Planning documentation can be reviewed at the beginning of the next cycle.--The team can measure its achievements versus the plan and evaluate ideas for continuous improvement.

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# Manufacturing intelligence vendor taps lean components to ease production bottlenecks.

From: [Manufacturing Business Technology](#) | Date: [September 1, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

By Staff

Manufacturing performance management vendor Activplant claims to have discovered a simple way to eliminate production bottlenecks by combining elements of Eliyahu **Goldratt's Theory of Constraints (TOC)** and the Toyota Production System.

The combination is necessary, says Dennis Cocco, chief product strategist, because most production-management approaches, including TOC, address the process of managing constraints once they are identified, but don't always reveal the best approach for actually finding the most critical constraints.

Cocco says Activplant encapsulated its methodology for finding constraints in a software application called Throughput Analyzer, which generates what Activplant calls the Throughput Capability Metric--a measurement that the vendor wants to patent.

"In manufacturing, identifying constraints traditionally is done by monitoring buffers to see which ones are backing up," Cocco says. "But the buffers aren't always placed in the correct locations to help identify constraints. The variable and seemingly random nature of shop-floor activities makes it almost impossible to understand and pinpoint chronic constraints."

Enter the Toyota Production System and the idea of one-piece flow.

"In theory, you achieve maximum throughput on an assembly line if you eliminate all buffers," Cocco says. "If you pace all the machines to Takt Time [the daily production number required for filling orders in hand divided by the number of working hours in the day], you will have maximum throughput, but that's an ideal."

Throughput Analyzer assumes that every machine is a constraint and measures it against that idea of one-piece flow. The application collects a few pieces of data from each machine and then gauges each machine's performance against the overall plant Takt Time. The resulting numbers are the machines' throughput-capability metrics.

"What happens is that the true constraints will surface, because they will have the lowest throughput capabilities," Cocco says. Once the true constraints are identified, Activplant determines why individual machines have become constraints.

Generally, Cocco says, it's one of four reasons:

A machine is running too slowly.

A machine is producing parts at less than optimal quality.

A machine's uptime numbers are lower than desired because set-up or changeover times are too long.

A machine is shut down too often due to equipment failure.

Once isolated, Cocco says, it's easier for users to devise strategies for eliminating constraints. He claims early adopters of Throughput Analyzer experience throughput increases of 10 percent to 25 percent.

Julie Fraser, principal at research firm Industry Directions, Cummaquid, Mass., calls Throughput Analyzer a breakthrough in manufacturing intelligence. "It not only lays out an important key performance indicator [the throughput capability metric]," she says, "but it does so by gathering only a few simple data points."

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## Using incentives to reduce overtime expenditures.(COST REDUCTION)

From: [Defense AT & L](#) | Date: [September 1, 2006](#) | Author: [Campbell, Regan H.](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

Chief of Naval Operations Adm. Michael G. Mullen has stated that "our need for reinvestment dollars has never been more acute." Because of this, the Navy has been exploring ways to reduce costs. One means is through the implementation of Lean Six Sigma, the Theory of Constraints, and value chain mapping. These concepts, rooted in the Toyota business model, are designed to reduce costs and remove constraints that prevent the completion of work in a timely manner. In implementing these processes, the Navy has identified a number of goals for the various commands and field activities. Specifically for the public naval shipyards, the Navy has mandated three goals:

[ILLUSTRATION OMITTED]

1. All availabilities on or ahead of schedule
2. All availabilities reduce cost by 25 percent
3. All availabilities reduce overtime to between 5 and 10 percent.

These goals are aggressive relative to the current performance of the public shipyards; however, a number of initiatives have been developed to help the shipyards meet them, and these initiatives are being institutionalized in cooperation with the four public shipyards.

### The Daily Priority List

One of the major initiatives developed to achieve the goals is the daily priority list. The DPL, based on Lean Six Sigma and Theory of Constraints principles, is designed to foster timely completion of events with little multi-tasking (finish what you start) and quick resolution of problems. In this system, the schedule is the key input, so it must be continually updated and refined to reflect an accurate picture of the project. The DPL is designed to identify the shipyard- and project-specific priorities from the schedules so that the critical chain items (those that have the least amount of buffer in the schedule) can be addressed for every project in the shipyard. Prioritizing work will allow the resources to be allocated to the right project(s) for the right task(s) at the right time. It will also reduce the costs, as overtime will be limited to those tasks that impact the **critical chain**. Clearly, the DPL tool seems appropriate for meeting the goals identified: projects ahead of schedule and under cost with reduced overtime. In fact, several availabilities completed recently that used the DPL were delivered early and below their allocated costs, among them USS Stennis, USS Nimitz, and USS Jackson.

Although there are merits to using the DPL on projects and within shipyards, there could be a major problem with its long-term implementation: the reduction of overtime at the shipyard. Specifically, the goal is a reduction of overtime from ~ 30 percent to between 5 and 10 percent. The reason for this reduction is that overtime in excess of ~ 10-15 percent is not budgeted, and there are no funds to be allocated to cover the additional costs associated with increased overtime.

Overtime is sometimes looked upon by industry as a means to avoid the high costs associated with hiring and training new employees, especially for a short-term workload requirement. However, if the workload requirement is long-term, then the use of overtime increases costs, since employees are typically paid at the rate of time-and-a-half instead of straight time.

At naval shipyards, a lack of resources frequently necessitates working overtime for extended periods of time, which defeats the purpose of using overtime as a cost-saver. Portions of this overtime are spent on noncritical jobs that have a great deal of buffer in the schedule. To understand the magnitude of this change, consider a "typical" submarine engineered refueling overhaul, which takes approximately 400,000 worker days to complete. Of those 400,000 days, 120,000 (30 percent) are performed as overtime, with workers receiving time-and-a-half. Reducing the amount of overtime by 80,000 days to 10 percent by hiring more employees and converting the work from overtime to straight time would save \$16 million, which could be considered the cost of avoidable overtime.

[ILLUSTRATION OMITTED]

## How to Handle Overtime

From the perspective of an economist or game theorist, providing time-and-a-half for overtime work can be seen as creating a financial incentive for employees to be less productive during regular working hours. This could be an unconscious response or a more formalized response from a union, such as a slowdown (in which work progress is deliberately slowed) or a work-to-rule tactic (in which workers perform their tasks exactly as they are required to but no better).

Some managers state that the workers should be happy with reduced overtime because it provides them with more time with their families. Although this may be an incentive for some, it is not an incentive for all—for one thing, not everyone has a family. At the Navy's shipyards, many blue-collar (and some white-collar) workers depend on overtime pay to maintain their quality of life. Many prefer overtime to a second job because it provides them with more competitive pay and does not necessitate their learning new skills. Overtime is a very real part of the blue-collar culture; these employees have expectations about the level of overtime they will work when they take a job. As such, a reduction in overtime is not an incentive to these workers; in fact, it is a disincentive and may actually be seen as punitive.

Some managers believe that overtime is a privilege given by management to meet their needs, not a right. This may be true, but it doesn't provide employees with the motivation to keep performing at an efficient and effective level. In fact, by not acknowledging the desire for overtime, naval shipyards may inadvertently cause employees to work less efficiently, so in the long term, the strategy of not acknowledging the desire for overtime may lead to reductions in performance and morale at the naval shipyards.

## Implementing Effective Incentives

Clearly, if we expect the DPL initiative to work, we need to implement effective incentives that are structured so that employees can realize the benefits in a reasonable amount of time because they will benchmark against receiving overtime funds in their paycheck every two weeks. In other words, using an incentive that will reward workers at the end of a two-year project will likely not foster the results the shipyard is looking for, whereas rewarding workers every quarter or every six months may foster positive results. The Navy (and the rest of the DoD) has experience with this, as many contractors who have incentive contracts are rewarded for performance every six months.

There are a number of ways to provide incentives that can promote a strong work ethic by making individuals aware that there are consequences for poor quality and rewards for great work. Incentives can be in the form of major corporate awards (e.g., Navy Superior Achievement Award) or in terms of individual raises and bonuses for early completions. Funds could also be designated to purchase new equipment requested by the shipyard. The Navy often uses these types of awards to promote performance. Financial rewards can be very powerful means to motivate but may put a strain on the Navy's finances, particularly since we are trying to cut costs. However, when compared to the cost of an overrun on schedule (it is estimated that each additional day of work in a naval shipyard costs \$100,000), it may be worthwhile to use bonuses to ensure timely or early completion of projects.

Other nontraditional means of rewarding employees include providing additional vacation days, parties at milestones, additional training so employees can develop different skills, and educational opportunities such as college classes.

Additional vacation or reduced work hours allow employees to spend more time with their families or on hobbies. It would require a financial commitment from the Navy to support this effort, which may be difficult to achieve in a cost-cutting environment. However, as mentioned above, the cost of this expense would be substantially less than the cost of a project overrun.

Low-cost incentives are a party, picnic, or other celebration at the successful achievement of a milestone. This not only recognizes the success of the group, but also provides an opportunity for team building. Team cohesion and team success can be powerful motivators for employees if they believe in the team leadership and the team mission. Once team cohesion is achieved, employees are willing to work hard for verbal praise or small tokens of recognition.

Providing training to naval shipyard employees to enable them to build upon pre-existing skills or learn new skills can increase workers' promotion potential or marketability. It could also allow employees to switch to different shops or codes

that have better conditions or career progressions. Finally, it could afford some employees the opportunity to train for nuclear positions at the naval shipyards, which tend to pay better than non-nuclear positions. These training opportunities could be offered at a relatively low cost through the training commands already located at the shipyards.

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Offering new educational opportunities can also increase the promotion potential and marketability of an employee. Educational opportunities could be offered in two ways: providing more college classes at the shipyard or certifying the skills already learned for college credits. Both of these initiatives could be spearheaded by the training commands. Providing additional college classes at the shipyard should be a relatively low-cost incentive, as the training commands already offer some college classes. In terms of additional college credits, the only cost to the Navy would be the additional paperwork and effort to certify classes as having been satisfied. Thus, both are potentially very good alternatives to consider.

### Culturally Appropriate Incentives

Depending upon the naval shipyard and its internal culture, some of the specific incentives listed above are likely to be more successful than others. For instance, employees at Naval Shipyard A may be more concerned about financial rewards because the cost of living in that area is higher than at Naval Shipyard B. Given these local differences, a shipyard should be authorized--within constraints--to determine what motivates its employees. In fact, different projects at a shipyard may need to use different incentives, based on the composition of their respective work forces. Projects should be given the latitude to decide what incentives work best for their employees. It will take some time to formalize these details; however, any start in incentivizing will likely save the naval shipyards time and money in the long run, as employees will maintain their motivation to deliver quality products in a timely manner.

Perhaps incentives will be less of a concern in the future, as new employees in the naval shipyards are not socialized in a culture that requires overtime. At that time, it may be possible to reduce incentives. At present, however, it is crucial to explore options for ensuring continued performance from our existing employees so that we can maintain the knowledge base and talent at our shipyards. By instituting incentives, the Navy can ensure that the naval shipyards are able to meet the goals outlined by Naval Sea Systems Command: reduced overtime, reduced costs, and successful completion of work in the scheduled time.

The author welcomes comments and questions. Contact her at [regan.campbell@navy.mil](mailto:regan.campbell@navy.mil).

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## Smart Operations 21 office formed at Pentagon.(In the News)

From: [Defense AT & L](#) | Date: [September 1, 2006](#) | Author: [Lopez, C. Todd](#) | More results for: [Goldratt or "Theory of Constraints"](#) or ["Critical Chain"](#)

WASHINGTON -- In February, Air Force leaders created a new program office at the Pentagon that will take the lead in optimizing the way the Air Force conducts its mission.

The Air Force Smart Operations 21 office, created in response to an initiative by Secretary of the Air Force Michael W. Wynne, will look at process improvement across the Service.

The new office provides top-level guidance for implementing AFSO21 initiatives. These initiatives will enhance a mindset in the Air Force that is already geared toward innovation, said Brig. Gen. S. Taco Gilbert III, director of the Air Force Smart Operations 21 office.

"The Air Force has always fostered a culture of innovation," Gilbert said. "We are trying to take that culture of innovation to the next level, where we look at all the processes involved in what we do. We look at not doing more with less, but at being smarter about the way we are doing business--eliminating work that is unnecessary. We have tried to capture lessons learned from industry and government agencies involved in process improvement."

Senior leaders designed the program specifically for the Air Force, and it is based on similar industry process improvement practices like Lean, Six Sigma, and **Theory of Constraints**.

"Air Force Smart Operations 21 is a term coined by Air Force senior leadership to represent not only a program to institutionalize continuous process improvement, but also to describe a new way of thinking about the Air Force," Gilbert said. "We want to be smart about the things we do for the future."

Process improvement involves looking at the way something is done, from beginning to end, and determining how it can be done better. By outlining a process, people can then look for redundancies and "non-value added work" to eliminate.

Non-value added work is that which adds nothing to a process. Examples could be forms that are filled out unnecessarily, or excessive travel to get replacement parts when it would be more practical to house those replacement parts at a work center, Gilbert explained.

Even after teams apply initiatives to a process and improve it, there is still more work to do, Gilbert said. Every process can continue to be improved and more waste can always be found. Continual process improvement is the nature of AFSO21.

"This isn't about a one-time pass and you're done," he said. "It's a continual process. After you go through once, you then examine the same process again and again. Generally, you find every process will require review four or five times and each time you find more to eliminate or that can be streamlined."

Gilbert said Air Force leaders have identified 10 main processes divided into three areas: governing, core, and enabling. The processes are: planning and executing strategic initiatives, managing processes and programs, developing and sustaining warfighting capability, deploying personnel and materials, conducting kinetic and related operations, conducting non-kinetic and related operations, caring for people, providing information support systems, caring for infrastructure, and managing financial resources.

Each of the processes has several sub-processes. In actuality, there could be thousands or tens of thousands of actual processes used in the Air Force to accomplish specific parts of the overall mission. Each one, no matter how small or large, can be improved, Gilbert said.

"Every process we have needs to be improved," he said. "Even in world-class organizations, you find that 60 to 70 percent of the activity in a particular process is waste--activity that doesn't add value to the overall output."

The Air Force logistics community has been applying AFSO21-type improvements to its own processes for years now, long before the Air Force decided to initiate AFSO21. That community found great success in applying Lean practices to processes like depot maintenance and engine repair, Gilbert said.

For instance, in KC-135 Stratotanker depot maintenance, Air Force Materiel Command returned an additional 100 aircraft to the operational fleet by applying AFSO21 practices. With C-5 Galaxy aircraft, they reduced overhaul time from 339 days to just 171 days.

At U.S. Air Forces Europe, the commander chartered a team to look at consolidated telephone operations. The command employed 77 telephone operators, including some working under a \$600,000 contract at Incirlik Air Base, Turkey. The team looked at the full range of processes associated with telephone operations and found ways to consolidate and streamline them.

The result was to eliminate inefficiencies through consolidation, reduce the manpower requirement to 65 operators, and eliminate the need for the Incirlik contract, Gilbert said. The process improvements will not only produce \$2.4 million in savings over the next seven years, they will also generate better standardization and services across the command.

While such an improvement proves an immediate benefit to the command's telephone operations, a larger benefit is realized when considering where those savings can be applied, Gilbert said.

"The real benefit from changing those processes is seen when you look at what it means for USAFE operations in general," he said. "If we can cut down on the contract and operations costs in a variety of these areas, we're talking about real savings that will translate into increased combat capability for the future."

By using AFSO21 initiatives, process times can be reduced, so work can be done more quickly. And by reducing waste in processes, resources like money, time, and people can be freed up to do other work, Gilbert said.

The AFSO21 office is in the process of creating the guidance for implementing continual process improvement across the Service. In addition, at each major command and Air Staff function there is a colonel or brigadier general designated to support AFSO21 operations and initiatives.

The office will also help develop training for those who need it, as well as create ways to ensure the AFSO21 mindset is encouraged throughout the entire Air Force, he said.

Gilbert said that while formal implementation of AFSO21 practices across the Air Force have just begun, he doesn't believe it will be short-lived or ineffective as other process improvement programs have been in the past.

"We have found that even skeptics, after they have participated in an AFSO21 event, come away convinced there is real possibility here, that there was a return on investment, and that they had an impact," he said. "AFSO21 is about a mindset for the 21st century. This is not a short-term program--it is a program to fundamentally change the culture of the Air Force for the long haul."

Staff Sgt. C. Todd Lopez, USAF

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## The art of lean program management.(PROCESS)

From: [Supply Chain Management Review](#) | Date: [September 1, 2006](#) | Author: [West, Mary](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

Tired of spinning your wheels on lean, Six Sigma, and other improvement projects that go on and on while producing precious few results? Then you may want to put in place a business discipline called lean program management. Essentially, it's the art of applying the principles of lean, Six Sigma, and constraints management to the actual management of those improvement projects.

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Currently, the two most popular business improvement programs are lean and Six Sigma, which increasingly are being combined into an approach called lean/Six Sigma. But many organizations' long-term efforts to apply those programs are running into difficulty. In many cases, these programs are running out of momentum--and in some cases, they have actually ground to a halt.

On the face of it, such difficulties are hard to imagine. After all, Six Sigma drives improvements in quality and reliability by reducing variation using a problem-solving methodology known as "DMAIC" (define, measure, analyze, improve, and control). And lean focuses on eliminating waste in new product development, manufacturing, and distribution in order to cut lead times and investment, increase flexibility, and reduce costs. Lean involves using as little as possible of the available resources--including time. What's not to like about lean or Six Sigma, and what could go wrong with them?

Plenty, as it turns out. Despite the increasing popularity of Six Sigma as an effective improvement methodology, many Six Sigma projects fail to deliver the expected results. (1) Similarly, some observers maintain that the vast majority of companies that have launched lean implementations have failed to see significant financial results. (2) These problems are not isolated to lean and Six Sigma initiatives. According to one study, 43 percent of performance improvement initiatives undertaken from 2002-2005 by the companies surveyed failed to achieve the strategic business and financial objectives that the initiatives were designed to support. (3)

Another problem is that these programs are seen as taking too long to produce meaningful results. The most often-cited complaint about Six Sigma is the long project cycle times. (4) It is estimated that most projects last six to nine months or even more (5)--an obvious opening for lost opportunity cost. (A project that yields \$25,000 per month in improvements leaves \$150,000 on the table when it takes ten months versus four months to complete.) Yet quite a few organizations have begun programs that take years before they see big improvements. The fact is most companies invest in improvement programs expecting to see fast and sizable changes. When the competitive landscape changes so quickly and dramatically, they simply cannot wait months or even years to see benefits.

As explained in an earlier issue of Supply, Chain Management Review (see "How Constraints Management Enhances Lean and Six Sigma," January/February 2006), many implementers of lean and/or Six Sigma programs find themselves faced with too many projects that take too much time with too little benefit. They spread their resources thinly rather than concentrating on the key levers--or constraints--of the organization. Managers complain that they don't know' which projects are "important" and which aren't. Aggravated by lengthy implementation times, the sheer project volume has led to "project fatigue," as managers get anxious about seeing results and worry about doing their "day jobs" well. Things only get worse when overextended projects are killed and replaced by new ones that eventually meet the same fate. Disillusionment and poor participation rates are not far away.

Several progressive companies have found a way out. They are utilizing a discipline that the authors call "lean program management" (LPM). LPM encompasses both strategy and execution. Essentially, it calls for applying lean and other improvement principles to project selection and execution themselves. Executed correctly, project selection can pave the way to a high return on investment, sustained leadership commitment, and long-term success. According to Larry Bossidy, author and former chairman of Allied Signal and Honeywell, "Execution is the missing link between aspiration and results." Picking the right projects doesn't matter if you are unable to execute them successfully. This article will detail the principles of the LPM approach as applied to both project strategy and execution, including several examples from successful companies.

## Examining the Strategic Context

Let's assume, for simplicity's sake, that the improvement programs are lean/Six Sigma (LSS). It is important to examine the strategic context for lean program management. We have identified five prerequisites:

Prerequisite 1: Improvement programs must align with the company's strategy and objectives.

Too many companies push "pet" projects instead of allowing business needs to drive project selection. As a result, key staff members do not work on the projects that bring the most value. To avoid this problem, the company's executive leadership must define the objectives of any lean/Six Sigma program and communicate them clearly and consistently throughout the organization prior to launching the program.

Many successful programs are based on a "burning platform," or a major business challenge that the company can overcome only by applying LSS. An example of a burning platform might be a need to retain customers or to introduce new products or services faster than the competition. By identifying a burning platform, the company ensures that every business leader is clear about why the company is adopting LSS principles. It is fundamentally important that the CEO and other executives speak with one voice about that platform.

Another technique for aligning Six Sigma programs to corporate strategy is a discipline called policy deployment or hoshin-kanri. Bank of America has excelled at using this alignment discipline to plan and execute its Six Sigma program. (6) Policy deployment ensures that all of a company's constituent parts face in the same strategic direction. For the planning phase, Bank of America executives named the most important strategies and communicated them over three pages. The first page covered the "what"--the vision, mission, goals, and the three-to-five-year breakthrough strategies. Page two dealt with the "how"--the 12-month tactical plan and key performance metrics. And the third page addressed the balanced scorecard--the performance measures that the company needed to track monthly progress against its benchmarks.

These performance metrics must be clearly defined by senior management. Without clearly defined success measures, it is impossible to have projects finish on time or to anyone's satisfaction. It is important to "begin with the end in mind," as author Stephen Covey prescribes.

Projects that don't align with a company's strategy can also hide significant employee-engagement issues. For example, if employees are told that the organization wants to improve customer service, but they learn that their improvements are being used to reduce headcount, you can forget about being successful with your improvement program--now or ever. The important point is to be honest and clear with employees about the program's rationale.

Prerequisite 2: Top management must be committed and actively involved.

Results of a recent survey published on the iSixSigma Web site show that 60 percent of respondents cited "lack of sustained executive sponsorship and commitment" as a key factor in why Six Sigma projects fall short of expectations. It is all too easy for senior managers to pay lip service to improvement projects. When there is a lack of true buy-in from the top, project selection is at risk of failing to address critical business needs. If the improvement projects selected are not considered business priorities, managers will not be engaged, and the projects will not get the attention, commitment, and resources they need to be successful.

The reason is simple: Six Sigma and lean involve making changes to major business processes that cut across organizational barriers. To be successful, improvement efforts cannot be led by anyone other than top management--specifically the CEO--whose authority reaches across those barriers. It is highly unlikely that Six Sigma would have succeeded at General Electric without Jack Welch's say-so or at Allied Signal without Larry Bossidy's steadfast leadership and commitment. Welch demanded that employees be "lunatics" about quality, and he made Six Sigma a major criterion for incentive compensation and promotion. Enthusiasm spread from management to the entire workforce.

To secure senior management's involvement, an executive steering committee should oversee the deployment of the improvement program. That committee can ensure that goals are set, priorities are agreed upon, projects are properly selected, resources are made available, and results are tracked against expectations.

Prerequisite 3: Projects must be focused on a growth strategy.

Constraints management (CM) posits that for any for-profit company, the goal is to make more money. The three global measurements to determine progress against that goal are: throughput (the rate at which the company makes money through sales); inventory (the amount of money captured within the company at any one point in time including the value of materials, parts, and assets); and operating expense (the rate at which the company spends money to convert inventory into throughput, that is, the costs of doing business). While improvement programs should attempt to simultaneously increase throughput (sales minus all totally variable costs), decrease inventory, and decrease operating expense, the main focus must be on improving throughput.

Companies that focus on throughput gain an advantage over competitors that are preoccupied with operating-expense or cost-reduction projects. Costs are everywhere: The companies that aim their improvement projects at cost-cutting will end up spreading their resources too thin and prolonging project-completion times. (7) Constraints management, however, posits that there only a very small number of areas (constraints) in a company that limit significantly higher levels of throughput. Focusing efforts on improving throughput allows the organization to focus its resources in the areas that will drive maximum value. Further, growth is all upside, whereas cost-cutting is finite. Realizing this, companies such as disk-drive maker Seagate Technology have decided to change the measure of their Six Sigma efforts from cost saving to increasing throughput.

Moreover, a goal of cost-cutting will encounter considerable resistance from employees fearful of losing their jobs. Why would employees be willing to help with "improvement efforts" if these translate into their jobs being lost? Likewise, there will not be any rush to complete projects promptly if job cuts are the anticipated result.

Prerequisite 4: Take an enterprise approach to program management.

Constraints management states that improvement efforts should be focused on the weak links of the organization--the constraints. In keeping with this philosophy, lean/Six Sigma projects should target improvements to those weak links. Trying to improve links that are already strong is simply a waste of time and resources. LSS programs achieve greater results by harnessing CM. Here is one example: A global electronics contract-manufacturing company conducted a study of 21 of its plants that had implemented lean, Six Sigma, or LSS/CM. The study revealed that those plants that had taken the combined approach contributed 89 percent of the total benefits achieved. Six Sigma by itself came in a distant second with a 7 percent contribution followed by 4 percent from lean applications alone/When Seagate used constraints management to help focus its Six Sigma projects, the drive maker saw its improvement projects finish much faster, with significantly higher rates of project completion. (9)

Prerequisite 5: Establish a cross-functional, process-focused infrastructure.

Several observers have noted that one of the top reasons why an implementation fails is the company did not establish the proper infrastructure for its improvement program. (10) A cross-functional, enterprisewide program management office (PMO) addresses this issue. It's imperative that the PMO be cross-functional so that LSS projects are focused on improving processes or value streams rather than on local department objectives.

When such projects are driven by departments, the results can be devastating. At one company, lean improvement projects were selected by department. In this case, the purchasing department conducted a sourcing project to reduce the costs of raw materials--specifically ball bearings. The purchasing teams found a way to reduce the material cost sharply by procuring the bearings from Asia rather than from a local provider. But they neglected to factor in the dramatic increase in lead times, which caused some stockouts on the shop floor. Consequently, the company lost some customers and came close to going out of business.

To establish this cross-functional PMO, a company needs to be a process-focused organization as opposed to a functionally focused one. A process-focused organization is characterized by being customer-focused and having companywide prioritization. Johnson & Johnson (J&J) has been successful in doing so as part of what its leadership calls "process excellence." In such an organization, projects are deployed from the cross-functional PMO rather than by department. Concomitantly, it is vital that key stakeholders in the process clearly understand the purpose and scope of the project before it starts--and that those stakeholders have the authority to approve solutions when necessary. To facilitate

this, leading companies like J&J assign processes to individuals known as "process owners." These owners are responsible and accountable for the process's performance, measured by such metrics as quote-to-cash, procure-to-pay, plan-to-fulfill, and issue-to-resolution.

## The LPM Implementation Steps

So what does it take to put lean program management into action? There are six key steps:

Step 1: Prioritize projects based on their impact and use of strategic resources.

The cross-functional project management team should prioritize projects by balancing the estimated benefits versus the effort involved. A project's impact should be estimated in terms of its global impact (considering throughput, inventory, and operating expenses) rather than by traditional measures, which typically end up being cost-accounting mirages.

The "effort" part of the equation should be measured by how much of the company's strategic resources--in particular, its people--are consumed by the project. The project pace is dictated by the most capacity-constrained resource. For example, if one key resource person is on several projects, the projects' pace will be determined by that person's availability and pace. Overutilization of key resources will almost always put the brakes on projects. It's crucial, therefore, to identify the right project team and structure to avoid burnout from overutilization. Not proactively dealing with the interactions between different projects greatly increases the risk of project failure. It's vital to identify the organization's strategic resources and to have the PMO use this information when prioritizing projects. In one case, an organization had launched a high-priority pilot project to implement lean/ Six Sigma. The involvement of several key employees was critical. Unfortunately, those staffers were already assigned to several other concurrent "high-priority" projects. It didn't matter how long and hard the other team members worked; the project took far longer than it would have had the organization properly prioritized projects by factoring in the impact on strategic staff resources.

Step 2: Use "**critical chain** project management" to plan and execute projects.

Well-regarded and well-publicized studies on traditional project management methods by the Standish Group and others show that only 44 percent of projects finish on time. (11) The studies also show that projects are usually completed at 222 percent of the duration originally planned and 189 percent of the original budgeted cost. At the same time, 70 percent fall short of their planned scope, and 30 percent are canceled before completion.

Such appalling statistics can be avoided by using an approach known as **critical chain** project management (CCPM). CCPM was introduced in 1997 by Eli **Goldratt**--the creator of constraints management (also known as the **Theory of Constraints**)--as a new approach to plan and execute projects "in half the time, all the time." CCPM benefits all project stages, from selection through execution and completion, by combining key elements of lean thinking, constraints management, and Six Sigma. (For more information, see the accompanying sidebar on "The **Critical Chain** Project Management Approach.")

Companies using this technique have reported the following: 95 percent on-time and on-budget completion rates; reduction of project duration by 50 percent or more; increases in project completion rates of up to 100 percent; enhanced project delivery success in terms of scope, cost, and schedule (to nearly 100 percent success); and reduced stress on project teams. (12) (Exhibit 1 summarizes how several example companies across a range of industries fared before and after implementing CCPM.)

Step 3: Minimize the number of concurrent projects. Given that most companies want to generate significant results from their improvement programs as soon as possible, the tendency is to initiate many projects concurrently--all with a high priority. This is compounded by the fact that a key measure for Six Sigma certification is the number of projects undertaken. However, one of the most important lessons that lean thinking teaches us is that pushing excess work into a process slows the process and dramatically increases lead times.

Anyone who has ever led a business improvement project or been involved in one knows how hard it is to finish on time. Too many projects running at the same time leads to excessive multitasking, which results in most projects taking significantly longer than necessary. Additionally, dependencies between projects increase because staff members are

working on multiple projects. As a result, project completion times are affected not only by the variability of a project's own tasks but also by the variability of tasks associated with other projects. For example, if a key individual is assigned to multiple projects at the same time and gets sick, all of his or her associated projects will be negatively affected.

To illustrate: If an organization undertakes three improvement projects--all at the same time with equal priority--the result of the excess work-in-progress (projects) on resource usage and project completion looks like the grid shown in Exhibit 2. It's very important to note that this example assumes zero efficiency loss due to changing tasks, so it actually minimizes the real-world negative effects of multitasking.

[ILLUSTRATION OMITTED]

Now suppose that the organization prioritizes the improvement projects, devoting the resources full time to each project in turn through to completion. Let's further assume that the project priority, from highest to lowest is A, B, and then C. Instead of all of the projects ending at approximately the same time, the most important ones complete sooner so the savings can surface earlier. The last project still finishes at the same time as before. Note again that this example excludes the negative impact of multitasking on efficiency. (See Exhibit 3.)

[ILLUSTRATION OMITTED]

The results are clear: If you initiate projects based on priorities and eliminate multitasking, performance improves drastically. It is imperative that the PMO controls the number of active projects at any given time. Focusing projects only on the organization's key constraints rather than flooding the organization with projects ensures that a few high-potential projects are done right. In addition, when the right resources are devoted to a limited number of projects, learning and results are maximized by shorter cycle times.

Step 4: Make data quality an imperative. Six Sigma is a fact-based approach to problem solving. Under Six Sigma, it is impossible to make accurate, data-driven decisions without good clean data. In many cases, Six Sigma projects take much longer because teams discover they lack data integrity. Data quality is a huge problem: One study put the annual cost to the U.S. economy of dirty data at more than \$600 billion. (13) An organization that lacks confidence in the integrity of its data will not buy into conclusions based on the data.

If an organization cannot vouch for the integrity of its data, it is imperative to first run a companywide data-quality initiative. The best way to kick-start such an initiative is to incorporate it into a corporate data stewardship or data administration program. These efforts are typically chartered to establish and maintain consistent data definitions and business rules so the firm can achieve a "single version of the truth" and save time on developing new applications and looking for data.

Step 5: Don't waste time and resources gathering unnecessary data, performing unnecessary analysis, and creating unnecessary metrics.

"Analysis paralysis" is one of the most prevalent problems afflicting projects--especially Six Sigma projects as they inherently involve a high degree of data analysis. Often, "black belt" practitioners tend to focus too much on analytical aspects of the methodology, such as data and tools, and devote less attention to higher-level project management aspects like avoiding "scope creep." As a result, many Six Sigma projects, while technically sound, take longer than expected. Time is wasted gathering data and creating measures that aren't directly linked to the original problem.

For example, one company was undertaking a spend-analysis procurement initiative using the DMAIC approach. Not long after the project's kickoff, it became apparent that the spend-data quality was poor because there was little or no policy compliance. Knowing this, the team still went ahead with building the spend-analysis application along with conducting analysis to validate the reports. The validation told them what they already knew: The data quality was poor because of noncompliance. The team would have saved a lot of time if it had solved the data-quality issue when it was first known.

To avoid this situation, projects should not be measured by Six Sigma activity--that is, by how much analysis has been performed and what metrics have been created. Time should not be wasted collecting and developing data and metrics that

are not directly linked to the project objectives. The question that should always be asked is: "What do we need to know to solve this problem?" If a data element or metric does not help answer this question, don't spend time on it.

Step 6: Pursue perfection, but tolerate failure.

Not every idea and subsequent associated project will be successful. This is simply a fact of life. Implementing improvement approaches such as lean and Six Sigma means launching new ideas and techniques, and that always involves some risk. For any improvement effort to be successful, people must be encouraged to take risks without being afraid of the consequences of mistakes. The important thing is to have a formal project management structure that recognizes mistakes so that they won't be repeated--in effect creating a culture of continuous improvement. It is fundamentally important to perform a "lessons learned" exercise at the end of every project, as prescribed during the Six Sigma "control" phase. Many organizations talk about doing this, but few actually do it. Even when the exercise is completed, these lessons are often filed away where they are of no use to anyone. As the saying goes, those who do not learn from history are doomed to repeat it. This is absolutely true for LSS projects.

In a lean/Six Sigma organization, a "lessons learned" step should be a formal part of the project plan. As per Six Sigma's mantra, project teams should always be looking for ways to make project tasks standardized and repeatable. And taking a lean approach means always looking for ways to eliminate waste within tasks. These lessons should be sent to the program management office, which can then consolidate and disseminate this feedback to the black belts and other practitioners through a variety of channels, including formal training. Subsequently, future projects will include researching lessons learned from projects of a similar nature, ensuring that the mistakes of the past are not repeated.

### Strategy and Execution

By applying lean program management principles to the strategy and execution of their LSS improvement programs, successful companies have been able to complete projects in far less time and consequently have generated much more value.

These principles--lean, Six Sigma, and constraints management--apply directly to project selection. And project selection is a key driver of improvement project success. A key principle of Six Sigma as it applies to project selection is ensuring that the projects selected have the potential to increase real, tangible shareholder value. Taking a lean approach to project selection means not wasting time and resources on projects that do not add significant value. Project selection should also be guided by the constraints management approach. This involves going from a cost-oriented approach that requires attention everywhere to a throughput-oriented approach in which everyone must work together and focus on key leverage points.

It is not enough to have the right strategy in place. Being able to execute successfully is a key differentiator between companies that are successful in their lean/Six Sigma programs versus those whose programs become bogged down by projects that take too long. When it comes to project execution, lean principles involve managing projects so that the most benefit is attained with the least amount of resources and the number of concurrent projects is minimized. The **critical chain** project management application results in projects being completed in far less time than under traditional project management methods. Further, applying Six Sigma to reduce variation in project tasks results in project completion times being more reliable and predictable.

The tools and techniques are available to achieve these results. It's time for supply chain professionals who are involved with lean/Six Sigma improvement efforts to apply some of those principles to the projects themselves. Doing so will ensure that they drive the most value for their businesses in the shortest time using the least amount of their precious resources.

Endnotes:

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## The **Critical Chain** Project Management Approach

The **critical chain** project management (CCPM) approach comprises the following elements. (See chart below.)

\* Remove unnecessary "safety" time from project task estimates. Use the mean task duration (or one that has a 50-percent probability of being successful). Typical estimates of task time contain a large degree of safety buffer time. However, because of Parkinson's Law (work expands to fill the time available) and the Student Syndrome (people waste safety time and start tasks at the last minute), this safety time actually expands the project time.

\* Identify the **critical chain**. This is the longest chain of tasks when you consider both task and resource dependencies. It is not to be confused with the critical path, defined as the longest chain of tasks based only upon task dependencies. CCPM recognizes that a delay in resource availability can delay a schedule just as much as a delay in dependent tasks.

\* Protect the due date by buffering the **critical chain**. Hitting the project due date is still crucial. But safety time is now moved to "the project buffer." This buffer comes at the end of the project, after the last **critical chain** task, where it will help rather than hinder the project's on-time performance. Typically the project buffer is 50 percent of the length of the **critical chain** tasks. In effect, we have reduced the total safety time hidden in the individual **critical chain** tasks and placed some of it in reserve.

\* Add buffers to noncritical chains that "feed" the **critical chain**. The **critical chain** is still exposed to overruns from noncritical chain tasks that link to it. CCPM protects the critical chain against overruns on these "feeding chains" by inserting a buffer at the point where the feeding chain intersects with the **critical chain**.

\* Schedule tasks for "late" starts. In traditional project management, tasks are scheduled as soon as possible after the start date. With CCPM, tasks are scheduled to start as late as possible based on the target end date. There are many benefits to delaying work as late as possible. You minimize work-in-progress and do not incur costs earlier than necessary. Also, there is better focus at the start of the project simply because there aren't as many tasks scheduled to begin.

\* Adopt a relay race mentality and discourage multitasking. Traditional project management approaches end up assigning people to work just a portion of their time on several tasks simultaneously. Thus, all the tasks take longer, causing the project to end later and inviting more quality problems. CCPM uses a relay race metaphor to put the focus on one task at a time. Each "runner" capitalizes on an early finish by the preceding runner; a fast leg can offset a slow leg to the team's benefit. Applying this approach to project management means that when one task is close to completion, the next task's resource must be on the track and ready to go. It takes the emphasis off scheduled start and finish dates and puts it on triggering preparation based on the preceding task's progress. No task should start earlier than scheduled, but once started, it must be finished as fast as possible.

[ILLUSTRATION OMITTED]

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EXHIBIT 1 Real-world Payoff of CCPM

Company	Before CCPM	Results After CCPM
High-Tech New Product Development	* 6 cameras launched in 2004.	* 15 cameras launched in 2005, with 25% lower R&D expenses.
HP Digital s	* 1 camera launched in spring window.	* 7 cameras launched in spring window. * All 15 cameras launched on time. * 1 out of 6 cameras launched on time.
Home Appliances New Product Development	* 34 new products per year. * 74% projects on time.	* Increased throughput to 52 new products in 1st year, and to 70+ in 2nd year, with no increase in headcount. * 88% projects on time.
Hamilton Beach/Proctor-Silex		
ASIC Design Technology Development LSI Logic	* 74% projects on time for small projects; major tool releases	* Due-date performance increased to 85% projects on time; major tools released on time for three years in a row. were late.
Submarine	* Job completion	* Job completion rate

Maintenance and Repair	rate = 94%.	increased to 98%.
U.S. Naval Shipyard, Pearl Harbor	* On-time delivery < 60%.	* Increased on-time delivery to 95+%.
	* Cost per job was \$5,043.	* Reduced cost per job to \$3,355, a 33% reduction; manning dropped by 25%.
		* Overtime reduced by 49%, a \$9M saving in first year.

Automotive Product Development	* Cycle time for prototype builds was 10 weeks.	* Cycle time for prototype builds is 8 weeks.
DaimlerChrysler		* Delivery date performance increased by 83% with much less firefighting.

Electrical Power Transmission, Engineer-to-Order	* 72 sales projects completed	* 171 sales projects completed per year.
ABB AG, Power Technologies Division		52% increase in throughput dollars.

Source: 2nd Project Flow Conference,  
Chicago, Ill., Sept. 8-9, 2005.

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# Alternative costing methods: Precision paint shop's dilemma.(2007 Student Case Competition)

From: [Strategic Finance](#) | Date: [August 1, 2006](#) | Author: [Juras, Paul](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

"We invested a great deal of time and money into developing the activity-based costing (ABC) system, and now I am not sure if it provides the information we really need for long-term decision-making purposes," Amy Wesling, plant manager of Precision Paint Shop's (PPS) Southern Plant, told her administrative team. "The ABC data helped us understand our costs better, but now I'm wondering if it's the right information to serve as the basis for helping us achieve our strategic goals."

## COMPANY DESCRIPTION

Precision Paint Shop (a fictionalized version of an actual Midwest company) is a privately held custom coater (painter) of automotive components for original equipment manufacturers (OEMs) and tier 1 and 2 suppliers. The company has annual revenues of \$90 million per year, with \$35 million in sales from the Southern Plant, which specializes in spray topcoat applications.

PPS specializes in the application of a series of coatings. Raw metal parts are received on consignment from the customer, finished with the desired application(s) of paint and other coatings, and shipped back to the same customer. The product lines consist of a large number of combinations of paint colors, types of coating, and paint finishes. Figure 1 provides a diagram of the production process, and "PPS's Production Process" (p. 53) provides a narrative of the production process.

[FIGURE 1 OMITTED]

Historically, PPS accepted most of the work assignments offered. Prices were market driven, and management used a form of standard costing to evaluate product profitability. Over the past three years, demand had significantly increased, especially in the higher-grade coatings. In fact, the product mix flip-flopped from 80% low-gloss (LG) finish two years ago to 85% high-gloss (HG) finish in the current year. Unfortunately, along with the increase in volume came a decrease in profits.

The immense number of combinations of coatings and color created complexity for the company. Also, the parts to be painted varied in size and shape, further complicating the painting process. The end result is that four characteristics--coating, color, shape, and size--were instrumental in determining the complexity of the operation. This variety initiated a mix of activities unique to each job. The very nature of the painting process and the need for a near-100% perfection level in the industry resulted in a high level of inspections, refinishing, rework, and scrap. Complexity had driven up overhead costs, leaving direct materials accounting for only 26% of total manufacturing costs.

## THE COSTING SYSTEM

Recently PPS moved away from a conventional standard costing system to ABC. The change was made to better understand the costs associated with painting the various products. The ABC analysis revealed the fundamental differences that existed between the different mixes of product characteristics. Table 1 provides an illustrative comparison of two versions of a bumper: an LG finish and an HG finish. After the ABC analysis, Chad Leaders, plant accountant, provided a report showing a significant change in the reported profitability levels of the various product lines. Table 2 summarizes the types of changes that took place. Once implemented, the ABC information was used to negotiate product pricing and report financial performance.

[TABLE 2 OMITTED]

## PLANNING FOR CAPACITY USE

The conveyor line was definitely a constraining resource of the painting process. Through her knowledge of **Theory of Constraints** (TOC), Mandy James, production supervisor, had developed a method for factoring the various elements into demand on conveyor capacity. Using bumpers as an example, she presented the template appearing in Table 3 and

compared an LG bumper to an HG bumper. The template starts with the quality issue. The greater the percentage of defects, the lower the yield rate (YR) for a production run. The more complex shapes and finishes have lower yield rates than the less complex ones. LG bumpers currently have a YR of about 94%, while HG bumpers run about 92%.

Defective products can be worked on in-house, and some can be recovered. For bumpers, the recovery rate (RR) is about 5% of units started. Since the recovered bumpers are brought up to an acceptable quality level, they contribute toward meeting customer demand and put no further demand on the conveyor capacity. The YR and RR can be combined to determine how many products must be processed to generate one unit of acceptable quality, which is called the run factor (RF). The RF is equal to  $1/(YR+RR)$ . If  $YR+RR=1$ , as with the LG bumper, then only one unit must be put on the conveyor to ultimately yield one unit of acceptable quality. The RF for the HG bumper is 103%, meaning PPS must paint 103% of the total bumpers required to yield enough bumpers of acceptable quality to satisfy customer demand.

Since the conveyor line is the constraint, the time a product spends on the conveyor is an important issue. Line speed can vary 10-18 feet per minute, depending on the size and shape of the product being painted. Mandy considers 18 feet per minute to be the standard time unit for the conveyor line. A complexity factor (CF) ranging between 1 (for fastest line speed) and 1.8 (for slowest speed) is determined for each product family and added to the calculation of demand. The CF is computed by dividing the standard line speed of 18 feet per minute by the line speed required for the specific product, so a faster line speed results in a CF closer to 1. The line speed of the HG bumper is currently 12 feet per minute, resulting in an RF of 1.5. The CF is then multiplied by the RF to get the total constraint demand factor (DF).

The DF is actually a demand placed on the conveyor per unit of finished good of a particular part type. Because parts can vary in shape and size, PPS needed a standard unit of measure to compare product profitability that factored in the total demand placed on the conveyor. The square footage of each part was chosen as the measurement unit because it represents the surface area of each part that's coated. As a result, the DF is divided by the total square footage of a particular part (e.g., a bumper) to yield the bottleneck demand factor (BDF), which is the demand factor per square foot of a particular size, shape, and finish. The profit level per square foot of finished good is divided by the BDF to yield the profit per throughput unit (PTU) on the conveyor. Table 3 shows the LG bumper has a lower profit per unit (\$10 per bumper, or \$1.00 per sq. ft.), but after adjusting for the respective demands on the conveyor, the LG bumper has a higher PTU.

## DECISION POINT

Management of PPS used ABC to obtain a better understanding of the "true" cost of the products in order to help make better pricing decisions. Management now wants to be more proactive in the use of costing information to help develop and implement organizational strategy in an environment where the demand exceeds current productive capacity. Based on the opening question posed by Amy, PPS's management was attempting to move away from merely trying to assign costs more accurately to using the cost information to support strategic decision making. Specifically, Amy wants to make strategic decisions about which product lines to promote and pursue. She is aware of the ABC process of assigning cost of resources to activities but considers this an operational rather than strategic issue. She isn't clear about whether ABC supports strategic decision making.

Mandy pointed out that the conveyor line was being fully utilized and jobs were being turned down because of the capacity constraint. She thought the capacity issue should drive any strategic decisions and that Amy should adopt the principles of TOC and throughput costing for strategic decision making. Mandy supported her position with the following example. "HG bumpers are a big part of production," she said. "We evaluated whether or not to increase the line speed when HG bumpers are being painted. The increase in speed will reduce the yield rate from 92% to 90%. There will be more defects, but the RR will increase to 6%, and, as Table 3 shows, the PTU will increase, and the finesse costs per unit would actually decline." (See "Finessing.")

Chad disagreed with Mandy's recommendation. Using Table 1, Chad noted that the HG finishes have higher reject rates, require additional painters, more colors, more inspections and maintenance costs, and slower line speed. The HG products are also treated as they pass through Stations 3 and 4. Since some of the costs related to resource demands are fixed costs, throughput costing shouldn't be used because these fixed costs would be ignored. He offered an alternative, Resource Consumption Accounting (RCA), which he had heard about at a recent local IMA chapter meeting. He thought RCA might be what Amy needed, but he wasn't entirely sure. Chad presented Amy with a brief description of the costing

method (see "Basics of RCA"). He offered to learn more about RCA by attending a continuing education session offered by IMA, but Amy wanted more information before making the investment in having Chad attend the session.

## REQUIREMENTS

The company currently has an ABC system, but throughput costing based on TOC and RCA have been offered as alternatives for supporting strategic decision making. Prepare a 15-minute presentation that discusses the potential strategic value of the ABC vs. TOC vs. RCA cost information in making strategic decisions in such a capacity-constrained environment. As part of the presentation, address the distinction between traditional cost analysis and strategic cost analysis. Since PPS has already undertaken an ABC analysis, assume their understanding of causal factors and relationships is fairly well-developed and need not be addressed in the presentation.

## PPS'S PRODUCTION PROCESS

PPS operates two 8-hour shifts, 240 days per year. The paint process involves a monorail conveyor line that moves at line speeds of 10-18 feet per minute, depending on the application and part complexity. The total paint cycle time is about 2.5 hours. The production schedule is created based on customer requirements, line speed, minimum lot (or batch) size, and the availability of racks. The material handlers bring the raw parts and racks to the line, and loaders rack each part, making sure it is racked properly so that a proper electrical ground is attained when it enters the e-coat tank.

### The Paint Process

First, the part is treated with chemicals (pre-treatment stage), which is a series of washing and rinsing to remove any grease or dirt and to prepare the part for paint adhesion with a phosphate spraying. Next, the part is submerged in a 20,000 gallon e-coat tank. As it comes out of the tank, it is sprayed with fresh, deionized water to rinse any "dragout" paint clinging to the parts, thereby eliminating appearance defects. The part then moves through four paint booths. Depending on the part type, however, all four booths may not be used.

\* Booth 1 has five automatic spray guns that apply primer. A part may or may not receive a primer coating, which provides additional protection against chipping and rusting.

\* Booth 2 has two manual sprayers as well as automatic sprayers that paint basecoat or enamel topcoat.

\* Booth 3 has one manual sprayer and automatic spray guns that apply clearcoat. Only high-gloss products receive the glossy clearcoat finish.

\* Booth 4 has two manual sprayers and automatic spray guns that also apply clearcoat for parts that require two coats.

While low-gloss products are being painted, booths 3 and 4 painters are idle, and the spray guns are turned off. Depending on the product line, the part receives a basecoat (high gloss) or an enamel topcoat (low gloss). After these processes, the paint is cured in another oven. As the product arrives back at the unload/load area, it is date-stamped, unracked onto a floor conveyor, inspected, unloaded, and packaged.

### The Setup Process

A five-minute setup "gap" is required when changing paint colors. This gives line workers the time to change the tooling racks, modify the line speed, purge the line of the old paint, and run the new paint through the system.

As the setup gap nears the paint booths, paint containers with the required colors are transported to the paint booth. While the last part from the prior color is painted, the paint lines are quickly purged of the old paint, flushed with solvents to clean the paint lines, and new paint is sprayed through the spray guns to obtain the desired consistency. As the gap ends and the raw parts appear, the painting begins again.

### Quality Assurance or Rework Process

The primary sources of rejections are dirt and dust in the manual hand sprayers, old equipment, and the nature of the industry. High-gloss products, which are much more expensive to reprocess, have substantially higher rejection rates than low-gloss products.

Rework mostly requires sanding. The product is sanded down to the e-coat primer and then moved to the line for reprocessing. Some products are sent to an outside stripper. Some defects can be corrected by finessing, which eliminates the need for complete reprocessing. Finessing allows the defect to be buffed out on parts that have the clearcoat glossy finish. Parts are considered "saved" when they can be unloaded along with the other painted good parts.

## FINESSING

PPS finesses approximately 100,000 bumpers per year, or about 5% of bumpers run on the conveyor. If the line speed is increased, the decline in the yield rate would create about 20,000 additional bumpers that the finesse department could work on. The finesse department can handle 125,000 per year when operating at maximum efficiency, and the variable costs for finesse are less than \$0.02 per unit, so the increase in units worked wouldn't generate much change in the amount of total costs. The table provides the supporting detail.

Finesse cost per unit at various defect levels

	ANNUAL COST	UNITS	COST PER UNIT
Current defect level	\$480,000	100,000	\$4.800
Defect level with increased line speed	\$480,400	120,000	\$4.000
Practical capacity to handle defects	\$480,500	125,000	\$3.840

## BASICS OF RCA

Resource Consumption Accounting (RCA) is based on costing methods developed by German companies and the activity costing philosophy of ABC. RCA takes a resource-based view of an organization and looks closely at the quantity of resources consumed and the underlying nature of the cost of those resources. Some of the key characteristics of RCA are the treatment of idle capacity, the use of costs other than historical, and the ability to group and track cost information at various levels. This comprehensive management accounting system can lead to improved decision support by providing more accurate product costs and a better understanding of the interrelationships between processes and costs.

## SUGGESTED READING

Tony Grundy, "Cost Is a Strategic Issue," Long Range Planning, February 1996, pp. 58-68.

David Keys and Anton van der Merwe, "Gaining Effective Organizational Control with RCA," Strategic Finance, May 2002, pp. 41-47.

Anton van der Merwe and David Keys, "The Case for Resource Consumption Accounting," Strategic Finance, April 2002, pp. 31-36.

Chwen Sheu, Ming-Hsiang Chen, and Stacy Kovar, "Integrating ABC and TOC for Better Manufacturing Decision Making," Integrated Manufacturing Systems, May 2003, pp. 433-441.

The Student Case Competition is sponsored annually by IMA to provide an opportunity for students to interpret, analyze, evaluate, synthesize, and communicate a solution to a management accounting problem.



High-Gloss Bumper	1.50	1.55	10	.155
Change Speed and YR	1.38	1.44	10	.144

(PTU)  
 ADJUSTED  
 PRODUCT  
 PROFIT PER  
 PROFIT PER THROUGHPUT  
 UNIT OF UNIT  
 FINISHED PROFIT PER  
 PRODUCT SQ. FT./BDF

Compare Two  
 Bumper Finishes

Low-Gloss Bumper	\$10.00	\$8.33
High-Gloss Bumper	\$12.00	\$7.76

Evaluate a  
 Process Change

	Current Process,	
High-Gloss Bumper	\$12.00	\$7.76
Change Speed and YR	\$12.00	\$8.32

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Understanding management accounting techniques in the context of organizational change: as strategic business partners with a responsibility to improve operations, management accountants must identify techniques that support incremental change and help transform their firm.

From: [Management Accounting Quarterly](#) | Date: [June 22, 2006](#) | Author: [Joseph, George](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

EXECUTIVE SUMMARY Driven by the need for organizational change, management accounting techniques have developed and proliferated at an unprecedented rate in the last few decades. Some critics, however, have charged that the changes are a "reinvention of the wheel" every few years. To put these issues in perspective, let's look at a framework created to illustrate the distinctive nature of these techniques in an organizational change context. The framework considers such factors as user resistance and organizational culture that can influence the applicability and implementation success of the techniques.

After tracing the history of management accounting beginning in 1850, accounting scholar Robert S. Kaplan comments, "Despite considerable change in the nature of organizations and the dimensions of competition during the past 60 years, there has been little innovation in the design and implementation of cost accounting and management control systems." (1) All the practices employed by companies and described in management accounting textbooks had apparently been developed by 1925, despite major changes in the nature and operations of organizations. To develop the field of managerial accounting, Kaplan and others encouraged academics to conduct field research and case studies "to describe and document the innovative practices that seem to work for successful companies." (2)

The pendulum swung in the other direction over the next decade as a plethora of new "techniques" in the management accounting area, for example, activity-based costing (ABC), Just-in-Time (JIT), and total quality management (TQM), subsequently found their way into general acceptance. Critics assert, however, that these management accounting techniques overlap and amount to "reinventing the wheel" every few years. (3) The objective here is to assimilate into one framework several factors that influence the application of management accounting techniques in organizations using types or levels of organizational changes categorized by N. Venkataraman. (4) The underlying goal for the framework is designed to reveal the distinctiveness of each technique in the organizational change context. Specifically, is there a systematic approach to applying change techniques and anticipating issues we may encounter in the change process? The application of this framework is illustrated using detailed case studies.

## DEVELOPING THE FRAMEWORK

In the new environment created by the power of computing and the displacement of traditional accounting tasks, companies are looking to their financial experts to "act as business partners with operations managers" by providing information to support decision making. (5) Accountants are increasingly involved in strategic management through the development and implementation of new accounting models integrating financial and nonfinancial information. (6) If the substance of the techniques overlaps, accountants need to clarify these overlapping areas to show how they may apply to support different strategic purposes.

Fundamental to organizational strategy is organizational transformation and change. Organizational transformation and change is an ongoing process, and accountants need to see their role in supporting such change. Firms continue to frame their strategy to respond to rapid changes created by globalization and technology. From a strategic purpose, therefore, firms are in a constant state of transformation and seldom reach a state of equilibrium. The nature of internal change and the techniques applied, however, will vary based on such factors as the nature of the change and influential factors internal to the organization.

There are a variety of change responses available to a firm that can be classified as either incrementally focused on efficiency or radically focused with the intent to enhance capability. (7) These influential factors internal to the firm can either constrain or enable the implementation of the techniques. In some instances, the techniques themselves can influence the internal factors. In sum, there are three factors in the framework:

- \* The nature of change,
- \* Influential factors, and
- \* Distinctive elements of change techniques.

## VENKATARAMAN'S ORGANIZATIONAL CHANGE LEVELS

Venkataraman classifies IT-induced business transformation strategies for change into five levels based on desired levels of benefits. (8) The levels of change (hereafter VCL) hinge on the business process or, more specifically, the purpose and extent of business process redesign. If the purpose is to rectify current deficiencies and increase efficiency, it involves incremental changes to current business processes at two possible levels, namely localized exploitation and internal integration. If the purpose is to enhance capabilities, it involves fundamental changes to the business processes that are possible at three levels, namely business process reengineering (BPR), business network, and scope redefinition. Table 1 illustrates these change levels.

Localized exploitation describes decentralized decisions made by functional, operational managers to deploy "isolated systems" influencing an activity such as a customer order entry system.

Internal integration involves integration of business activities to streamline organizational processes. This level addresses the question of interdependence of organizational roles across functional lines. For example, when CAD/CAM is integrated with the bill of materials, routing, and payroll, it results in greater efficiency and effectiveness than operating the CAD/CAM in isolation.

Business process reengineering is the dividing point between the incremental changes and radical changes. Business process reengineering involves fundamental changes to the design of organizational processes to exploit technological capabilities. It is not bound by historical management principles but takes advantage of opportunities that technology offers in innovative ways.

Business network is implemented through business process redesign that redefines "the nature of relationships among multiple external participants in the business network" to provide products and services to the marketplace. (9) This level is flexible to accommodate customer needs and provides the opportunity to exploit competence in the larger business network of interrelated participants.

Scope redefinition involves strategic analysis to determine optimal areas for resource allocation "based on fundamental shifts in competence due to technological and strategic enablement." (10) This level is the result of successful strategies within an area that may redefine the organization's positions in terms of products, markets, and technologies. For example, success from a technological innovation may result in spinning off the benefits of innovation into a separate revenue-generating product. As an example, Venkataraman describes American Airlines's successful SABRE reservation system, which became independent and turned out to be its most profitable unit.

## ORGANIZATION-SPECIFIC INFLUENTIAL FACTORS

Internal organizational factors, such as organizational structure and culture, influence change and the implementation of management accounting techniques. Yet these factors often are not taken into account in the implementation of management accounting techniques. For example, Jerold Zimmerman observes: "Total quality management, reengineering, activity-based costing, the **theory of constraints**, value chain management, just-in-time, and the balanced scorecard all assume that agents will enthusiastically adopt the new approach because it promises to maximize firm value." (11)

Organizational structures may either be centralized or decentralized. The role of technology in the creation of such structures has changed over time. Earlier, procedures were difficult if not impossible to specify and document, and individual initiative related to technology was a key factor in growth. Thus, decentralization supported individual initiative and technology change. In contrast, structured processes and procedures supported the existence of centralized organizational structures. (12) With technology permeating the organization at all levels, a centralized structure is

necessary to initiate change, particularly as technology initiatives such as enterprise resource planning (ERP) systems require support of personnel at all levels. Specifically, decentralized environments support incremental change, but radical change requires a centralized structure because it permeates the organization.

Organizational structure also relates to two other factors, namely organizational user resistance and culture. User resistance would relate to intensity of change (i.e., radical change would result in greater user resistance than would incremental change). Organizational culture would also influence change. For example, in some industries, a culture of change may be more ingrained than in others (e.g., technology and biotechnology, as opposed to processed foods). The influence of culture may therefore vary with the firm's size, age, and industry. The greater the impact of the change, however, the more the impact on the existing culture, and, therefore, the greater the challenge to the success of that change technique. Therefore, a centralized management structure, with increased top management involvement would be necessary to implement radical change. In some instances, the ingrained culture may be so strong that the technique (combined with an incentive structure) may be necessary to drive change in the existing culture. The balanced scorecard may be a management accounting technique that can support this cultural change, but a decentralized structure is sufficient to implement "incremental" change as it has less impact on existing culture (see Table 2).

## MANAGING CHANGE AND CHANGE TECHNIQUES

Management accounting techniques involve changes in individual processes, which is why such "change techniques" can be used to manage change. Christopher Ittner and David Larcker, for example, point out that "process management initiatives can vary from incremental improvements in existing processes to radical business process innovation." (13) The components of the change framework provide the foundation for understanding the mechanism for change through applying the change techniques. VCL provides the context for placing the tools in the organizational context, particularly in relation to their distinctive strengths. Influential factors such as culture and user resistance vary with the levels of change and impact the choice and implementation of management accounting techniques. From localized to scope redefinition, the goal of the framework is to understand the unique aspects of these techniques that can support organizational change strategy.

## MEASUREMENT (ACTIVITY-BASED INFORMATION SYSTEM)

Activities and processes provide the basis for integration. Activities form the basic unit of measure, and one or more activities form a business process. Understanding processes and their impact on decisions is critical before changes made to activities can add value to the organization. An activity orientation (as opposed to a transaction orientation) results in an activity-based information system (ABIS). (14) The "work-centric" information provided by an ABIS forms the basis for a number of decision-making and change-enabling tools, besides business process reengineering (BPR). Bala Balachandran points out, "whether... performing business process reengineering/improvement, time-based management, total quality management, yield management, balanced scorecard, thru-put maximization, budget justification, resource management, profitability management, or strategic cost management, the core foundation to all of these initiatives is activity-based measurement." (15)

In fact, organizations have used ABC/M as an "enabler" for their "improvement" programs. Gary Cokins points out that businesses such as Coca-Cola Company and Honeywell have used ABC/M output data to serve as "an enabler to their ongoing improvement programs, like six sigma, lean production, change management, cycle-time compression, core competency, business process reengineering, product rationalization, target costing, and channel/customer profitability." (16) Therefore, an activity-based measurement system forms an important support tool for the measurement of change initiatives. This is the recognition that "activities are the language of business," so ABC/M sets out to provide a "careful linkage between these activities to the resources and products/services a business creates." (17)

In the framework, therefore, ABC provides a key role as the enabler, linking the strategy to the different change techniques. As Robin Cooper and Robert Kaplan state, "The ABC system provides the front-end justification for reengineering improvement programs to reduce or eliminate inefficiencies in organizational activities." (18) Charles Horngren, et al., point out that ABC/M involves the extension of ABC to enable management decision making in areas that include cost reduction and process improvement decisions. (19) According to Kofi Nyamekye, "With the detailed true activity costs, managers of the enterprise can examine in detail the true costs of business processes and determine which

ones must be re-engineered." (20) In sum, activities and the information systems that capture activity-based information are important for successful implementation of BPR.

## MANAGEMENT ACCOUNTING CHANGE PROGRAMS

Other change techniques support changes in the organization at different levels, based on their intensity (see Table 3).

**Theory of Constraints (TOC)** and continuous improvement (also called kaizen) are change techniques that relate primarily to the local change level. TOC involves identifying and removing bottlenecks. A bottleneck is any condition that impedes or constrains the efficient flow of a process. Excessive amounts of work-in-process inventories at certain process points are indicative of bottlenecks. The buildup of inventories also shows the cycle time of production. ABC helps determine the activities that add value and those that need improvement. Under continuous improvement (kaizen), workers generally have superior knowledge about how to improve processes and reduce costs because they actually work with the manufacturing processes. To facilitate the process, workers share information on actual costs. The influential factors such as user resistance and cultural impact are at the minimum, and a centralized structure would operate favorably in implementing this technique.

An example of a change technique that requires coordination across functional lines is total quality management, which involves coordinating a quality program throughout the organization. (21) TQM begins with a mission and the setting of performance improvement opportunities, goals, and priorities for each functional area. This quality program involves all departments working in coordination. Therefore, there is need for integration of activities from different departments in this approach to quality management. Here, again, the level of user resistance would be less, and the cultural impact, while important, would be easier to infuse, given that it is more in line with existing tasks.

Business process reengineering developed as a response to the need for corporations to become leaner and more flexible. According to Michael Hammer and James Champy, BPR generally involves radical redesign of organizational processes to achieve dramatic improvements in critical measures of performance. (22) ABC systems support the information component as it helps measure processes that relate to activities, which are, in essence, components of processes. For example, the process is defined as "as a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer." (23) BPR has much more impact on the organization than previous levels and is the level of change that "disrupts" existing systems. Therefore, there is much more likelihood of user resistance and the need for culture changes, requiring centralized structures to support changes at this level.

Supply chains and JIT are examples of management techniques that can support implementation of organizational change at the business network level. Under the JIT system, the organizational processes must coordinate with the supplier activities to enable suppliers to produce and deliver defect-free materials or components as they are required. For example, as processing time and setup costs drop in a fast food restaurant, the organization can move closer to JIT manufacturing and reduce the waste and quality problems that arise with batch production. Therefore, they can coordinate with suppliers to make more frequent deliveries, increase quality, and reduce waste. This level involves forms of BPR and can lead to user resistance. Moreover, the integration of cultures of two organizations can result in greater cultural challenges.

Scope redefinition, unlike previous strategic change levels, results in a new unit. The management techniques in this case must adequately measure the effectiveness of the change to be able to determine the alignment of the fundamental shift with the firm strategy. Measurement systems such as the balanced scorecard (BSC) and Economic Value Added (EVA[R]) are useful to measure the alignment of performance to strategy.

The balanced scorecard enables "strategy-focused organizations" to map their strategy to BSC perspectives and develop corresponding measures. (24) The balanced scorecard, which requires top management support to be successful, also influences corporate culture because it enables individuals to understand firm strategy and be involved in its execution on a daily basis. In addition, the criteria set by the scorecard forms a basis for evaluating projects and, therefore, the basis for discussions and reasoning that can influence firm culture. The computations for EVA align profits and incentives to strategy. EVA uses ABC to assign costs to products to assess profitability and often bases bonuses on efficiency and cycle times rather than on annual sales. These computations align profits and incentives to strategy. Therefore, process change measures enable overall EVA calculation.

To summarize, the change techniques can be enablers or primarily performance evaluation techniques, but they serve the overall purpose of supporting organizational change. For example, ABC as an enabler focuses on activities that support all categories of change. Change techniques may support short-run and localized change and more radical and extensive change impacting external stakeholders. These range from TOC to BPR, JIT, and supply chain management (SCM). Other change measurement techniques can play the evaluation role, such as the balanced scorecard and EVA. The common element in these change techniques is that they are process oriented.

## APPLYING THE FRAMEWORK

We must assess several factors to determine the applicability of change: Is the need for change clearly defined? What level of change and form of measurement are most appropriate? What are the appropriate change techniques that can support implementing the change? What are possible associated factors that can influence implementation of the change? For example, to overcome resistance, do we have (1) centralized (top management) involvement in the implementation process and (2) information as a means to make a convincing argument?

To illustrate the application of the framework, I use Harvard cases that have applied these management accounting techniques.

Case 1: Colorscope is an example of a small firm seeking ways to compete in an increasingly intense competitive environment in pre-press printing. (25) The external environment had changed with the advent of new technology, and new players entering the market had increased the supply side of the industry. Because Colorscope was not the market leader, its only option was to adopt a cost containment and quality control strategy. A simplified activity-based costing system was used to measure customer profitability. Colorscope found that many customers were unprofitable, and a few customers were responsible for most of the firm's profits. On further analysis, it was determined that rework, initiated through internal defects or by customers, formed a major cost item.

The firm had to decide on questions such as customer pricing and process improvement decisions based on this information. Was there need for incremental or radical change in its operations? Considering the size of the operations and cost of rework, it needed to control costs while maintaining quality and to manage customer profitability. The problem required internal quality management and closer interaction with customers. Colorscope initiated quality improvement techniques, an incremental change, to limit in-house errors. It was easier to initiate this change given the size of the firm (hence the culture was one that could adapt to changes) and the nature of the change (as it did not incite user resistance).

Case 2: RBC is the case of a large bank in the regulated Canadian banking sector. (26) With deregulation, however, the competitive landscape abruptly changed. As RBC had been using ABC information for several years, it was able to adapt to the changing environment by focusing on measuring the sources of costs and profits by product and customer and developing a strategy based on that information. According to a manager, "without infusion of real data and accurate driver rates, customer profitability was scattershot." The bank changed the strategy from product orientation and cost control to customer focus. It implemented a CRM system, in essence a "business network" level change, to increase interactions with the customer. The firm also underwent a change in organizational structure in response to the new strategy. RBC acquired customer-specific information and developed a centralized information system to enable all remotely located units to have uniform access to customer information. It could now understand the needs of customers and market products to make customers profitable. RBC also was able to understand costs of activities, encourage the use of less costly activities, and discourage the use of costly ones.

Shifting from a product focus to customer focus was not without problems, particularly given changes in the power of different functional heads (marketing and product managers) and resource allocation. The cultural divide between the two functional areas did not help matters. With top management support, a new hire to head the CRM operations, and the use of sophisticated software, however, the strategy gained acceptance. These efforts notwithstanding, there were challenges in aligning the interests of the bank and the customer, particularly from the long-term perspective. In the end, measurement provided greater transparency and the focus to implement new strategy to respond to the problem.

Case 3: Kanthal is the case of application of customer relationship management (CRM) to a manufacturing firm. (27) A new president from the outside saw the need for a strategic plan. An examination of the cost structure revealed that with increased automation of several production functions, selling, general, and administration costs had increased

substantially to 34% of total costs. More important, no further analysis of the costs was made, and they were arbitrarily treated as period costs. Under new management, this cost came under scrutiny. Kanthal's new management used ABC costing to analyze these costs. The results were quite surprising. Kathal found that some large customers were the most unprofitable because they were consuming the more expensive resources of the firm through frequent orders of nonstocked items. Sales staff did not accept the findings that the existing incentive structure did not meet organizational goals and needed change, but the objectivity of the ABC information formed a stronger basis to convince salespersons of the need for changes. The firm recognized the need to negotiate with customers, particularly when they realized that one of their large customers was using the system to meet the needs of their JIT inventory system. Additionally, the new information provided the basis for negotiations with customers, which resulted in changes in the internal structure and cultures of both organizations when they realized that they would both benefit from increased cooperation. The firm used EDI to integrate the information of the large customer so that it could better predict demand. In order to implement the new strategy, the firm made changes in pricing, discounts, and compensation plans for employees.

Case 4: Chemical Bank illustrates the implementation of the balanced scorecard at a large bank. (28) There was new competition because the external environment for banks had changed with the introduction of new technology, such as Internet banking. Subsequent to a merger with Manufacturers Hanover (creating a new entity, a scope redefinition level change), the firm now had to deal with the two cultures that were not always congruent. Chemical Bank, with advice from consultants, used the balanced scorecard to address the cultural divide resulting from the merger. The scorecard provided the goals, measures, and language that supported the creation of a unified culture. The ABC system differentiated between profitable and unprofitable customers, supporting the development of products and services targeted to profitable customers to retain their loyalty and to migrate unprofitable customers to services that were less expensive and more profitable to the firm. The bank also experienced conflict with the existing culture and the accepted way of "hammering on outcomes" when salespersons were asked to develop "completed contacts" each week (i.e., leading indicators). The BSC, however, helped to change the culture. It was both "motivating and obligating." It motivated the salespersons when they saw that the "contact" drivers led to positive product sales results. The fact that management received reports of these measures also motivated salespersons to stay on track.

The change framework provides a systematic basis to bring coherence to business situations by identifying key issues embedded in the details. Each of the cases saw the need for internal changes due to the external change environment created by globalization and technology. There was the need for measurement. ABC worked as a measurement system that highlighted the problems and served to track the implementation of the change techniques. For example, in both the RBC and the Kanthal cases, the firms responded to external pressures by closer examination of their costs using ABC. This analysis resulted in a better understanding of issues, particularly related to customers. They developed strategies that resulted in the CRM. There was user resistance as evaluation measures and new systems disrupted existing ways of doing things. Top management support helped overcome much of the resistance. In the Chemical Bank case, the BSC provided direction to guide the new merged firm into a unified new strategy, overcoming the cultural challenges of two different banks. The balanced scorecard worked as a "forward-thinking" tool to create a new culture that could support strategy by tying compensation packages to financial measures as well as nonfinancial (BSC) measures related to customer satisfaction and customer retention.

#### NEEDED: A BROADER VIEW

In order to support management decision making and add value, management accountants need to understand the challenges facing firms in the environment of change. In this environment, a myopic focus on the management accounting techniques will lead to situations where "you can't see the forest for the trees." Accountants need a broad view of the organization, the ability to understand the organization in the context of its environment, and the individuals that form part of it.

It is useful, therefore, to see the issues in the context of an encompassing framework that can support the implementation of the tools by providing a theoretical basis to understand their application. Problems appear unstructured in the environment of change, and it is often important for managers to make sense of these problems. Accountants can support the process by assisting in the measurement of key processes to identify the source of problems and support the strategic response. The individual techniques will undergo evolution, but the underlying concepts will help accountants understand the issues and create an environment of greater transparency while helping management adjust to change.

No framework is without caveats. Firms may be in different stages in their growth, may form part of an industry that is emerging and attracting a certain dynamic talent, or may have reached saturation and need revitalization. When these unique aspects are recognized, the general concepts underlying the framework become applicable and effective. n

## ENDNOTES

(1) Robert S. Kaplan, "The Evolution of Management Accounting," *The Accounting Review*, July 1984, p. 390.

(2) *Ibid.*, p. 415.

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660.

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## Amazon Top 10 organizational change Books; As of May 30,2006.(Brief article)

From: [Advertising Age](#) | Date: [June 5, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

- 1 The First 90 Days: Critical Success Strategies for New Leaders at All Levels by Michael Watkins
- 2 The Goal: A Process of Ongoing Improvement by Eliyahu M. **Goldratt** and Jeff Cox
- 3 The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm by Tom Kelley, et. al.
- 4 Leading Change by John P. Kotter
- 5 Managing Transitions: Making the Most of Change by William Bridges
- 6 Reframing Organizations: Artistry, Choice and Leadership by Lee G. Bolman and Terrence E. Deal
- 7 The Heart of Change: Real-Life Stories of How People Change Their Organizations by John P. Kotter and Dan S. Cohen
- 8 Ten Rules for Strategic Innovators: From Idea to Execution by Vijay Govindarajan and Chris Trimble
- 9 Harvard Business Review on Innovation by Clayton M. Christensen, et al.
- 10 The Power of Appreciative Inquiry: A Practical Guide to Positive Change by Diana Whitney, et. al.

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# Pursuing pharmaceutical quality and economy: forward-looking pharmaceutical companies build continuous improvement techniques into their processes from day one.(Quality Improvement)

From: [Biopharm International](#) | Date: [June 1, 2006](#) | Author: [Chatterjee, Bikash](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

The pharmaceutical industry's recent emphasis on continuous improvement, operational excellence, and process analytical technology has motivated us to evaluate the basic tenets of our approach to quality. Historically, the ability to ensure that a drug meets its intended form, fit, and function has been achieved through the application of the quality infrastructure, i.e., standard operating procedures, policies, specifications; qualification or validation, i.e., commissioning, installation qualification (IQ), operational qualification (OQ), performance qualification (PQ), process validation; and testing, i.e., in process and final release. However, despite these processes, the number of drug recalls continues to rise, escalating from 176 in 1998 to 354 in 2002, according to the US Center for Drug Evaluation and Research. (1)

The use of regulations as a primary means of ensuring product quality began to decline in early 2000, when industry pushed back on FDA's Part 11 compliance requirements for electronic signatures and electronic data exchange, challenging the cost and effort associated with implementation, versus the actual benefit to product quality. Today, however, industry and regulatory agencies are moving toward a more scientific approach to ensuring product quality.

The International Conference on Harmonization (ICH) Q8 and Q9 guidance documents (2,3), for example, define a scientific approach to process characterization, advocating a quality by design framework. Risk management is an integral part of this approach.

Similarly, the US FDA's "GMPs for the Twenty-First Century" initiative focused on quality by design, risk management, continuous process improvement, and quality systems. Rolled out in 2004, this initiative challenged industry's traditional approaches to ensuring product quality by encouraging employees to look beyond traditional inspection methodologies for ensuring product performance. The early process and product characterization emphasized in the quality-by-design and risk-management approaches do not inherently conflict with validation. On the contrary, by deepening the level of scientific understanding of a manufacturing process, the approaches ensure that a process is well understood before it is considered "validated." Methods that involve continuous improvement and real-time control, however, do pose a significant question: Are these quality methods inconsistent with the basic tenets of validation that have served as the backbone of the industry's quality structure for so many years? Once you have "validated" a manufacturing process, how much can you improve it--through real-time control or any sort of continuous improvement step incorporated into Lean, Six Sigma, etc.--without having to file manufacturing supplements with FDA? How much of an impediment are those filing requirements?

## The Validation Paradigm

The challenge of validation is that it has been viewed as a necessary evil--a regulatory activity that cannot be avoided when manufacturing regulated products. The effort and cost associated with validation continue to escalate as industry and regulatory groups increase their understanding of pharmaceutical processes and identify an increasing number of process variables that must be controlled. Biotech adds another layer of complexity by introducing the qualified pilot or intermediate-scale model as an integral component of the validation equation. (4)

The prohibitive cost of characterization studies at full scale requires us to establish clear, scientific arguments to show how process development studies relate to full-scale validation lots. The complexity of biotech processes demands an even higher level of scientific argument. As we increase our understanding of biopharmaceutical processing, the value associated with traditional validation diminishes, and industry responds accordingly. The integration of equipment validation and process validation provided incentive to measure the capability of our processes and analytical methods. However, somewhere along the way, the incentive for validation shifted from a need to measure processes, to a need to satisfy a regulatory requirement as quickly and as cheaply as possible.

Over time, industry came to believe that validation had to include a broader range of equipment and processes and a greater level of detail, and as a result, validation costs went up. In response, the industry attempted to distribute the

responsibility for validation among participants in the quality process. For example, industry suddenly decided that validation had to include commissioning activities and engineering pre-cursor activity to equipment qualification, so they started requiring that contractors and subcontractors test and document various aspects of IQ. The approach of requiring increased involvement from vendors also extended to factory acceptance tests. Such tests--which have ranged from simple vendor testing and certification to constructing simulator panels to mimic the actuation of automated components--have also ranged in their true relevance to the validation process.

Market drivers completely unrelated to the field of validation often have determined the amount of effort put into validation. For example, when equity markets dried up in the late 1990s, emerging biotech companies shifted their emphasis from scientific investigation to bringing product to market as quickly as possible. The industry looked for cheaper and faster ways to push through the validation process to move programs forward quickly. The result was simpler process validation studies that focused on building three validation lots to demonstrate process predictability, rather than focusing on true process understanding. Likewise, companies began buying more equipment from suppliers who offered "canned" validation protocols that could be purchased and implemented, rather than developing their own protocols to challenge the equipment and thus increase the probability the equipment would meet the needs of the process. The implication of these shifts was that validation was necessary, but not essential to sound process development.

This short-cut approach to validation resulted in processes that were less stable at the commercial scale. FDA's recent revelations about high-profile, approved products that may be unsafe, such as Vioxx and Serevent, and Congress's pressure on industry to find ways to reduce the cost of drugs to the general public, have impacted both Big Pharma and biotech. In response, the industry has recognized the need for a better way to reduce process and product risk.

The answer was a shift to a more scientifically driven development approach, often referred to as "Operational Excellence," or "Process Excellence." This approach integrates process, quality, and business requirements to promote the science of development.

These quality initiatives integrate Six Sigma, Lean Manufacturing, Kepner-Tregoe, **Theory of Constraints**, Design of Experiments, and Balanced Scorecards to establish process understanding. These methodologies emphasize the need to objectively define, measure, and characterize critical variables that affect a process. While testing and data collection are integral components, verification is the final culmination of the quality assessment--not the basis of quality.

Looking closely at these approaches, however, reveals that they based in a large part upon an approach that has been integral to our quality systems for over 70 years--Walter Shewhart's cycle of Plan, Do, Check, Act (PDCA).

Plan, Do, Check, Act

Walter Shewhart, an enterprising statistician who worked at Bell Laboratories in the US during the 1930s, developed the science of Statistical Process Control. An offshoot was the PDCA Cycle, often referred to as "the Shewhart Cycle." This tool was adopted and promoted from the 1950s on, by W. Edwards Deming, the renowned quality management authority, and as a result the tool also became known as "the Deming Wheel" (Figure 1).

[FIGURE 1 OMITTED]

The PDCA Cycle was the first tool broadly adopted as a framework for continuous improvement. PDCA is a four-step quality improvement cycle that promotes continuous improvement based on the method of design (plan), execution (do), analysis (check), and evaluation (act). Sometimes referred to as plan/do/study/act, the cycle emphasizes the constant attention and reaction to factors that affect quality.

The chief advantage of the PDCA cycle--flexibility in moving through each phase of the cycle--is also its biggest challenge, because it left the door open for subjectivity. Subjectivity has long been the downfall of our industry. Without a clear vision for success or a defined method for evaluation, the potential exists to rely on unscientific process development and characterization activities, which can lead to incorrect or incomplete conclusions. For example, univariate analysis methods--often called One-Factor-at-a-Time (OFAT) studies (5)--have been the backbone of the small-molecule pharma industry, as well as the biopharm industry. Such studies, however, do not possess the power to fully characterize a process. The result is a false sense of security that the process characteristics are understood.

An analogy would be that of trying to solve the popular "Rubik's Cube" puzzle. It may be relatively simple to get one side of the cube all one color, thus providing the impression of progress towards your goal. However, the reality is that you are actually further from success than when you started the exercise (Figure 2). Because of these limitations, other industries abandoned the OFAT approach 30 years ago, deeming it ineffective for process characterization and verification.

[FIGURE 2 OMITTED]

The biopharmaceutical industry, too, has come to recognize that the OFAT approach is insufficient. The industry has also realized that to be successful in combining quality, technical, and business requirements in the drug development lifecycle, it must realign not only its scientific approach to process understanding, but also its thinking within the organization. As a result, Operation Excellence initiatives have moved to frameworks such as Six Sigma to provide a roadmap that can meet this need.

### Six Sigma and Its Roadmap

In 1986, Motorola established a framework designed to integrate quality, process, and business requirements into the product development lifecycle. Motorola recognized that variation is the death knell of any process, so the company set out to establish a methodology to identify and eliminate variation. They called this approach Six Sigma (6) (Figure 3).

[FIGURE 3 OMITTED]

In the late 1990s, CEOs Jack Welch from GE and Larry Bossidy from Allied Signal adapted the Motorola model to a set methodology called the DMAIC roadmap. DMAIC is an acronym for Define, Measure, Analyze, Improve and Control. These are the five phases necessary to measure, characterize, and control a process (Figure 4).

[FIGURE 4 OMITTED]

Within each step of the roadmap, a defined set of tools is applied. Each phase in the DMAIC process is intended to guide the members of an improvement team through the project in a manner that provides relevant data and in-depth process understanding. The DMAIC project management approach allows businesses to make the best possible decisions with the available data and resources. The five-steps of the DMAIC process are as follows:

1. Define: Clearly define the problem and relate it to the customer's needs (generally, with a cost benefit to the organization identified).
2. Measure: Measure what is key to the customer and know that the measurement is good.
3. Analyze: Search for and identify the most likely root causes.
4. Improve: Determine the root causes and establish methods to control them.
5. Control: Monitor and make sure the problem does not come back.

Within each DMAIC phase, there is a set of deliverables that must be completed to ensure all project requirements are met. A summary of the deliverables and typical activities for each phase of the DMAIC process is shown in Table 1.

Looking closely at the tools within the DMAIC methodology reveals elements that have been part of the quality toolkit since its inception. Cause and effect diagrams, Failure Mode and Effects Analysis (FMEA), and process capability analysis, among others, have been used broadly by process and quality engineers in multiple industries for years. What separates the DMAIC roadmap from the isolated application of these individual tools is the methodology around the application of the tools. In DMAIC, the process evaluation is based on the objective acquisition and analysis of data, in lieu of representative testing and inference.

### Lean Manufacturing

Although Six Sigma and the DMAIC toolkit focused on eliminating process variability, there still remained the need to bring products to market faster and more cheaply. As a result, the biopharmaceutical industry has turned to the principles of Lean Manufacturing to increase the efficiency of our processes. The ideas of Lean Manufacturing are based on the Toyota Production System approach of eliminating waste in every aspect of a company's operation. Lean focuses on time variability, in contrast to Six Sigma's focus on process variability. In their book *Lean Thinking*, Jim Womack and Daniel Jones (7) recast the principles of Lean into five principles:

1. Value: Every company needs to understand the value customers place on their products and services. It is this value that determines how much money the customer is willing to pay for them. This analysis leads to a top-down, target-costing approach that has been used by Toyota and others for many years. Target costing focuses on what the customer is willing to pay for certain products, features, and services. From this, the required cost of these products and services can be determined. It is the company's job to eliminate waste and cost from the business processes so that the customer's price can be achieved at great profit to the company. In the biopharmaceutical and pharmaceutical world, value is often associated with quality and data, rather than with standard cost.

2. Value Stream: The value stream is the entire flow of a product's lifecycle, from the origin of the raw materials used to make the product through to the customer's cost of using, and ultimately disposing of, the product. Only by studying and obtaining a clear understanding of the value stream (including its value-added and waste) can a company truly understand the waste associated with the manufacture and delivery of a product or service.

3. Flow: One significant key to the elimination of waste is flow. If the value chain stops moving forward for any reason, then waste occurs. The trick is to create a value stream in which the product (or its raw materials, components, or sub-assemblies) never stops in the production process, because each aspect of production and delivery is in harmony with the other elements. Carefully designed flow across the entire value chain will minimize waste and increase value to the customer. Achieving this kind of flow is a challenge in our industry because many of our processes are batch processes. Even so, within the context of the total value stream, there are significant opportunities to move towards continuous flow.

4. Pull: A traditional Western manufacturer uses a style of production planning and control whereby production is "pushed" through the factory based upon a forecast and a schedule. A pull approach dictates that we do not make anything until the customer orders it. To achieve this requires great flexibility and very short cycle times of design, production, and delivery of the products and services. It also requires a mechanism for informing each step in the value chain what is required of them today, based on customers' needs.

5. Perfection: A lean manufacturer sets perfection as a target. The idea of total quality management is to systematically and continuously remove the root causes of poor quality from the production processes so that the plant and its products move toward perfection. This relentless pursuit of the perfect is the key attitude of an organization that is "going for lean."

Lean has been enthusiastically embraced by our industry because the tools are simple and improvement can be realized quickly. Although Lean is often initiated because of cost or efficiency reasons, there is another perspective to Lean that is often overlooked: quality.

Our industry should think of Lean as a quality initiative--not a business-driven one. While it is true that the basis for Lean is to eliminate waste and maximize the value-added activities of a process, another benefit of Lean is the way it simplifies and standardizes the process. The result is improved predictability. If you map the DMAIC and Lean tools together against the Shewhart PDCA Cycle, you find they follow the same framework; the tools within both toolkits are designed to address the same basic requirements of the PDCA cycle (Figure 5).

[FIGURE 5 OMITTED]

Validation and Plan, Do, Check, Act

Mapping validation, as applied by the biopharmaceutical industry today, may seem inconsistent with the principles of the Shewhart PDCA Cycle, DMAIC, and Lean. The basis of traditional validation is verification against predetermined acceptance criteria. However, if we divide the validation process into its components, there is more similarity than difference between validation and these improvement methods. The steps of the validation life cycle map well to the

Control, Measure, and Analyze phases of the DMAIC roadmap. What is missing is the Improve stage. Six Sigma and Lean principles are predicated on the absolute requirements of demonstrating that the process is in control. By building on an efficient and objective framework for characterizing, measuring, and optimizing a process, it is possible to achieve a level of confidence that the process will be predictable and reproducible. No amount of testing will ever approach this level of confidence; heightened testing and large sampling can still only infer the process is in control. (As many have said, you cannot test quality into the product.) The irony in applying validation to the PDCA model is that its efficacy is only as good as one's understanding of the key process input variables that steer the process. In the absence of this, validation degenerates to a paper exercise.

## Conclusion

The twenty-first century GMP initiative advocates the need for building process understanding throughout the process development lifecycle. Tools such as Six Sigma, DMAIC, and Lean Manufacturing provide a framework for objective characterization and analysis of a process's key parameters. This knowledge, coupled with a quality system framework for specification, in-process, and release testing, can significantly elevate the level of quality built into the final product or process. While at first glance validation might appear to be inconsistent with these improvement initiatives, the elements of the validation lifecycle map to the control, measure, and analysis phases of the PDCA lifecycle. The most effective application of validation is achieved by using these optimization tools in the process characterization and development phases of a process long before validation. Until characterization and evaluation frameworks are more fully integrated into the drug development lifecycle, validation will remain a costly and time-consuming exercise capable only of providing limited assurance of process and product stability.

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## Quick Recap

- \* Pharma companies are incorporating scientific quality approaches to improve product safety and reduce costs.
- \* Lean manufacturing principles can improve the validation process.
- \* Good manufacturing practices require process understanding as much as sophisticated quality approaches.

Table 1a. Summary of DMAIC phase deliverables

		Define
DELIVERABLES		ACTIVITIES/TOOLS
* Identify the Customer(s)		* Supplier-Input-Process-Output-Customer Requirements (SIPOC)
* The Problem Statement	* Develop list of Critical To Quality (CTQ's) from Customer Expectations	* Process Map * Bar Chart * Gap Analysis
* Select the team		* Quality Function Deployment
* Identify the Process(es) to Improve	* Cost of Poor Quality (COPQ) Analysis	
* Create a High-level Process map (SIPOC)	* Scope and Charter Project	* Cause & Effect Matrix * Stakeholder Analysis * Pareto Chart * Project Charter Form * Gantt Chart

Measure

DELIVERABLES		ACTIVITIES/TOOLS
* More Detailed Map of "As-Is" Process	* Determine Project "Y"	* Swim-Lane Diagram * Value Stream Mapping * Pareto Charts
* Determine Requirements for Project "Y"	* Verify Integrity of Measurement System	* Fishbone Diagram * Force Field Analysis * Check Sheets * Concentration Diagrams
* Data Collection Plan		* Process Cycle Efficiency
* Capability of "As-Is" Process		* Failure Mode and Effects Analysis (FMEA) * Measurement System Analysis/Gage R&R * Process Control Charts * Capability Studies

Analyze

DELIVERABLES		ACTIVITIES/TOOLS
* More Detailed Map of "As-Is" Process	* Determine Project "Y"	* Swim-Lane Diagram * Pareto Charts * Fishbone Diagram
* Determine Requirements for Project "Y"	* Verify Integrity of Measurement System	* Check Sheets * Concentration Diagrams * Process Cycle Efficiency * FMEA
* Data Collection Plan		* Measurement System Analysis/Gage R&R * Process Control Charts * Capability Studies

Table 1b. DMAIC phase deliverables

Improve

DELIVERABLES	ACTIVITIES/TOOLS
* Determine Relationship between Key X's and Project Y	* Process Flowcharting
* Develop Potential Solutions	* Response Surface Methods
* Select the Best Solution	* Monte-Carlo Simulation
* Optimize the Solution	* Value Stream Mapping
* Pilot the Solution	* Solution Selection Matrix
* Establish Operating Tolerances	* Mistake Proofing
	* Pull Methodology
	* Setup Reduction
	* Total Production Maintenance (TPM)/5S
	* FMEA
	* Line Balancing
	* Process Tolerancing

Control

DELIVERABLES	ACTIVITIES/TOOLS
* Documented Process Changes & Controls	* Risk Assessment of Changes-FMEA
* Process Control Plan	* Control/Action Plan
* Training Plan for New Process	* Standard Operating Procedures
* New Process Metrics	* Project Commissioning Plan
* Expected Financial Benefits	* Process Validation
* Approve Improvement Commissioning Plan	* Process Control Charts
	* Capability Studies
* Replication Opportunities	* Visual Controls
	* Preventive Maintenance

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## C-5 work earns Robins coveted award: ALC first Defense Department organization given international honor

From: [The Macon Telegraph](#) | Date: [May 5, 2006](#) | Author: [Gene Rector](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

An international business and academic institute has placed a "world class" stamp on C-5 maintenance at the Warner Robins Air Logistics Center.

The Maryland-based Institute for Operations Research and the Management Sciences announced this week that the center will receive its prestigious Franz Edelman Award in November at the institute's annual conference in Pittsburgh.

The award - now in its 35th year - is recognized as the "Super Bowl" of operations research, Robins officials said.

Robins is the first Defense Department organization to take the Edelman prize. General Motors won the award last year. Other past winners have included Motorola, AT&T and Continental Air Lines.

The late Franz Edelman, a native of Germany and for many years an RCA Corp. engineer, was noted for the imaginative way he used computer systems to improve decision-making, management and operations.

This week's announcement is the second significant recognition for the center's support of the C-5. Robins also was the first Defense agency to become a Shingo Prize gold level recipient in September for excellence in manufacturing.

"What's so great about the Edelman award is that we have a totally independent business and academic community recognizing us," said Bill Best, deputy director for the 402nd Aircraft Maintenance Group at Robins. "It's not the Air Force winning this. It's us - Warner Robins ALC."

The center was recognized for its use of **critical chain** project management to reduce the time required to overhaul the massive C-5 cargo aircraft from 240 days two years ago to the current 160 days. The maintenance flow day reduction also cut the average number of C-5s on base from 12 to 7.

**Critical chain** project management enabled the center to focus on the right tasks every day, Best said.

The computerized process offers decision makers a visual display of aircraft tasks and highlights the ones that are most important.

"In the past, we made the entire aircraft a priority and we would move all of our people to the one that was in the most trouble," he said. "In reality, only pieces of the airplane needed attention - for example, the landing gear - so we were wasting our other skills. This system takes individual tasks on all the airplanes and prioritizes them. It enables us to identify and focus on the critical ones."

Best said the reduction in C-5s at Robins means operational units have more aircraft at their disposal. "And that enables them to generate additional revenue of at least \$49.8 million per year in hauling cargo for the Army, Marines or whoever they're hauling for," he emphasized.

It also means Robins has excess capacity that can be devoted to other workload. "If we're not doing C-5s, that means we have the capacity to do something else," Best said. That could mean additional base revenue of \$119 million through 2008 and almost \$250 million by 2009, he said.

Col. David Holcomb, the C-5 system program manager at Robins, said he was thrilled with the Edelman outcome.

"The 402nd Maintenance Wing has executed **critical chain** project management brilliantly," he was quoted in a base news release. "The team's outstanding contribution to our nation's security warrants this prestigious award."

Other agencies competing for the 2006 Edelman prize included Animal Health Institute and Cox Associates, the U.S. Commercial Aviation Partnership, Omya Hustadmarmor and Molde University of Norway and Travelocity and Sabre Holdings.

The institute is an international scientific society with 10,000 members, including Nobel Prize laureates, representing such diverse fields as aviation, health care, law enforcement, the military, engineering and telecommunications.

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# We All Fall Down.(We All Fall Down: Goldratt's Theory of Constraints for Healthcare Systems)(Brief article)(Book review)

From: [Small Press Bookwatch](#) | Date: [May 1, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)



**Newspapers**

We All Fall Down

Julie Wright & Russ King

The North River Press Publishing Company

PO Box 567, Great Barrington, MA 01230

0884271811 \$24.95 [www.northriverpress.com](http://www.northriverpress.com)

We All Fall Down: **Goldratt's Theory Of Constraints** For Healthcare Systems, delightfully co-authored by Julie Wright and Russ King is an entertaining and thought-provoking novel in which co-authors Julie Wright and Russ King explore the intricate world of TOC and its effective use when applied to health care and service industries. Engagingly whisking its readers through Beth Segar's every-day digressively tedious life in combat with coworkers and happiness, We All Fall Down depicts the amusing tale of her introduction of Theory of Constraints in the workplace and its immediate effectiveness. We All Fall Down is unique and very highly recommended reading.

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## 3 CUs Share Strategies for Delivering Mortgage Value.(Pentagon Federal Credit Union)(State Employees Credit Union)(Eastern Financial Florida Credit Union)

From: [Credit Union Journal](#) | Date: [April 17, 2006](#) | Author: [Diekmann, Frank J.](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

ORLANDO, Fla. -- There are values beyond just pricing. Just ask Pentagon FCU, or any of two other credit unions that have found value is often best expressed not on the balance sheet, but in the intangibles.

During a Financial Solutions Symposium here hosted by WesCorp and Callahan & Associates, a trio of credit unions shared their strategies for building their mortgage portfolios. Below is a look at each.

### A Trip To The Bankers' School Teaches Lesson About CUs

ORLANDO, Fla.-For Pentagon FCU's Deborah Ames Naylor, VP-mortgage services, all it took was a trip a school hosted by the Mortgage Bankers Association to demonstrate the value a credit union can bring to the mortgage lending process for the consumer.

Apparently, members see the value. PFCU has watched first mortgages grow to \$3 billion by February of this year, up from about \$1.5-billion in 2005. In all, it has 14,500 first mortgages held in portfolio, 20,700 fixed equity loans representing \$880 million, and 21,400 home equity lines representing \$1.4 billion.

Pentagon FCU has one of the largest mortgage operations among credit unions, operating seven days a week from 8:30 a.m. to 10 p.m. from mortgage lending offices in Eugene, Ore., Omaha, Neb., and its home market of Alexandria, Va.

The credit union offers fixed products of 10, 15, 20 and 30 years, but really focuses on ARMs because its military membership tends to relocate often. Last year it introduced a 40-year loan, Ames Naylor noted, but it "has not taken off like we thought it would. Members are really looking at the interest-only ARMs that we don't offer and don't plan to offer."

It also offers fixed equity loans of five to 20 years with LTVs to 100% at competitive rates. On lines of credit, it offers an interest-only option with an LTV cap of 80%, and regular payment up to 90% LTV.

"We have a very high-quality portfolio. We monitor very closely including for utilization," she said, adding that one reason for the close eye is the loans it makes in certain areas have appreciated quickly and could be overvalued.

Among the "member values" PFCU offers, said Ames Naylor, is a 90-day lock with a contract or refinance fee, no lender fees, jumbos priced similarly to conventional loans, and its PenFed Realty CUSO. Other member value is delivered via low rates, partnerships with vendors to keep costs down, and online status available on second mortgages. "We squeeze our vendors hard to keep our costs down," said Ames Naylor.

As for another feature, she explained, "In Washington, D.C. you can't find a house under \$350,000 so we do a lot of jumbos in the D.C. area and we find our pricing gives us a real advantage.

As interest rates have risen, Ames Naylor said PFCU has become concerned over losing the first mortgage market. For that reason it bought a real estate firm in the D.C. area that has 18 agents called PenFed Realty. Instead of the 6% commission typically charged, PenFed charges 4% and credits 1% of the price back to the member. "The reason we did this is we hope we will get the mortgage," she said, adding Pentagon Federal is looking to partner with others in the Realty program.

Ames Naylor noted Pentagon Federal places a lot of emphasis on first mortgages on online applications, with more than 95% of apps received electronically through Mortgagebot, through which it is connected to Fannie Mae and Fiserv's Unifi Pro origination solution.

The credit union also receives 50% of applications for second mortgages online, and members can similarly check status online. "One thing we did find is that when we put up the conditions, if we indicated we need your tax returns and they faxed it, they are on the phone in five minutes. The member expectations are that you are going to update your system as soon as they've done it," she said.

### Billions In Mortgages Based On One Very Simple Credo

Yes, we're big, but member-friendly comes in all sizes. - Phil Greer

ORLANDO, Fla.-State Employees Credit Union in Raleigh, N.C., is the second biggest natural-person CU in the world, yet it credits all of its growth and complex operations to some rather simple principles.

Chief among them is to do right by the member.

SECU is apparently doing all right itself. It has \$7.3 billion of ARMs (69,551 loans) and another \$1 billion (11,770 loans) in fixed rates, portfolio, and services \$1 billion in fixed-rate loans.

"Today's economic climate means risk management is more important than ever," noted Greer. "Deregulation, industry consolidation and industry overcapacity all have combined to make competition more fierce in the mortgage lending market. Stronger competition has resulted in short-sighted behavior by some lenders in their efforts to maintain marketshare or just stay in business."

Greer pointed to another quote about the financial services marketplace: "Don't rely on a slightly lower interest rate or faster loan approval process to gain a lasting competitive advantage. Differentiate yourself by offering value-added products and superior customer service." That statement was made by Ellen Scholemer, VP-business development, GE Capital, in 1987.

SECU, which made fixed-rate loans from the 1950s through 1980, began offering ARMs in the 1980s seeking to do "something unique so we were not going head to head with the big lenders."

"After years of experimentation during the 1980s, we came out with a two-year ARM. It wasn't really rocket science, it was a desire to do something right for the members," said Greer. "We started this in the fourth quarter of 1993 and finally settled upon the two-year ARM."

SECU's ARM product has a maximum change per adjustment of one percentage point with a maximum change over the life of the loan of eight percentage points. It is indexed to the one-year CMT, charges no PMI, and offers a 90% LTV. Typically SECU charges 150 BPs below the 30-year fixed, typically 50 BPs above the one-year ARM.

"In the worst-case scenario," said Greer, "a member comes out ahead vs. fixed rate for 10 years on 90% of the loans made. It's very easy to demonstrate that to them."

But all that pricing isn't what SECU believes its strength. "How do we put members first?" asked Greer. "None of our staff are on any commission. We desire to be our members' trusted advisor. We give timely disclosures and we service what we sell, because we think it's important to keep that relationship. With the exception of Fannie/Freddie loans, there is no PMI."

SECU also pays interest on the escrow, charges a low origination fee of one half of 1% capped at \$750. It closes refinances in its branches with no attorney and no title insurance, and it charges no prepayment penalty. "This saves the member easily \$500 to \$600 per closing," said Greer.

In addition, it uses a 30% to 40% debt-to-income ratio, and has a very decentralized lending authority with mortgage officers at its 180 branches empowered to approve mortgages. "All we really ask of our loan officers is to be reasonable," he explained. "We want a reasonable ability to repay, reasonable credit history and reasonable collateral." State Employees does not use an automated system to approve mortgages.

SECU also does a 90% cash out refinance, modifies rates when rates decline as a "somewhat defensive" measure on which it charged a fee but did not require new documentation or "jumping through hoops," uses a single file credit report, stated income above 650 BEACON. Thirty-eight to 40% of SECU's mortgage loans are to members who are at or below median income, according to Greer.

The CU has had a 90-day delinquency rate of .24%, foreclosure losses (without PMI) have averaged over the past eight years .0089%. A 2005 CUNA Membership survey found 98% member satisfaction, with 69% of SECU members considering it their PFI.

"Mortgage lending is something that is important to members individually, and also important to communities in which they reside," Greer told the meeting. "You need to do the right thing, and that's what we attempt to do day in and day out."

## 1 CU Learns The **Theory Of Constraints**

ORLANDO, Fla.-Sometimes you can be too successful.

When mortgage rates began their slide in the 1990s and the first of the mortgage refi waves began, Eastern Financial Florida Credit Union found itself in the same position as many other lenders, especially in South Florida, where members kept the phone ringing and the fax machine humming with applications. That was not the good news.

Kendrick Smith, chief investment officer with EFFCU, said that while pursuing an MBA in 2003 he would come to learn of the Theory of Constraints, a theory he would soon be putting to use.

With a mortgage balance sheet of \$2 billion, and a Broward County, Fla. market where the average house price is \$400,000, mortgage lending has become an important function within the credit union that was founded to serve employees of the old Eastern Airlines. But to get to where it is today, Smith said it had to reexamine its mortgage workflow and all the challenges the organization was facing.

First, it took apart the process, beginning with contacts and moving onto origination, mortgage processing, underwriting, closing, post closing, loan review, secondary market, document management and internal audit.

In examining its challenges, Eastern Financial found it was difficult to respond to urgent member requests with too much expediting going on and priorities being shuffled. Lead times had become too long, (at the time 95% of the people with a mortgage had an economic incentive to refinance), with consistent work in process and a workplace that had become stressful, leading to high turnover. It also found that all the overtime wasn't being equated with profits, and all the ineffective multi-tasking on the part of staff members required a lot of rework due to errors. "It was kind of embarrassing," he admitted.

Here, the credit union turned to the **Theory of Constraints**, developed by Eliyahu M. **Goldratt**. "The **Theory of Constraints** is a continuous improvement philosophy that looks at an organization as a system," Smith explained. "It focuses on improving the 'throughput' from the system. Instead of focusing on costs, you focus on getting things through the system faster, which then reduces costs. By increasing throughput, the end-result will be improved."

But before improving, "constraints" must be identified. "The theory compares the system to a chain or a network of chains," Smith went on to explain. "The weakest link within the system is the system's 'constraint.' Improving any piece of the chain won't matter because it will still break at the weakest link. By improving the performance of the constraint, the weakest link is strengthened and throughput is improved."

In EFFCU's case, underwriting was identified as the weakest link after an operational analysis that included asking the question, "Do I have enough protective capacity in front of the constraint and behind the constraint? One of the things that **Theory of Constraints** does is it identifies what are the core issues," said Smith.

In the past, he noted Eastern Financial would take any application even if it really couldn't close the loan in a reasonable time.

"You have to regulate the flow of applications into the pipeline at the speed of which the underwriter can process them," said Smith. "When we went through the operational analysis, some very startling things came out of it. We learned we were losing money on every loan we did. "

By ensuring its internal process could handle the workload, its pricing became more competitive as it also improved member service. It began delivering closing dates at the time of application. "Do you know how many phone calls stopped coming when we explained that we hit our delivery date 99% of the time? We developed placeholders in the schedule, so that if a friend of the CEO showed up, we could close the loan in five days. This also reduced the volume of errors we had. If you have a closer making the same mistake and you don't close for 180 days, you could have several hundred loans with the same mistake."

Overall, EFFCU appears to have succeeded. Smith said he hasn't heard a member complaint in two years, it has increased its loan capacity 24% without adding any headcount, and it has dropped the cost from \$1,900 per file to \$1,360 per file.

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## Best Practices Can Be Learned In The Strangest Of Places.(National Credit Union Administration (US government))(DFCU Financial)(Column)

From: [Credit Union Journal](#) | Date: [April 10, 2006](#) | Author: [Diekmann, Frank J.](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

As you may have noticed, I'm not wearing a hat in the photo that accompanies this column. That's because I've taken my hat off to the folks involved in the conversion bid by DFCU Financial Credit Union in Dearborn, Mich., to become a bank. Not a mutual. Not a "savings institution." A bank.

You have to admire chutzpah and the folks behind these conversions have it by the 10-gallon hat full. Two weeks ago I thought the "converters" had issued a never-to-be-topped claim when they insisted the reason they haven't disclosed more information about the conversion to members is because they are prohibited from doing so by NCUA. Yes, the same NCUA that has been passing regulations and insisting that these credit unions and the law firms and consultants behind them disclose MORE! Indeed, NCUA has been criticized by some of the uninformed in Congress for this very thing-upholding member rights.

But now, as is reported in this issue, that preposterous claim has officially been topped by a new complaint from the conversion crowd, which has been upset that the folks fighting the conversion at DFCU Financial, a group calling itself DFCU Owners United, haven't allowed them to address their members. What? A group not permitted to tell its side of the story!

The small groups behind these charter conversions have all followed the same playbook: take a year or two and begin laying the groundwork for the conversion by running member business loans up to the 12.25% or letting capital slide until it approaches PCA triggers (in both cases, giving the CU a "reason" to cite for the conversion). The boards secretly meet and discuss the conversion plan and then foist it upon the membership quietly (if possible) and quickly (vote NOW! and win a prize). And at no point in the process, according to their playbook, are any dissenting voices permitted, any critical views tolerated, and certainly no meeting or forum is to be held until the word "deal" is preceded by the word "done."

The Coalition of Credit Union Charter Options, a small group of former CUs that have converted to banks, has sent letters to the media complaining that it is not being permitted to tell its side of the story. A representative of the Coalition, Marvin Umholtz, a former credit unionist who has gone to the other side, stood outside a meeting room in Michigan last week and complained he was being "ignored."

Hmm, wonder where the folks fighting the conversion and loss of their ownership stake and equity learned that tactic?

On a far brighter note, WesCorp and Callahan & Associates hosted a meeting last week in Orlando that examined financial trends and included several panel discussions on credit union strategies. (By the way, I don't know if Orlando is getting closer to Tampa or Tampa to Orlando, but it's turning into Talando or Orampa, take your pick).

If there is one trend that has defined credit union operations over the past five years it's been the growth of mortgage lending and its slice of the overall portfolio pie. Rock-bottom home loan rates have kept everyone's pipeline full (as one CU at the meeting shared, TOO full), making it easy for just about everyone to be successful.

Rising rates will now identify those that have truly been successful in building a mortgage operation during the good times from those credit unions that have simply been having good times grabbing the low-rate fruit, separating the APRs and the oranges, so to speak.

Among the former are Pentagon FCU and Eastern Financial Florida Credit Union. Both are billion-dollar-plus operations, not surprisingly, that could invest in internal processes. Both, too, are in markets that have seen rapid appreciation (Washington, D.C./Northern Virginia and South Florida). Debbie Ames Naylor, VP-mortgage services at Pentagon, told the Callahan/WesCorp meeting the credit union's military membership has led it to focus on ARMs, since so many members are reassigned long before ever paying down a mortgage. It has also placed emphasis on "member values" that have included a 90-day lock with contract or refinance fee, no lender fees, jumbos priced similarly to conventional loans, and the purchase of a local real estate firm it operates as a CUSO called PenFed Realty.

Kendrick Smith, CIO with Eastern Financial Florida, had a story that will sound familiar to many. During the mid-1990s refi boom, it was busy-too busy. Phone calls were going unanswered, applications were sitting in the pipeline for 180 days, and worst of all, errors were being made. Employees were stressed out and leaving, moving to other mortgage lenders that were hiring anyone with a pulse (filling slots, no doubt, created by their own stressed out former employees).

For EFFCU, Smith said, the key to turning things around came in understanding the "**Theory of Constraints**," a modern day management theory built around the age old tenet: "you're only as strong as your weakest link." In its own review, EFFCU learned it was losing money on nearly every loan it did. By overhauling everything, it ensured its internal process could handle the workload and its pricing became more competitive as it improved member service. "You have to regulate the flow of applications into the pipeline at the speed at which the underwriter can process them," said Smith.

The best news? "I haven't had a member complaint in two years," he said.

We'll have more details on this session in an upcoming issue.

Frank J. Diekmann is Publisher of The Credit Union Journal.

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## Cost-effective & simple bottleneck buster.(Overall equipment effectiveness and downtime )

From: [Automotive Design & Production](#) | Date: [April 1, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

"One of the biggest challenges in manufacturing is to get more net good parts off the end of the line," says Dennis Cocco, president and CEO of Activplant Corp. (London, Ontario; [www.activplant.com](http://www.activplant.com)), a provider of manufacturing software. Cocco admits that there is plenty of information that can be--and is, in many cases--being collected from a variety of sources in order for plant personnel to determine why the appropriate number of good parts isn't coming off of the end of the line. A couple of the things that are often measured, he says, are overall equipment effectiveness (OEE) and downtime. But he contends, "There's no correlation between OEE data, downtime data, and where throughput constraints are. We know that for a fact."

Wait a minute. If a machine goes down, that means there's no production coming off of that machine: isn't that a contributing factor to overall production. Not necessarily, Cocco counters. Chances are, there is a buffer so that the machine really doesn't have an effect, at least not in the short term. He goes on to point out that there are a multitude of interdependencies within a manufacturing environment such that it can be difficult to determine just what really needs to be analyzed. "You can measure tons of data and still not know where your constraints are." So in order to provide a way to look at an entire plant and determine where the constraints are and how the constraints match up so that resources can be directed to the right places, Cocco says they've developed what they're calling a "Throughput Analyzer," which he describes as a "throughput capability metric that combines the notions behind the **Theory of Constraints** and the Toyota Production System. It's a percentage-based metric that quickly identifies, as a percentage, which workcells are the biggest constraints in the plant."

As is the case with the other elements of Activplant's manufacturing intelligence software products, the information is accessed directly from shop-floor devices or systems (e.g., PLCs, MES or quality systems). He describes what is necessary for the analyzer as being "a very light amount of data from the automation layer." Essentially, the analyzer makes a determination of how well an operation is at producing one-piece flow. Constraints are analyzed by Four loss categories:

- \* Quality
- \* Speed
- \* Downtime (e.g., equipment failure)
- \* Uptime (taking into account such things as changeovers and tooling trials).

Based on this assessment, the constraints with the biggest impact can be addressed. "This is a very attractive solution for a CFO," Cocco notes, explaining that by providing an overall look at the constraints within a plant the CFO is able to determine whether investments in capital equipment and/or maintenance are being targeted where there is the best potential returns.

The Throughput Analyzer could also be a great boon to those who would prefer not having to move their production operations to low-wage countries. "You'd be amazed at how many plants are running at the 40% range of what the theoretical maximum output of the plant could be," Cocco says.

One of the terms he uses a lot when it comes to understanding what's going on in the manufacturing operation is "clarity." A word that he doesn't use as often but could would be "simplicity," in that the Activplant Performance Management System (APMS) is arranged so that it is not only simple to install but simple to use. A good example is part of what it calls its ActivEssentials offerings, Insight for Microsoft Excel. Cocco explains, "Most plants run on Excel; people like to do their analysis in Excel." So what they've done is create the means by which there is an automated, live link between what's happening on the plant floor linked to the cells in Excel. This provides the means by which custom reports can be created at as little as half the cost of what's ordinarily required to produce them. What's more, Cocco points out that it isn't

necessary to understand the intricacies of databases in order to use the tool. "Our core strength is the ability to take a lot of disparate data from the shop floor and put context to it so that people can understand what it really means," he says.--GSV

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## Scheduling systems: scheduling affects everything in an operation, but usually gets the lowest share of technical resources.(Manage)

From: [Graphic Arts Monthly](#) | Date: [April 1, 2006](#) | Author: [Cross, Lisa](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Shorter cycle times and downward pressure on prices--the reality under which most print firms operate--place increasing emphasis on optimizing use of assets and resources. Automated scheduling systems offer a tool with powerful potential to maximize both throughput efficiency and resource allocation.

Scheduling affects everything in an operation, from supplies to customer service to resource allocation. But in many companies, scheduling receives the least technical resources. Most firms still execute scheduling through a combination of magnetic chips on planning boards and static spreadsheet programs. But the components are now available, say experts and users, for widespread automation of scheduling, using applications that will allow for managing production based on real-time data collected by ERP/print management systems.

But before investing in any system, suggests Kevin Cooper, a professor at Cal. Poly State U., printers should ask themselves a few questions, such as:

Am I losing work by not having this? Will I gain work by getting this?

Will I add or lose administrative staff with this system? Will jobs get through the plant faster with the system? If yes, why; and could this be solved without the system? Will this system impact production efficiency in any way?

What measurable cost improvements will happen as a result of the system, and will they justify the costs?

"Be careful not to overspend on technology in an attempt to oversimplify the business information flow" says Cooper, who formerly managed operations at several RR Donnelley sites and also is GAM's best practices editor. "Also, beware of becoming a slave to a system where managing it becomes the focus over managing the business."

Cooper says he has witnessed many instances where managers become overwhelmed with system information and the information system focus becomes bigger than the focus on the customer and on the business fundamentals.

"Systems become integrated into a business, and owners don't have good metrics to measure its true cost," says Cooper.

Such untabulated costs include the transition to a new system, the cost of training for and maintaining a new system, and the cost of keeping it current as technology evolves.

Automated scheduling requires use of an MIS system that can integrate to the scheduling system, but approximately 50% of U.S. printers run their shops with a custom-coded solution that can't connect with the new breed of scheduling systems, says Hal Hinderliter, director of the Graphic Communication Institute at Cal. Poly. and GAM's Workflow editor.

"We get calls from potential clients with their own shop floor and estimating systems that want to add our scheduling solution, but their current systems can't work with other software" says Vincent Lawrence, president of Graphic Arts IT, a scheduling system provider.

### New breed of schedulers

A number of print management systems providers are stepping up with scheduling products newly linked to operations data systems. Leading the industry in installations is EFI, which gained numerous offerings in this area with the acquisition of the former PrintCafe. (Scheduling-specific offerings are distinguished in this report from broader capabilities seen in enterprise resource planning systems or ERPs.)

"Most companies view scheduling only as a tool to make sure jobs are on time and know what customer service can promise the customer," says Udi Arieli, product management director of CIM and product manager for PrintFlow, EFI's scheduling module.

Another barrier is that the classic "scheduling board" tends to be under the direct control of the plant owner. Lots of them are wary of technology. "They know that digital automation is good for other processes in their shop," says Hinderliter, "but don't want to lose control over the scheduling. Of course, an automated scheduling system can actually give them more control, but that's a hard sell."

Arieli contends that while manual scheduling using a white board works, it is not the optimal tool. Why? Because after managers spend time scheduling work, when it is time to print the job, the status of everything may have changed by the time a job reaches production.

"Magnetic boards are good visual aids" acknowledges John Fleming, president of print-LEADER Software. But reports generated from a scheduling system provide a picture of what is actually happening.

The Sheridan Group was an early adopter of automated scheduling. The \$287 million publication printer evaluated a lot of scheduling systems, but found many operated as electronic versions of white boards, says Douglas Ehmann, VP and chief technology officer of the Hunt Valley, MD firm.

Arieli, whose AHP Systems was acquired by PrintCafe (and later became part of EFI) is viewed by some experts as the "Renaissance Man" of automated scheduling, in part for his development of the Theory of Global Optimization, based on familiar operations theory of constraints concepts, as applied to print manufacturing.

In a nutshell, the Theory premises that all steps in all areas of the print production process must be optimized and synchronized to achieve maximum throughput. Any changes in the scheduling of a single job affects all jobs and, ultimately, all production capacity.

"A print manufacturing operation is a chain of interdependent links," Arieli explains. "A change in any job step can affect all other steps of that job, as well as other jobs in the queue or in process" he says. Each job follows a linear process through the shop, says Arieli, but the mix of all jobs presents a dynamic and constantly changing picture.

"Achieving maximum throughput is the only way to increase profitability in a business that consists mostly of fixed costs," says Arieli.

The profitability of a company is created by the sum of all its jobs, he says, not the theoretical profitability of individual jobs. This means that throughput is far more important than job costing or cost accounting.

Printer LAGraphics, Burbank, CA, 185 employees and \$30 million in sales, increased throughput by 10% to 15% after implementing EFR's PrintFlow scheduling system.

"We were using a typical magnetic scheduling board that was rarely up to date, and too many people were constantly changing things," says Bill Jacot, VP manufacturing. "With PrintFlow, our schedulers can control the workflow throughout the plant. Our project managers can schedule and prioritize jobs by date and time" They can view the schedule from their offices and see the loading for the whole plant, says Jacot. Because the scheduler is integrated into the LAGraphics's MIS system, managers can determine in advance if the company will make deadlines or if renegotiation is needed.

Automated scheduling systems hold the potential for production managers to fill capacity above budgeted hourly rates for time and to improve contribution--by as much as 20%, says Graphic Arts IT's Lawrence. "A good system shows where there is available time to pack jobs and identifies bottlenecks so managers can redistribute work and eliminate overtime."

Scheduling also influences a print shop's ability to grow. "There is a greater emphasis on scheduling as a business moves up the size continuum because more structure is needed to manage operations" says Scott St. Cyr, CEO of Cyrious Software. "Every time sales doubles, your operational systems have to fundamentally change."

Cyrus just rolled out a new version of its Control 3.0 scheduling system. Before founding the company, St. Cyr owned five rapidly-growing sign printing shops. He developed an automated scheduling system to accommodate business growth.

Automated scheduling can't be piecemeal, says Ty Tidwell, GM of Franklin Estimating Systems, which will launch a scheduling system in July to accompany its product line. "It needs to be tied to estimating and shop floor data collection."

The Sheridan Group also uses EFRs PrintFlow, which the firm's Doug Ehmann describes as "a rule-based system with powerful algorithms that duplicate many of the processes an experienced and talented scheduling person would use. It's fast and can consider many more constraints and options than are humanly possible", he says. "We investigated other technologies to help us with scheduling but, until PrintFlow was developed, none could manage in real-time our very complex and critical production processes;" he notes.

He says PrintFlow reduces production costs by smoothing the workflow and maximizing operational resources prone to form bottlenecks in a plant. "We can quickly consider the timing impact of different production alternatives--like using different equipment, and changing labor and shifts" reports Ehmann. Sheridan uses EFI's shop floor data collection module to feed real-time machine activities into PrintFlow. With it, "We can have up-to-date job status for even better on-time performance," notes Ehmann.

\* MORE INFO ONLINE: [www.cyrussoftware.com](http://www.cyrussoftware.com), [dims.com](http://dims.com), [efi.com](http://efi.com), [entpms.com](http://entpms.com), [graphicartsit.com](http://graphicartsit.com), [franklinestimating.com](http://franklinestimating.com), [printleader.com](http://printleader.com), [printersplan.com](http://printersplan.com), [printers-plus.com](http://printers-plus.com), [printstream.com](http://printstream.com)

Lisa Cross Senior Editor

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## Three-questions accounting: this proposed new name for Throughput Accounting shows that we have to answer three important questions to see if a decision is good for a company.(Management Accounting)

From: [Strategic Finance](#) | Date: [April 1, 2006](#) | Author: [Corbett, Thomas](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

There has been quite a lot of discussion regarding the Theory of Constraints' (TOC) approach to management accounting, which has become known as Throughput Accounting (TA). Some people have called it a new paradigm in management accounting, but others have said that it's simply a new way of showing old cost accounting concepts, such as variable costing.

In these discussions, four main criticisms have been leveled at Throughput Accounting: (1) TA is basically the same thing as variable costing, (2) it is valid only when there's a production bottleneck, (3) it regards operating expenses as fixed, and (4) it is only a short-term decision tool. But these criticisms are based on confusion about TA's methodology and how it works. Throughput Accounting is only concerned with the relevant costs and revenues associated with a decision. Here I hope to expose any misunderstandings so that we can have a healthy debate based on what TA really is, not on misinterpretations of what it is.

### Bridge between decisions and profitability

Before I address the misunderstandings, let's define what a management accounting system should do.

A manager's responsibility is to make decisions that will take an organization toward achieving its goal. Management accounting is a bridge between these actions decisions and that goal. Basically, management accounting is trying to provide managers with the answer to a simple question: "If I take this action make this decision, will it increase my organization's performance in relation to its goal?"

But if we don't know the organization's goal, we can't evaluate whether a decision or action is good or not, and we can't devise a proper management accounting system.

In the case of the organizations that I'll talk about here, the goal is to make money now and in the future. Thus, our management accounting system has to help us answer the question: "If I take this action make this decision, will my company's profitability increase?"

The performance measurements used to assess a company's profitability are net profit (NP) and return on investment (ROI). They show the position of the company in relation to its goal, but they aren't very useful for making day-to-day decisions. Management accounting has to make this connection so that the managers can know what course to take.

Today most companies use some sort of cost accounting system as their management accounting. Part of the logic behind cost accounting methodologies is that when we reduce the cost of a product we are increasing the company's profitability. This is one way that cost accounting creates the bridge between our decisions actions and the company's profitability.

But Throughput Accounting doesn't allocate costs to products. It creates the bridge by answering three questions, each one related to a TA measurement:

- (1.) What will be the impact of our decision on the amount of money the company generates?
- (2.) What will be the impact of our decision on the amount of money we spend to operate the company?
- (3.) What will be the impact of our decision on the amount of money captured in the company?

Here are the formal definitions of the three measurements (throughput, investment, and operating expense).

### Throughput

Throughput (T) is the rate at which the system generates money. This is fresh money that comes into the company-it's all the money that comes into the company minus what's paid to vendors. This is the money the company generated-the money paid to vendors is money generated by other companies.

The formula to calculate throughput per unit is:

$Tu = P - TVC$  where: Tu = Throughput per unit of product P = Price per unit of product TVC = Totally variable cost

As you can see, throughput has two sides: revenue and totally variable costs. The use of the words "variable" and "cost" may be confusing because of the measures used in cost accounting. The fundamental element here is the word "totally"-totally variable in relation to units sold. A totally variable cost is the amount incurred when one more product is sold. The obvious example is raw material costs: For each extra unit sold, the company incurs the value of the raw material of that product. Other things also may be classified as TVC, depending on the nature of the operation. If the cost variation is directly proportional to the variation in production volume, then it is a TVC and should be subtracted from the product's selling price to calculate its throughput.

Both products and companies can have throughput. A product's throughput is its price minus its totally variable cost. A product's contribution to the company's throughput is its throughput multiplied by the number of units sold. Consequently, a company's throughput is the summation of all the products' throughput. Throughput is the only one of the three measurements that is identified with individual products.

### Operating Expense

Operating expense (OE) is all the money the system spends in turning investment into throughput. As I mentioned earlier, there is no allocation of costs to products. As Eliyahu M. **Goldratt** said in his book *The Haystack Syndrome*, "Operating Expense (OE) is intuitively understood as all the money we have to pour into the machine on an ongoing basis to turn the machine's wheels." Here we include wages for the company's CEO, direct labor, rents, depreciation, etc. TOC doesn't classify expenses as fixed, variable, indirect, or direct, so OE is all other costs except totally variable costs. The increases and decreases in OE are analyzed on a case-by-case basis, taking into account their impact on the bottom line.

### Investment

Investment (I) is all the money that's trapped inside the company. The company's buildings, land, computers, furniture, machines, trucks, inventories (raw material, work-in-process, and finished goods), and the like are classified as investment. This measurement might be mistaken for the conventional accounting measurement of assets, but they actually differ drastically when referring to work-in process and finished goods inventory. The value ascribed to the work-in-process and the finished goods inventory is their TVC. One of the objectives here is to eliminate the generation of "apparent profits" due to the cost allocation process.

Throughput Accounting says that the three measurements are sufficient for us to build the bridge between NP and ROI and the managers' daily actions. These formulas show this bridge:

$Net\ Profit = Throughput - Operating\ Expense$   
 $Return\ on\ Investment = (Throughput - Operating\ Expense)/Investment$

With these three measurements (T, I, and OE) you can determine the impact a decision has on your company's bottom line. Any decision that has a positive impact on ROI is a decision that moves the company toward its goal. You don't need to calculate NP or ROI for the entire company--you can calculate the incremental NP and ROI. If they are positive and if the ROI is equal to or greater than a predetermined ROI, the decision is good.

**Goldratt** also said, "In evaluating any action, we must remember that we have three measurements, not just one. Otherwise, extremely devastating actions will be taken. This means that the final judge is not the measurements themselves but the relationships between these measurements." This is exactly what TA tries to do and why it doesn't allocate costs to products. TA uses the relationship among its three measurements to evaluate the impact a decision will have on the company's profitability. You don't need to calculate the cost of products to measure the impact of a decision on the company's NP and ROI.

## How throughput accounting can help

Now let's look at two simple examples that show how TA can help managers make good decisions (decisions that will increase the company's profitability).

### Example A: Increasing a Local Efficiency

Let's analyze the situation of company XYZ. The demand for its products has gone down, which has caused it to have idle capacity in all of its resources, and it is starting to lose money. Almost all organizations have been here at least once. One of the most common decisions companies ponder in this situation is how to reduce the cost of some of the products they are producing. The logic is that if a company reduces the cost per unit of some of its products, its profitability will increase.

XYZ is thinking of investing \$1,000 to increase the efficiency of an activity where a family of products is produced. By doing so, it will be able to reduce the direct labor in that activity and transfer a worker to another activity. That is, with this investment the activity will be able to process its products with less effort, so the products' cost will go down.

Using TA to evaluate this decision, let's answer the three questions:

(1.) What impact will this decision have on the company's throughput?

As this company already has idle capacity everywhere, increasing the efficiency of one activity won't have an effect on throughput. Nor will transferring a worker someplace else. Thus, the company's total throughput will stay the same.

But this doesn't mean that the company's profitability will stay the same. Remember, we have to answer all three questions in order to know what the impact on the company's profitability will be. The net profit formula is  $T - OE$ . If  $T$  hasn't changed, we can still increase NP by decreasing OE. So let's answer the second question.

(2.) What impact will this decision have on the company's operating expense?

Here we have to see if we'll be able to reduce the company's operating expense by increasing the efficiency of this activity. Will we fire anyone because of this decision? Will we reduce the rent on one of our facilities because of this? Things like that.

In this case we didn't fire anyone, but we transferred a worker to another activity, so the company's operating expense won't be reduced. Yet we can't forget that we need to invest \$1,000 to have the increase in efficiency, so OE goes up because of the depreciation of this investment. Suppose the depreciation rate is 10% a year. OE goes up by \$100 a year. This already points out a paradoxical situation where we reduce the cost of some products while we increase the company's total cost at the same time.

If throughput will stay the same and operating expense will increase by \$100, XYZ's annual net profit will decrease by \$100. The company's loss would increase. But let's answer the last question to see what the impact on the company's profitability will be.

(3.) What impact will this decision have on the company's investment?

Will XYZ be able to sell an asset (like a warehouse or a machine) because of this decision? Even though more idleness will be associated with the activity, we won't be able to reduce the activity's capacity because we can't sell less than 100% of the asset. If this is the case, the company's investment will increase \$1,000.

Thus, our net profit will fall by \$100, and our investment will increase by \$1,000. This is clearly not a good decision.

### Example B: Reducing Cost per Unit

Another improvement some companies try to make in such a situation is to use their resources to the maximum so that they can have a lower cost per unit. That is, they will produce everything they can so that they can spread their manufacturing costs among as many units as possible. This will certainly reduce the cost per unit and reduce idleness, but will it increase the company's profitability? Let's use TA to see.

(1.) What impact will this decision have on the company's throughput?

If the company produces more than it can sell, this won't increase its throughput. Therefore T will stay the same.

(2.) What impact will this decision have on the company's operating expense? If XYZ produces more than it can sell, its OE will go up because its inventory will increase, and, consequently, its carrying costs will go up. Here we have the same phenomenon of decreasing the cost of products and increasing the company's total cost at the same time.

(3.) What impact will this decision have on the company's investment?

Its investment will go up because the company will increase its inventory of finished goods and work-in process in order to keep its resources busy and distribute its manufacturing costs among more products.

T will stay the same, but OE and I will increase. Therefore, we can say that this decision will reduce the company's profitability even though it has reduced the cost per unit. This example illustrates how allocating costs to products will many times lead to wrong decisions.

Basic misunderstandings

Now that you've seen a basic overview of TOC's management accounting system, let's address some of the most common misunderstandings surrounding it.

Throughput Accounting is the same as variable costing.

Variable costing calculates the contribution margin of products, which is usually the price minus direct materials and direct labor costs. It also considers all other costs as fixed and thus is considered a short-term management tool.

The contribution margin calculation is quite similar to TOC's throughput measurement. The difference is that TOC doesn't state a priori what should be included in the throughput calculation. What it says is that throughput is price minus totally variable costs. What a TVC is will depend on the company's reality. Direct materials are the most common example, but, in some circumstances, direct labor can be a TVC if it is paid per part produced.

The biggest differences are that variable costing considers other costs as fixed and TA doesn't and that TA looks at the impact a decision will have on its three global measurements. Direct costing doesn't look at the impact a decision will have on the company's throughput.

There is a physical constraint.

Some critics of TA say that one of its assumptions is that there is a physical constraint--a bottleneck--for each product. This misunderstanding probably comes from the fact that TOC started as a production scheduling methodology that focused on identifying and exploring bottlenecks. But TOC has evolved, and one of its basic assumptions is that every company has at least one constraint. The constraint doesn't need to be a physical one, like a bottleneck--it can be a marketing constraint, i.e., the company doesn't have enough demand for its products.

With or without a physical constraint, TA looks at the impact a decision will have on its three global measurements. Answering the three questions will still show the impact a decision will have on the company's profitability, with or without a physical constraint.

Operating expense is a fixed cost.

"In this view, operating expenses are unrelated to decisions made about products sold and customers served; some would call them fixed costs." So said Robert S. Kaplan and Robin Cooper in their book *Cost & Effect*. This is probably the most common criticism about Throughput Accounting. That is, many people believe one of TA's basic assumptions is that most costs are fixed. This is part of the same misunderstanding that confuses TA with variable costing.

TOC doesn't assume that operating expenses are unrelated to decisions made about products sold and customers served. First of all, as we've seen, TOC doesn't assume that operating expense is fixed. It assumes that it isn't totally variable and that the time to analyze increases or decreases in OE is when we make decisions because decisions make costs vary. We have to analyze each decision by considering its impact on the three measurements of throughput, investment, and operating expense.

Again, Throughput Accounting's main objective is to answer all three questions. If TA assumed that OE was fixed, it wouldn't have to answer the question: "What impact will the decision have on the company's OE?"

TA is for the short term only.

Because of the misunderstandings regarding TA and variable costing and the assumption that OE is fixed, many people say that TA is good for short-term decisions but not for long-term decisions.

TA can be used for both. Whenever we are answering the three questions, we are, at least implicitly, determining a time frame for the analysis. Thus, all we have to do to use it for long-term decisions is to answer the three questions with a longer time horizon in mind. Example: What is the impact this decision will have on the company's T, OE, and I in the next five years?

But we need to know where the company does and doesn't have flexibility to increase volume and or variety of products. This is something that TOC and Lean are quite good at, and neither of them allocates costs to products to do this.

#### WHAT'S IN A NAME?

One way of helping to defuse these misunderstandings is to change the name of the methodology. The name Throughput Accounting makes you think that it focuses only on throughput and disregards other important variables--that is, it assumes expenses are fixed. This name was probably given as a counter position to cost accounting and to emphasize that throughput is the most important avenue for improvement.

I believe Three-Questions Accounting (3Q Accounting) is a better name because it shows that we need to answer the three questions to judge if a decision is good for a company. And this is exactly what TOC's management accounting system does.

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#### Throughput Accounting at FIAMA

By using Throughput Accounting, FIAMA is operating with new and more flexible commercial policies, which allows it to compete with its Asian competitors in the world market. To develop these new policies, the company didn't have to use the cost of products or their margins. The focus of its decisions was always the impact on the bottom line, using TOC's three measures: throughput, operating expense, and investment. Let's take a look.

FIAMA is a family textile business that was founded in Brazil on May 30, 1961, as a printing service provider. After a few years it expanded, specializing in the manufacture of artistic and decorative fabrics. Its slogan is "Expression in Fabrics."

Over the years the company has increased and modernized its industrial complex, investing in the weaving, printing, and finishing areas. In 2002, FIAMA received Brazilian and British NBR ISO 9001:2000 certification for its Quality Management System. This increased its market credibility even more.

The company's main markets are hotels, retail, wholesale, furniture, and decorators, and it sells through its chain of distributors in Brazil, Mercosur, the U.S., and Europe.

One of the company's core products is Chenille, a yarn that's used in the production of fabrics for decoration, such as upholstery, curtains, and bedspreads, and which is made in a process that uses two or more yarns to make one single yarn, the Chenille.

The Chenille production process at FIAMA goes through five steps:

- (1.) Purchase of yarns;
- (2.) Production of the Chenille on the Chenille machine;
- (3.) Production of the fabric in the weaving area;
- (4.) Dyeing, printing, and finishing; and
- (5.) Shipping.

The company has estimated that to meet an increased demand for its fabric, it would have to produce 21,000 kilos of Chenille (about 94,500 linear meters of fabric) monthly, but it doesn't have enough capacity to produce this amount. The Chenille machine has a capacity of 13,000 kilos per month.

Because the company wanted to take advantage of this opportunity to increase its sales, it analyzed two alternatives to outsource part of the Chenille production process.

The first alternative was to outsource step 2, that is, buy the yarns and outsource the production of the Chenille yarn. The second alternative was to buy the Chenille yarn already made (outsource steps 1 and 2). Whichever alternative it selected, the company would still handle steps 3, 4, and 5.

#### Analyzing the alternatives

FIAMA used Throughput Accounting to analyze both alternatives, estimating the impact each one would have on throughput, operating expense, and investment. Chenille yarn is used in many of the company's products, but to keep FIAMA's data confidential and to simplify the explanation of the concepts in this article, I created an average Chenille product on which to base the analysis.

Table 1 shows the impact of these two alternatives on throughput.

#### Impact on OE

Whatever the outsourcing alternative chosen, the company won't need to hire anyone. As a matter of fact, the company estimates that it still won't be using all of its available capacity in the other steps of the process. Therefore, there should be no big increases in operating expenses. To be conservative, the company estimated an R\$15,000 month increase in OE for both alternatives. (R\$ is the symbol for the real, the Brazilian currency. There are more or less 2.1 reais for one U.S. dollar.)

#### Impact on Investment

The company estimated that there would be no significant impact on investment.

## Answering the Questions

Table 2 shows the impact the two alternatives would have on the company's profitability.

As you can see, both alternatives increase the company's profitability. But alternative 1 is better because it has a lower TVC and thus a higher throughput per unit. Therefore, the company should use alternative 1 to outsource part of the Chenille production. FIAMA should use alternative 2 only if alternative 1 can't supply all 36,000 meters needed.

Table 1: Impact on Throughput

	Average Product		
	CURRENT	ALT. 1	ALT. 2
Price/meter	R\$10.26	R\$ 10.26	R\$ 10.26
TVC/meter	R\$ 5.56	R\$ 7.39	R\$ 8.38
Throughput/meter	R\$ 4.70	R\$ 2.87	R\$ 1.88
Extra production (meters)		36,000	36,000
Extra throughput/month		R\$103,320	R\$67,680

R\$ is the amount in Brazilian reais.

Table 2: Impact on Company's Profitability

	ALTERNATIVE 1	ALTERNATIVE 2
Impact on Throughput	R\$103,320	R\$67,680
Impact on OE	R\$ 15,000	R\$15,000
Impact on Net Profit	R\$ 88,320	R\$52,680

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# Roger C. Schank, The Connoisseur's Guide to the Mind: How We Think, How We Learn, and What it Means to be Intelligent.(Book review)

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ROGER C. SCHANK, The Connoisseur's Guide to the Mind: How We Think, How We Learn, and What it Means to be Intelligent (New York, NY: Summit Books, 1991, ISBN: 0671678558, 273 pages, \$20.00).

ELIYAHU M. **GOLDRATT** and JEFF COX, The Goal, 3rd revised edition (Great Barrington, MA: The North River Press, 2004, ISBN: 0884271781, 384 pages, \$24.95).

Instead of soliciting book reviews from renowned scholars or practitioners for this issue, I took the liberty of writing reviews for two of my favorite books. I hope these reviews entice you to read these books and that you find the books helpful for your teaching, research, or practice. Neither book is new but both contain many insights relevant to today's information systems. The first book is A Connoisseur's Guide to the Mind: How We Think, How We Learn, and What it Means to be Intelligent, by Roger Schank. Those who enjoy the study of memory and learning will find this book informative, intriguing, and highly entertaining. Although Schank's book is out of print, you should be able to find this book at your library or via a used bookseller or online auction service such as Half.com, Amazon's marketplace, or Ebay. The second book is The Goal by Eliyahu **Goldratt** and Jeff Cox. This book has a practical bent that helps readers interested in measurement and system design to support production scheduling operations. Both books are delightfully easy to read despite the incredibly complex topics they discuss. I hope you enjoy them as much as I have.

In The Connoisseur's Guide to the Mind, Schank explores the processes involved in thinking and learning while entertaining readers with great stories about many of his travel and dining experiences. In a previous book published in 1977, Scripts, Plans, Goals and Understanding, Schank and his co-author, Robert Abelson introduced "the restaurant script." The restaurant script is now used in many cognitive science and information systems courses to illustrate the premise that people possess mental structures called scripts that they use to understand and to make inferences about sequences of events. Although restaurants serve as the backdrop for many of the tales in The Connoisseur's Guide to the Mind, Schank goes far beyond the restaurant script to explore various aspects of how the mind works.

Schank uses a trip to Japan to introduce the usefulness of stereotypes for understanding. He then entertains readers with tales from Spain to illustrate how expectations form the basis of our understanding of the world around us and how violations of those expectations lead to learning. Next he uses Korean barbecue to introduce slot and filler knowledge structures and a trip to Minnesota to explore memory search techniques. Experiences in Atlanta, Paris, and Milan introduce scripts, script failures, and script alterations. An elaborate description of ordering wine in Chicago leads to a discussion of reminding and memory organization packets. An experience changing a plane ticket to Barcelona and a story about over-indulging on foie gras in Brussels set the scene for a discussion of the complexities of case-based reasoning. Wine-tasting provides an interesting illustration of indexing in memory. Schank introduces goals, plans, and belief systems in the context of door-to-door champagne purchases in Champagne. He discusses remembering and misremembering based on his 40th birthday party in Paris and combines the distinctions of eating versus dining with the usefulness of questions in learning. He extols the benefits of storytelling while debating whether memory is episodic or semantic, and implores educators not to train students to take tests but rather to help students acquire new goals and learn experientially.

Whether you are a researcher who examines questions involving memory and the mind, a teacher interested in knowing more about how your students think and learn, or whether you are a practitioner wanting to improve your own learning and memory, you are bound to find some nuggets of wisdom buried in some funny and sometimes frivolous stories in The Connoisseur's Guide to the Mind. This fun book will whet your appetite for Schank's more recent and more conventionally serious work.

While Schank defied academic cultural norms by mixing stories of travel, dining, and wine-tasting with theories of memory and learning, Eliyahu **Goldratt** and Jeff Cox went a step further by creating a fiction novel, The Goal, in which they present the **Theory of Constraints** in a remarkably understandable manner.

The Goal features main character Alex Rogo, manager of a production plant that is failing. Shipments are late and orders often fall through the cracks. Alex is given three months to turn the plant around or be shut down. Meanwhile, Alex's marriage is in a similar state of disarray because of his many hours of overtime working to save the plant. Using traditional measures, Alex struggles but is unable to find the key to turning his plant around. Fortunately, Alex encounters a former physics professor, Jonah, who challenges Alex to think in nontraditional ways. Jonah uses Socratic instruction to lead Alex to employ thinking processes and to ask questions such as what to change, how to change it, and how to measure the result of the change. Alex applies these thinking processes to the plant and also to his personal life. He finds solutions to the plant problems in unusual ways. For example, by observing his son's Boy Scout troop on a hike, Alex discovers the drum-buffer-rope concept for improving scheduling and reducing bottlenecks.

The Goal challenges conventional management and accounting methods; in fact, the authors claim the measurements called for by many of the traditional methods are to blame for many company failures. To illustrate this, once Alex finds some of the solutions that will help the company as a whole start making money (which is "the goal"), he realizes that those actions will result in negative evaluations of his plant. It turns out the inefficient operations are a direct result of the measurement systems (including traditional cost accounting) used to evaluate them. To change the operations, then, requires a change in the measurement systems. Amazingly enough, although the first edition of The Goal was initially published in 1984, relatively few changes have been made in the traditional measurement systems criticized therein. Many companies have made the changes internally, and some professors have adapted their teaching of these concepts; however, if you read this book I am sure you will recognize concepts that are still taught today. In the end, Alex is able to convince his superiors to ignore some of the measurements they had previously held sacred, and in so doing, he saves his plant and his marriage.

The Goal has much to offer academicians and practitioners alike. If your research focuses on designing better systems, be sure to consider the effect of the concepts illustrated in this book. If you teach cost accounting or measurement systems, be sure to incorporate these concepts. You may want to make The Goal required reading for your students, as they will be able to clearly and easily understand concepts such as throughput, bottlenecks, and the **theory of constraints**. If you are a practitioner in accounting and or information systems, carefully consider the adoption of the **theory of constraints** and related concepts and consider changing your measurement systems accordingly. If you like The Goal, then you will also want to read the follow-up novels, including **Critical Chain**, **It's Not Luck**, **The Race**, and **Necessary But Not Sufficient**.

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## Sweet profile.(CANDY WRAPPER)(Brian Hoffmann )(Interview)

From: [Candy Industry](#) | Date: [March 1, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

As marketing manager of the Holiday Retail and Food Gift business segments of Chicago-based World's Finest Chocolate, Inc. (WFC), Brian Hoffmann oversees the marketing efforts for these new corporate expansion initiatives. Part of his job involves developing new retail-appropriate packaging for some of the company's most popular chocolates, such as Continental Almonds, Mint Meltaways and Caramel Whirls

He's also responsible for the marketing activities for the Queen Anne brand, which WFC acquired from Gray & Co. in January of 2006. Queen Anne is the #1 selling chocolate cordial cherries brand in the country and its extensive distribution network will provide significant support to WFC's retail expansion strategy.

Prior to joining WFC, Hoffman was a project manager for Chicago-based Information Resources, Inc. He spent a couple of years working for his client Diageo where he assisted the company in managing its alcoholic beverage brands, including Smirnoff, Jose Cuervo, Johnnie Walker, Baileys, Guinness and many others. (Hoffman denies, however, having access to samples during his stint at IRI!)

What did you think you would be when you grew up? As a kid growing up in a small town, I thought that the garbage man who got to ride on the back of the truck had the coolest job. Luckily for me, my dad brought me to his office one day and from that moment I knew I wanted to go into business.

Name one or some of your favorite movies. Braveheart, Crash, The Natural, Sin City, Forrest Gump, Old School, Shawshank Redemption, Trainspotting.

Describe your perfect dream vacation. Sailing a 75-ft. sailboat with some of my closest friends around the Greek islands, and visiting each and every nightspot.

What book are you currently reading? Unfortunately, I really only have time for textbooks these days, but I recently read *The Goal* by Eli **Goldratt**, a truly entertaining read for those interested in the strategic implications of operations management.

Aside from a family member, whom would you most want to be stranded with on a deserted island? Well I'm not married and I don't have a girlfriend, so I can be honest and not get into trouble ... Jessica Alba

What's your pet peeve? People that don't return phone calls or e-mails in a timely manner.

I'd give anything to meet: My grandfather one more time. A distant second would be Benjamin Franklin.

The best piece of advice that I've gotten: From my hometown barber: "You'll spend the majority of your life working, so choose a career that you'll enjoy and a job that you look forward to every morning when you wake up."

What excites you most about your job? There are a lot of things that excite me about my job, but what makes World's Finest Chocolate really special to me is its rich heritage in fundraising, which enables the company to assist countless organizations and thousands of children to raise money for worthy causes.

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Manufacturing's most influential thinkers & doers: you know Jack Welch, but you may not know Taiichi Ohno. Both, however, made huge marks on manufacturing during the past three and a half decades. so, arguably, did Richard Nixon.

From: [Industry Week](#) | Date: [March 1, 2006](#) | Author: [McClenahen, John S.](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Think about the people who have had the greatest impact on manufacturing during the past 35 years, the first 35 years of IndustryWeek's existence. It's much easier to come up with names of doers than of thinkers. Four years after he was succeeded by Jeffrey R. Immelt, General Electric Co.'s John F. "Jack" Welch Jr. is foremost among the doers. During his 20-year tenure as chairman and CEO, he promoted decision-focused "workouts" to solve problems, championed Six Sigma, periodically evaluated executive performance and sent the bottom 10% packing, and insisted that if a business wasn't No. 1 or No. 2 in its market, it be fixed, sold or closed.

However, during the past 35 years, manufacturing has had its share of seminal thinkers as well. Among the more familiar names is Harvard University's Michael Porter, who asserts the primacy of strategy in business success. Also at Harvard, there's Clayton Christensen whose notions of managing disruptive technological changes challenges some of Porter's ideas about the constancy of strategy. Less widely known but still powerful among the thinkers is Eliyahu M. **Goldratt**, an unconstrained idea-man whose **Theory of Constraints** helps manufacturers remove broken links from their value chains and improve performance and profits. Indeed, three-quarters of IW's Top 25 Best Plants in 2004 said they used **Goldratt's** theory as a tool to help them improve performance.

During the past 35 years, manufacturing also has had a distinguished group of people who have been both thinkers and doers. Former Intel Corp. CEO Andrew S. Grove, who famously asserted that only the paranoid survive, tops the roster. But close behind is Michael Dell, chairman of the eponymous computer firm. He crafted a new kind of supply chain and launched a revolutionary business model, an Internet-based approach to purchasing, mass customization and, at least until early 2005, remarkable after-sale service. "A classic example" of a new and innovative business model, judges Adrian Slywotzky, a vice president and member of the board of directors at Mercer Management Consulting Inc. in Boston.

At the same time, for many manufacturing executives, the late Peter Drucker was the one-person management benchmark for 35 years--and for many years before 1970. Drucker's basic message is that people are the most important asset of a manufacturing company, or of any other organization, and that management's primary job is to give people the freedom to perform.

W. Edwards Deming (statistical quality control) together with Joseph J. Juran (the "internal customer") and Armand W. Feigenbaum (Total Quality Control) have been among the most-recognized quality-process thinkers of the past 35 years, each with the remarkable distinction of having their ideas more widely accepted by companies in Japan before they were embraced by manufacturers in the U.S. "Trendsetters" is the word Anthony J. Mayo, executive director of Harvard Business School's Leadership Initiative uses to describe these three quality gurus.

The roster of the most influential continues with former U.S. Secretary of Labor and now Brandeis University professor Robert B. Reich. He argued the case for a national industrial policy for several years before he joined the Clinton cabinet in 1993. And lately, while many in manufacturing continue to pay only lip service to the subject, Reich has been advancing new thoughts on worker education and training. Focus not on specific job skills but on the kinds of knowledge and critical thinking the industries of the future will need, he urges.

Re-examining capitalism and leading a quest for purpose beyond economic success, former Royal Dutch/Shell executive and London Business School professor Charles Handy, a self-described social philosopher and reluctant capitalist, changed the ways we think about work with two books during past 10 years: the more philosophical "The Hungry Spirit" (1997, Broadway Books) and the more autobiographical "The Elephant and the Flea" (2002, Harvard Business School Press).

Tom Peters, co-author of the pioneering book "In Search of Excellence" (1982, Harper & Row); Peter M. Senge, an expert on organizational learning; Gary Hamel, an expert on strategy and innovation; and futurist Alvin Toffler made the first

10 on Accenture's 2003 list of the top 50 business thinkers. Michael Porter, Robert Reich and Peter Drucker did as well. And all belong on the list of people having the greatest impact on manufacturing during the past 35 years.

However, "the best manufacturing thinkers of the last several decades" are Taiichi Ohno and Shigeo Shingo, contends Mercer's Slywotzky. Ohno was a Toyota Motor Co. vice president and Shingo a consultant. In laying out the principles now often collected under the label "lean," they challenged the prevailing notion that manufacturing had to be done on a large scale with long runs and large inventories. They challenged the notion that quality control was something done at the end of the production line. And they challenged the notion that a production line keeps running no matter what. "What they introduced went 100% against the grain and the mindset of great manufacturers of that time, both inside Japan and outside Japan," Slywotzky stresses. The famed Toyota Production System, which emphasizes reducing waste and eliminating defects, is a product of their work. Its impact can be seen at Toyota, the "hundreds of Toyota suppliers" and "the hundreds of companies in the West that, with a 10- or 15-year lag, sometimes a 20-year lag, began to rethink and change their manufacturing," Slywotzky says.

Another groundbreaker is Ken Iverson, who in the 1970s at steelmaker Nucor challenged the then generally accepted notion that large-scale production was essential to survival and success. "He implemented a way of making steel that was a string of regional plants. [He showed] that you don't have to make 4 million tons a year to be profitable; you could make 200,000 tons a year and be even more profitable than the people that made 4 million tons," notes Slywotzky. "This was a real crack in the thinking."

Mercer's Slywotzky has cracked conventional thinking as well and that puts him on the roster of the most influential. His highly praised book "The Profit Zone" (1998, Times Books) contends that market share as a goal is dead and that in the pursuit of profits executives must base strategies on what consumers want.

Oracle chairman Larry Ellison, Microsoft Corp. chairman Bill Gates, Siebel Systems founder Tom Siebel and SAS Inc. CEO James Goodnight are four combination thinkers and doers that Harvard Business School's Mayo singles out for praise as knowledge workers who have provided "the tools that allow people to take leaps in manufacturing."

Finally, the word "leap" leads to Richard M. Nixon, 37th President of the United States and the person Rebecca A. Morgan believes has had the greatest impact on manufacturing during the past 35 years. With his historic opening to China in February 1972, Nixon helped bring China into the modern world and enabled China to move from a closed economy to "whatever you call the economy they have now," says Morgan, president of Fulcrum ConsultingWorks in Cleveland. "I certainly don't think [Nixon] intended for [China] to become a major manufacturing economy that took our jobs," she states. "But if he didn't, you really have to ask the question, Where did he think they were going to get the money to buy our stuff?."

#### Where Are All The Women?

Women are conspicuously absent from the roster of thinkers and doers who have had the greatest impact on manufacturing during the past 35 years. Why? Probably because women haven't been at the table for very long.

Rebecca A. Morgan, president of Fulcrum ConsultingWorks, Cleveland, has had her own business for 15 years. But for the previous 15 years she was a woman in manufacturing and, she states, "I was the only woman there." Only in the past 15 years have women started coming into manufacturing, "and then they had to work they way up," emphasizes Morgan. "We really haven't had that many years to make a major impact." However, speculates Morgan, 15 years from now women may be having a major impact on manufacturing. But they may not be American women."

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## Playing the hand that's dealt: a discouraging and unpredictable economy will challenge manufacturers to come up with winning strategies, including lean that's mean.

From: [Industry Week](#) | Date: [February 1, 2006](#) | Author: [McClenahan, John S.](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

LEAN. AGILE. AGGRESSIVE. ENLIGHTENED. COMMITTED. COMMUNICATIVE. U.S. manufacturing executives and their companies will have to be all these things--and more--if they're to make the best of 2006. While the big-picture economic numbers are encouraging, even inspiring, they don't show the discouraging details nor do they take into account such upsetting events as a new surge in energy prices. And it's those details and events--along with plain old market surprises--that can make a mess of management's best-laid plans.

If you're a manufacturer in the U.S. and look to GDP growth as a performance benchmark, you have to be pleased with what the OECD sees ahead for the U.S. economy and overseas markets. The Paris-based group of 30 industrial nations, formally known as the Organization for Economic Cooperation and Development, expects the U.S. economy to grow at an inflation-adjusted rate of 3.5% this year, smack dab on its non-inflation potential. Elsewhere, the OECD foresees real GDP in Japan expanding at a respectable rate of 2%, and the euro-using nations accelerating their average growth rate to 2.1%. "With price stability being maintained, a powerful impetus arising from the Asian and U.S. economies and the re-spending of oil exporters' higher revenues, the case for a prolonged world expansion, finally extending to convalescent European economies, looks plausible," said Jean-Philippe Cotis, OECD's chief economist, as 2005 was coming to a close.

Robert "Doc" Hall demurs. There are too many wild cards, including higher energy prices, another disruptive hurricane season and shortages of copper, cement and steel, to have much confidence in any forecast, says Hall, a founding member of the Association for Manufacturing Excellence and professor emeritus of operations management at Indiana University's Kelley School of Business. "I am pretty sure that most of the larger companies have some concern over the continuation [and] stability of their supply base. And it could hit them where they really don't have some great options."

The solution, "by default," to their supply-chain problems is lean manufacturing, says Hall. During the past year or two, interest in lean has been growing, although with "not much understanding of what they're getting into," he claims. Rather it's been more of an attitude that lean is "just something you got to do to survive." And to make lean--basically the streamlining of production and other manufacturing processes--go well this year, several things must happen, Hall insists. First, he says, senior management has to understand that lean "is a people thing and they have to lead it." That could include, he says, a line worker calling a supplier or a customer to resolve an issue. Second, a company can't make the transition from whatever it's now doing to lean without adopting lean accounting, which is linked to something's value rather than to its cost. Otherwise, "you're always looking at it through a foggy set of numbers," says Hall. Third, leaders must resolve the conflict between an IT system that takes three or four months to change over to lean and their desire to change a process in two weeks. And fourth, there must be better collaboration between non-competing companies so that they can learn faster at the grass-roots level. "Denser learning networks" is the description that Hall uses. The Canadians, for example, have local consortia of plants within driving distance of each other. So if a manufacturer is trying to do a better job of setting up a screw machine, the company can turn to a guy 30 miles away who has done it. You go see him, go look at what he did and talk with him, says Hall. It's not a big deal. "It's not Marco Polo returning with a great message from the Far East or something."

IN 2006, CHINA'S CONTINUED DEMAND FOR raw materials will affect prices, including the price of steel, believes John Vande Vate, executive director of the Executive Masters in International Logistics degree program at the Georgia Institute of Technology in Atlanta. Also, "the continuing imbalance and large volume of exports coming out of China--and frankly, globally--will mean that transportation capacity is heightened and expensive," he adds. And North American manufacturers, especially automakers, need to be prepared for a "wave of imports from China that will just rip the bottom out of the market," warns Vande Vate. "The best way I can think to defend against imports from a country whose cost structure you can't compete against is to be able to offer the customer things you can't offer from that distance."

At the same time manufacturers are confronting these marketplace realities, they must recognize that their use of lean techniques to reduce inventories is on a "collision course" with global sourcing to reduce component costs, he contends, adding that "it's hard to be lean from 5,000 miles away." Vande Vate has studied the impact of lean and global sourcing on several industries. While his data show the number of days of inventory have dropped an impressive 40% since 1991

for Nissan, 82% since 1995 for Nokia and 61% for Hewlett-Packard, and 73% since 1999 for defense contractor Northrop Grumman, these are net percentages. He emphasizes the percentages and attendant cost savings would have been even greater but for global sourcing, which adds inventory days to the supply chain, somewhat offsetting the reduction in inventory days resulting from making manufacturing processes leaner. "North American manufacturers have been guilty of a somewhat knee-jerk reaction to the opportunities for global sourcing," making it an all-or-nothing decision, he laments. "The real question [to be asked] is what aspects of our manufacturing process--what components--should we be sourcing, if any, and what aspects of the process should we be delaying to the last minute?" The best answer, he believes, has come from cell phone manufacturers, who have divided their manufacturing process into building the hardware and product completion, essentially component production and assembly and packaging.

MANUFACTURING EXECUTIVES faced with rising energy costs also have a choice, insists Peter Tertzakian, chief economic officer for ARC Financial, a Calgary-based investment management and merchant banking firm focused on Canada's oil and gas industry. Executives can see high energy costs as damaging to the business and complain about them, or they can see higher prices as an opportunity and seize it to distinguish their companies from their peer groups by becoming a low-cost producer. For example, without naming names, he cites "progressive" companies in forest products that have made synthetic natural gas from waste bark and chips, believing the payback period for their investments would be only two to three years compared with a predictable six or seven years when energy prices were lower. "And in at least one case that I am quite familiar with, it turns out the payback period is even less than that," Tertzakian relates.

During the last half of 2005, and particularly during the final calendar quarter, prices for such commodities as steel, copper, oil, natural gas and plastic resins were "extremely volatile," leaving manufacturers with higher costs and limited opportunities to pass those costs through to customers, states Pat Furey, senior commodity manager at Sunnyvale, Calif.-based Ariba Inc., a company that advises manufacturers on sourcing strategies. That situation promises to continue for at least part of this year, with raw material costs "squeezing" manufacturers' margins, he says. But entering into short-term contracts for such commodities as steel and plastic resins is a strategy "a lot of people" have been pursuing to try to remain competitive, he reports. "Where traditionally they may have gone with an annual contract for their steel buy or their resin buy, maybe now they are going quarter-to-quarter" in hopes prices will decrease in three months or market volatility will be less. Manufacturers also are lining up alternative sources of supply to guard against market disruptions from such things as hurricanes. And it's a strategy with a bonus. "In an environment where you don't necessarily have supply restrictions, you can use those backup sources to create a little competition and manage some of your costs," notes Furey.

Finally, Matt Tormollen, chief marketing officer of Austin-based Pavilion Technologies, sees the need for manufacturers to invest in what he calls "more flexible but obedient infrastructure." Put into the form of a question, companies need to ask whether they have the equipment and software that will allow them to react quickly to changes in the business environment. Specifically, he says, does the company have the capability of quickly accelerating production of a high-margin product to something close to its theoretical maximum while simultaneously driving costs out of commodity products? Pavilion's answer to making it happen for Cemex SA de CV, a Mexican company that is one of the world's three largest cement producers, was process optimization software for milling operations. "What we have been able to do for Cemex is to simultaneously increase production while reducing energy costs per unit and maintaining environmental emission limits," reports Tormollen. "That trifecta has really the bottom line of what you can get through this flexible obedient infrastructure."

### Best Practices From Best Plants

SOME MANUFACTURERS HAVE STRATEGIES IN PLACE THAT PROMISE TO SERVE THEM WELL AGAIN in 2006. And the 125 plants that have been finalists in IndustryWeek's annual Best Plants competition since 2001 especially have best practices that other plants can put to work this year. The use of specific practices depends upon the segment of manufacturing and individual plants. But among the tools that have been proven to be useful are benchmarking, applying the **Theory of Constraints**, implementing the Toyota Production System, implementing lean manufacturing, implementing Six Sigma quality processes, implementing agile manufacturing, adopting continuous replenishment or just-in-time, adopting cellular manufacturing practices, separating standard and build-to-order production, adopting quick-changeover methods, and implementing self-directed or empowered work teams for production workers.

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## Robins C-130 workers hope to reduce length of overhauls by 'working smarter'

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Col. Pedro Vasquez is introducing a cultural change, and the natives - at least so far - are not only restless but in some cases disagreeable.

Vasquez isn't trying to win hearts and minds in some foreign country. Instead, he wants to reshape things in his own organization at Robins Air Force Base - the C-130 Production Squadron.

At issue is the time required to overhaul the four-engined, multipurpose aircraft. The average has been about 180 days to virtually strip the airframe, repair cracks and corrosion and put all the elements back together. Vasquez wants to cut that by at least 30 percent.

If he's successful, more C-130s will be available to combat units, particularly special operations forces who have limited aircraft and an extensive role to play in the war on terror. Aircraft availability rates for almost every variant of the C-130 have dropped over the last five years. That means fewer aircraft can fly assigned missions.

"In fact, Special Ops Command called and said we had more of their aircraft on our ramp than they had in the sandbox," Vasquez said. The "sandbox" generally refers to Iraq and Afghanistan.

Although the standard C-130 is used to haul cargo within a certain theater or war zone, special ops tasks are uniquely different - from gunships to in-flight refueling of helicopters to inputting and removing forces from hostile territory. Twelve of the 25 C-130s currently undergoing maintenance at Robins belong to special ops units.

The veteran aircraft maintenance officer unveiled his plan in November, borrowing heavily from a program used by C-5 employees at Robins. Working on a much larger cargo aircraft, the C-5 teams required only two years to cut overhaul times from 350 to 171 days. The program is called **critical chain** project management, or CCPM.

"CCPM is a way of making us work smarter, not harder," Vasquez said. "We align our forces based on the most urgent need. Instead of multitasked crews working a specific aircraft from beginning to end, we assign our people to what our scheduling software says is the 'hot' aircraft."

Jerry Herrin has 17 years as a C-130 aircraft mechanic. He's not too happy with the change, believing that work crew integrity will suffer.

"I guess I'm from the old school," he admitted. "The old way seemed to work real good. I don't know what brought about the change. I don't think you can go wrong by assigning crews to one aircraft. I hope I don't get in hot water, but that's the way I feel."

Stephanie Quensen, an aircraft mechanic with more than four years at Robins and another 11 in private industry, believes the old way was better.

"People cared and they knew what needed to be done," she said. "There's too much going on in the new system. There's no dedication. The computer system still has bugs in it. We need to go back to dedicated crews."

Section chief Joel Donihoo takes a more hopeful view of CCPM. He believes the new system will enable mechanics to work aircraft more expeditiously. He also believes getting more aircraft into the hands of warfighters is a deadly serious goal.

"We have an opportunity to impact 9/11 every day," he said. "If getting an aircraft out one day early saves a life, then it's worth it."

Donihoo is also a senior master sergeant in the Air Force Reserve. He's assigned to the 19th Air Refueling Group at Robins as an individual mobilization augmentee.

He was deployed to the war zone with the 19th during part of 2005.

"Fortunately, a large percentage of our people have military backgrounds," Donihoo said. "You don't have to preach to the choir too much. They understand this isn't Piggly Wiggly but the defense business."

Vasquez said he was frank with his more than 700 workers last November. "I told them to prepare to be frustrated for six to nine months," he said.

Working the aging C-130 fleet - with many aircraft more than 30 years old - is never easy. The McAllen, Texas, native uses medical terms to describe what happens when the Lockheed turbojet comes in for overhaul every four to five years.

"The C-130, particularly the low density, high demand fleets, is used constantly," Vasquez said, "and the wear and tear is really bad. You don't know the condition it's in until it gets here. Sometimes it's like a patient coming in for surgery. You open them up and you say, 'Oh, man.' You either want to close them up or put a tag on their toe."

But that's when the mechanics and engineers take over. "I call them 'surgeons of maintenance,'" he said. "The older the aircraft is, the more complicated the repair. Sometimes we're at the point of assisted living or hospice. But these guys come up with some great fixes."

He believes CCPM will take hold and yield the results everyone wants.

"Aircraft maintenance is a hard contact sport," Vasquez said. "It's not a world of staff summaries and e-mails. Some diehards don't want to budge. But we told the workers the warfighters needed more aircraft. They're doing great things in the sandbox and we need to work smarter. They all said, 'OK, we're ready to start.' "

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# How constraints management: enhances lean and six sigma.(business success)

From: [Supply Chain Management Review](#) | Date: [January 1, 2006](#) | Author: [Spector, Robert E.](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Lean and Six Sigma are two of the most effective business-improvement techniques available today. However, many companies still struggle to harness one or both disciplines to achieve the desired results. One solution is to combine lean/Six Sigma with a third business-improvement approach--constraints management. By bringing constraints management into the equation, companies can identify where to focus the lean and Six Sigma efforts for maximum success.

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Companies that have embraced lean and Six Sigma have had some impressive initial results. However, these popular business-improvement disciplines have not always worked for everyone--even when they have been combined. A number of companies have either not achieved the touted benefits or, after initial success, have seen their improvement efforts grind to a halt.

Recently, a few leading companies have used another business improvement approach, namely constraints management, to focus their lean and Six Sigma efforts and amplify their results. Constraints management looks at the business as chains of dependent events and focuses improvement efforts on the weak links in the chains. On the face of it, the inclusion of yet another sophisticated business process might seem to lead to excessive complexity. But in practice, this new layered approach actually can simplify management's job by providing a focusing mechanism for improvement initiatives.

This article will discuss the benefits of the new approach, beginning with a refresher on lean and Six Sigma in an effort to clarify how the application of constraints management techniques can help to jump-start stalled lean and Six Sigma implementations. To aid understanding, we refer to the example of an automotive parts plant (real but unnamed). This company had a relatively straightforward production process in which steel rolls were received, cut and shaped, plated, assembled, painted, and then shipped to the customer. Market demand on the parts plant calls for 30 parts an hour. Before the new blended process disciplines were applied, the stamping area had a throughput of 35 parts per hour. The plating and painting operations handled ten and 40 parts an hour, respectively, with final assembly running at 20 parts hourly. Unfortunately, the plant frequently suffered from missed due dates, poor quality, shortages of the right parts (with plenty of the wrong parts), and low morale. Piles of work-in-process (WIP) were seen everywhere in the plant. And, expediting was the norm.

We will look later at how the new business disciplines made a difference to this plant's operations. (Exhibit 1, on page 44, depicts the main activities at the plant, omitting inspection areas for simplicity.) First, though, it's helpful to revisit some of the fundamentals.

## A Closer Look at Lean

Lean focuses on the elimination of waste, defined as anything unnecessary to produce a product or service. Seven wastes are particular targets: excessive motion, waiting time, overproduction, unnecessary processing time, defects, excessive inventory, and unnecessary transportation.

The lean approach is a natural outgrowth of just-in-time practices and the Toyota Production System. The term was coined by James Womack after his groundbreaking study of automotive manufacturing detailed in the book, *The Machine that Changed the World*. In the 1950s, lean manufacturing was pioneered and first applied effectively by Toyota, and today the automaker is the global leader in implementing organization-wide lean.

Lean aims to eliminate waste in every area of the business, including customer relations, product design, supplier networks, and factory management. The objectives are to use less human effort, less inventory, less space, and less time to produce high-quality products as efficiently and economically as possible while being highly responsive to customer demand. Lean is directly opposed to traditional manufacturing approaches that are characterized by economic order quantities, high-capacity utilization, and high inventories. In lean terms, high inventories diminish a company's competitive advantage; instead, it should strive to produce only what it knows it can sell.

The lean implementation approach is as follows:

1. Define value from the end customer's perspective. Value is defined by customer needs and expectations.
2. Identify the entire value stream for each service, product, or product family and eliminate waste. A value stream consists of all the actions required to bring a product through manufacturing and assembly. Tools such as value-stream mapping are used to determine which actions do not add value and, thus, can be eliminated.
3. Make the remaining value-creating steps flow. Here the focus is on maximizing value by producing only what's needed in the shortest time possible with the fewest resources.
4. Pull to customer demand. Everything is produced at the rate of customer demand only.
5. Pursue perfection. Empower employees with waste elimination tools and create a culture of continuous improvement.

### Revisiting Six Sigma

Six Sigma was pioneered by Motorola Corp. in the mid-1980s to improve manufacturing yields. The discipline evolved from the quality programs of the 1980s (cost of quality, zero defects, and total quality management) utilizing the collective knowledge of management gurus W. Edwards Deming, J.M. Juran, Philip Crosby, and others. Its primary goal is the elimination of variation in products and service processes to such a degree that six sigmas of variation (99.9997 percent yield) will fit within the specification limits defined by customers. The Six Sigma performance target is virtually defect-free processes and products: 3.4 or fewer defective parts per one million opportunities. Defects may be related to any aspect of customer satisfaction: high product quality, schedule adherence, or cost minimization, for instance. (1)

The Six Sigma discipline includes the use of statistical tools and techniques to help analyze and reduce variation so the process can become more predictable and reliable. Once the process is under control, tools such as root-cause analysis can then be used to help reduce the average processing time. Here's an example of a typical Six Sigma project: reducing the variability of response times at a call center that has an average customer response time of 20 seconds. The calls are being answered in as little as 10 seconds and as long as 90 seconds--a wait time that quickly leads to irritated customers.

The Six Sigma drive for defect reduction, process improvement, and customer satisfaction is based on the concept that everything is a process and all processes have inherent variability. Data is used to understand the variability and drive process-improvement decisions. Six Sigma comprises the following key themes:

- \* Customer-centric: Stakeholder value is the starting point for all Six Sigma improvements.
- \* Process-focused: Mastering business processes is a way to build competitive advantage in delivering value to customers.
- \* Data- and fact-driven: Decisions are based on established data and facts.
- \* Standardized and repeatable: Customers value consistent business processes that deliver world-class levels of quality.
- \* Collaboration without boundaries: Six Sigma expands opportunities for collaboration as people learn how their roles fit into the "big picture" and as they recognize and measure the interdependence of all activities in a process.
- \* Drive for perfection, tolerance for failure: Understand that no company has ever achieved great results without some mistakes along the way.

### The Emergence of Lean/Six Sigma

In the past five years, companies have begun to realize that using either lean or Six Sigma exclusively has serious limitations. Six Sigma will help eliminate defects and variation and, thus, increase the reliability of processes. But, it will

not address the question of how to optimize process flow, and it does not address the competitive element of speed. Lean, for its part, will help reduce complexity, but it does not address reliability as Six Sigma does.

By combining these complementary approaches into what is now called lean/Six Sigma, companies can address the key competitive elements of speed and quality. For example, on a call center project, Six Sigma would help identify a customer requirement to answer calls within 19 seconds and then enable 95 percent of the calls to be answered in no less than 15 seconds and no more than 25 seconds. Meanwhile, lean would help reduce the length and volume of the calls, and help reduce the need for full-time staff and facilities. Or, on a supply chain project, Six Sigma could help identify the root causes of variation in schedule and production processes, while lean would contribute to lower manufacturing cycle times and inventory to meet market demand.

To further illustrate how lean/Six Sigma can be applied concurrently, let's take a look at the automotive parts company example. Exhibit 1 shows the old process with market demand of 30 parts an hour. The auto parts plant was operating in a "push" fashion--orders were pushed through the plant. But lean prescribes the use of a demand-pull system, with orders being pulled through the plant according to a final-assembly schedule that is synchronized to customer demand. In our example, the set-up time for the stamping press was measured in days and was highly unpredictable. By applying lean reduction techniques, set-up can be reduced first to a few hours and eventually to less than 10 minutes.

To enable the kanban logistics system--to pull material through the system to the customer--both lean and Six Sigma tools can help drive variation out of the process and eliminate nonvalue-added activities.

Exhibit 2 shows the new process after application of lean/Six Sigma. (Market demand is still 30 parts an hour.) Set-up reduction techniques have been applied at the press operations to cut set-up times. These techniques can also dramatically increase effective capacity as well as the ability to reduce batch sizes. Six Sigma problem-solving techniques have helped to increase the quality at the plating operation (previously experiencing a lot of rework) so that its effective yield is slightly more than market demand of 30 parts hourly. Lean concepts have been implemented at all operations to help reduce waste, and preventive maintenance is now being done to avoid machine and tool breakdowns, which has resulted in a significant boost in final-assembly throughput. Finally, a pull scheduling system has been implemented that pulls product through the system at the rate of market demand.

Dramatic improvements have been made. The process is now predictable and under control. Inventory, particularly WIP inventory, has been slashed by more than 70 percent. Cycle time has been halved, and customer service levels are now up 95 percent.

### Problems with Implementation

Yet while there have been examples of dramatic results, lean manufacturing programs at many manufacturing companies have had trouble staying on track, according to a recent article by the ARC Advisory Group. "Many lean programs are in trouble," says Ralph Rio, research director of ARC's lean manufacturing practice. (2) In the Lean Enterprise Institute's recent survey, 36 percent of lean practitioners viewed their companies' "backsliding to the old ways of working" as a major obstacle.

The same phenomenon has been observed with companies that have implemented Six Sigma. Even those that have had great initial results with their implementations are now encountering difficulty maintaining their programs' momentum. In some cases, the programs have actually ground to a halt.

Why is this happening? Part of the problem is that many of the companies that have effectively implemented lean and/or Six Sigma have too many such projects. Managers have been heard complaining that that they've reached a point of saturation where they don't know which projects are "important" and which aren't. This problem can arise from the core assumptions behind these disciplines. Lean's central assumption--that waste reduction will automatically result in a rise in business performance--is not valid in all circumstances; nor is the Six Sigma assumption that reducing variability everywhere will automatically lead to an overall systems improvement.

It is difficult to argue against the underlying philosophy of improvement. The economic reality, however, is that companies seek the most improvement for the least investment. Trying to improve all of a company's individual processes

at the same time requires tremendous time commitments by many people throughout the company. In truth, wringing variation out of processes and eliminating waste everywhere does not necessarily lead to decreased spending or increased throughput. How do managers determine which projects are important and which aren't? If everything is a priority, then nothing is a priority.

There is also the common issue of viewing these improvement projects only in terms of local optimization without looking at the "big picture." In one notable case, a manufacturer's purchasing department launched an initiative to lower the cost of raw materials. The conclusion: The company could save money on a particular component by purchasing the part from China. Although the raw-material cost savings were real, they came at a huge price. The new delivery times were long and unreliable--as long as six weeks--yet cycle time was a key competitive factor in the company's marketplace. The band-aid measure: large warehouses full of component inventory. The company came close to going out of business.

This was a classic case of local improvements quickly compromising the entire system. Companies that have begun enterprise-wide lean/Six Sigma efforts--with many improvement projects running at the same time--are very susceptible to this type of problem.

So how can managers understand the effects of local initiatives on the whole company? The answer is to combine lean/Six Sigma with the systems focus of constraints management.

### A Refresher on Constraints Management

Constraints management (CM) is based on the **Theory of Constraints** developed by Eli **Goldratt**, an Israeli physicist. (3) CM looks at companies as systems. A system can be defined generally as a collection of interrelated, interdependent components or processes that act in concert to turn inputs into defined outputs in pursuit of a particular goal. Likening systems to chains, CM defines the weakest link as the constraint--the system's limiting factor. (See Exhibit 3.)

A common theme in the success stories of CM implementations is how quickly results are attained. That's because the focus on constraints is, de facto, a focus on the areas where there's the most potential for improvement.

There are essentially two different types of constraints: physical and policy. A physical constraint is usually a capacity-constrained resource, such as a machine or person. It can also be the market itself: excess capacity can result if demand dries up. A policy constraint, which is the dominant type of constraint, can be any business rule that conflicts with the goal of making more money. An example: the prescribed use of large batch sizes in order to be "efficient" but at the expense of longer lead times.

Thinking of a business as a money-making machine--with money entering the machine and money captured inside--helps explain the value of the CM approach. The money produced by the machine is called "through put," defined as "the rate the machine generates money through sales." Note the word "sales"; if something is produced but is not sold, it's not throughput. Nor is throughput the same as gross revenue. Some revenue generated by the machine is produced by vendors, and this revenue element simply flows through the machine. So throughput equals gross revenue minus all variable expenses (raw material costs, sales commissions, and so forth).

The money captured in the machine is called "inventory." (In this case it includes not only the materials and parts made but also all assets, including buildings and equipment.) And, the money the machine uses to turn inventory into throughput is called "operating expense." This definition includes all direct and indirect labor and all overhead. Consider these as the unavoidable costs of doing business. They are short-term, nonvariable costs; over the next financial period, it doesn't matter how many units are sold--the employees must still be paid.

Throughput, inventory, and operating expense can be easily tied to the bottom-line financial measures of net profit and return on investment (ROI).

Constraints management argues that the greatest improvements come from addressing issues at the weakest links in the chain. Improvements at nonconstraints have very little positive impact on the overall system and can even be detrimental. The CM approach consists of the following:

\* Key focusing steps: This refers to **Goldratt's** five original "processes of ongoing improvement": 1) identifying the constraint, 2) exploiting the constraint, 3) subordinating everything else to the constraint, 4) elevating the constraint, and 5) repeating the steps. These steps apply whether the system is manufacturing, distribution, sales, or project management.

\* The thinking processes (TP): These are the methods to enable the focused improvement of any system. The purpose of the TP is to help answer the three questions essential to achieving focused improvement: What to change? What to change to? How to cause the change?

\* Throughput accounting (TA): This is the CM alternative to cost-based management accounting. TA is not costing, and it does not allocate costs to products and services. Rather than focusing on costs, it focuses on profit maximization by managing constraints.

\* Application-specific solutions: This includes supply chain and operations activities and project management operations.

### Combining CM with Lean/Six Sigma

Companies that have effectively implemented lean and Six Sigma have driven much of the waste and variation out of their processes. The easy gains have been achieved. So how do their managers decide which lean/Six Sigma improvement initiatives to launch next?

First, they have to keep in mind the ultimate goal of any improvement initiative: to increase shareholder value by improving net profit and ROI. Constraints management provides a framework for measuring the impact of a local initiative on those bottom-line measures. For example, when throughput is increased--without adversely affecting the CM definitions of inventory or operating expense--then net profits and ROI are simultaneously increased. When deciding whether to undertake a local lean/Six Sigma improvement, managers should take into account its impact on all three measures--throughput (making money through sales), inventory (all assets), and operating expense.

The CM position is that the emphasis should first be on increasing throughput, then on reducing inventory, and finally on reducing operating expense. By applying a CM framework to lean/Six Sigma efforts, companies can more easily avoid the problems incurred by placing too much priority on reducing operating expense.

Consider the many examples of businesses that have focused excessively on eliminating waste with the objective of cutting costs, while not applying at least as much effort to selling more. Excess capacity--usually in the form of people--is viewed as waste. This viewpoint can lead to several long-lasting problems. First, cutting capacity to match existing demand leaves little room for increases in demand. Once capacity has been reduced, it's not easy to increase it again. It takes time and money to find and hire skilled workers. A second problem is the effect of such moves on morale--and on future improvement efforts. Just how are workers expected to cooperate with any future lean/Six Sigma efforts if they know they are improving themselves out of a job? By that point, any hope of continuous improvement initiatives has been dashed.

To determine where the focus should be for improvement initiatives, it's important to remember that a system of dependent events is governed by a very small number of constraints. The 80/20 rule states that 20 percent of the initiatives will yield 80 percent of the results. Once you realize that constraints govern the system's performance, it becomes clear that only a few things can be done that will have a significant impact. In fact, the 80/20 rule becomes the 99/1 rule.

A process is needed to manage the system to confirm that the constraint is the center of attention. The following are the five focusing steps of constraint management:

1. Identify the system constraint. What and where is the limiting factor? A review of the company's symptoms can quickly lead to a diagnosis of the constraint. For example, in a plant that can't make enough products to meet demand, the constraint can be a capacity-constrained machine or work center.

2. Decide how to exploit the constraint. Once the location of the constraint has been identified, managers should try to maximize its performance. For example, if a machine is capacity-constrained, all sources of wasted and idle time should be eliminated.

3. Subordinate everything else to the constraint. It's vital to determine that the nonconstrained resources are working solely to support the constraint. For example, with a capacity-constrained machine, all other resources would produce at the same rate as this machine and run no faster.

4. Elevate the constraint. Managers have to take whatever action is necessary to eliminate the constraint. Additional capital investment is considered at this point. Breaking a capacity constraint could take the form of additional equipment or people.

5. Return to step one, but beware of inertia. At some point, the constraint is broken and moves somewhere else. It's essential to recognize the location of the new constraint and to redirect efforts rather than continuing to focus on the old broken constraint. For example, production capacity might be raised to the point that the market is now the constraint, and efforts should then be focused on improving sales and marketing.

Following these five steps helps facilitate the development of a process of continuous improvement. This has to happen because the company always has a new constraint. So lean/Six Sigma improvement initiatives should be evaluated and prioritized--and periodically re-evaluated and reprioritized--in the context of their impact on the company's successive constraints. For example, if a company is capacity-constrained, lean tools should be used to eliminate waste and improve the flow using demand-pull scheduling. On the other hand, if the constraint is external--if the company has more capacity than demand--then Six Sigma projects should be aimed at areas that will make the system's offerings more attractive to potential customers. Key areas in this regard include customer response time and the reliability of delivery promises.

#### A Complementary Approach

It's apparent now that these three business-improvement approaches are not exclusive of each other and are, in fact, complementary. Constraints management is a systems-based way of thinking to determine where the organization should focus its efforts. In short, Constraints management can be used to focus on the right problem and the right solution at the right time in the right place. Lean and Six Sigma tools and techniques can then applied where they will drive the most benefit--eliminating waste and reducing variation at the constraint.

Savvy supply chain managers don't waste time and resources on projects that are simply strengthening already stronger links of the chain. Instead, they are turning to constraints management to focus lean/Six Sigma efforts on the weak links. (The sidebar, on "Seagate's Achievements" offers a good example.) And they are making sure that when they've dealt with a constraint, they shift the focus of their efforts to the next constraint. For companies that are just starting their lean/Six Sigma efforts, constraints management will accelerate results by first focusing on the areas where the most improvement opportunity lies.

#### Endnotes

(1) Peter S. Pande, Robert P. Neuman, and Roland R. Cavanagh, *The Six Sigma Way* (New York: McGraw-Hill, 2000).

(2) Ralph Rio, "Successful Execution of a Lean Program," ARC Advisory Group.  
([www.arcweb.com/NewsMag/auto/lean-mfgins37-111104.asp](http://www.arcweb.com/NewsMag/auto/lean-mfgins37-111104.asp)).

(3) Eliyahu M. **Goldratt**, *The Goal*, second edition (Great Barrington, MA: North River Press, 1994).

RELATED ARTICLE: [Seagate's achievements.](#)

The world's leading provider of hard disk drives, Seagate Technology LLC, has adopted both constraints management and Six Sigma. The company has 42,000 employees worldwide; in fiscal 2004, it shipped more than 79 million drives, generating revenues of \$6.22 billion and net income of \$529 million.

In 1998, Seagate launched Six Sigma as a global initiative. The discipline has proved to be a resounding success, producing \$1.2 billion in savings to date with 8,000 employees certified in Six Sigma and 4,700 completed Six Sigma projects in all. However, there were some drawbacks in the company's approach. Among them: The Six Sigma

practitioners didn't have a way to prioritize projects, and projects were taking too long to complete--six months on average. To address these problems, Seagate decided to integrate constraints management tools with Six Sigma. The move has had these results:

- \* Projects are now more focused.
- \* Problems are much less ambiguous.
- \* Project completion rate has increased by 80 percent.
- \* The number of projects completed within three months increased by 70 percent.

Seagate is now using constraints management tools to effectively identify and drive the most appropriate Six Sigma projects. The company has also implemented the CM **Critical Chain** Project Management application to bring the first 15,000 rpm disk drive to market. The drive maker reported on its CM activities in a paper "Integrating the TOC Thinking Process and Six Sigma," which was presented at the **Theory of Constraints** International Certification Organization Conference in October 2004.

Robert Spector is a manager in the Supply Chain Strategy Practice at Deloitte Consulting LLP and is a Certified Enterprise Lean/Six Sigma (EL/SS) Black Belt Practitioner.

EXHIBIT 3

Snapshot of the Three Business-Improvement Disciplines

	Six Sigma	Leaner
Guiding	Reduce Variation/ Principle	Eliminate Waste Defects
Methodology	1. Define 2. Measure 3. Analyze 4. Improve 5. Control	1. Define Value 2. Identify the Entire Value Stream 3. Make Value Flow 4. Pull to Customer Demand 5. Pursue Perfection
	Constraints Management	
	Guiding	Manage Constraints Principle
	Methodology	1. Identify Constraint 2. Exploit Constraint 3. Subordinate Processes 4. Elevate Constraint 5. Go Back to Step 1
	Focus	Problem      Process
	Primary	Reliability, Objectives      Simplification Predictability

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# The U.S. manufacturing landscape: a summary of results from the 2005 IW/MPI Census of Manufacturers.(CENSUS OF MANUFACTURERS)(Cover \Story)

From: [Industry Week](#) | Date: [November 1, 2005](#) | Author: [Vinas, Tonya](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

## PLANT PROFILE

WHILE MANY ASPECTS OF U.S.-based manufacturing have been debated in recent years--usually with the goal of "fixing" manufacturing--two attributes have not been widely addressed: We are old and stubborn. \* Like elderly parents who long since should have abandoned the family home for a condo in Florida, manufacturers are refusing to leave older facilities for ones more suited to modern production. Despite advances in technology and operations that require far less space and far more integration, U.S. manufacturing is done largely in plants built at least two decades ago. Are manufacturers missing an opportunity to lower overhead--and therefore costs--and improve processes, by not updating or abandoning old facilities? Perhaps. \* Additionally, the IW/MPI Census shows that almost half of U.S. manufacturers are in the industrial equipment, automotive or construction sectors. For all of the lip service politicians like to give to high-tech and biotech manufacturing taking over, most of manufacturing going on in the United States today is "old school."

## OPERATIONS

THOSE THAT HAVE JUMPED on the process improvement bus seem to be headed in the right direction. But those that haven't are like homeowners who don't heed mandatory evacuation warnings before a hurricane or tornado--it's easier in the short term but could be deadly in the long. \* The good news is that about fourth-fifths of the manufacturers surveyed for the 2005 IW/MPI Census recognize the value of process improvement, have embraced one or more methods and are spreading these methods to areas other than production at their plants. The bad news is that one-fifth of those surveyed have no primary improvement method and an even larger percentage report no progress toward world-class status, which puts them at an incredible disadvantage. Additionally, respondents are to be commended for making quality, continuous-improvement certifications and customer service top strategic practices, but they could be leaving money on the table by not looking closer at other practices: energy usage management and open-book management, for instance.

## OWNERSHIP

Private 84.9%  
Public 15.1%

Note: Table made from pie chart.

## TYPE OF PLANT

Discrete 71.9%  
Process 16.6%  
Both of Hybrid 11.5%

Note: Table made from pie chart.

## LOCATION

Midwest 38.6%  
Northeast 17.1%  
West 14.8%  
South 27.8%  
No response or other 1.6%

Note: Table made from pie chart.

## YEAR SINCE START-UP

More than 20 years	68.3%
11 to 20 years	19.2%
5 to 10 years	9.1%
Less than 5 years	3.3%

Note: Table made from pie chart.

## VOLUME/PRODUCT MIX

Low volume/High mix	46.3%
High volume/High mix	19.8%
Low volume/low mix	17.1%
High volume/Low mix	16.8%

Note: Table made from pie chart.

## REVENUE OF PARENT COMPANY

LESS THAN \$100 MILLION	7.5%
\$100 MILLION-\$499 MILLION	9.5%
\$500 MILLION-\$999 MILLION	4.2%
\$1 BILLION-\$5 BILLION	4.5%
\$1 BILLION-\$10 BILLION	3.2%
MORE THAN \$10 BILLION	3.5%

## INDUSTRY

Industrial equipment and machinery	19.8%
AUTOMOTIVE	12.7%
CONSTRUCTION	11.9%
CONSUMER PRODUCT DURABLES	9.2%
CONSUMER PACKAGED GOODS/NON DURABLES	8.5%
PHARMACEUTICALS, BIOTECHNOLOGY, MEDICAL	5.1%
PRINTING AND PUBLISHING	4.8%
HIGH-TECH	4.7%
AEROSPACE	4.2%
CHEMICALS	3.7%
DEFENSE INDUSTRY	1.9%
NONE OF THE ABOVE	13.5%

## FOCUS ON MARKET STRATEGY

HIGH QUALITY	71.8%
SERVICE AND SUPPORT	56.4%
TOTAL VALUE	39.0%
FAST DELIVERY	35.3%
CUSTOMIZATION	32.4%
LOW COST	26.5%
INNOVATION	21.6%
PRODUCT VARIETY	14.1%
NONE OF THESE	0.2%

Note: Table made from bar graph.

## PRIMARY IMPROVEMENT METHOD

Lean manufacturing	35.7%
Total Quality Management	15.9%
Lean and Six Sigma	8.0%
Other	7.0%
Agile Manufacturing	4.4%
<b>Theory of Constraints</b>	4.0%
Six Sigma	1.5%
Toyota Production System	1.5%
None	21.9%

Note: Table made from pie chart.

## CHANGE IN OUTPUT UNIT VOLUME/PAST 12 MONTHS

Decreased more than 20%	3.8%
Decreased 11%-20%	4.5%
Decreased 1%-10%	7.2%
Stayed the same	10.0%
Increased 1%-10%	32.0%
Increased 11%-20%	24.5%
Increased more than 20%	18.0%

Note: Table made from pie chart.

## WHERE METHOD IS APPLIED (MULTIPLE RESPONSES POSSIBLE)

PRODUCTION	82.3%
MATERIALS MANAGEMENT	43.4%
SHIPPING AND LOGISTICS	39.3%
PURCHASING	32.1%
CUSTOMER RELATIONS	26.5%
ENGINEERING	23.2%
SUPPLIER RELATIONS	19.7%
ADMINISTRATION	19.4%
FINANCE AND ACCOUNTING	16.3%
RESEARCH AND DEVELOPMENT	9.3%
OTHER	3.1%
NONE OF THESE	11.1%

## STRATEGIC PRACTICES (MULTIPLE RESPONSES POSSIBLE)

CONTINUOUS-IMPROVEMENT PROGRAM	66.5%
QUALITY CERTIFICATIONS (E.G., IOS)	45.4%
CUSTOMER SATISFACTION SURVEYS	45.1%
BENCHMARKING	34.6%
ENVIRONMENTAL MANAGEMENT	25.3%
TOTAL PRODUCTION MAINTAINANCE	21.7%
ENERGY MANAGEMENT	16.1%
OPEN-BOOK MANAGEMENT	15.0%
NONE OF THESE	13.6%

[GRAPHIC OMITTED]

## ABOUT THE 2005 IW/MPI CENSUS OF MANUFACTURERS

**Methodology:** The IW/MPI Census of Manufacturers was conducted in late spring 2005. We asked more than 100 questions of manufacturers across the United States. There were 668 respondents (540 by mail and 128 online), and all responses were anonymous.

**Results:** INDUSTRYWEEK will report on the survey results in dedicated features and as part of related coverage. Dedicated features in future issues include:

Dec. 2005: Benefits, transportation and raw material costs. Jan. 2006: IT investments and effectiveness.

April 2006: Managing customers and suppliers.

**Online:** Census results will be included in a twice-a-month Continuous Improvement newsletter. For more information on all of INDUSTRYWEEK.COM newsletters, see [www.industryweek.com](http://www.industryweek.com).

**About MPI:** The Manufacturing Performance Institute, is a Cleveland-based research organization specializing in research development, analysis and communications.

For a summary of the complete results or industry-specific data from the 2005 IW/MPI Census of Manufacturers, contact MPI at 800-603-22 72 or online at [www.mpi-group.net](http://www.mpi-group.net). For specific questions regarding the study or the IndustryWeek/MPI Benchmarking Toolkit, an interactive manufacturing improvement tool, e-mail [support@mpi-group.net](mailto:support@mpi-group.net).

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## PRESS RELEASES

### U.S. Air Force Warner Robins Air Logistics Center Adds "2006 Chief of Staff Team Excellence Award" to Its Accolades.

From: [Business Wire](#) | Date: [November 6, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

Dramatic Productivity Gains on C-5 Aircraft MRO Program Using Realization's "Execution Management System" Honored for the Third Time

SAN JOSE, Calif. -- Realization Technologies today is proudly joining in the applause for the dramatic bottom-line results achieved by the Warner Robins Air Logistics Center in Georgia through the implementation of its Execution Management System. The most recent award, the 2006 Chief of Staff Team Excellence Award, joins a growing list of national and international honors awarded to Warner Robins - including the 2006 Franz Edelman Award and the Shingo Prize Gold Award - for streamlining its maintenance, repair and overhaul (MRO) program for the C-5 aircraft line.

The 2006 Chief of Staff Team Excellence Award recognizes Air Force teams that use a systematic approach to enhance mission capability, improve operational performance and create sustained results. Utilizing Realization's execution management system, Warner Robins was able to reduce the number of simultaneous C-5 aircraft in the MRO program from twelve to seven, as well as reduce the time spent on each C-5 aircraft by 33 percent. By effectively putting five valuable aircraft back in operation, Warner Robins is not only keeping vital equipment running to support military personnel on the front lines, it also generated additional revenue of around \$49.8 million per year, and is projected to generate an additional \$119 million in revenue through 2008 and \$248 million through 2009. Furthermore, these five C-5 aircraft represent a replacement value of about \$2.3 billion for the U.S. Air Force.

"Warner Robins' experience demonstrates the sea-changing level of productivity improvement achievable through execution management," said C. Sridhar, vice president of maintenance, repair and overhaul solutions at Realization Technologies. "Successfully executing complex projects in the face of uncertainties will continue to be one of the most difficult challenges for private and public organizations, but execution management is unique in its ability to meet this challenge and help organizations of all types generate tremendous, measurable results."

Warner Robins is just one of several military organizations, including the Air Force Operational Test and Evaluation Center (AFOTEC), as well as private organizations that have discovered the breakthrough benefits possible through execution management. Execution management helps organizations manage uncertainties that can delay or derail large-scale projects, including product development, engineering and construction, and facility and facility and equipment maintenance and overhaul. It offers a broad range of benefits ranging from significant cost savings to improved productivity, employee morale and culture.

"Warner Robins is honored to be recognized for the efficiency improvements achieved on the C-5 aircraft line," said Bill Best, Deputy Director, Aircraft Maintenance Group, Warner Robins Air Logistics Center, United States Air Force. "The results have been phenomenal to this point, and we only expect them to further improve in the future. Execution management has made a huge difference in our organization, and more importantly, has helped us keep more C-5 aircraft in the air where they are needed most."

The two other awards received by Warner Robins are:

\* The Franz Edelman Award recognizes outstanding examples of innovative operations research that improves organizations throughout the world - and often changes people's lives. Past winners include IBM, General Motors, Motorola, and Continental Airlines.

\* The Shingo Prize for Excellence in Manufacturing honors businesses and researchers throughout the world, highlighting the value of using and expanding the body of ideas and lean/world-class manufacturing practices. Recognized as North America's premiere manufacturing award program, the Shingo program has recognized leading worldwide organizations for nearly 20 years, including Boeing, Lockheed Martin, Maytag, and Ford Motor Company.

## Execution Management System

Realization offers the first successful management system for efficient and reliable execution of projects. Based on the proven principles of **Critical Chain**, it has helped a growing number of organizations increase sales and profits. It works by providing clear task priorities and early warning signals across departments and to all levels of management.

### About Realization

Recipient of the prestigious 2006 Franz Edelman award for its work with Warner Robins Air Logistics Center, the company has helped organizations increase speed and efficiency in new product development, engineer-to-order manufacturing, construction, maintenance, repair and overhaul, and other project based operations. Founded in 1999, Realization has over 180 customers in a wide range of industries and regions around the world. The company is headquartered in San Jose, California. To learn more, please visit [www.realization.com](http://www.realization.com).

# OpenMFG Introduces Major Upgrade of Open Source-Based ERP Solution.

From: [PR Newswire](#) | Date: [November 1, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Version 2.0 Features CRM, Multi-Currency, and Powerful New Manufacturing Tools

NORFOLK, Va., Nov. 1 /PRNewswire/ -- OpenMFG, the leading provider of open source-based enterprise solutions for small manufacturers and distributors, today announced the long-awaited version 2.0 of its Enterprise Resource Planning (ERP) software. Major enhancements include multi-currency capabilities, a new Customer Relationship Management (CRM) module, as well as significant new functionality in the solution's Manufacturing and Scheduling module.

OpenMFG's flagship product is an advanced ERP software solution built with open source components, such as Qt, the Linux operating system, the PostgreSQL database, and the OpenRPT report writer. Available OpenMFG modules include Inventory Management, Product Definition and Costing, Work Order Management, Manufacturing and Scheduling, Capacity Planning, Purchase Order Management, Sales Order Management, Shipping and Receiving, Project Management, Sales Analysis, Accounts Payable, Accounts Receivable, a full General Ledger, and now, Customer Relationship Management.

According to Ned Lilly, chief executive officer at OpenMFG, this latest software release -- actually the fifth major release of the software -- enables the company to expand globally, horizontally and vertically. "To date, we have primarily focused on the United States market, but now with full multi-currency support, and a growing international community of partners and translators, we can compete worldwide," said Lilly. "The new CRM module, our most requested feature, is the beginning of some major new horizontal functionality across multiple industries. And the MPS and Buffer Management subsystems expand our leadership position in the manufacturing vertical."

## Manufacturing Improvements

While earlier versions of OpenMFG had strong support for Material Requirements Planning (MRP), version 2.0 now features a full Master Production Schedule (MPS) and Forecast capability. MPS works in parallel with MRP, and enables high-level sales and operations planning by product or product family. As a result, companies can be more proactive and strategic in planning, particularly with regard to items with long lead times.

The M/S module has been further strengthened with the addition of OpenMFG Buffer Management. This new feature draws upon the Theory of Constraints model and lean manufacturing concepts to provide users with more flexibility and control over their manufacturing process. By defining "buffers" around time, inventory and capacity, Buffer Management provides companies with the flexibility to reprioritize and reorganize manufacturing to address production bottlenecks or accommodate unforeseen circumstances.

## CRM

Also included in version 2.0 is a new CRM module with robust incident management functionality for tracking and managing customer communications and trouble tickets. Incident Management is fully integrated with a user-by-user "To Do" manager (also new in 2.0), as well as various existing OpenMFG functionality such as lot and serial number inventory history, detailed customer history and billing information, and visibility into the manufacturing schedule.

Another often-requested feature is a truly universal address book that stores all contact information and addresses in one place for the entire system. Now an "Account" can be any or all of the following: prospect, customer, vendor, partner, or competitor. Accounts can have an unlimited number of sub-accounts, contacts, and addresses. And automated OpenMFG tools make the import of contact information from legacy CRM systems easier than ever.

## Multi-Currency

With the addition of multi-currency capabilities in version 2.0, multi-national customers can now conduct their business in as many different currencies as they need. Currency rate conversion is maintained in the system, and any fluctuations

(e.g. between order time and receipt of payment) are posted to a variance account in the general ledger. Prior to the release of version 2.0, OpenMFG customers in Canada, the U.K., and India have been actively testing and using this feature.

Under the company's innovative hybrid license, customers and partners have full access to the application source code, and any enhancements made to the product flow back to OpenMFG for review, quality testing, and possible incorporation into the baseline product. Over 90% of the new functionality in version 2.0 was either developed directly by a customer, or underwritten by a customer (with development by either a reseller partner or OpenMFG itself).

One Canadian customer, Pemla Inks of St. Leonard, Quebec, partnered with OpenMFG on both the multi-currency capabilities and CRM module. They also added functionality that supports a percentage-based Bill of Materials, crucial to companies in process flow manufacturing industries such as inks. Paul Tatham, Vice President of Operations at Pemla, noted, "OpenMFG's community-based development approach allowed us to secure a sophisticated ERP solution to replace a legacy, dysfunctional system. Pemla was looking for a product that could be deployed quickly at an affordable cost, and fit with our Linux migration plans. OpenMFG was the right solution." In addition to assisting Pemla in its implementation project, OpenMFG's local partner in Quebec, AS Plus Informatique, also contributed a French translation of the software; Pemla currently runs users in both English and French.

#### About OpenMFG

OpenMFG, LLC develops next-generation enterprise resource planning (ERP) software applications powered by open source software such as Linux, PostgreSQL, and Qt. OpenMFG products give companies visibility into costs, supply chains, processes, inventory and financial operations with a lower cost of ownership than competing products, and are sold to end-user customers through a global network of value added partners. For more information, please visit the company Web site at <http://www.openmfg.com/>.

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Web site: <http://www.openmfg.com/>

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## Goldratt Consulting CEO Alex Knight Featured on Better Process Show

From: [Newswire Today](#) | Date: [October 11, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

LONDON--Alex Knight reveals how companies can have profits equal to their current net sales in under four years.

Alex Knight, CEO of Goldratt Consulting, shares his insights into the challenges facing companies in today's dynamic global business environment in his interview on "Better Process", a manufacturing process improvement show hosted by Ken Rayment. Knight also offers his insider perspective on the Theory of Constraints and Dr. Eli Goldratt's latest innovation, Viable Vision.

Knight reveals how companies that enter into the Viable Vision process can, in less than four years, have profits equal to their current net sales. Viable Vision is designed to help companies get the maximum financial payback from their TOC-based process improvements. Business leaders facing new and more complex business threats, such as international competition and spiraling costs, have been receptive to Dr. Goldratt's ideas since traditional approaches are not as likely to inspire the breakthrough thinking these organizations require to succeed. Plus, Dr. Goldratt's credibility and the pay-for-performance component of the Viable Vision offer make it a low-risk, must-consider proposition.

Could a Viable Vision be possible for your company? Listen to the interview with Alex Knight at [PodcasterNews.com](#) and see what you think.

The complete Viable Vision Offer Event schedule is available at [GoldrattConsulting.com](#). Events for 2006 are as follows:

- Tokyo, Japan on October 17, 2006
- Taipei, Taiwan on October 19, 2006
- Aguascalientes, Mexico on November 9, 2006
- Beijing, China on November 28, 2006
- Warsaw, Poland on December 4, 2006

# iGrafx Establishes Enterprise Software Agreement with the U.S. Department of Defense.

From: [Business Wire](#) | Date: [October 3, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

Department of the Navy is the first to take advantage of iGrafx business process analysis tools under the DoD blanket purchase agreement

TUALATIN, Ore. -- iGrafx[R], a leading provider of Business Process Analysis tools, announced it has established a Blanket Purchase Agreement (BPA) with the Department of Defense (DoD), the world's largest purchasing organization, as part of its Enterprise Software Initiative (ESI). The ESI is a joint project designed to implement an enterprise software management process within the DoD. By pooling software requirements and presenting a single negotiating point for leading software vendors, ESI provides pricing discounts lower than the General Services Administration schedule pricing.

Under the terms of the ESI agreement, the Department of the Navy has recently deployed iGrafx software. The Naval Air Systems Command (NAVAIR) AIRSpeed initiative, an integral part of the Navy's overall rollout, is designed to drive process efficiencies and embed a culture of continuous process improvement throughout their enterprise of over 37,000 military, civilian and contractor support personnel.

"NAVAIR is driving the deployment of an integrated Lean, Six Sigma and **Theory of Constraints** construct for continuous process improvement as we strive to create a fundamental cultural transformation that will enable our workforce to become more efficient and productive," said Dale L. Moore, Deputy Corporate Deployment Champion for NAVAIR AIRSpeed. "Leveraging the DMAICV methodology, the iGrafx software tools are improving our ability to Define, Measure, and Analyze our current-state process value streams while increasing the effectiveness of our future-state value stream definition and Improvements, subsequent process Controls, and realization of real results through Validation. We can now rapidly codify our processes and visualize them dynamically, conduct what-if scenario simulations, and make well informed improvements in our continuous pursuit of perfection -- resulting in remarkable cost savings, improved quality, and reduced cycle time."

"The Navy has joined other defense agencies in choosing iGrafx solutions to assist them in uncovering inefficiencies in their organizational processes," said Ken Carraher, iGrafx President. "Bottlenecks and poorly understood processes plague every organization and drain their ability to execute. Our industry leading process excellence tools are essential for anyone wanting to eliminate inefficiencies and improve quality."

The BPA establishes three authorized DoD contractors -- SoftChoice, Softmart and SHI -- to provide software licenses, maintenance, and media for iGrafx[R] FlowCharter[TM], iGrafx[R] Process[TM] for Six Sigma, iGrafx[R] BPEL[TM] Generator, iGrafx[R] Enterprise Modeler[TM], and iGrafx[R] Enterprise Central[TM]. For more information on purchasing iGrafx products through the ESI program, please visit the ESI Website -- <http://www.esi.mil/main.asp>, the Department of the Navy IT Umbrella Website -- <http://www.it-umbrella.navy.mil/index.shtml>, or the ESI ITEC site which hosts the approved BPA's -- <http://www.itec-direct.navy.mil/>.

## About iGrafx

iGrafx provides a comprehensive family of business process analysis tools that help organizations model, improve and manage processes and technologies that support, simplify, and automate their operations ([www.igrafx.com/products/](http://www.igrafx.com/products/)). Whether aligning business objectives with IT systems, complying with mandatory regulations, deploying Business Process Management, or undertaking initiatives such as Six Sigma and Lean, iGrafx provides the ability to leverage results, improvements and controls across these efforts, resulting in increased return on investment. iGrafx helps organizations deliver process excellence in a controlled, centralized and collaborative manner. iGrafx is a division of Corel Corporation. [www.iGrafx.com](http://www.iGrafx.com)

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# An Overwhelming Majority of Managers Believe Managing Execution is More Important Than Planning and Analysis.

From: [Business Wire](#) | Date: [September 20, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

SAN JOSE, Calif. -- Survey of Leading Organizations Validated by Real-Life Customer Data Reveals Execution Management Benefits: Improvements in Productivity, Employee Morale and Culture

More than 100 managers in a wide range of project organizations believe in the value of execution management to help achieve a broad spectrum of positive results, according to a survey released Friday, Sept. 15, at Realization's 2006 Customer Conference held in Chicago. Execution management provides clear task priorities and manages uncertainties that can delay and even derail the timely completion of projects, including product development, engineering and construction, and facility and equipment maintenance and overhaul.

Conducted by Realization Technologies, an execution management systems provider with more than 180 customers worldwide, the September 2006 survey found that a substantial percentage of respondents believe that their organizations are benefiting from execution management. In addition, the majority indicated that execution management is of equal or greater importance than analysis and planning within their organizations when it comes to delivering positive, bottom-line results. The survey targeted organizational managers across a range of industries, company sizes and project requirements. Findings include:

--Seventy-eight percent of respondents indicated that their organizations had developed a culture where execution occupies equal or greater importance than planning and analysis

--Sixty-eight percent of respondents saw an improvement in time savings/thru-put of more than 10 percent

--Fifty-two percent of respondents' organizations realized cost savings in excess of 10 percent per project

Realization Execution Management Survey Page

--Sixty-one percent of respondents believed that execution management had improved overall employee moral

--Seventy-seven percent of respondents experienced positive cultural change

--Eighty-three percent of respondents believed that if execution management systems were applied across their entire organization, cost savings would exceed 10 percent

--Eighty-three percent of respondents believed that the application of an execution management system made their organizations more competitive

Validating the survey findings, several customers at the 2006 Customer Conference provided examples of the range of benefits possible by implementing Realization's execution management system:

"Warner Robins has dramatically improved the efficiency of our C-5 aircraft maintenance repair and overhaul program," said Bill Best, Deputy Director of Warner Robins Air Logistics Center, United States Air Force. "We decreased the number of C-5s in the repair cycle at any point in time from 12 to seven. By putting five planes back into operation, we've generated additional cargo hauling revenue for our customers of at least \$49 million per year. We couldn't be happier with the results, and expect to see continued improvements in the future throughout other aircraft production lines."

"Our work with Realization has been a tremendous catalyst for positive change throughout all aspects of our business," said Benge Scott, CEO of Valley Cabinet Works. "In just one year after implementing the system, revenue increased by 88 percent, and we are on track to increase the number of projects we're able to complete in 2006 by more than 50 percent over 2005. The results to date have been phenomenal, and have met or exceeded our expectations."

"We admire our customers for tackling the tough problem of project execution, and achieving impressive, measurable results," said Sanjeev Gupta, president and CEO of Realization Technologies. "Most organizations have difficulty executing projects on time and on budget, which is one of the most significant issues facing today's competitive global organizations. They tend to focus their management energies on creating

elaborate plans, but fail to execute those plans in the face of uncertainties. To be successful, organizations must change the rules by which project uncertainties are managed, and execution management can help all types of organizations meet this challenge."

Additional survey findings revealed that the ability to meet deadlines was most often selected (64 percent) as a key benefit of execution management by survey respondents. Additional benefits reported by respondents included: shortened project duration (62 percent), ability to take on more projects (52 percent), decreased staffing requirements (39 percent), and less overtime (39 percent).

Realization's Customer Conference, which concluded Friday, Sept. 15, featured a keynote address by Dr. Eliyahu M. **Goldratt**, inventor of the **Theory of Constraints** (TOC) and author of "The Goal" and many other books on business and supply chain management.

### Execution Management System

Realization offers the first successful management system for efficient and reliable execution of projects. Based on the proven principles of **Critical Chain**, it has helped a growing number of organizations increase sales and profits. It works by providing clear task priorities and early warning signals across departments and to all levels of management.

### About Realization

Recipient of the prestigious 2006 Franz Edelman award for its work with Warner Robins Air Logistics Center, the company has helped organizations increase speed and efficiency in new product development, engineer-to-order manufacturing, construction, maintenance, repair and overhaul, and other project based operations. Founded in 1999, Realization has over 180 customers in a wide range of industries and regions around the world. The company is headquartered in San Jose, California. To learn more, please visit [www.realization.com](http://www.realization.com).

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# Goldratt's Theory of Constraints Yields Award-Winning Results Again

From: [Newswire Today](#) | Date: [September 19, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

LONDON-- Both 2005 and 2006 Winners of Prestigious Franz Edelman Award applied Theory of Constraints (TOC) principles

The Institute for Operations Research and the Management Sciences (INFORMS) recently awarded its 2006 Franz Edelman Award for Achievement in Operations Research to Warner Robins Air Logistics Center. The 2006 award winner has one thing in common with the 2005 winner, General Motors. Both companies achieved their outstanding results by applying Dr. Eliyahu M. Goldratt's Theory of Constraints (TOC) concepts to restructure their processes.

General Motors implemented an improvement program that rapidly identified and improved bottlenecks, leveraging a fundamental TOC principle. They achieved increased assembly throughput, higher productivity, and faster launches. GM estimated the savings generated by this effort to be over \$2 billion. Warner Robins applied TOC Critical Chain theories to dramatically shorten its C-5 transport aircraft repair and overhaul process time by 33%, keeping more aircraft in service, and generating incremental revenue of \$50 million per year.

Mr. Kenneth Percell, the Executive Director of Warner Robins Air Logistics Center, will present his organization's successes at the upcoming Theory of Constraints International Certification Organization Conference to be held in Miami on November 4-7. Dr. Goldratt will also speak at the TOCICO Conference.

Theory of Constraints, made famous in Dr. Goldratt's global bestseller, *The Goal*, is a strategic approach to achieving performance breakthroughs in large, complex environments with high degrees of uncertainty. TOC focuses on improving throughput, reducing inventory, and increasing sales and profits and delivers significant financial gains within a relatively short time.

Thousands of companies around the world have implemented TOC-based improvements and generated substantial results. However, Dr. Goldratt believes that for a company to get the full financial benefit from TOC, the entire enterprise must be engaged, including the senior management team.

Viable Vision is Dr. Goldratt's newest TOC innovation designed to help companies get the maximum financial payback from their TOC-based improvements. Says Dr. Goldratt, "When I do a Viable Vision analysis with a company, I am satisfied only when I see how it can, in less than four years, grow net profits to be equal to current net sales."

Business leaders facing new and more complex business threats, such as international competition and spiraling costs, have been receptive to Dr. Goldratt's ideas since traditional approaches are not as likely to inspire the breakthrough thinking these organizations require. Plus, Dr. Goldratt's credibility and the pay-for-performance component of the Viable Vision offer make it a low-risk, must-consider proposition.

Dr. Goldratt is traveling the world inviting business leaders to learn about Viable Vision. The next Viable Vision Offer Event schedule is as follows

- Toronto September 26
- São Paulo September 28
- Tokyo October 17
- Taipei October 19
- Aguascalientes, Mexico November 9
- Beijing November 29
- Warsaw December 4.

## New Partnership Offers Additional Management Consulting Services.

From: [PR Newswire](#) | Date: [August 28, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

MILWAUKEE, Aug. 28 /PRNewswire/ -- The WhiteLight Group LLC, a leading provider of management consulting services, today announced an agreement to provide **Theory of Constraints** (TOC) services through a merger with Odyssey Solutions Group LLC.

The WhiteLight Group LLC is a recognized leading provider of business application software and services. Their core strength is delivering tactical solutions to strategic business problems. Odyssey Solutions Group LLC specializes in identifying and enabling company processes and behaviors necessary to drive business innovation and optimization to increase profits and reduce costs.

"By combining strengths with Odyssey Solutions Group LLC, we bring a more powerful set of solutions to the marketplace," said Keith Kummer, CFO of WhiteLight Group LLC. "We have a lot in common, including a strong reference base and a strong passion for what we do."

Since 2002, the WhiteLight Group has provided quality services with exceptional experience in the areas of enterprise resource planning (ERP) solutions, business intelligence, supply chain, and employee/supplier self-service technologies. The WhiteLight Group has grown to over 30 consultants in four Midwestern offices and has continually expanded its depth and breadth of service offerings.

"Our merger with Odyssey Solutions Group allows us to build on our success and add a high value add service offering to our customers," said Kummer. "The results from using the tools and techniques of TOC are overwhelmingly positive."

The services will be offered to clients under the banner of Odyssey Solutions Group according to Jeff Rideout, President of Odyssey Solutions Group. There has been a growing demand from manufacturing executives for assistance to help them improve their operating performance and understand their business better. The combination of resources and capabilities from these two companies delivers an unmatched package of service-oriented consulting. "This is a great fit, says Rideout, "Our resources and expertise are complimentary, and the people share a similar pride in their work, which was important for both firms."

### About WhiteLight Group LLC

The WhiteLight Group LLC is a management consulting firm focused on helping their clients acquire, implement, and support business applications including Oracle, JD Edwards for ERP and Business Objects for business intelligence, coupled with a business process optimization unit focused on **Theory of Constraints**. WhiteLight Group provides quality services with exceptional experience in the areas of enterprise solutions, business intelligence, supply chain, and customer/supplier self-service technologies. They are also a value added reseller of the premier business applications Oracle JD Edwards and Business Objects.

The WhiteLight Group LLC also has offices in Chicago, IL, Oshkosh, WI, and Cincinnati, OH to effectively serve the Midwest marketplace. More information about WhiteLight Group can be found at <http://www.whitelightgrp.com/> .

### About Odyssey Solutions Group

The Odyssey Solutions Group has successfully taught and implemented the **Theory of Constraints** approach in more than 30 organizations across a variety of manufacturing industries. Project engagements are hands on and typically involve a combination of teaching basic and advanced TOC concepts, applying those concepts to a unique environment, and helping implement them in the company real world. Typical engagements involve everything from developing long-term strategy with senior executives, teaching TOC workshops to managers, and/or implementing mission critical tactics with shop floor workers. More information about Odyssey Solutions Group can be found at <http://www.odysseysg.com/> .

For additional information or a sample copy,

Contact: Kristin Kentra at [kkentra@whitelightgrp.com](mailto:kkentra@whitelightgrp.com) or at 708-588-9916x12.

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Web site: <http://www.whitelightgrp.com/> <http://www.odysseysg.com/>

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## Dr. Eli Goldratt, Author of "The Goal," to Keynote 2006 Realization Customer Conference in Chicago.

From: [Business Wire](#) | Date: [August 15, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

SAN JOSE, Calif. -- Famed Management Advisor and Inventor of the "**Theory of Constraints**" to Discuss His Latest Insights About Leading and Managing Project-Based Organizations

Realization Technologies, the pioneer in execution management systems, today announced that Dr. Eliyahu M. **Goldratt**, father of the **Theory of Constraints** (TOC) and author of several books on business and supply chain management, will keynote this year's Realization Customer Conference, to be held September 14-15, 2006 in Chicago.

Dr. Eli **Goldratt** is a physicist turned management advisor who developed TOC, a body of knowledge on the effective management of organizations as systems. His book, "**Critical Chain**", was hailed as the first breakthrough in project management in 50 years by the Harvard Business Review. An excerpt from Financial Times' "The Definitive Guide to Project Management" says, "Rather than risk confusion this book has been written to reflect just one: the **critical chain** method. Projects managed using the critical chain method have been shown to have a far greater chance of delivering the required outputs on time and on budget than those managed any other way."

"We are honored to have Dr. **Goldratt** joining us in Chicago and look forward to hearing his new insights on execution management," said Sanjeev Gupta, president and CEO of Realization Technologies. "His ideas and insights have been instrumental in our efforts to help organizations throughout the world achieve dramatic gains in project performance."

In addition to Dr. **Goldratt**'s keynote, the conference will feature presentations by a number of organizations that have enjoyed recent success implementing execution management strategies, including the U.S. Air Force, CNAT (Spain), Thyssen Kruppe and Xerox. Details about the conference and registration information may be obtained by visiting [www.realization.com](http://www.realization.com).

### About Realization

Realization offers the first successful management system for efficient and reliable execution of projects. Recipient of the prestigious 2006 Franz Edelman award for its work with Warner Robins Air Logistics Center, the company has helped organizations increase speed and efficiency in new product development, engineer-to-order manufacturing, construction, maintenance, repair and overhaul, and other project based operations. Founded in 1999, Realization has over 180 customers in a wide range of industries and regions around the world. The company is privately held and headquartered in San Jose, California.

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## Business Improvement Expert and Best Selling Author, Dr. Eli Goldratt, to Speak in Toronto During Global Tour.

From: [Business Wire](#) | Date: [August 2, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

TORONTO -- Dr. Eliyahu M. **Goldratt** will present his Viable Vision Offer Event at the Sheraton Centre Toronto Hotel September 26. Toronto is among one of the few North American venues for Dr. **Goldratt's** presentation this year. He traveled to China and India in June and will go to Mexico and Brazil in September.

Dr. **Goldratt** is lauded as the father of the **Theory of Constraints (TOC)**, a strategic approach to achieving performance breakthroughs in large, complex environments with high degrees of uncertainty. TOC focuses on improving throughput, reducing inventory, and increasing sales and profits. Dr. **Goldratt** introduced TOC in his best selling book, *The Goal*, which has sold more than 4 million copies worldwide. *The Goal* has been translated into 27 languages including Spanish, Russian, Indian, Chinese and Japanese and is required reading in major business schools around the globe. Thousands of organizations have proven the validity of **Goldratt's** concepts by implementing TOC-based operations improvements and achieving significant results without assuming unacceptable risks.

Viable Vision is Dr. **Goldratt's** newest innovation designed to help companies get the maximum financial payback from their TOC-based improvements. Dr. **Goldratt's** latest research indicates that organizations can only do so when the entire enterprise, including the executive staff, is engaged. Viable Vision is the comprehensive step-by-step procedure Dr. **Goldratt** developed to accomplish this.

Executed through an organization's management team, the Viable Vision process promises significant financial results beyond those expected from implementing TOC improvements alone within individual operations or departments. Says Dr. **Goldratt**, "When I do a Viable Vision analysis with a company, I am satisfied only when I see how it can, in less than four years, grow net profits to be equal to current net sales."

During his Viable Vision Offer Event, Dr. **Goldratt** will explain the step-by-step analytical process participating companies will undergo to determine how to achieve this exponential profit growth.

The global Viable Vision Offer Event schedule and registration for Toronto or future events is available online at [www.media2.goldratt.info](http://www.media2.goldratt.info).

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# Naval Aviation Enterprise Chooses PowerSteering for Lean Six Sigma Deployment; PowerSteering to Help Drive Transformation Through Lean Six Sigma.

From: [Business Wire](#) | Date: [July 31, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

CAMBRIDGE, Mass. -- PowerSteering, the market leader in On-Demand Enterprise Performance Improvement solutions for Lean, Six Sigma and Operational Excellence today announced that the Naval Aviation Enterprise (NAE) AIRSpeed team has selected PowerSteering Software as its exclusive deployment management solution to support its Continuous Process Improvement efforts led by the highest levels of the United States Navy.

The NAE is a warfighting partnership where interdependent issues affecting multiple commands are resolved on an Enterprise-wide basis. The NAE enables communication across all elements of the Enterprise, fosters organizational alignment, encourages inter-agency and inter-service integration, stimulates a culture of productivity, and facilitates change when change is needed to advance and improve. Working together optimizes the use of existing resources, manages the costs associated with generating readiness, and harnesses change as a positive force within our Navy and Marine Corps.

The NAE AIRSpeed team's mission is to reduce the cost of doing business and maximize the value of delivered products and services across Naval Aviation. AIRSpeed applies a combination of Lean, Six Sigma, and **Theory of Constraints** methodologies to deliver cost wise current and future readiness for the Fleet.

"NAE AIRSpeed conducted a comprehensive vendor evaluation including our existing internal solution. We chose PowerSteering because it was intuitive, flexible, and highly configurable. The productivity capabilities around project searching and knowledge sharing were especially important to us and very complementary to AIRSpeed's objectives," noted Dale L. Moore, AIRSpeed Deputy Corporate Deployment Champion of the Naval Air Systems Command.

"We are delighted that NAE AIRSpeed has decided to partner with PowerSteering for Lean Six Sigma program management. I'm confident that our breadth and depth of LSS deployment experience, coupled with our defense industry expertise, will be a significant asset to the NAE," said Stephen Sharp, PowerSteering CEO.

NAE's use of PowerSteering will be extensive including advanced metrics, executive dashboards, best practice methodology templates, black belt productivity tools, idea portal, keyword search and knowledge management capabilities.

## About AIRSpeed

AIRSpeed is the NAE's philosophy of continuous process improvement. It is also a strategy and set of tools used by the entire NAE. The NAE measures the efficiency and effectiveness of the NAE by the single Fleet-driven metric of "aircraft and carriers ready for tasking at reduced cost."

## About PowerSteering Software

PowerSteering Software is the leader in On-Demand Enterprise Performance Improvement providing flexible solutions for Lean, Six Sigma, Operational Excellence and other strategic initiatives including Merger Management, Project & Portfolio Management, New Product Development and Strategic Sourcing. Its easy-to-use, On-Demand solutions provide executives at NAVAIR AIRSpeed, the U.S. Army, Raytheon, Textron, Tyco, IBM, Merck, Best Buy, Johnson & Johnson, and others with real-time executive visibility, strategy alignment, and team productivity capabilities to drive strategy and accelerate results across the enterprise. Visit [www.powersteeringsoftware.com](http://www.powersteeringsoftware.com) for additional information.

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## Activplant Breaks New Ground with Throughput Analyzer.

From: [Canadian Corporate News](#) | Date: [June 12, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

LONDON, ONTARIO, Jun 12, 2006 (CCNMatthews via COMTEX) -- Next-generation tool will help manufacturers save significantly on operating costs

Activplant, the standard in performance management solutions for the world's leading manufacturers, today announced the general release of the ActivApplications - Throughput Analyzer, a strategic application within the Activplant Performance Management System (APMS). A key component of this application is the introduction of the patent pending Throughput Capability Metric, which uses information captured from the automation layer in the plant to identify and qualify a resource's current performance against the overall plant Takt Time, a measure used to match the pace of work to the average pace of customer demand. The Throughput Analyzer is designed to help customers identify which resources are constraining the product flow within high volume discrete manufacturing facilities, enabling them to resolve problems immediately and achieve the best possible improvements in plant performance.

The Throughput Analyzer is the first in the company's line of ActivApplications, a new suite of next-generation applications that draw upon the capabilities of the APMS. Based upon the Toyota Production System, a framework for organizing manufacturing facilities with the goal of eliminating waste, and Eliyahu M. **Goldratt's** Theory of Constraints, a body of knowledge on effective management of organizations as systems, the Throughput Analyzer makes it simple for manufacturers to identify those key constraints which most impact the bottom line.

"Manufacturers need to be able to improve plant performance by eliminating bottlenecks one constraint at a time," commented Greg Gorbach, Vice President, Collaborative Manufacturing at ARC Advisory Group. "By focusing directly on true constraints, Activplant's Throughput Analyzer brings a higher level of clarity to manufacturing operations and can significantly improve efficiency on the plant floor."

Unlike other Manufacturing Execution Systems (MES), the Throughput Analyzer needs to capture just four loss categories - quality, speed, downtime and uptime - in order to pinpoint key bottlenecks on the plant floor. Moreover, this commercial off-the-shelf application captures data directly from shop floor devices and systems (e.g. MES or quality systems), which is closer to where problems occur. Simplifying this process helps manufacturers realize efficiencies much faster than has ever been possible before.

"Manufacturers are looking for solutions that quickly and easily identify key constraints so that they can protect their bottom line," said Ted Williams, Activplant Chief Executive Officer. "With this in mind, we developed the Throughput Analyzer, to offer customers a unique off-the-shelf, root cause analysis solution which will deliver a high return on their investment in weeks rather than years."

The Throughput Analyzer will be available for general release on June 15, 2006. For information, please visit [www.activplant.com](http://www.activplant.com).

About Activplant: An enterprise manufacturing intelligence market leader, Activplant's performance management solution has set the standard in operational excellence within the world's largest and most admired manufacturers. Aimed at high-volume, high-automation plants, Activplant's solution consolidates plant floor data into relevant real-time and historical information, enabling productivity gains by optimizing product, people, equipment and processes. With Activplant solutions, plant managers and manufacturing executives can focus on the key issues in their facilities that ultimately improve product quality, accelerate new product launches and drive performance gains. Activplant is a privately held company based in London, Ontario. For more information please visit [www.activplant.com](http://www.activplant.com).

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## UT Professor Shares in Prestigious Business Award for Helping Military Increase Revenues \$49.8 Million Annually.

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From: [PR Newswire](#) | Date: [May 4, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

KNOXVILLE, Tenn., May 4 /PRNewswire/ -- A University of Tennessee professor is part of a team that won the prestigious Franz Edelman Award for generating increases in U.S. military revenues valued at \$49.8 million annually by radically streamlining the maintenance and repair process of the Air Force's largest transport plane, the C-5.

The work took only eight months and cost less than \$1 million.

UT professor Mandyam Srinivasan, together with Warner Robins Air Logistics Center in Georgia and software provider Realization Technologies Inc., won the competition that's been called the "Super Bowl" of business operations research and management sciences. Five finalists competed for the top prize, which was awarded May 1.

Srinivasan, the Ball Corp. Distinguished Professor of Business, is an internationally renowned expert in Lean Management and Theory of Constraints. He is a core member of the UT College of Business Administration's executive MBA and Lean Enterprise faculty.

#### Winning project

Warner Robins Air Logistics Center is a primary U.S. Air Force maintenance and repair facility for the C-5, C-17 and C-130 transport planes and the F-15 fighter jet. The C-5 is the largest transport plane flying, but it is an aging, out-of-production aircraft, according to the team.

Before UT became involved in Warner Robins' operation, C-5 repairs took an average of 240 days and the facility had up to 13 C-5s -- or more than 10 percent of the fleet -- under repair at one time. Because a C-5 can generate at least \$40,000 in daily revenue by transporting goods for the various branches of the military, more than \$500,000 of potential income was tied up per day by planes under repair in the facility.

Warner Robins was under significant pressure from the U.S. military to reduce maintenance turnaround time and get more planes flying.

Bill Best, deputy director of an aircraft maintenance group at Warner Robins and graduate of UT's Aerospace MBA program, partnered with Srinivasan to meet the challenge. As part of his Aerospace MBA program, Best had worked with Srinivasan to significantly cut costs in another area of the center and realized the potential of applying a business tool called **Critical Chain** Project Management to the C-5 project.

**Critical Chain** Project Management helps facilities analyze processes and use resources more efficiently. Realization Technologies Inc. is the provider of Concerto, a well-known software for implementing **Critical Chain** Project Management.

By implementing this business practice, Warner Robins was able to reduce C-5 turnaround time to 160 days and the average number of C-5s under repair from 13 planes to seven.

Annual revenue and cost savings implications from this program have been enormous, the group's data show. Having five additional planes operational at a time generates an estimated \$49.8 million annually. The cost for replacing the capacity of five C-5s, should that have been necessary, would have been about \$2.37 billion.

Also, because of the extra workforce capacity generated through these efficiency improvements, Warner Robins is expected to bring in additional revenue of \$119 million through 2008 and \$248 million through 2009. By having fewer C-5s under repair in the facility, 11 dock spaces are now available for other work. Had the center opted to build 11 new dock spaces the cost would have been about \$220 million.

Ken Percell, the senior-most civilian at Warner Robins noted during the awards ceremony, "There is another key consequence that we measure not in dollars, but in human lives. The five C-5s returned to the Air Force will immediately reduce dangerous convoy operations in combat areas, saving uncounted lives that might have been lost in these dangerous operations."

Srinivasan said reducing the number of aircraft in the repair facility also means there is less competition for limited resources. Repair teams are able to focus on fewer jets at one time, and maintenance quality has improved.

With the C-5 success under its belt, Warner Robins is implementing **Critical Chain** Project Management on the C-130s to reduce its work-in-process from 24 aircraft down to 15.

#### Contacts:

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Cindy Raines, (865) 974-4359, craines1@utk.edu

#### Srinivasan's background

Mandyam M. Srinivasan teaches in the Professional MBA, Executive MBA Program and Aerospace MBA Programs and helped develop an innovative MBA program focusing on the Integrated Value Chain. He also teaches in executive development programs such as the Lean Enterprise Systems Design Institute, the Supply Chain Management Certification Program and the Lean MRO Enterprise Program. He received his doctorate from Northwestern University.

He received the UT Chancellor's Award for Research and Creative Achievement in 1996, was selected as a College of Business Administration Stokely Scholar for 1999-2001 and has received numerous teaching awards, including the John B. Ross Outstanding Teacher Award in 2002, the Tennessee Organization of MBAs Outstanding Teacher Award in 2002 and the Allen Keally Award for Outstanding Teaching, Research and Service in 2006.

Before moving into academics, Srinivasan worked for five years in two leading automobile manufacturing companies and has successfully installed and managed the materials planning and control systems for both of these companies.

Srinivasan is the author of "Streamlined: 14 Principles for Building and Managing the Lean Supply Chain."

His current research interests are in creating flow in high-variety, low- volume manufacturing systems and performance modeling of manufacturing and telecommunication systems. His work appears in many journals including Operations Research, Management Science, IIE Transactions, IEEE Transactions on Communications, and Queuing Systems. His research and teaching efforts have been supported by grants from numerous organizations, including Northern Telecom, General Motors, Allied-Honeywell, IBM and the National Science Foundation. He is the editor of IIE Transactions on Design and Manufacturing and is an associate editor of International Journal of Flexible Manufacturing Systems.

#### The Edelman Award

The 35th annual Edelman Award, given by the Institute for Operations Research and the Management Sciences, recognizes projects that use "the most sophisticated analytical tools employed in operations research to make a major impact on an organization and the people that it serves." The international competition is open to for-profit and nonprofit, corporate and governmental organizations.

The other four finalists for the 2006 Edelman Award were Animal Health Institute and Cox Associates; The U.S. Commercial Aviation Partnership, comprising Airports Council International-North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and More Research/Molde University College; and Travelocity and Sabre Holdings.

#### Previous Franz Edelman Award winners

2005 -- General Motors Corp.  
2004 -- Motorola, Inc. with Emptoris Inc.

2003 -- Canadian Pacific Railroad  
2002 -- Continental Airlines  
2001 -- Merrill Lynch Inc.  
2000 -- Jeppesen Sanderson Inc.  
1999 -- IBM  
1998 -- Bosques Arauco, S.A.  
1997 -- Society Nationale des Chemins der Fer Francais (SNCF) and SABRE  
Decision Technologies  
1996 -- South African National Defense Force  
1995 -- Harris Corp./Semiconductor Sector  
1994 -- Tata Iron & Steel Co. Ltd.  
1993 -- AT&T  
1992 -- New Haven Health Dept., AIDS Division  
1991 -- American Airlines Decision Technologies  
1990 -- Health Care Financing Administration  
1989 -- ABB Electric Inc., Waukesa, Wisc.  
1988 -- City of San Francisco Police Dept.  
1987 -- Syntex Laboratories Inc.  
1986 -- Southland Corp. (CITGO Petroleum Corp. Subsidiary)  
1985 -- Weyerhaeuser Co.  
1984 -- Blue Bell Inc.  
1983 -- Air Products and Chemicals Inc.

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Web site: <http://www.tennessee.edu/> <http://pr.tennessee.edu/news>

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# Warner Robins Air Logistics Center Wins 2006 Franz Edelman Award for Achievement in Operations Research.

From: [Business Wire](#) | Date: [May 2, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

HANOVER, Md. & MIAMI -- The Institute for Operations Research and the Management Sciences (INFORMS(R)) today announced that Warner Robins Air Logistics Center (WR-ALC) has won the 2006 Franz Edelman Award for Achievement in Operations Research (O.R.) for its entry "Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center." The culmination of a rigorous competition referred to as the "Super Bowl of O.R.," the Franz Edelman Award brings together the very best examples of innovation in the discipline from large and small, for-profit and nonprofit, corporate and governmental organizations around the world. Past winners in the 35-year history of the Franz Edelman competition have included GM, Motorola, Continental Airlines, the New Haven Health Department and the City of San Francisco Police Department.

The winner was announced last night at a VIP reception and gala dinner at the InterContinental Hotel in Miami, Florida during the INFORMS conference, "Applying Science to the Art of Business." More information about the conference is available online at <http://www2.informs.org/Conf/Practice06/edelman.htm>

The other finalists were Animal Health Institute and Cox Associates; The US Commercial Aviation Partnership, comprising Airports Council International - North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and More Research/ Molde University College, and Travelocity and Sabre Holdings.

The 2006 Franz Edelman Award winning entry, "Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center (WR-ALC)," was presented by WR-ALC, the University of Tennessee, College of Business Administration and Realization Technologies, Inc. The winning entry discussed how WR-ALC used Operations Research in 2005 to arrive at a radically different approach to manage the repair and overhaul activity on its C-5 transport aircraft. WR-ALC used an O.R. technique called **Critical Chain** to reduce the number of C-5 aircraft undergoing repair and overhaul in the depot from twelve to seven in just eight months. The time required to repair and overhaul the C-5 aircraft was reduced by 33 percent. The five additional aircraft now in operation have generated immediate additional revenue of at least \$49.8 million per year. The replacement value for these aircraft is estimated at \$2.37 billion. The additional workload the center is accommodating will bring in additional revenue of \$119 million through 2008, with this number projected to increase to \$248 million by 2009.

In accepting the award, Ken Percell, the senior civilian at WR-ALC stated: "Warner Robins is extremely pleased to receive the Franz Edelman Award for our work on reducing flow days for the C-5 aircraft line. The results underscore the gains that a proper application of these tools can offer to the Air Force. This accomplishment should reinvigorate the use of Operations Research in the Air Force and across all branches of the military in general."

## About INFORMS

The Institute for Operations Research and the Management Sciences (INFORMS(R)) is an international scientific society with 10,000 members, including Nobel Prize laureates, dedicated to applying scientific methods to help improve decision-making, management, and operations. Members of INFORMS work in business, government, and academia. They are represented in fields as diverse as airlines, health care, law enforcement, the military, financial engineering, and telecommunications. The INFORMS website is [www.informs.org](http://www.informs.org). More information about operations research is at [www.scienceofbetter.org](http://www.scienceofbetter.org).

Please note: Photos are available upon request. For further information, please also feel free to contact John Birdsong, Chief, Media Relations, WR-ALC/PA, Tel: 478-222-1024; [John.Birdsong@robins.af.mil](mailto:John.Birdsong@robins.af.mil)

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## UT Professor Shares in Prestigious Business Award for Helping Military Increase Revenues \$49.8 Million Annually.

From: [PR Newswire](#) | Date: [May 4, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

KNOXVILLE, Tenn., May 4 /PRNewswire/ -- A University of Tennessee professor is part of a team that won the prestigious Franz Edelman Award for generating increases in U.S. military revenues valued at \$49.8 million annually by radically streamlining the maintenance and repair process of the Air Force's largest transport plane, the C-5.

The work took only eight months and cost less than \$1 million.

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### Winning project

Warner Robins Air Logistics Center is a primary U.S. Air Force maintenance and repair facility for the C-5, C-17 and C-130 transport planes and the F-15 fighter jet. The C-5 is the largest transport plane flying, but it is an aging, out-of-production aircraft, according to the team.

Before UT became involved in Warner Robins' operation, C-5 repairs took an average of 240 days and the facility had up to 13 C-5s -- or more than 10 percent of the fleet -- under repair at one time. Because a C-5 can generate at least \$40,000 in daily revenue by transporting goods for the various branches of the military, more than \$500,000 of potential income was tied up per day by planes under repair in the facility.

Warner Robins was under significant pressure from the U.S. military to reduce maintenance turnaround time and get more planes flying.

Bill Best, deputy director of an aircraft maintenance group at Warner Robins and graduate of UT's Aerospace MBA program, partnered with Srinivasan to meet the challenge. As part of his Aerospace MBA program, Best had worked with Srinivasan to significantly cut costs in another area of the center and realized the potential of applying a business tool called **Critical Chain** Project Management to the C-5 project.

**Critical Chain** Project Management helps facilities analyze processes and use resources more efficiently. Realization Technologies Inc. is the provider of Concerto, a well-known software for implementing **Critical Chain** Project Management.

By implementing this business practice, Warner Robins was able to reduce C-5 turnaround time to 160 days and the average number of C-5s under repair from 13 planes to seven.

Annual revenue and cost savings implications from this program have been enormous, the group's data show. Having five additional planes operational at a time generates an estimated \$49.8 million annually. The cost for replacing the capacity of five C-5s, should that have been necessary, would have been about \$2.37 billion.

Also, because of the extra workforce capacity generated through these efficiency improvements, Warner Robins is expected to bring in additional revenue of \$119 million through 2008 and \$248 million through 2009. By having fewer C-5s under repair in the facility, 11 dock spaces are now available for other work. Had the center opted to build 11 new dock spaces the cost would have been about \$220 million.

Ken Percell, the senior-most civilian at Warner Robins noted during the awards ceremony, "There is another key consequence that we measure not in dollars, but in human lives. The five C-5s returned to the Air Force will immediately reduce dangerous convoy operations in combat areas, saving uncounted lives that might have been lost in these dangerous operations."

Srinivasan said reducing the number of aircraft in the repair facility also means there is less competition for limited resources. Repair teams are able to focus on fewer jets at one time, and maintenance quality has improved.

With the C-5 success under its belt, Warner Robins is implementing **Critical Chain** Project Management on the C-130s to reduce its work-in-process from 24 aircraft down to 15.

#### Contacts:

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Cindy Raines, (865) 974-4359, craines1@utk.edu

#### Srinivasan's background

Mandyam M. Srinivasan teaches in the Professional MBA, Executive MBA Program and Aerospace MBA Programs and helped develop an innovative MBA program focusing on the Integrated Value Chain. He also teaches in executive development programs such as the Lean Enterprise Systems Design Institute, the Supply Chain Management Certification Program and the Lean MRO Enterprise Program. He received his doctorate from Northwestern University.

He received the UT Chancellor's Award for Research and Creative Achievement in 1996, was selected as a College of Business Administration Stokely Scholar for 1999-2001 and has received numerous teaching awards, including the John B. Ross Outstanding Teacher Award in 2002, the Tennessee Organization of MBAs Outstanding Teacher Award in 2002 and the Allen Keally Award for Outstanding Teaching, Research and Service in 2006.

Before moving into academics, Srinivasan worked for five years in two leading automobile manufacturing companies and has successfully installed and managed the materials planning and control systems for both of these companies.

Srinivasan is the author of "Streamlined: 14 Principles for Building and Managing the Lean Supply Chain."

His current research interests are in creating flow in high-variety, low-volume manufacturing systems and performance modeling of manufacturing and telecommunication systems. His work appears in many journals including Operations Research, Management Science, IIE Transactions, IEEE Transactions on Communications, and Queuing Systems. His research and teaching efforts have been supported by grants from numerous organizations, including Northern Telecom, General Motors, Allied-Honeywell, IBM and the National Science Foundation. He is the editor of IIE Transactions on Design and Manufacturing and is an associate editor of International Journal of Flexible Manufacturing Systems.

#### The Edelman Award

The 35th annual Edelman Award, given by the Institute for Operations Research and the Management Sciences, recognizes projects that use "the most sophisticated analytical tools employed in operations research to make a major impact on an organization and the people that it serves." The international competition is open to for-profit and nonprofit, corporate and governmental organizations.

The other four finalists for the 2006 Edelman Award were Animal Health Institute and Cox Associates; The U.S. Commercial Aviation Partnership, comprising Airports Council International-North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and More Research/Molde University College; and Travelocity and Sabre Holdings.

Previous Franz Edelman Award winners

2005 -- General Motors Corp.  
2004 -- Motorola, Inc. with Emptoris Inc.  
2003 -- Canadian Pacific Railroad  
2002 -- Continental Airlines  
2001 -- Merrill Lynch Inc.  
2000 -- Jeppesen Sanderson Inc.  
1999 -- IBM  
1998 -- Bosques Arauco, S.A.  
1997 -- Society Nationale des Chemins der Fer Francais (SNCF) and SABRE  
Decision Technologies  
1996 -- South African National Defense Force  
1995 -- Harris Corp./Semiconductor Sector  
1994 -- Tata Iron & Steel Co. Ltd.  
1993 -- AT&T  
1992 -- New Haven Health Dept., AIDS Division  
1991 -- American Airlines Decision Technologies  
1990 -- Health Care Financing Administration  
1989 -- ABB Electric Inc., Waukesa, Wisc.  
1988 -- City of San Francisco Police Dept.  
1987 -- Syntex Laboratories Inc.  
1986 -- Southland Corp. (CITGO Petroleum Corp. Subsidiary)  
1985 -- Weyerhaeuser Co.  
1984 -- Blue Bell Inc.  
1983 -- Air Products and Chemicals Inc.

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Web site: <http://www.tennessee.edu/> <http://pr.tennessee.edu/news>

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## Warner Robins Air Logistics Center Wins 2006 Franz Edelman Award for Achievement in Operations Research.

From: [Business Wire](#) | Date: [May 2, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

HANOVER, Md. & MIAMI -- The Institute for Operations Research and the Management Sciences (INFORMS(R)) today announced that Warner Robins Air Logistics Center (WR-ALC) has won the 2006 Franz Edelman Award for Achievement in Operations Research (O.R.) for its entry "Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center." The culmination of a rigorous competition referred to as the "Super Bowl of O.R.," the Franz Edelman Award brings together the very best examples of innovation in the discipline from large and small, for-profit and nonprofit, corporate and governmental organizations around the world. Past winners in the 35-year history of the Franz Edelman competition have included GM, Motorola, Continental Airlines, the New Haven Health Department and the City of San Francisco Police Department.

The winner was announced last night at a VIP reception and gala dinner at the InterContinental Hotel in Miami, Florida during the INFORMS conference, "Applying Science to the Art of Business." More information about the conference is available online at <http://www2.informs.org/Conf/Practice06/edelman.htm>

The other finalists were Animal Health Institute and Cox Associates; The US Commercial Aviation Partnership, comprising Airports Council International - North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and More Research/ Molde University College, and Travelocity and Sabre Holdings.

The 2006 Franz Edelman Award winning entry, "Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center (WR-ALC)," was presented by WR-ALC, the University of Tennessee, College of Business Administration and Realization Technologies, Inc. The winning entry discussed how WR-ALC used Operations Research in 2005 to arrive at a radically different approach to manage the repair and overhaul activity on its C-5 transport aircraft. WR-ALC used an O.R. technique called **Critical Chain** to reduce the number of C-5 aircraft undergoing repair and overhaul in the depot from twelve to seven in just eight months. The time required to repair and overhaul the C-5 aircraft was reduced by 33 percent. The five additional aircraft now in operation have generated immediate additional revenue of at least \$49.8 million per year. The replacement value for these aircraft is estimated at \$2.37 billion. The additional workload the center is accommodating will bring in additional revenue of \$119 million through 2008, with this number projected to increase to \$248 million by 2009.

In accepting the award, Ken Percell, the senior civilian at WR-ALC stated: "Warner Robins is extremely pleased to receive the Franz Edelman Award for our work on reducing flow days for the C-5 aircraft line. The results underscore the gains that a proper application of these tools can offer to the Air Force. This accomplishment should reinvigorate the use of Operations Research in the Air Force and across all branches of the military in general."

### About INFORMS

The Institute for Operations Research and the Management Sciences (INFORMS(R)) is an international scientific society with 10,000 members, including Nobel Prize laureates, dedicated to applying scientific methods to help improve decision-making, management, and operations. Members of INFORMS work in business, government, and academia. They are represented in fields as diverse as airlines, health care, law enforcement, the military, financial engineering, and telecommunications. The INFORMS website is [www.informs.org](http://www.informs.org). More information about operations research is at [www.scienceofbetter.org](http://www.scienceofbetter.org).

Please note: Photos are available upon request. For further information, please also feel free to contact John Birdsong, Chief, Media Relations, WR-ALC/PA, Tel: 478-222-1024; [John.Birdsong@robins.af.mil](mailto:John.Birdsong@robins.af.mil)

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## Department of the Navy to Launch ASQ Lean Six Sigma Certification Process to Accelerate Performance Improvements.

[www.ScienceofBusiness.com](http://www.ScienceofBusiness.com)   [www.MafiaOffers.com](http://www.MafiaOffers.com)   +1 303-909-3343   [info@scienceofbusiness.com](mailto:info@scienceofbusiness.com)

From: [Business Wire](#) | Date: [April 27, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

MILWAUKEE -- The Department of the Navy (DoN) is taking a deep dive into Lean Six Sigma by teaming with the American Society for Quality (ASQ) on a Lean Six Sigma Black Belt certification process. Through this development, spearheaded by Nicholas Kunesh, the deputy assistant secretary of the Navy for Logistics, the Navy and Marine Corps Acquisition Enterprise is showing a strong commitment to the resources and expertise needed to effectively implement Lean Six Sigma, deliver cost-effective readiness and capability, and create a culture of continuous process improvement.

ASQ is the world's leading authority on quality and an expert in certification and standards development. The agreement represents the collaboration of the DoN and ASQ to develop a testing standards program geared to the unique needs of the Navy and Marine Corps team - and administered by ASQ.

ASQ will conduct pilot certification program testing with 50 participants at eight sites around the country April 28. Following the pilot program, ASQ will conduct another certification exam in late September 2006 for an expected 100 participants.

Since the 1990s, commercial businesses have used Lean Six Sigma methodologies and tools to drive efficiency improvements, increase employee morale, and improve customer satisfaction.

The Navy and Marine Corps Acquisition Enterprise (NAVSEA) - which designs, develops, builds, and supports the U.S. fleet of ships, aircraft, and combat systems - recognized the importance of providing certification through an authoritative third-party source such as ASQ. Multiple Navy commands were involved with development of this process.

Doug Smith, process improvement manager, at NAVSEA's Lean Six Sigma College in Norfolk, Va., noted, "ASQ has had an internationally recognized Six Sigma certification program in place for years. We wanted to take full advantage of the Society's program and offer a certification based on the Navy's Body of Knowledge for Black Belts, which integrates Lean, Six Sigma, and Theory of Constraints.

"What ASQ brings to the table," Smith continued, "is an external accreditation and validation of our training programs that is consistent with industry."

According to Jerry Mairani, ASQ president, "ASQ is very excited about this new program and our role in the Navy and Marine Corps' drive to improve readiness through Lean Six Sigma and other quality improvement programs.

"We anticipate this experience with the Navy and Marine Corps will lead us to creating programs that will make our fighting forces within these, and all branches of the service more effective in meeting the challenges the United States faces in the coming years."

The American Society for Quality [www.asq.org](http://www.asq.org) has been the world's leading authority on quality for 60 years. With more than 90,000 individual and organizational members, the professional association advances learning, quality improvement, and knowledge exchange to improve business results, and to create better workplaces and communities worldwide. As champion of the quality movement, ASQ offers technologies, concepts, tools, and training to quality professionals, quality practitioners, and everyday consumers, encouraging all to Make Good Great(TM). ASQ has been the sole administrator of the prestigious Malcolm Baldrige National Quality Award since 1991. Headquartered in Milwaukee, Wis., the 60-year-old organization is a founding partner of the American Customer Satisfaction Index (ACSI), a prominent quarterly economic indicator, and also produces the Quarterly Quality Report.

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## Made2Manage Connect 2006 Sees 30 Percent Increase in Attendance; Conference Delivers Custom Education, Consulting, and Networking Opportunities to More Than 700 Customers.(Company overview)

From: [Business Wire](#) | Date: [April 24, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

INDIANAPOLIS & DENVER -- Made2Manage Systems Inc., the leading provider of enterprise resource planning (ERP) software and a broad range of services for manufacturers, saw record attendance today at its 12th all-customer conference, Made2Manage Connect 2006, at the Adam's Mark Hotel in Denver.

Made2Manage Connect 2006 marks the first all-customer event held by Made2Manage Systems since the company launched an aggressive acquisition program in August 2004. Customers from three of Made2Manage Systems' five business units, including Made2Manage, DTR, and AXIS, are in attendance.

"We've seen a 30 percent increase in attendance over the 2004 conference," said CEO Jeff Tognoni. "We attribute the increase, in part, to our growing number of customers. But other variables, including increasing customer satisfaction levels and the value of the conference itself, are also driving attendance."

More than 700 customers, technology business partners, and product experts convened in Denver today to launch the conference with an opening session, kicked off by corporate comedian Greg Schwem, as well as an evening networking event at the Red Rocks Park & Amphitheater. The conference continues tomorrow and Wednesday with attendees choosing from 85 educational breakout sessions to build a learning portfolio based on their product/version, job function, interests, unique needs, industry, and/or level of system expertise. Course topics range from some of the hottest issues and trends in manufacturing and technology to basic how-to courses that provide users with ways to further leverage their systems.

More than 90 product experts will staff a variety of conference attractions to assist attendees with their most critical business challenges. Offerings include free one-on-one sessions with consultants, a software-testing computer lab, and a Solutions Fair, providing an interactive overview of the full range of Made2Manage Systems' products and services.

The company's second annual executive summit, led by the Made2Manage Systems executive team and held in conjunction with the conference, offered content to more than 40 executives from customer companies on topics ranging from strategic planning to Theory of Constraints-based manufacturing.

More than 20 customers attending the conference are celebrating a 10-plus-year partnership with Made2Manage Systems. Four manufacturers, including Jasper Seating Company, Inc., Chemtech Plastics, Inc., PEMCO Corporation, and Fuserashi International Technology, Inc., are being honored with Summit Awards, which celebrate companies that are able to achieve a significant return on investment or strategic advantage using Made2Manage Systems' products and services.

One such customer, Carl Cottrell, IT director for Casey Machine & Tool Inc., repeat conference attendee, and recipient of a 10-plus-year anniversary award, said, "I attend the conferences for a couple of primary reasons. It affords me a rare opportunity to discuss the utilization of our ERP system with other individuals who are using the same platform in a variety of manufacturing settings. The networking results in ideas I can bring back to our environment. The conference also gives me a valuable block of time to discuss key issues with the Made2Manage technical staff and become familiar with Made2Manage Systems' new product offerings. I also find it rewarding to put a face to the voices that support me in my daily endeavors."

About Made2Manage Systems, Inc.

With more than 2,200 customers worldwide, Made2Manage Systems has a 20-year track record of delivering enterprise resource planning software and a broad range of services that meet the unique market specifications of more than 30 manufacturing sectors, including industrial and commercial machinery, fabricated metals, rubber and plastics, electronics, analytical and measuring equipment, furniture and fixtures, durable goods, and metals, wire and cable. Made2Manage Systems' sustained leadership position in the ERP marketplace is built on a commitment to fostering productive, long-

lasting customer relationships, developing a quality product line based on unique industry specifications, and providing excellence in customer support and professional services. For further information, visit [www.made2manage.com](http://www.made2manage.com). The company may be reached via e-mail at [info@made2manage.com](mailto:info@made2manage.com) or at (800) 626-0220.

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## GS1 UK looks at 30 years in the supply chain; Data standards body talks to the experts about the most important advancements in the supply chain.

From: [M2 Presswire](#) | Date: [April 24, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

M2 PRESSWIRE-24 April 2006-GS1 UK: GS1 UK looks at 30 years in the supply chain; Data standards body talks to the experts about the most important advancements in the supply chain(C)1994-2006 M2 COMMUNICATIONS LTD

RDATE:24042006

LONDON - To celebrate its 30th anniversary, GS1 UK, the independent supply chain standards body, asked some of the industry's leading experts to identify the most significant advancements in the supply chain over the past three decades.

The Global Institute of Logistics, ARC Advisory Group and Cranfield School of Management all provided their insights. The highlights ranged from the increased importance of the supply chain in the role of business to the expanding reach of global trade.

Dr. Paul Chapman is senior research fellow at Cranfield School of Management. He observed that business success is heavily reliant on which suppliers companies chose to work with and how they work together to meet customer expectations. "There are few bigger changes in business than the recognition that it is supply chains that compete, not companies," said Chapman. "Organisations in the public and private sector now realise that they must work together with supply chain partners in order to satisfy their customers."

Stephen Tierney of the Global Institute of Logistics noted that the opening of trading borders and increase in global business continue to influence the role of the supply chain in business. "China joining the WTO was an important milestone in supply chain history," said Tierney. "And Exel Logistics' shift from being state owned to an independent company, marking the new trend of outsourced logistics."

The internet and other technology developments have made a major impact on the efficiency of the supply chain. Simon Bragg, European Research Director at ARC Advisory Group said, "Over the last 30 years, significant supply chain developments would include **Goldratt's theory of constraints**, the realisation of the importance of the Forrester (bull-whip) effect, lean thinking, postponement concepts, linear programming and constraint programming optimisation engines, the supply chain council's SCOR metrics and all EDI/internet integration technologies. Overall, it is probably the EDI/internet integration technologies that have enabled the greatest impact on supply chain performance."

Dr. Chapman added, "Global standards have been a critical enabler to all the recent supply chain achievements. The supply chain only works when its network of organisations adhere to a set of agreed standards."

Steve Coussins, Chief Executive of GS1 UK said, "The supply chain has always mirrored technology developments in the trading of goods. GS1 UK has been here from the advent of bar codes through to RFID helping businesses across the supply chain benefit from these technologies and evolving business practices. By driving the implementation of common global standards in the UK we have helped to simplify communication, achieve greater accuracy and increase efficiencies for all supply chain participants large and small."

Notes to Editors

About GS1 UK

GS1 UK has driven innovation in the supply chain for over thirty years. It is part of the global GS1 organisation, dedicated to the development and implementation of global data standards and solutions for the supply chain. GS1 standards are the most widely used in the world. GS1 UK helps industry to implement these data standards through the use of bar codes, RFID, Global Data Synchronisation (GDS) and electronic business messaging.

[www.gs1uk.org](http://www.gs1uk.org)

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## Made2Manage Systems Honors PEMCO Corporation for Achievements Using Manufacturing Software; Manufacturer Implements Supply Chain Management Solution to Improve Data, Product Flow.

From: [Business Wire](#) | Date: [April 24, 2006](#) | More results for: [Goldratt or "Theory of Constraints" or "Critical Chain"](#)

DENVER, INDIANAPOLIS & BLUEFIELD, Va. -- Made2Manage Systems Inc., the leading provider of enterprise resource planning (ERP) software and a broad range of services for manufacturers, and PEMCO Corporation (PEMCO), a designer and manufacturer of high-quality mining and industrial products, today announced PEMCO's acceptance of the software provider's 2006 Best Use of an Individual Made2Manage Application award.

The award, part of Made2Manage Systems' Summit Awards, honors the innovative use of a specific application within the Made2Manage product suite and demonstrates the positive impact this application has had on the manufacturing operations of a Made2Manage customer. PEMCO will receive the award this afternoon at the Adam's Mark Hotel in Denver during Made2Manage Systems' premier customer conference, Made2Manage Connect, for the outstanding results achieved using Made2Manage Systems' supply chain management tools.

In 2000, PEMCO still tracked the movement of all its components on spreadsheet schedules and was thus unable to accurately project both the time requirements and material levels for each of the 1,000-plus job orders it annually receives. Supplies consistently ran out, jobs temporarily sat idle, and frustration grew among the company's customers, plant employees, and sales teams. While the company had previously installed Made2Manage Systems' core ERP solution a decade earlier, PEMCO sought to add on an application capable of running its expanding supply chain.

The following year, the company implemented the Made2Manage Supply Chain Management application (M2M(TM) SCM) and said goodbye to its spreadsheet production plans and schedules. The solution's advanced planning tools enabled PEMCO to capably balance demand with available capacity and material limitations, and then employ Theory-of-Constraints-based algorithms to design plans that would drive the highest throughput. The solution's advanced scheduling tools helped PEMCO ensure the availability of materials and heighten the likelihood of on-time deliveries.

Since implementing the SCM application, PEMCO has realized the following benefits:

- Improved on-time delivery performance--from 43 percent to 75 percent.
- Reduced customer service costs and improved customer satisfaction numbers through better on-time delivery and improved job tracking.
- Prevented product shortages through just-in-time material availability.
- Captured quality checks throughout production process.
- Reduced rework.
- Saw more accurate job costs when coupling the M2M SCM application with labor bar coding.
- Established an enhanced pricing model through access to improved cost data.
- Generated more new sales and repeat sales.

"Because of its vast capabilities, the SCM application supports our build-to-order business very well," said Jim Starks, PEMCO Corporation controller. "Product now flows smoothly and efficiently through our facility, rework has been minimized, throughput is being maximized, and warranty work is nearly non-existent. The improved quality of information and improved flow of product through the plant has even resulted in revamped employee morale and job satisfaction."

## About PEMCO Corporation

Based in Bluefield, Va., PEMCO Corporation designs and manufactures high quality mining products, from power centers to variable frequency drives, and industrial products, from dry type transformers to climate controlled power equipment enclosures. For more information, visit [www.pemco.net](http://www.pemco.net) or call (276) 326-2611.

## About Made2Manage Systems, Inc.

With more than 2,200 customers worldwide, Made2Manage Systems has a 20-year track record of delivering enterprise resource planning software and a broad range of services that meet the unique market specifications of more than 30 manufacturing sectors, including industrial and commercial machinery, fabricated metals, rubber and plastics, electronics, analytical and measuring equipment, furniture and fixtures, durable goods, and metals, wire and cable. Made2Manage Systems' sustained leadership position in the ERP marketplace is built on a commitment to fostering productive, long-lasting customer relationships, developing a quality product line based on unique industry specifications, and providing excellence in customer support and professional services. For further information, visit [www.made2manage.com](http://www.made2manage.com). The company may be reached via e-mail at [info@made2manage.com](mailto:info@made2manage.com) or at (800) 626-0220.

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## Business Improvement Expert and Best Selling Author, Dr. Eli Goldratt, Coming to Raleigh.

From: [Business Wire](#) | Date: [April 21, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

RALEIGH, N.C. -- **Goldratt** Consulting Ltd. announced that Eliyahu M. **Goldratt** will be presenting his Viable Vision Offer Event at the Hilton Hotel in Research Triangle Park (RTP) on May 11th. Raleigh is among the few USA venues for Dr. **Goldratt**'s presentation this year. He travels to Amsterdam in May, to Australia, China and India in June, and to Toronto in September.

Dr. **Goldratt** is lauded as the father of the **Theory of Constraints** (TOC). His best selling book, *The Goal*, is included in the curriculum of many major business schools around the world. *The Goal* has sold over 4 million copies worldwide and is always a "Top Seller in Books" on Amazon dot com. It has been translated into Spanish, Russian, Indian, Chinese and Japanese.

Viable Vision is based on **Goldratt**'s years of practical experience testing and applying scientific principles to transform real manufacturing, distribution and project management-type companies. "When I do a Viable Vision analysis of a company, I am satisfied only when I clearly see how it is possible to bring the company to have, in less than four years, net profit equal to its current total sales," says Dr. **Goldratt**.

During the Viable Vision Offer Event, Dr. **Goldratt** will explain how it is possible for a company to substantially increase sales and profits and how the Viable Vision tools and solutions are difficult for competitors to copy. The result of the Viable Vision process is a road map for companies to achieve exponential growth in profits without relying on new product breakthrough or focusing on niche markets.

"When we were presented with the Viable Vision concept, we were intrigued," says an owner and President of a manufacturing business. "However, we were skeptical that someone could come up with something that we hadn't thought about ourselves. But, after meeting with Dr. **Goldratt**, we had to agree that his Viable Vision for our company could be real."

The Viable Vision Offer Event runs from 8:00AM to 4:30PM on May 11th. Cost is \$595 for single attendee, or \$495 each when three or more from same company attend. Registration available online at [www.media.goldratt.info](http://www.media.goldratt.info).

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## Rocco Surace, CPA, CVA, Jonah of Buffalo, NY, Named Regional Director for the U.S. and Canada of Goldratt Consulting.

From: [Business Wire](#) | Date: [April 21, 2006](#) | More results for: [Goldratt](#) or "[Theory of Constraints](#)" or "[Critical Chain](#)"

LONDON -- **Goldratt** Consulting, LTD has announced the appointment of Rocco Surace as the organization's Regional Director for the United States and Canada effective immediately.

Rocco Surace, CPA, CVA, Jonah, is a partner with Gaines Kriner Elliott LLP, a certified public accounting and advisory services firm based in Buffalo, New York. Mr. Surace's responsibilities will include managing the operations of **Goldratt** Consulting in the U.S. and Canada, the professional development and recruitment of consultants, and the promotion and follow-through of **Goldratt** Consulting Viable Vision Offer Events.

Surace's credentials include: certifications in the Theory of Constraints from the TOC International Certification Organization; Certified Public Accountant; Certified Valuation Analyst. He is a graduate of Niagara University and is a member of the university's Board of Advisors.

The next **Goldratt** Consulting Viable Vision Offer Event in North America will be held on May 11, 2006 in Raleigh, North Carolina at the Hilton Hotel in Research Triangle Park. The event will feature world-renowned business improvement expert Dr. Eli **Goldratt**. Dr **Goldratt** is lauded as the father of the **Theory of Constraints** and his books are included in the curriculum of many major business schools in the United States and around the world. His first book, "The Goal," has sold more than four million copies worldwide. During the Viable Vision Offer Event, Dr. **Goldratt** advises business executives how their companies can earn, within four years, net profits equal to their current net sales. Viable Vision seminar registration information is available now at [www.media.Goldratt.info](http://www.media.Goldratt.info).

For more information, contact:

Dr Lisa Lang, Global Marketing Director, 303-909-3343

[lisa.lang@goldrattgroup.com](mailto:lisa.lang@goldrattgroup.com)

**Goldratt** Consulting Ltd.

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## News From INFORMS: Five Finalists Compete for Franz Edelman Award for Achievement in Operations Research.

From: [Business Wire](#) | Date: [April 3, 2006](#) | More results for: [Goldratt](#) or ["Theory of Constraints"](#) or ["Critical Chain"](#)

HANOVER, Md. -- The Institute for Operations Research and the Management Sciences (INFORMS(R)) today announced five finalists that will compete for the 2006 Franz Edelman Award for Achievement in Operations Research. The winner of the Franz Edelman competition will be announced at a special awards banquet on Monday, May 1, 2006 at the Hotel InterContinental in Miami, Florida (See: <http://www2.informs.org/Conf/Practice06/index.htm>).

Each year, the Franz Edelman competition recognizes outstanding examples of Operations Research (O.R.)-based projects that have transformed companies, entire industries and people's lives. O.R. uses advanced analytical methods to make better decisions and is a disciplined way to improve almost any business situation in nearly any type of organization in the public or private sector. Past Franz Edelman winners have included General Motors, which used O.R. to save more than \$2 billion through improved productivity at 30 assembly plants in 10 countries, and a team from the city of New Haven and Yale who won for preventing AIDS through an innovative needle exchange program.

"O.R. is more important today than at any time since it first came to prominence during World War II," said Mark Doherty, Executive Director, INFORMS. "For the last 35 years we've recognized the best work in the discipline and many of our award winners have proved transformative. For example, pricing policies known as revenue or yield management pioneered by Franz Edelman Award-winner American Airlines have become the norm. Each of these finalists lives up to that standard."

Ranging widely in industry and geographic origin, the 2006 Franz Edelman finalists are: Animal Health Institute and Cox Associates; The US Commercial Aviation Partnership, comprising Airports Council International - North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration; Omya Hustadmarmor and M0re Research/ Molde University College; Travelocity and Sabre Holdings; and Warner Robins Air Logistics Center and the University of Tennessee. Descriptions follow:

Animal Health Institute and Cox Associates: Quantitative risk analysis for animal antibiotics.

For decades, scientists, consumers and politicians have struggled with the possible human health effects of using antibiotics on animals. Proponents held that healthier animals make for a safer food supply and healthier people; opponents countered that scarce antibiotics shouldn't be wasted on animals, especially if doing so runs the risk of increasing antibiotic-resistant strains of disease. The dearth of evidence led politicians in Europe to apply the Precautionary Principle by banning antibiotics used for growth promotion in food animals; American politicians debated the same move.

Applying O.R. techniques and models, the Animal Health Institute (AHI), along with its member companies and outside O.R. firm Cox Associates, created new ways to inform this debate. They created new methods that succeeded in applying available science and data to quantify the potential human health impacts of specific animal antibiotic uses, despite uncertainties and data gaps. The quantitative bounding methods and results showed that the quantitative risks to human health from specific important animal antibiotics are minimal and that the greater risk could arise from not treating animals. Armed with these methods and results, regulators and scientists in the US were able to agree that the quantitative human health risks from continued use of specific animal antibiotics to prevent animal illnesses appear to be relatively minor. To date, none of these animal antibiotics has been banned. As predicted, continued prudent use has been accompanied by steady reductions in human health risks from food borne illnesses. By showing how to quantify previously unquantifiable human health risks, AHI and Cox Associates have helped to create a powerful role for using quantitative science and data in the worldwide debate on appropriate risk management of animal antibiotics.

The US Commercial Aviation Partnership: Industry-government coalition ensures a balance between security and aviation-system performance.

Since 9/11, there has been an outpouring of support for measures aimed to increase the security of the air transport system. However, in an era of limited resources and with airlines standing on the brink of bankruptcy, it is vital government decision-makers have the right information to help them implement measures that strike the right balance between truly enhanced security and the continued vitality of the air transport system.

To meet this goal, a consortium comprising government, airlines and industry formed the US Commercial Aviation Partnership (USCAP). USCAP used Operations Research to create a unique model and analytical process that combines system dynamics with econometrics to provide a 30-year evaluation of the impacts of proposed security measures on each key stakeholder. Members of USCAP include Airports Council International - North America, Air Transport Association, Department of Homeland Security, Department of Transportation, The Boeing Company, and the Transportation Security Administration.

Omya Hustadmarmor and M0re Research / Molde University

College: Optimizing the supply chain of calcium carbonate slurry to the European paper-making industry.

Planning shipments throughout Europe can be like a massive Sudoku game. From a single processing plant, Norwegian company Omya Hustadmarmor supplies calcium carbonate slurry to the paper manufacturers throughout Europe. For shipping planners, an important rule is that using bigger boats to ship goods lowers the cost per unit. But the little boats provide more flexibility to get the goods to customers when things happen at sea, ships are delayed or disabled, weather gets in the way, and customer orders are changed. Planning the optimal shipments and making sure they get to their locations on time often requires intricate maneuvers that are difficult to do by hand, even more difficult without the use of smaller ships.

M0re Research / Molde University College and Omya Hustadmarmor conducted a project that led to the development of a Decision Support System built on concepts of O.R. The system, implemented by Optimal Logistics, provides planners with the information they need to make stronger and faster decisions. The resulting system saves several million dollars a year by optimizing distribution, reducing costs and lowering overall oil consumption by more than 10 percent. This enabled Omya Hustadmarmor to limit price increases and aided a planned expansion into additional markets.

Travelocity & Sabre Holdings: Supporting Travelocity's transition to travel retailer and an economic turnaround.

In 2002, a changing business and competitive landscape forced online travel agency Travelocity to shift its current business model due to losses in both revenue and market share. In order to thrive in a new business environment and regain share, Travelocity needed to become an active retailer by negotiating marketing agreements with suppliers (airlines, hotels, etc.), managing web content and expanding into more profitable lines of business.

Using O.R., Travelocity Revenue Management and Sabre Research Group collaborated to improve Travelocity's performance through modeling of customer behavior, product pricing and analyzing supplier agreements. The result: since 2002, Travelocity has more than doubled its annual revenues and the O.R.-based models have contributed millions of dollars per year to Travelocity earnings.

Warner Robins Air Logistics Center and the University of Tennessee: Streamlined project management: the **critical chain** way.

In 2005, the Warner Robins Air Logistics Center (WR-ALC) in Georgia used operations research to arrive at a completely different method for managing the repair and overhaul activity on its C-5 transport aircraft. Working with Realization Technologies and faculty from the University of Tennessee, WR-ALC used an O.R. technique called **Critical Chain** to reduce the number of C-5 aircraft in the depot undergoing repair and overhaul from 12 to 7 in just eight months (March 2005-October 2005). As a direct consequence, the time required to repair and overhaul the C-5 aircraft has reduced by 33 percent.

The 5 additional aircraft now in operation have generated immediate additional revenue of at least \$49.8 Million per year. The replacement value for these aircraft is estimated at \$2.37 Billion. The additional workload the Center is

accommodating in the dock spaces freed up will bring in additional revenue of \$119 Million through 2008, with this number projected to increase to \$248 Million by 2009.

#### About INFORMS

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# Spain's TINSA Using Realization's Execution Management System for Developing Real Estate.

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## Managing Execution Increases Speed and Efficiency

SILICON VALLEY, Calif., Jan. 25 /PRNewswire/ -- Realization Technologies today announced that TINSA, Real Estate Appraisals Ltd., the most important Spanish real estate appraisal company, both in number of valuations carried out and in staff and technology employed, is managing the execution of its 75 real estate developments per year with the company's execution management system. Unlike administrative systems that are heavy on planning and tracking, Realization's system helps managers execute.

"Applying the principles of **critical chain**, our execution management system helps managers get the job done," explains Sanjeev Gupta, Realization CEO. "With clear execution priorities, time and resources are better used and more projects get done faster."

At TINSA, developers are hindered by hundreds of requests from vendors, clients and others, each of which slows down progress and impacts due dates. By managing the execution of responding to such requests, TINSA is increasing the speed and efficiency of its developers and staff.

## About Realization Technologies, Inc.

Realization Technologies is the first organization to provide execution management systems for project based organizations. Unlike administrative systems that are heavy on tracking and reporting, execution management is about getting the job done. Used by over 150 leading organizations throughout the world, Realization's systems are based on the execution rules of **critical chain**.

Realization is headquartered at 2 North First Street, San Jose, Calif. 95113. Website is <http://www.realization.com/>.

RT195-012506

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