

# Where Best To System Invest

Using a dentist's office as a hypothetical example, the authors outline seven steps that can help determine where priorities for office automation investment should lie.

BY BARRY FLOYD AND BOAZ RONEN

A medium-sized manufacturing firm, having experienced substantial productivity gains on its shop floor, recently invested \$3 million in technology to get a similar improvement in its office operations. The company's goals were to reduce the clerical work force by 10%, to shorten the response time to customer complaints and to managements' requests for information, and to improve communication among senior staff members.

After a year of struggling with the new technology, the firm found that it had been forced to increase its technical staff. But the response times to information requests remained about the same. Communication among senior managers was only moderately improved. Worst of all, only half of the new equipment was being used.

The company's goals were not unreasonable. Experts in office automation always list increased productivity, expanded work capabilities and higher levels of satisfaction for both employees and clients among the benefits of putting computer and communications technology into the office. But technology that improves efficiency without improving the organization's bottom line and overall system performance may be inappropriate. For example, improving a typist's efficiency when the typist is used only 75% of the time is money ill spent.

Surprisingly, certain techniques used to analyze the overall performance of shop floor production systems can be applied to office technologies, despite the

## Steps to Managing by Constraints

Identifying and determining how to manage a system's constraints is a multistep process.

### STEP ACTIVITY

1. Identify the goal of the system.
2. Identify appropriate measures to achieve the goal.
3. Identify the system constraint.
4. Decide how to exploit the system constraint.
5. Subordinate all of the system to the above decision.
6. Elevate the constraint.
7. Go Back to Step 3—reevaluate the system and its new constraints. Don't let inertia be the system's constraint.

Source: Floyd & Ronen.

belief that the two work environments are essentially different. These methods analyze the complete system, emphasizing throughput, operating expenses and inventory-over efficiency, utilization and output.

One production floor technique, called Management by Constraints (MBC), developed by E.M. Goldratt, focuses on adjusting system constraints to optimize the overall performance of an office system. A system constraint is anything that prevents the system from reaching its stated performance goals. The basic premise of MBC is that higher returns may be gained by investing in the constraining resource instead of the non-constraining resource. Increasing production capacity for resources that are not constraints on the process typically leads to excess inventory without improving overall system performance.

Furthermore, the MBC method says that most often it is preferable to adjust the system so its constraining resource is its most expensive resource or is an external resource. For example, in a dentist's

office, many office procedures could be automated, such as the compilation and maintenance of mailing lists and the storage and retrieval of patient data storage. But the goal should be to make the most expensive resource, in this case the dentist's activities, the constraining resource.

To accomplish this goal, Goldratt has defined seven steps that focus recursively on the constraints that inhibit gains in performance. Those

steps are:

- Identify the goal of the system.
- Identify appropriate measures for achieving those goals.
- Identify the system constraint.
- Decide how to exploit the system constraint.
- Subordinate all of the system to the above decision.
- Elevate the constraint and, once the constraint is adjusted,
- Reevaluate the system to ensure it is set up correctly.

### 1 Identify the Goal of the System.

Many analysts tend to focus on the performance of only one component of a system. Although each component has its own goal, it must be consonant with the organization's goal and the system goal. For most organizations, both of those overall goals are to make the endeavor profitable. Improvements that do not help get goods and services out the door at an appropriate cost will create a negative impact on

## MANAGEMENT

### OFFICE AUTOMATION

the bottom line. For example, creating a system to build up inventory is of no help if new customers are not being recruited at the same time.

The goal of our hypothetical dentist is to be profitable while providing excellent quality dental care for his patients. Although our dentist has a thriving practice, he realizes that the number of clients with dental decay is decreasing due to the use of fluoride and are requiring his highly skilled tasks less frequently. Wary about the future, he wonders whether computer technology could make his office more productive while reducing his costs.

## 2 Identify Appropriate System Performance Measures for Meeting the Organization's Goal.

Human behavior is strongly influenced by the measures set up to evaluate that behavior. Therefore, the measures used to evaluate performance within the process must be in line with the system goal. The measures must be global rather than local, as global measures provide incentives for coordinating each of the subunits in the system. To be considered, any technological advance should have a positive impact on one of these measures.

We have selected five global measures, three from the MBC approach and two of our own, that can be used to realize the system goal: throughput, operating expenses, inventory, lead time and quality.

The first measure, throughput, refers to the amount of goods and services actually sold to a customer. Output differs from throughput in that it includes all unsold goods and services. Many managers mistake output for throughput, believing that merely creating the product creates profits for the organization. They forget that a product without a customer has to be stored, a costly proposition.

Our dentist's throughput corresponds most directly to the number of patients he sees in a day. Since dental patients are rarely turned away, the dentist's output is typically equivalent to his throughput.

The second measure, operating expenses, is the area in which traditional office automation analyses most often predict unrealized savings. Typically, such analyses assume that costs will automatically be reduced if automation can save an employee time. However, if the employee's newfound time is not used to modify throughput in a positive way, operating expenses will not be decreased. In fact, costs could grow higher if the new technology requires additional maintenance

## Measures To Consider in Step 2 of MBC

Focusing on these parameters, rather than on efficiency alone, can steer an organization toward profitability.

- Throughput
- Operating Expenses
- Inventory
- Lead Time
- Quality

Source: Floyd & Ronen.

or operating personnel. For example, installing a patient-scheduling system should be done only if it gives an office manager time to provide better customer service.

The third measure, inventory, represents money invested in raw materials, work in process and finished goods. Although some inventory is necessary, lower inventory reduces expenses and improves profits. The dangers of excess inventory are well known: damage, theft, spoilage and obsolescence.

Our dentist's inventory primarily takes the form of the number of clients in the office waiting for service. This value should neither be zero nor so large that customers decide to leave.

The important fourth measure, lead time, refers to the response delay between the time a customer requests a product or service and the time he or she receives it. Short lead times can provide a competitive advantage.

In the dentist's office lead time is the difference between the time a person calls for service and the time of the appointment. The ultimate objective is to get the lead time close to zero.

## □ ELEVATE THE CONSTRAINT UNTIL IT BECOMES THE MOST COSTLY RESOURCE.

The last measure, quality, is a multidimensional concept that depends on the process used in creating the product or service.

Quality dental work is reflected in a number of ways, such as the number of patient complaints, the appearance of the work and the degree of interaction between the dentist and the patient.

How does improved performance by these five measures translate into a positive return on our office technology investment—a profitable office? The first three measures—increases in throughput, decreases in operating expenses and a drop in inventory—can be reflected immediately in the cash flow of the organization and, ultimately, the company bal-

ance sheet. The two other measures are more difficult to relate as directly to the company's financial health. However, both decreases in lead times and improvements in quality generate positive changes in sales and market share over a longer time frame.

## 3 Identify the System Constraint.

System constraints can be either internal or external.

An external constraint could be the market—it may simply not want all the products the organization produces. An internal constraint can be a department, such as finance or purchasing; an individual who is carrying an inordinately heavy work load; or a machine, such as a copier or a fax machine.

These constraints can be identified in many ways. Perhaps the simplest but most effective is to ask office workers which aspects of the work environment restrict their work flow. A second technique is to visit the work site, allowing the analyst to see where system constraints are causing mountains of inventory to build up. If the dentist is waiting for patients to arrive, it is clear that some other aspect of the office's operation is the constraining resource.

Analytical techniques also can be useful. Work load analysis identifies the most utilized resource, which typically is also one of the constraints on the system. Another analytical technique is to contrast the resources used by the jobs that are overdue with the jobs that are on time. The resources involved in the late jobs are usually the bottlenecks.

## 4 Decide How To Exploit the System Constraint.

The notion behind exploiting the system constraint is to improve the performance measures without changing the production capacity of the existing system. One way is to assure that the constraining resource is used 100% of its available time. For example, the dentist should work at his desired rate without having to waste time waiting for patients to arrive.

The second way to exploit the system constraint is to reformulate the mix of products that flows through that resource so it will increase the overall profitability of the organization. For example, assuming the dentist were the constraint, he could increase revenues by performing more of the costly work that takes the same amount of time as less costly work.

## MANAGEMENT

### OFFICE AUTOMATION

Finding an acceptable mix may be difficult. Often, the products that pass through an organization vary widely, with each requiring attention by the constraining resource for reasons other than profitability.

#### **5** Subordinate Other System Decisions to the Above Decision.

The MBC perspective envisions the constraining resource as the drum of the system, with the other system components marching in step to its beat. Accordingly, if the dentist is the constraining resource, the office manager and dental assistant should adjust to the dentist's rate of work. The office manager shouldn't schedule as many patients as possible; rather, the manager should book only as many patients as the dentist can serve. Similarly, the dental assistant should prepare only as many compounds for patching teeth as the dentist requires.

Similarly, if the dental assistant is the constraining resource, patients should be scheduled so that the assistant is able to serve each of them adequately. This could result in the dentist being idle for periods during the day. If this constraint is unacceptable, step six, "elevate the constraint," may be required.

#### **6** Elevate the System Constraint.

Once the system is working as effectively as possible with the current constraint, the goal should be to overcome that constraint and further improve the system.

Two ways to improve system capacity are either to hire additional personnel or to purchase technological resources that will support the constraining resource. For example, if the dental assistant is unable to perform the work quickly enough, another assistant could be hired or technological support could be provided to improve the assistant's performance. If the office manager finds it difficult to keep track of patient schedules, a user-friendly scheduling system with automatic prompts and alerts could help. The goal is to elevate the constraint until it becomes the most costly resource; in our example, the dentist. If a resource is to remain idle, it should be the lower cost resource, such as the dental assistant or the office manager.

If the dentist is the constraint, a system that would allow him to easily retrieve and update patient records might be in order. Such equipment could reduce his

## Suggestions for Further Reading

These articles and books can provide extra insight into how to identify and manage the constraining resources in a system.

Eden, Y. and B. Ronen. "Managing Indirect Costs," working paper (Tel Aviv University, Management Faculty, 1988).

Floyd, Barry and Boaz Ronen. "Office Automation: A Management by Constraints Approach," working paper #89-20 (New York University, Stern School of Business, 1989).

Fox, R. "The Theory of Constraints," paper presented at the National Association of Accounting conference on Cost Accounting of the '90s (Montvale, N.J., 1988). NAA Publication No. 88219.

Garvin, David A. "Competing on the Eight Dimensions of Quality," *Harvard Business Review* (November-December 1987) pp. 101-109.

Goldratt, E. M. and J. Cox. *The Goal* (Milford, Conn.: North River Press, 1986).

Pliskin, N. "Interacting With Computers Can Be a Dream or a Nightmare: A User's Point of View," *Interfacing with Computers* (forthcoming).

Sasso, W.C., J.R. Olson and A.G. Merten, "Procedures for Office Analysis: A Critical Review," working paper #119, (New York University, Information Systems Department, 1986).

Schonberger, R.J. *World Class Manufacturing* (New York: Free Press, 1986).



time spent with patients, improving throughput. It could also improve the quality of the dentist's service by enhancing his interaction with patients. In this situation, office technology should not be applied to help the office manager or the dental assistant, unless it improves performance of one or more of the five measures. Purchasing a computer system to reduce the time it takes to send out bills is not fruitful if the office manager already has slack time.

A second way to elevate the constraint is to make organizational changes to the system, such as off loading some of the activities performed by the constraining resource to other system resources. The dental assistant, for example, could be asked to perform less-skilled dental functions, such as cleaning.

In more traditional approaches, such a strategy may not be considered. In cost accounting, for example, overhead is typically assigned on the basis of hours worked, which discourages the transfer of a task from an efficient resource to a less efficient one. But the MBC system makes clear that it may not be important for the dental assistant who takes on the task to do it as efficiently as the dentist could. The MBC's global cost/benefit analysis may instead reveal that, by off loading the task from the constraining resource, a better opportunity exists for increasing throughput and, ultimately, increasing profits.

#### **7** Go Back to Step Three—Reevaluate the System To Ensure It Is Set Up Correctly.

The goal in this MBC analysis is to end with the constraint at a desired location. Thus, once a system has been evaluated and desired changes have been made, the system should be reevaluated to determine which resource has become the new constraint. If it is not where the organization wishes it to be, the process should be repeated to identify the new system constraint and place it where desired.

A major reason for the failure of office automation to produce expected benefits is a breakdown in the analysis process. Analysis using the Management by Constraints approach can provide the proper focus needed for investing in truly appropriate office technologies.

Most important, MBC points out the danger inherent in applying IS technology to areas that are not constraints on the system. Implementing any technology in an organization is a difficult process and, if it is not needed (something the workers quickly discover), the technology will not be used. □

*Barry Floyd is an assistant professor of information systems at the Stern School of Business, New York University. Boaz Ronen is a lecturer on information systems at the Faculty of Management at Tel Aviv University.*