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CYCLE TIME REDUCTION: CONCEPTS AND CASE STUDIES

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TUTORIAL

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ABSTRACT

Increasingly organizations compete based on time. As a result, cycle-time reduction is a key agenda for organizations interested in achieving increased customer service and reduced cost. With improved cycle time, organizations can often eliminate or reduce inventory while expanding customer service offerings.

The purpose of this tutorial is to present the fundamental concepts of cycle time reduction and to show how IS can be used to reduce cycle time, increase customer service, and reduce costs significantly. The tutorial examines several organizations that used IS as a way to leverage cycle time for competitive advantage.

Keywords: Cycle time reduction, customer service, cost reductions.

I. INTRODUCTION

Organizations are under increasing pressure to get more done with less and less. This phenomenon spurred the creation of the FedEx Center for Cycle Time Research. The primary focus of its research is the reduction of cycle time in such a way that reduces cost and/or improves customer service. It is not about speed for speeds sake. Many companies use technology to help with their cycle time reduction initiative. In fact, the use of, such as in Internet stock trades, information technology is often the catalyst for cycle time reduction.

Unfortunately, many organizations believe that the only way to cut costs is to compromise customer service. Nothing could be further from the truth if proper use of cycle time reduction is employed. The effects of cycle time reduction are illustrated in this article first in a discussion of cycle time reduction concepts (Sec. II), then by a description of the FedEx Center for Cycle Time Reduction (Sec. III) and finally by several case studies conducted by the Center.

II. CONCEPTS OF CYCLE TIME REDUCTION

THE 3% RULE

One of the key components of cycle time reduction is "the 3% rule. " When looking at organizational processes in terms of cycle time reduction, the 3% rule is often a good place to start. The 3% rule states that:

only 3% of the elapsed process is actually needed to complete the activity.

Insurance claims are a good example of the 3% rule. Completing the claim may take only 5 minutes, but it often takes 30 days to have the claim processed. The rest of the time the claim is waiting for information, getting lost, getting found, expediting, etc.

The 3% rule is particularly true in the book publishing business. One of the authors (Wetherbe) published 18 books. The first twelve books each took about one year from when the last period was dotted until the book was actually published. To understand the problem, consider this scenario. In the 1970's, the average book on information technology had a life cycle of approximately five years. With the way technology is changing, the maximum life cycle is now three years. With one year lost to production time, the revenue life cycle of the book is seriously compromised.

Several years ago, Wetherbe wrote a book that he wanted to published quickly. To do so, he created his own publishing company. It took one week to print the book and bind with a jacket. In three months, sales *of So What's Your Point?* (Wetherbe and Wetherbe 1993) generated enough revenue to cover the production costs.

The 3% rule reveals a great deal of "low hanging fruit just waiting to be plucked." payoffs in cycle time reduction are phenomenal.

THREE BUSINESS INITIATIVES

Over the past 25 years, three business initiatives provided popular strategies for improving organizational performance. They are:

- Total Quality Management (TQM),
- Business Reengineering (BR), (Hammer and Champy, 1993) and
- Cycle Time Reduction (CTR) (Wetherbe, 1995).

These strategies differ in some respects but also overlap and have similarities (Fig. 1).

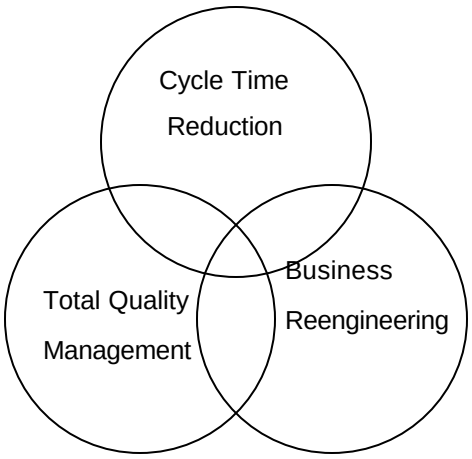


Figure 1. Overlapping Relationship of Total Quality Management, Business Reengineering, and Cycle Time Reduction.

TQM and BR are similar in that:

- they rely on strong consistent top management support,
- the goals, measures and problem solving methods used must be highly intertwined, and
- there is a strong customer focus.

A big distinction between TQM and BR is their impact over time. TQM is a slow incremental improvement process while BR is generally considered to involve drastic improvements through radical means. TQM involves gradual change (e.g. 5% annual) as was illustrated by the Japanese improvements in manufacturing. Business reengineering involves radical improvement (e.g. 50% or more) as was illustrated with the restructuring of Progressive Insurance [Wetherbe, 1995] As shown in Figure 2, when they are used alternately there is actually a synergy between the two.

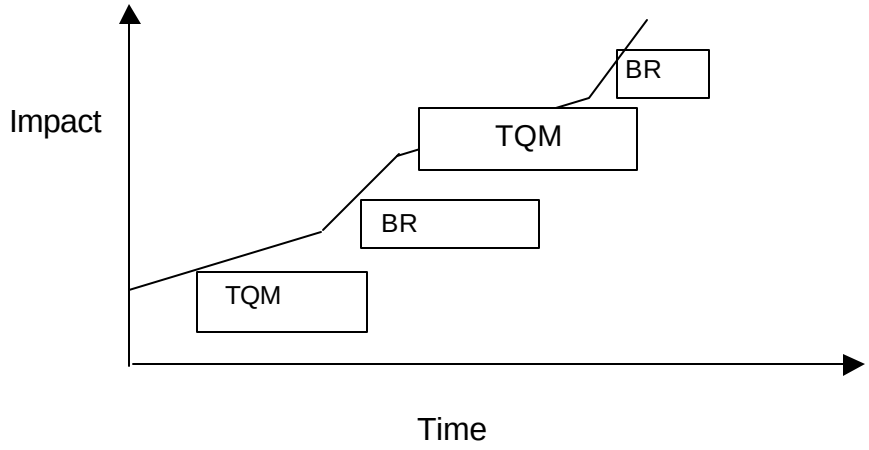


Figure 2. Quality Reengineering Synergy.

CTR, like TQM and BR, is another way of improving performance. CTR can be combined with TQM and/or BR initiatives or done on its own. However, CTR does not require the radical change that is required of BR and can be done incrementally.

MATTER OF FOCUS

The role of CTR in relation to TQM and BR is a matter of focus. Of the three common aspects of TQM, BR and CTR: Time, Cost, and Customer Services (Fig. 3) the most constraining is time. Time is the only "fixed" variable. As a result, it is the focus of CTR, as the name implies. Many organizations realize that *economy of time* is a key to competitive advantage just as they recognized *economy of scale* in the past. For example, many people thought that Wal-Mart was successful because it placed large stores in small towns and superstores in large cities (economies of scale). The key to their success, however, was having fast inventory turns (economy of time). Their improvement was a result of replacing inventory with information. Wal-Mart used EDI with its vendors to improve cycle time for inventory turns and replenishment.

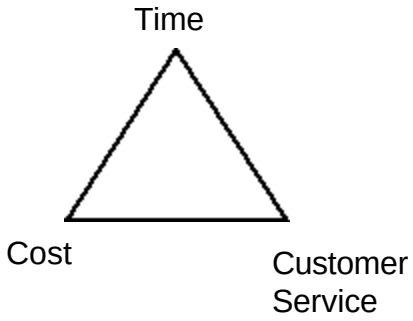


Figure 3. Aspects of TQM, BR, and CTR

Several evolving technologies support this philosophy. For example, using the Internet, people can access their investments to determine their balance at anytime, from anywhere, and look at different stocks and bonds from a variety of perspectives. Similarly, a presentation in Boston, can be viewed simultaneously in other cities and stored digitally for subsequent use.

THE "ING"s OF CYCLE TIME REDUCTION

Given that an organization is viewed as a system of interconnected activities, how do we go about reducing the cycle time within them? Trying to reduce cycle time in large organizations or several interconnected organizations requires pressure at the right points.

Leverage

Through our research (Wetherbe, 1995, Nichols et. al, 1996, Frolick, 1996, Nichols, 1996), we identified five major constructs that organization should consider for CTR. These constructs can be used as a framework for determining the points of leverage for cycle time reduction. These construct areas are:

- Management/Organization
- Human Resources
- Product Management
- Operations
-

Each construct has a set of points of leverage that are nothing more than words that end in "ing." They provide a checklist for uncovering CTR opportunities.

The idea is to apply a small amount of leverage to obtain a big reduction difference in cycle time. For example, how did Wetherbe publish a book in eight days? What "point of leverage" did he discover to reduce the cycle time from a year to one week? The answer is *anticipatory scheduling* - one of the "INGS." Let us explain further.

Authors are notoriously unreliable about meeting deadlines. In fact, some books in their third edition have never been published on time. As a result of unreliable authors, publishing companies generally do not make any publishing arrangements for the book until they actually receive the completed manuscript. When the manuscript is received, the publisher begins to try to find a production date for the book. The average publishing shop has a backlog that can be up to one year. Most publishers will not vary this schedule.

Once one understands the chain of events for the publication of a book, it is clear that the key to reducing cycle time in the publication process was the firm commitment to a manuscript deadline date. In this relationship - author, publisher, printing company - the point of leverage is being able to commit to a manuscript deadline so that the publisher can schedule the book's production. The point of leverage is *anticipatory scheduling*. As a result, *So What's Your Point*? Was published in eight days.

We now explore the constructs of CTR and their associated "INGs" or points of leverage.

CONSTRUCT SUMMARY

The five constructs for cycle time reduction are summarized in Table 1 on the next page. The purpose of the constructs and the 46 "ING" words shown in Table 1 is to provide a framework, checklist, or methodology for investigating potential areas of cycle time reduction. Since it is useful to understand something before changing it, we try to determine which of the "ING" activities provides the greatest point of leverage for cycle time reduction.

CONSTRUCT 1: MANAGEMENT/ORGANIZATION

Management/Organization is the first construct used to study CTR. These points of leverage or "ING" words are pertinent to the reduction of cycle time from a management or organizational perspective:

Visioning

Visioning involves creating an awareness for a desired state or condition. A few examples of visioning include:

- Henry Ford's "a car in every garage,"
- Federal Express' "absolutely, positively overnight," and
- President John Kennedy's "man on the moon by the end of the decade."

By simply creating a shared vision organizations can often reduce cycle time.

Front-ending.

Front-ending is planning and preparing for something before you start. Examples include starting a company or launching a technical project. To illustrate front-ending, consider painting a room. The two ways to go about this task are:

1. Buy supplies, get out the brush and get started. When you are finished you may have to spend ten times the amount of time it took to paint to clean up the mess.

Table 1. Cycle Time Reduction "ING" Words

Management/Organization

- Visioning
- Front-ending
- Aligning
- Transforming
- Flattening
- Balancing
- Investing
- Consolidating
- Distributing
- Implementing
- Benchmarking
- Learning

Human Resource

- Empowering
- JIT-training
- Modeling
- Self-directed teaming
- Cross-functioning
- Case-working
- Co-locating
- Teleworking
- Measuring
- Rewarding

Product Management

- Identifying
- Innovating
- Prototyping
- Time-boxing
- Mass-customizing
- Platforming
- Deriving
- Postponing
- Reusing

- Empowering
- JIT-training
- Modeling
- Self-directed teaming
- Cross-functioning
- Case-working
- Co-locating
- Teleworking
- Measuring
- Rewarding

Operations

- Conceptualizing
- Challenging
- Eliminating
- Integrating
- Parallelling
- Anticipatory-scheduling
- Informating
- Simplifying
- Standardizing
- Automating

Inter-organizational

- Networking
- Partnering
- Risk-sharing
- Outsourcing
- Virtualizing

or

2. Move the furniture and drape it with plastic, put masking tape over the moldings, doorways, etc. In essence, taking the time to prepare prior to painting. It may take two hours to prepare, one hour to paint, and one-half hour to clean up.

Preparation time is front-ending that reduces the overall cycle time. Another example is designing a car so that not only is production time reduced but required maintenance after purchase is also reduced.

Aligning

Typically, functions are out of alignment. For example, retailers and distributors view the world differently. A key to reducing cycle time is to get functional areas within an organization or in separate organizations to understand the role that they play for each other. For example, the role of the credit department is to never to lose money. As a result, when a "risk" applies for credit, the credit department denies credit. This policy often causes the sales department to refer to the credit department as the "sales prevention department." The two are out of alignment. By having the two departments communicate the effects they have on each other, the alignment problem can be corrected.

Transforming

Transforming is the willingness to change the organization. For example, in many banks a single point of contact is used for all dealings with the bank, rather than separate people for the checking, savings, and mortgage departments.

Flattening

Flattening removes unnecessary layers from an organization. The best example of flattening is Peter Drucker's (1992) metaphor about a symphony orchestra. There are no "managing directors of flutes," "supervisors of oboes,"

etc. The conductor communicates to the entire orchestra at the same time. Middle management is virtually non-existent. In today's organization, more knowledge workers are empowered to make decisions based on the problem at hand. Organizations are flatter and whoever needs to assume a leadership role does so at the appropriate time.

Balancing

Balancing, which is related to aligning, keeps the units of the organization stabilized with respect to one another: i.e., they have enough inventory to satisfy customer needs. An organization is optimized by sub-optimizing the units within it. For example, the sales department cannot be the only department that specifies what should be in inventory. They might like to have one product of every kind, color, and shape in inventory. Manufacturing, on the other hand, would likely counterbalance sales by having only one product in one color and one shape to achieve production efficiency. Balancing is the recognition that tradeoffs need to be made and making sure that they happen.

Investing

Investing capitalizes the idea, product, or organization. Often a monumental leap must be made such as, for example, GM's creation of the Saturn division.

Consolidating

Consolidating refers to reducing or compressing inventory or operations to reduce cycle time. For example, a national retailer of upscale shoes realized that 20% of their inventory generates 80% of their sales. However, they typically wanted a complete inventory in each store.

To reduce cycle time, they decided to consolidate their inventory (reduced by 90%), and use overnight delivery (that's the cycle time part) for shipping shoes that are purchased infrequently. This action also improved customer service by offering free, next day delivery of shoes that were not available.

Distributing

Distributing is basically the opposite of consolidating. Inventory and/or operations are expanded to reduce cycle time and cost as well as improve customer service. An organization's operations, strategic direction, and objectives all play a part in which approach is the right one.

Implementing

Implementing is the ability of taking an idea and making it happen. The ability to implement is crucial to cycle time reduction. In many organizations, however, too little emphasis is placed on this element. As a result, many projects are unsuccessful.

Benchmarking

Benchmarking compares the cycle time of an organization to that of its competitors in the industry as well as other industries.

Learning

Learning refers to the on-going education about other companies from benchmarking and making continuous improvements. Learning involves continual assessment and adjustment based upon what is or is not working.

CONSTRUCT 2: HUMAN RESOURCES

The human resources construct focuses on the people issues necessary to reduce cycle time. The following "ING" words examine the reduction of cycle time in the human resources organization:

Empowering

Empowering enables people to make decisions. It is done at the lowest possible level in an organization and it is one of the easiest ways to reduce cycle time. Empowerment allows people to add value to the organization. Managers should apply the value-added test whenever a matter comes to them for approval. They should question whether or not it is really necessary for them to spend time on an item when the decision could have been made lower in the organization. For example, FedEx empowered employees with immediate check

writing authorization up to $1000 to cover any customer claim that the employee feels is legitimate. Hewlett-Packard empowers its secretaries with a $2000 limit credit card to obtain supplies needed to get their jobs done. By doing so, they eliminated the purchasing approval maze common in most organizations.

JIT-Training

Just-in-Time (JIT) Training reverses the old notion that employees are either trained or not-trained. JIT training refers to educating a person on a topic when needed to perform a specific task. For example, computer-based JIT training on sales forecasting may be what sales personnel need to be productive in their quarterly sales forecasts.

Modeling

Modeling allows people to learn by example. Rather than simply describing a skill, observing the behavior "in action" becomes part of the learning process. Research has demonstrated that cycle time can be reduced as a result of learning through modeling behavior. Through modeling, the learner can attempt to imitate what they observe until they perfect the skill.

Self-directed Teaming

Self-directed teaming involves assembling teams by the team members with minimal management involvement. These teams have significant latitude in determining how they will achieve results. This process closely resembles how children pick teams when playing games. The best players are the team leaders and they select their team members based on known skills. The medical community has long assembled self-directed teams to solve particular problems.

Cross-functioning

Cross-functioning involves assembling people from the various business units to streamline the activities that they perform. The result is the examination of the effect that the units have on one another; for example, knowing how the "right hand" of the organization affects the "left hand."

Case-Working

Case-working is the concept of providing the customer with one contact person as their interface with the organization. For example, at Universities, the case-worker is used to recruit students, arrange student loans, and advise students to reduce cycle time by providing a seamless point of information.

Co-locating

Co-locating means placing people close to one another so that they can be productive. While technology can be used to bridge physical distance to some extent, research results supports the idea that there is no substitute for physical proximity (Wetherbe and Vitalari, 1994). For example, if faculty from IT and Marketing need to do research together, telling them to do it will not net the same result as intermixing their offices.

Teleworking

Teleworking allows people to work in places other than the traditional job site. Resources include PCs, video, voice mail, and fax. Creativity and productivity are two important considerations here. Unlike manual laborers, knowledge workers are not necessarily the most productive from nine-to-five. Giving them the tools and time away from the office helps enable the creative process.

Measuring

Measuring is the process of determining how long it takes to do something and comparing it to previous occurrences to determine variance from the norm. Information systems professionals, for example, are always asked for estimates and expected to track how long it takes to accomplish their tasks.

Rewarding

Rewarding ensures that the organization's reward system provides valued outcomes customized to individual employees. It helps ensure that the organization is aware of what motivates individual employees.

CONSTRUCT 3: PRODUCT MANAGEMENT

The "INGs" of product management include:

Identifying

Identifying what the customer wants early in the product management process is key to cycle time reduction. Best Buy, for example, did research early in their history to determine what customers wanted. Their primary finding was that customers disliked the way other consumer electronic companies did business. They disliked high-pressure, commissioned salespeople trying to steer their decision, pushing an extended warranty, and waiting fifteen minutes for their merchandise. As a result, Best Buy does not employ commissioned salespeople. The employees are there to answer questions without pushing products. It is a supermarket paradigm.

Innovating

Innovating involves creating a new product. It generally involves a creative solution. For example, many parents felt that it was inconvenient to install/remove child seats from their cars. As a result, Chrysler created integrated child seats.

Prototyping

Prototyping is the process of "trial and error/success" in problem solving. By nature, we follow "trial and error/success" in the way we approach problems. Here are some ordinary examples of prototyping: seasoning food when cooking, then tasting, then seasoning some more until it tastes right; trying on clothes before buying them; or arranging furniture after it is delivered versus how it is arranged in your mind's eye at the store. Hanging pictures on the wall is a very good example because it illustrates a key concept of prototyping - the visual. Analytically, we can center and level pictures, yet how many nail holes are we covering when we finally complete the hanging?

Time-boxing

Time-boxing is used for large projects. Not only is the completion deadline for a project determined, the project is divided into manageable pieces. The completion of each piece of the project is celebrated. The more mammoth a task, the more likely it is to never be completed. Time-boxing reduces projects into more manageable pieces. It is through the use of short term time boxes that we reduce cycle time. The more mammoth the task, the more likely it will never be completed because one heroic effort is too huge to accomplish. For example, if people had to attend college for four years before taking an examination on all their work, the success rate would be much lower. Time boxes in college are represented by semesters or quarters, which are manageable steps toward the goal of a college degree.

Mass-customizing

In mass-customizing, a product meet the needs of individual customers. For example, Motorola ships its beepers to stores without the outside case. Customers are then allowed to choose a case when they buy the beeper. The final product assembly is performed at the store.

Platforming

In platforming, one basic design is used to derive multiple products. For example, Saturn automobiles share a common platform on which all of their cars are built.

Deriving

Deriving is closely related to platforming. It refers to one product evolving from another. Software products may be the best example of deriving. New versions of a product have many similarities to the original but also have many new features. Another example of deriving is Chrysler's integrated car seats discussed under Innovation. These seats proved to be so popular in their initial vehicles that they were used in many other Chrysler products.

Postponing

Postponing is waiting as long as possible to decide what the final product is going to be. For example, all Benetton sweaters are white. They are dyed different colors at the last minute to meet market demands.

Reusing

Reusing is self-explanatory. Related to cycle time, reuse is planned from the beginning to be intentional rather than happenstance. For example, most speakers prepare a speech so that it can be used frequently rather than just once.

CONSTRUCT 4: OPERATIONS

The operations area is a good candidate for cycle time reduction. The following "INGs" are "points of leverage."

Conceptualizing

Conceptualing means "getting the big picture." Wetherbe and Vitalari (1994) found great differences between good performers and poor performers in organizations. Good performers are much better at conceptualizing when they solve problems. When reviewing an organization's IT department, for example, bad performers tend to look at individual PCs whereas good performers examine an entire organization's information architecture.

Challenging

Challenging is questioning everything about a process or product to determine whether or not it is essential. From a cycle time perspective, challenging involves asking questions until reaching the heart of the organization’s problems.

Eliminating

Cycle time improves when organizational processes or functions are eliminated that do not add value or are unessential. For example, an organization may find it needs fewer warehouses if they use express shipping capabilities.

Integrating

Integrating more closely couples operational processes or functions so that they work better together. Microsoft, for example, decided to integrate several popular products into an integrated suite called Microsoft Office.

Paralleling

Paralleling is accomplishing more than one operation at the same time. For example, every time a men's suit retailer sells a suit, the retailer is simultaneously doing market research since their point of sale terminals are a first source of marketing feedback.

Anticipatory Scheduling:

Anticipatory scheduling determines in advance when something will be done.

Informating

Informating (a new word and likely an abuse of the English language) is the process that ensures that information flows freely so that everyone knows what is happening. For example, National car rental agency takes the information from one transaction and uses it as the basis for building a relationship with that customer. Another example is the use of “cookies” to allow companies to profile their customers. Although controversial, "cookies" allow e-commerce retailers to shorten the order entry cycle time process by identifying who you are when you log onto their site.

Simplifying

Simplifying refers to performing operations in a prescribed or customary way. For example, identification numbers are a target for simplifying. Why does each airline assign their own special frequent flyer number? The customer could just as easily choose a number that is meaningful to them. Banks show some progress here in that they allow people to choose their own PIN numbers.

Automating

Automating is the use of technology to improve or eliminate a manual process. However, using technology for every problem is less effective than improving the process and then automating it.

CONSTRUCT 5: INTER-ORGANIZATIONAL

Inter-organizational processes are becoming increasingly popular. The "INGs" for reducing cycle time between organizations are:

Networking

Networking is communicating or collaborating between organizations. Mitsubishi, for example, is investing billions of dollars in a network to connect all their customers and suppliers.

Partnering

In partnering, organizations share information and other resources. The primary challenge is getting the partners to behave appropriately in information sharing. A facilitator is probably essential for partnering to occur. The problem is to combine different corporate cultures, different country cultures, and different social cultures. For example, one CTR project involved combining Texans with Northern Californians, Japanese, and Midwesterners - and getting them to cooperate in partnering .

Risk sharing

In risk sharing, multiple companies contractually agree to pool their resources to bring a new product to market. For example, a computer manufacturer might have a new product that they think will be a big seller. The retailer might be unsure about the product. To obtain the retailer's cooperation, the computer manufacturer agrees to share the risk of the profitability of the product.

Outsourcing

Outsourcing is contracting with another organization to perform a function, produce a product, or deliver a service to reduce cycle time for the first

organization. In an earlier example, we discussed General Motors' use of platforming in production of the Saturn to reduce cycle time. In contrast, what did GM do with the entire line of Geo cars? Under a joint venture with Toyota, GM outsourced the production of the Geo-Prism, outsourced another product to Isuzu, and a third to Suzuki. So, the whole product line is completely outsourced. It was another way to achieve CTR and freed GM to make new products or enhance others.

Virtualizing

Virtualizing is the creation of an entity from several different companies, which would not exist otherwise. These are commonly known as virtual organizations.

III. THE CENTER FOR CYCLE TIME RESEARCH

The FedEx Center for Cycle Time Research (FECCTR) was formed in 1993 as a strategic alliance between FedEx and The University of Memphis. The purpose of the Center is to conduct research concerning ways to reduce the time it takes to complete organizational processes in a way that reduces cost and increases customer service. Organizational processes include activities such as processing insurance claims, admitting patients to a hospital, designing a product, establishing credit, scheduling a class, ordering a product, or moving a package from point A to point B. Composed of a group of staff and students, the FedEx Center for Cycle Time Research is dedicated to:

- Performing research projects that address cycle time reduction issues.
- Documenting and developing a body of knowledge about the innovative use of technology and techniques to reduce cycle time.

- Providing benchmark cycle times on various business processes.

- Providing a research publication - *Cycle Time Research* - as an outlet for publishing research results on cycle time reduction.

RESEARCH

Activities of the FedEx Center for Cycle Time Research include:

- **Programs and workshops** - Presentations on leading practices in cycle time reduction, drawing from nationally prominent practitioners and scholars.

- **Research** - Scientific investigation into cycle time issues using case studies, field surveys, field experiments, and laboratory experiments.

- **Student projects/internships** - Experimental training of students who participate in relevant projects under the supervision of specified individuals in sponsor firms.

- **Working papers** - Preliminary publication of major research being conducted by faculty and selected papers prepared by graduate students.

- **Information clearinghouse** - Central location for information on specific cycle time topics, literature, training programs, faculty, and organizations.

- **Training programs** - Programs for FedEx, their customers, and other interested groups are offered through the FedEx Center for Cycle Time Research.

A key characteristic of cycle time research is that it is interdisciplinary. Therefore, cycle time research draws from various academic disciplines to achieve results. The cycle time team works with personnel from both FedEx and the customer organization to be studied in a virtual team approach. The team is assembled based on the cycle time project to be undertaken. The next section addresses a few of the cycle time reduction studies conducted by the Center.

IV. THE CYCLE TIME STUDIES

Since its inception in 1993, the FedEx Center for Cycle Time Research has conducted numerous studies for companies around the globe. The approach for each of these studies was based on the problem that existed. This section describes four of these studies. They deal with:

- Packaged software
- Inter-organizational supply chain
- Computer supplies
- Software testing

CYCLE TIME REDUCTION STUDY - PACKAGED SOFTWARE

Insight Direct was founded in 1987 as a distributor of computer hardware and software. Their business grew substantially, to the point where they have over 1 million customers. These customers place an average of 2000 orders per day,with peaks up to 3000 orders per day. Insight Direct's 400 order entry terminals allow its salespeople to serve customers orders for over 6,000 product stock keeping units (SKU's) offered by the firm (Frolick, 1996).

The Challenge

Insight Direct wanted to broaden its software product base to address customer demand for the latest software products. If a customer asked for a

software product that Insight Direct did not have in stock, there was a good chance that they would take their business elsewhere. To keep the customer, Insight Direct wanted to broaden its software product offering tenfold. While admirable, one can imagine the complexity of managing 57,000 products. To add to the problem, while thousands of software titles are available, only 25 titles have a turnover rate high enough to justify holding them in inventory.

Insight Direct wanted to sell every software product available but did not want to keep the products in inventory. This goal was problematic given the existing systems and practices.

The Original Order Entry System. The time it took to obtain out-of stock software and fill an order could take up to seven days. In a best case scenario, it took Insight Direct three days from the time the customer placed the order to get it into the distribution center. It then took an additional two days to ship the product to the customer. The total cycle time for this best case scenario was five days

A significant problem with this order processing system was that salespeople would take orders for computer products not knowing if they were in stock. It was not until the evening after the order was taken that a computer program would check customer orders against inventory. If the product was not in stock, it would have to be backordered (Figure 4).

This process was expensive and time consuming especially when considering that one piece of software retailing for $55 typically has a gross profit of approximately eight dollars. Insight Direct realized that the current system was not adequate for reducing cycle time, increasing customer service, and making the packaged computer software order process profitable. They therefore set out to develop a new information system to support the process.

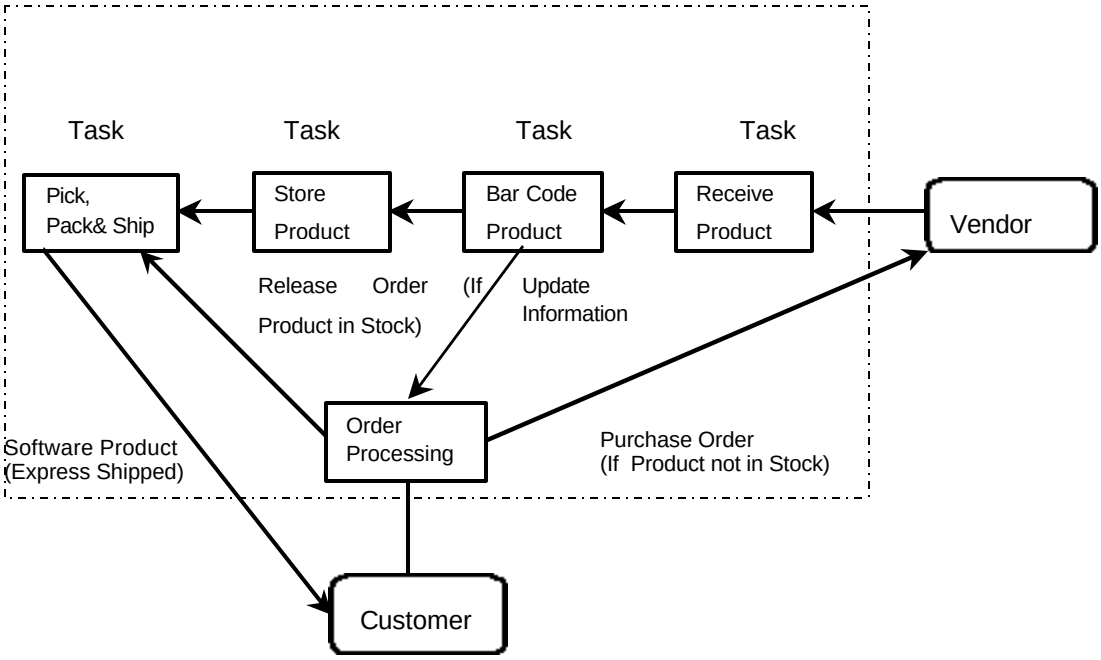


Figure 4. Order Processing Prior to the Inter-organizational Information System

The Solution

To solve this problem, Insight Direct decided to build an easy-to-use system that would allow it to access its vendors' software product inventory on-line. They developed an information system (IOIS) that allowed them to interact with their vendors. This system created a competitive advantage in packaged computer software distribution.

The Order Processing System. The initiative required significant collaboration between Insight Direct and its software vendors. A key to reducing cycle time is for organizations in an relationship to understand each other's needs better.

The IOIS was developed to allow salespeople to determine product availability interactively for each product SKU that they have in the system on a real-time basis, regardless of inventory location. For example, some products

may be stored at Insight Direct's distribution center while others reside at a software vendor's location. This system allows salespeople to serve customers better by providing timely and accurate product availability (Figure 5). Vendor's inventory is checked and an order placed, via EDI, with the vendor offering the lowest price.

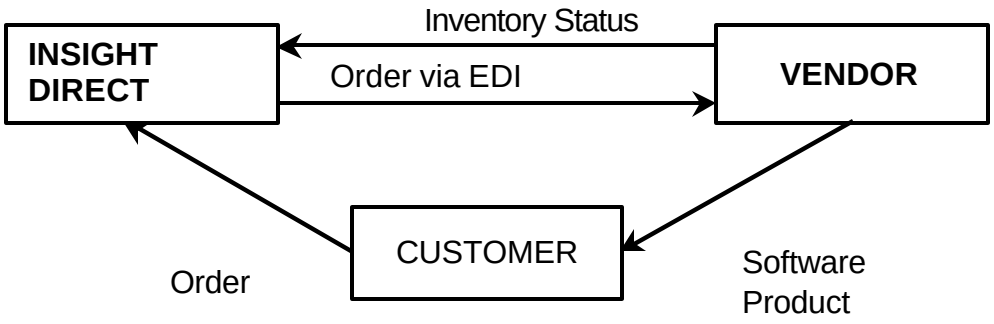


Figure 5. Order Processing After the Information System

The new IOIS allowed Insight Direct to grow its packaged software profitably and in a customer service-oriented manner. The new system yielded several benefits (Table 2).

Table 2: Summary of IOIS Benefits at Insight Direct

	Before IOIS	**After IOIS**
Cycle time from customer order to product delivery	Best case - 3 days Worst Case - 7 days	Best case - 1 days Worst Case - 3 days
Percentage of product SKUs sold directly from inventory	100%	20%
Number of products offered	6,000 titles	35,000 titles
Cost of processing an order	Several dollars	A few cents

Perhaps the largest contribution the IOIS made was to Insight Direct's bottom line. By using the IOIS to drop ship software from vendors directly to

customers, order processing costs were reduced by 95% A process that once cost several dollars per order now costs only pennies.

Keys to Success

To be successful, it was determined that the system needed to simplify the order process, reduce order processing cycle time, increase customer service, and reduce costs.

The keys to success, in keeping with the ING words mentioned earlier, were:

- *Transforming* the original order processing system into an IOIS
- *Automating* the order entry process
- *Simplifying* the process

Summary

To reduce order processing cycle time, increase customer satisfaction, lower costs, and become more profitable, Insight Direct implemented an IOIS. This system allowed them better to handle the numerous orders they received from their customer base of over one million. Information sharing proved to be one of the key factors to the success of this cycle time reduction initiative.

CYCLE TIME REDUCTION STUDY - INTER-ORGANIZATIONAL SUPPLY CHAIN

This study differs from the from the packaged software study in that rather than examining cycle time issues within one organization, it involves an environment. It examined cycle time performance across a "typical" supply chain in the computer electronics industry. These organizations included a major supplier of semiconductor components, a world-wide producer of computers and related peripheral equipment and a major computer products retailer (Nichols, et al., 1995).

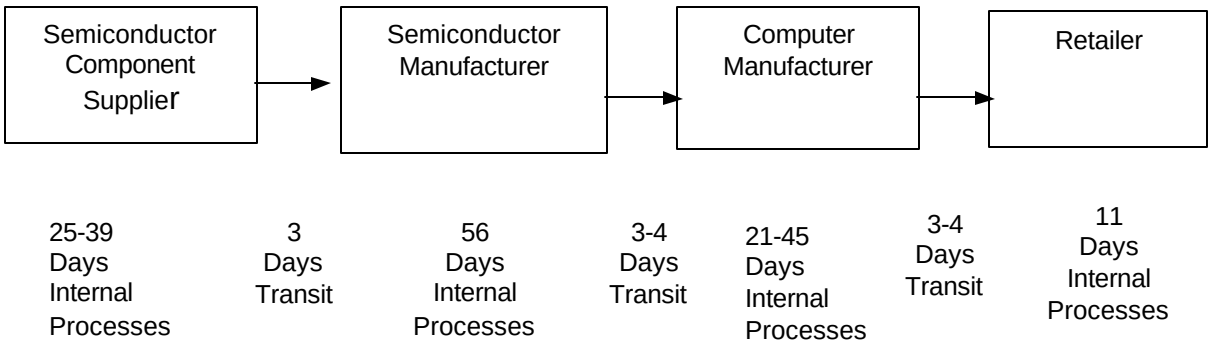
The Challenge

Although several cycle time reduction impediments were identified, the key obstacle was the lack of required information across the supply chain. Simply stated, as product moved from one organization to the next, the "left hand often did not know what the right hand was doing" resulting in unnecessarily long cycle times and inventory imbalances. Given the problems that most organizations have when they move information internally, moving information across a supply chain is even more difficult.

The Original Inter-organizational Relationship. Representatives were brought together from each of the organizations in the supply chain. This meeting facilitated an opportunity for participants to become acquainted, to learn about the approaches to cycle time reduction, to gain insights into cycle time problems encountered by each organization, and to consider the merits of a collaborative initiative to improve cycle time performance across the supply chain.

Each organization provided an overview of its key processes within the supply chain, discussed current cycle time performance, and presented areas viewed as major cycle time obstacles. In addition, several small breakout groups allowed participants to focus on specific topics.

Workshops were then conducted to help each organization examine the cycle times within their organizations for this particular process. The result was a set of supply chain process worksheets that provided a framework for team members to further examine current processes and cycle time, both internally and across the supply chain. The group then used these worksheets to develop an overall supply chain process map (Figure 6).



* Contractual

Overall Material Flow Cycle Time: 119-163

Figure 6. Supply Chain Overview

A recurring theme in the cycle time problems discussed by the group members was a critical lack of information. The specific problems discussed varied by organization and situation, but consistently, it was a matter of a lack of information both within organizations and between supply chain members.

The Solution

The main point of leverage for improving cycle time performance across the supply chain was "informating" or information sharing. To facilitate the informating process, the research team decided to explore the development of an inter-organizational information system (IOIS).

The Inter-organizational Information System. To construct the IOIS properly, the research team set out to determine the information requirements of the new system. This is one of the most critical issues to be considered when developing IOIS's.

Using the methods laid out by Wetherbe (1991), the research team conducted a cross-functional, joint application design approach to determining

these requirements. The methods used were business systems planning (BSP), critical success factors (CSF) and ends/means (E/M) analysis.

Upon completion of the information requirement determination process, the analyst translated the requirements into a prototype to help refine and evolve the requirements. The result was an IOIS that was designed to meet the information requirements of the supply chain members, and in doing so, provide a critical resource required to improve cycle time across the entire supply chain.

Keys to Success

Project teams members identified a number of benefits associated with the project other than developing the IOIS prototype. These benefits included establishing contacts across the supply chain, gaining insights into current organizational practices, and joint projects between supply chain members.

The keys to success, in keeping with the ING words, were:

- *Informating* the inter-organizational information system
- *Visioning* the benefits of cooperating with others in the supply chain
- *Partnering* with others in the supply chain in a win/win environment

Summary

In many cases, processes are a product of evolution, rather than the result of a precision design effort. Reengineering processes across the supply chain may hold benefits of a greater magnitude than those associated with internal reengineering efforts. Development of an IOIS represents a key enabler to reengineer the processes of the supply chain.

Information is the key factor required to improve cycle time performance across the supply chain. Providing decision makers within the organization with the "right" information, in the necessary format, and in a timely manner is the challenge. The development of an IOIS presents an effective means for providing

this information. It helps to benefit organizations in a wide range of areas and results in a stronger overall supply chain.

CYCLE TIME REDUCTION STUDY - COMPUTER SUPPLIES

Daisytek International, headquartered in Plano Texas, is a wholesale distributor of over 6,000 nationally-branded non-paper consumable computer supplies. Companies such as Canon, Epson, Hewlett Packard, IBM, Kodak, 3M, Sony, and Xerox are among the approximately 150 original equipment manufactures whose products Daisytek sells. Daisytek's customer base is in excess of 14,000, including value-added resellers, computer and office superstores, buying groups, and merchandisers (Nichols, 1996).

The Challenge

Daisytek is known as a highly innovative, low-cost distributor. Daisytek's success did not come overnight. Nearly two decades and two entirely different distribution systems had gone by since the company began operations.

Their original distribution system, which worked for some time, became inefficient and needed modification if they were to remain competitive in their industry.

Original Distribution System. In the late 1980's, Daisytek promoted itself as a low-cost supplier. The company established a network of regional distribution centers (DCs) across the United States. By 1990, Daisytek operated five distribution centers, located in Dallas, Los Angeles, Atlanta, Chicago, and Parsippany, New Jersey (Figure 7). At this point, all orders were shipped via a ground-based shipping system.

As Daisytek's order volume grew, so did the complexity of the operation. Customers increasingly complained about their orders vanishing. The regional DCs operated with small staffs and low levels of automation. This form or

organization, together with problems with their ground carrier, caused Daisytek significant problems and presented serious obstacles for growth.

The Solution

The options were to build more regional DCs and maintain the status quo or to break from the industry tradition and consolidate their distribution into a "superhub" to realize economies of scale in both technology and operations.

New Distribution System. Daisytek selected the "superhub" concept, a radical change in their distribution operations. Daisytek's 1995 distribution network, centered in Memphis, looked very different from what it did in 1990 (Figure 8).

Several factors contributed led to locating in Memphis:

- Memphis is considered to be America's distribution center. More freight move through Memphis every day than any other inland city in the United States.

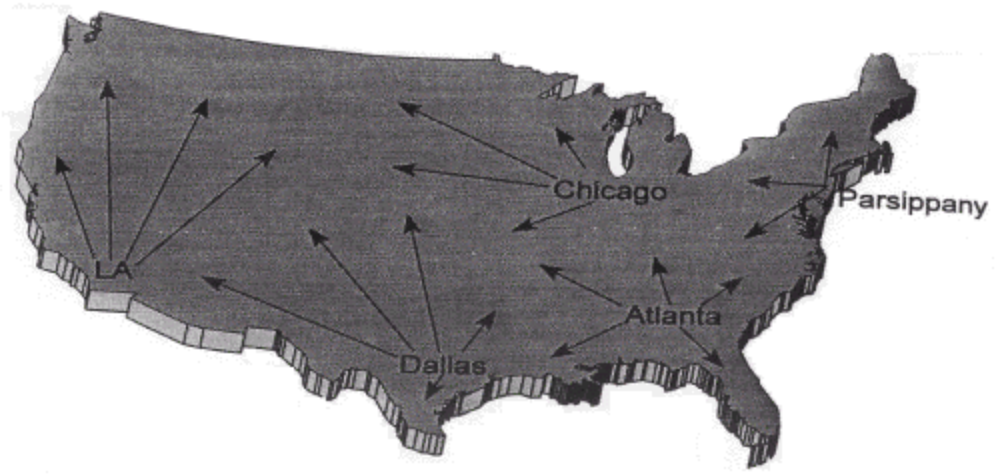


Figure 7. Daisytek's Decentralized U.S Distribution Network.

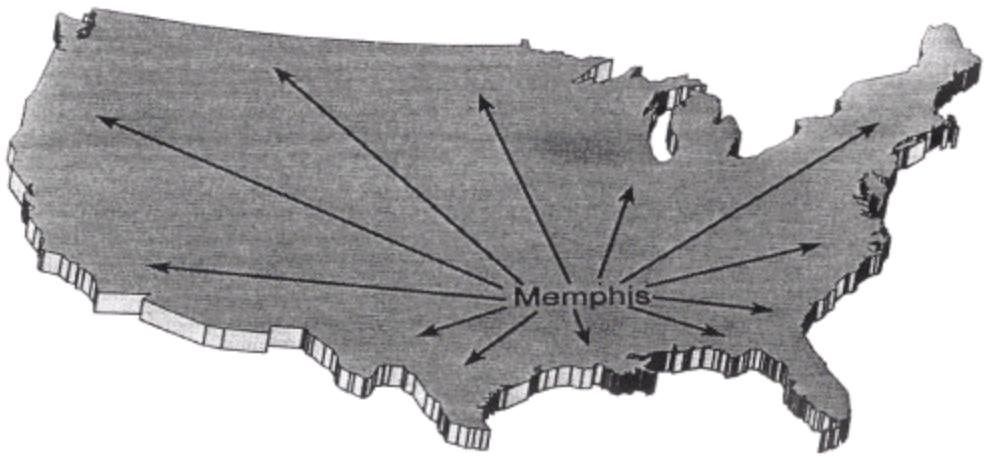


Figure 8: Daisytek Distribution: The Memphis Superhub

- Memphis has an excellent transportation infrastructure.

- Most important to Daisytek was that Memphis is home to FedEx, the world's largest air distribution company.

Daisytek now operates a 176,000 square foot distribution center near FedEx.

As a result of their strategic partnership with FedEx, Daisytek was able to integrate its own advanced information systems capabilities with FedEx's freight tracking system and "time-definite" transportation services. The integration of their distinctive information systems competencies allows Daisytek to track any customer's order at any time, at any point in the delivery cycle, within minutes.

Keys to Success

Daisytek's distribution strategy incorporates a number of key principles of cycle time reduction. The key to success, again in keeping with the ING words, were:

- *Consolidating* the various decentralized DCs into a "superhub" DC
- *Automating* their new "superhub" with state of the art warehouse automation
- *Informating* the process by linking their information systems with the FedEx order tracking system
- *Co-Locating* by siting their "superhub" in Memphis to take full advantage of the capabilities that FedEx offers.
- *Partnering* with FedEx for a mutually beneficial, long term relationship.

Summary

To overcome the cycle time problems that Daisytek had with their original distribution system, they opted to change their distribution network radically. Armed with a leading-edge distribution strategy, a strategic alliance with FedEx and its innovative use of information technology, Daisytek is its industry's leader. Not only does the new system boast a 95 percent fill rate on customer orders, it is often able to exceed customer expectations in terms of delivery time.

Using cycle time reduction innovations, Daisytek remains the industry's low-cost distributor, while servicing steadily increasing demand for its products overnight.

CYCLE TIME REDUCTION STUDY - SOFTWARE TESTING

This study focused on a systems development group within an organization that has one of the largest IS functions in the United States. This particular group is responsible for developing, maintaining, and supporting one of the organization's largest applications. The software testing process at this organization historically was not very successful (Frolick and Janz 1998).

The Challenge

In the past, many information systems (IS) organizations focused their attention on the quick delivery of systems rather than assuring that the software is tested rigorously. Now, however, organizations recognize that it is more effective and less expensive to test for errors earlier in the systems development process. The same consideration is true of the organization in this study.

The Original Software Testing Process. At one time the organization performed both functional and structural testing. Structural testing is used primarily by developers to verify that their code matches design, while functional testing is used primarily by testers and customers to validate that the software delivers the required capabilities (Dyer, 1993). Functional testing was well documented while structural testing was not. This situation, as well as several other issues, affected systems testing negatively.

When structural testing was performed in the organization, it was not done by the developers but rather by a quality assurance (QA) group whose sole responsibility was software testing. This software testing approach caused a great deal of tension between the QA group and the systems developers. This tension eventually led the organization to abandon the QA approach to testing as it was seen as counterproductive to development efforts.

Structural testing was perceived within the organization as a thankless job affording little opportunity for career progression. For example, one tester was told that to be promoted within the organization he would have to transfer out of the testing group. The organization had no standards for structural testing.

Overall, functional testing within the organization was well planned and elaborate. The major problem found was that functional testing surfaced errors that should have been uncovered in structural testing. In addition, since testing

was performed solely at the functional level, it was possible to miss many of the structural problems

Another problem with functional testing dealt with creating a good set of data to test each default or test condition. Given the complexity of constructing such a data set, it was no longer done. As a result it was possible to miss important functional features. As one tester pointed out, up to 30% of the functional testing time was spent investigating problems caused by faulty test data.

Other problems with the original software testing system included:

- no formal methodology for systems development,
- no formal walkthroughs,
- no documentation,
- little interaction between groups, and no stress testing.

These problems led to a lack of confidence in the testing process and the overall quality of the systems, as well as low employee morale. Consequently, the organization took several steps to overcome its testing problems.

The Improved Software Testing Process. *The organization adopted an iterative approach to improving software testing with a focus on improving cycle time and delivery predictability.*

The first round of change involved the establishment of a test team. The test manager was assigned testing responsibilities. The test process was documented, and daily meeting and status reports were implemented. With the implementation of these changes, testing took almost 14 days and was viewed as much more effective than past functional tests which took an average of 20 days. Given this success, another iteration of testing change was implemented.

The second round of software testing changes involved refinements that included:

- increased management involvement in testing decisions,
- implementation of input validation, and
- establishment of testing roles and responsibilities.

The resulting test required less than six 20-hour days, a significant improvement in testing cycle time over the first round of changes.

The third round further refined the testing process to include formal test administration, principles and guidelines for testing, and job logs for tracking/resolving test problems. This set of tests required less than four 12-hour days with 50% fewer staff than the previous round of tests, a five-fold improvement in the person-hours required to test the system. The significance of the cycle time reduction in software testing can be seen in Figure 9

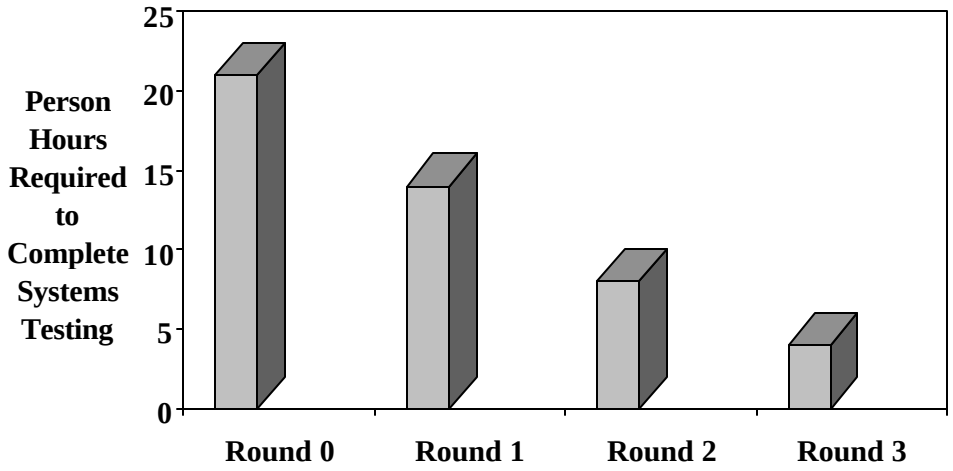


Figure 9. Time/Staff Reduction in System Test

Keys to Success

These changes demonstrate that the organization realized the importance of software testing and wished to improve the process. Additional success will be realized in their software testing process by:

- *Transforming* software testing so that it is considered to be important from project inception

- *Cross-functioning* the software testing team so that testing experts come from all areas of the organization to help understand the testing process.

- *Rewarding* the people that perform testing so that it is no longer considered to be a dead-end job. Rewarding helps ensure that the best talent is part of the testing effort.

- *Standardizing* the testing process through the adoption of one systems development methodology

Summary

Errors are more common, more pervasive, and more troublesome in software development than with other technologies. Even when programs are written correctly, oversights made by one programmer are often shared by others.

This case study outlines some of the testing challenges faced by a large information systems organization and highlights a few of the steps taken to improve cycle time and testing quality. It is important to point out that these problems are not unique to this organization. The lessons learned here can be applied to the majority of IS organizations.

SUMMARY OF CYCLE TIME STUDIES

As this sample of four studies demonstrates, cycle time reduction efforts are taking place in a variety of organizational processes. Often times, information is the key factor for improving cycle time. The challenge is often providing decision makers with the right information in the necessary format in a timely manner. In providing this information, organizations often turn to information technology.

V. CONCLUSIONS

As organizations come under increasing pressure to compete in today's fast changing business environment, they look for the one issue to give them competitive advantage. This issue is often to seek a way to reduce their cycle time in such a way as it decreases cost and/or increases customer service. Often companies use technology to help reduce cycle time. In these cases information technology is the catalyst for cycle time reduction.

Given this interest in cycle time, we established the Center for Cycle Time Research as a strategic alliance between FedEx and The University of Memphis. The primary focus of the center is to conduct research on ways to reduce cycle time. As a result of our research, we have been able to develop and refine methodologies of reducing cycle time. As we continue working with different organizations in different industries, we hope to understand more fully the wide variety of cycle time reduction opportunities.

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REFERENCES

Drucker, Peter (1992) "The New Society of Organizations," *Harvard Business Review*, (70:5): 95-104

Dyer, Michael (1994) "Distribution-Based Statistical Sampling: An Approach to Software Functional Testing," *IBM Systems Software*, pp. 107-114.

Frolick, Mark (1996) "Cycle Time Reduction in the Order Processing of Packaged Computer Software," *Cycle Time Research*, (2:1) pp. 81-87

Frolick, Mark and Brian Janz. (1996) "Cycle Time Reduction in the Software Testing," *Cycle Time Research*, (4:1) pp. 23-31.

Hammer, M and J. Champy (1993) *Reengineering the Corporation: A Manifesto for Business Revolution*, New York, NY:HarperCollins,

Nichols, Ernest L, Mark N. Frolick, and James C. Wetherbe (1995) "Cycle Time Reduction: An Inter-organizational Supply Chain," *Cycle Time Research*, (1:1) pp. 63-81.

Nichols, Ernest L (1996) "Computer Supplies Overnight: Distribution Operations At Daisytek International, Inc.," *Cycle Time Research*, (2:1) pp. 53-58.

Wetherbe, James C. (1991) "Executive Information Requirements: Getting it Right." *MIS Quarterly*, (15:1): 51-65.

Wetherbe, J.C. and N.P Vitalari, *Systems Analysis and Design* : Best Practices, West Publishing, St. Paul, MN, 1994 .

Wetherbe, James C. (1995) "Principle of Cycle Time Reduction: You Can Have Your Cake and Eat It Too." *Cycle Time Research*, (1:1) pp. 1-24.

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